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THAMBAL MARIK COLLEGE
RESEARCH JOURNAL
MULTIDISCIPLINARY RESEARCH JOURNAL

Volume-1

PEER - REVIEWED

September 2024



RESEARCH, EXTENSION & PUBLICATION COMMITTEE (REPC)
THAMBAL MARIK COLLEGE, OINAM



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Thambal Marik College
Research Journal
Multidisciplinary Research Journal

Volume-1

September, 2024

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Thambal Marik College Research Journal, are annual Journal of a peer-reviewed Multidisciplinary Research Journal covering a wide spectrum of subjects ranging from Science to Humanities.

ISSN: Under process
Printed in Manipur, India

Published by Research Extension and Publication Committee (REPC), Thambal Marik College,
Oinam -795134, Manipur, India

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Contents

1. Craniofacial Anthropometric Measurements of Andro, a Scheduled Caste Population of Manipur • N. Mamta Devi and Ksh. Sunita Devi	01-05
2. ABO Blood Group Polymorphism among the Tellis of Tellipati Village, Manipur • Ksh. Sunita Devi, N. Mamta Devi, and L. Romeo Singh	06-11
3. The Role and Status of Women in Aimol Society • A. Taruni Devi	12-16
4. Paris polyphylla Smith., The Wonder Herb • L. Sangita Devi, M. Bharat Singh, L. Saratkumar Singh, A. Silla Devi, and S. Puneshwari Devi	17-20
5. “Enhanced Properties and Potential Applications of Polyvinyl Alcohol/Na ⁺ -Montmorillonite Nanocomposites” • Oinam Dibeshwor Singh and Th. Dhanamanjuri Devi	21-27
6. Phytochemical Evaluation of the Rhizome of Kaemferia Rotunda • Thokchom Sharatchandra Singh	28-33
7. Phytosociological Study of Riparian Woody Plant Communities along the Thongjaorok River Manipur, North-East India. • Lilabati Laishram, L. Samabati Devi, and G. Premeshwori Devi	34-42
8. Physico-Chemical Analysis of Water Quality at Thongjaorok River, Bishnupur, Manipur. • G. Premeshwori Devi, Lilabati Laishram, and L. Samabati Devi	43-47
9. Study of Frequency, Abundance, and Density of Plant Species of Thambal Marik College, Oinam, Bishnupur District, Manipur • L. Samabati Devi, Lilabati Laishram and G. Premeshwori Devi	48-53
10. Relationship between Women’s Educational Status and Age at Marriage • Sangeeta Maisnam, H. Merina, S. Bharati, Th. Roda and L. Ipiton	54-57
11. Common Fixed Point Theorems For Biased Type (R_s) • Oinam Budhichandra Singh and Heisnam Manglem Singh	58-65
12. Experimental Study of Transport Mechanisms of Carriers in Photocurrent Growth and Decay in Molar-Dependent nCdS Thin Films • M. Dinendra Singh and K. Kunjabali	66-71
13. Effect of Vanadium Substitution in $YBa_2Cu_3O_{7-\delta}$ High-Temperature Superconductor • R.K Romen Singh, and Rajkumar Shanajaoba Singh	72-79
14. An Optimal Certainty Contribution of a One Sided Neighbour Balanced Design • K. Praphullo Singh	80-85
15. Perception towards COVID-19 among the People Living in Chikim Village, Manipur, India • Rajkumari Sanatombi Devi, Sumati Rajkumari, Rajkumari Latasana Devi	86-90
16. Current Economic Landscape of Weaving Co-operative Societies in Bishnupur District, Manipur • Pebam Surjit Singh and Kumam Praphullo Singh	91-94
17. Fish Diversity of Oinam Lake, Bishnupur District, Manipur, India • M. Shomorendra, N. Anupama Devi and Y. Norjit Singh	95-98
18. A Micro-level Study of Workforce Participation in The Bishnupur District, Manipur (2001 - 2011) • O. Sanaton Singh, T. Sorojini Devi, K. Medhabati Devi, and M. Rita Devi	99-103
19. The Influence of the Vedas on Ancient Indian Literary Tradition • Kangjam Bimola Devi and Nahakpam Chanu Anita	104-109
20. Global Warming: Causes, Effects and Remedies • H. Devikarani Devi, L. Ibomcha Sharma, Ng. Tomba Singh	110-114
21. A Contribution of Urban Morphology and Functional Analysis: A Case Study of Bishnupur Town • P. Gunamni Singh and K. Praphullo Singh	115-120
22. Merger Agreement and its Legacy on the Present Socio-Political Problems of Manipur H. Budhichandra Singh	121-125
23. The Correlation between Anthropometric and Motor Fitness Parameters of Indian Male Volleyball Players • Longjam Baleshwor Singh	126-136
24. Changing Dynamics of Regional Parties in Indian Politics with Special Reference to Manipur • Oinam Muhindro Singh	137-143
25. Thambal Marik College Research Journal (TMCJRJ)	i - ii

Craniofacial Anthropometric Measurements of Andro, a Scheduled Caste Population of Manipur

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ABSTRACT

The objective of the study is to explore a systematic inquiry regarding stature, cranial shape, and nasal shape of both sexes amongst the Andro people. Anthropometric measurements are applied to obtain a distinct body structure of living subjects for identifying age, stature, and various dimensions related to a particular race or an individual. A population-based cross-sectional study was carried out in Andro. Methodologies employed include a pilot survey, schedule form, case studies, and measurements with an Anthropometer, sliding calliper, and spreading calliper. This study included 217 people from Awang Leikai and 86 from Makha Leikai. Among them, 100 healthy people aged 15-60 were selected for measurements. Andro males have short stature whereas females have medium stature. The mean values of male stature are higher than females. Males were taller with larger head length, longer nasal height, and nasal breadth than females.

Regarding the Cephalic Index (CI) of the Andro males, it falls under Dolicocephalic. Both males and females have a similar nasal index classification mesorrhine. The present study is derived from the measurements i.e., the head length, nasal length, nasal breadth, and nasal height by applying the Anthropometric measurements of the Andro people. Therefore, it was concluded that anthropometric measurements can play a significant role in determining the sex and ethnicity of characteristic pure races of national importance.

Keywords: Anthropometry, Stature, Race, Andro, Mesorrhine.

1. INTRODUCTION

Andro is a scheduled caste group of Manipur recognized under the constitution of India. The village is located on the eastern side of the hill slope of Nongmaiching hills and occupies a vast forest. It is 20 km from the district headquarters in Thoubal and 27km from Imphal capital. The village is surrounded by the Marings in the West, Keithelmanbi in the East, Yairipok in the South, and Lamlai in the North. They are also known as 'Loi' or 'Chakpa' included in the list of Scheduled Caste in 1956 (Devi, N.M.,1998)

Their society is relatively small-scale and technologically simple. They are tradition-bounded people who still preserved and worshipped the ancestral sacred fire inside the shrine of their

village God named 'Panam Ningthou'. They are well-known for preserving and continuing their old customs and practices till date. Anthropometric measurements among the Andros show that they have mongoloid craniofacial and body physique.

The anthropometry technique helps with the study of body proportion and absolute dimensions that vary widely with age and sex within and between racial groups (Damon A. *et al* 1967). These measurements are defined based on anatomical landmarks. With this technique, we have derived a vivid picture of the physique of the Andro population.

2. MATERIALS AND METHOD

In the present study, Anthropometric measurements were taken by Martin's method. The sample size consists of 100 subjects in the age group of 15 to 60 years both male and female shown in the table. Data collection was done by using the Scheduled form, Questionnaire, Case history observation, and Anthropometric measurements. All the measurements i.e., Maximum head length and maximum head breadth were taken by using a Spreading Caliper (Blunt) whereas Nasal height and nasal breadth were taken by Sliding Caliper. Finally, the person was advised to stand straight against the vertical scale of Martin's Anthropometer without shoes or slippers for total stature. The distribution of the sex-wise sample study is shown in Table 1

Table 1: Distribution of subjects sex-wise.

Community	Frequency		Total
	Male	Female	
Andro	50	50	100

The data thus collected from the field site was analyzed using standard statistical devices such as Mean, Standard Error (S.E.), Standard Deviation (δ), etc., and Index was also calculated from the suitable measurements.

3. RESULTS AND DISCUSSION

The statistical analysis was done firstly between males and females of Andro. The present study comprises five (5) anthropometric measurements. Out of five measurements, two(2) indices are calculated.

Table 2.1: Frequency distribution of maximum head length among the Andro (MHL)

Sl. No.	Class	Male			Female		
		Range	Frequency	P.C	Range	Frequency	P, C
1	Very short	X-16.9			X-16.1		
2	Short	17.0-17.7			16.2-16.9		
3	Medium	17.8-18.5	10	20.0	17.0-17.7	7	14.0
4	Long	18.6-19.3	40	80.0	17.8-18.5	17	34.0
5	Very Long	19.4-X			18.6-X	26	52.0

The frequency distribution of Maximum Head Length (MHL) is given in Table 2.1. It is shown that the majority of males have long heads with a percentage of 80 while the females have very long heads with 52p.c. Regarding the mean and standard deviation values in Table 2.7, the Andro males have long heads.

Table 2.2: Frequency Distribution of Maximum Head Breadth (MHB) among the Andro

Sl. No.	Class	Male			Female		
		Range	F	P.C	Range	F	P.C
1	Very Narrow	x-13.9	22	44.0	x-13.4	7	14.0
2	Narrow	14.0-14.7	22	44.0	13.5-14.1	14	28.0
3	Medium	14.8-15.5	6	12.0	14.3-14.9	20	40.0
4	Broad	15.6-16.3			15.0-15.7	7	14.0
5	Very Broad	16.4 -			15.8-	2	4.0

The frequency distribution of Maximum Head Breadth (MHB) is given in Table 2.2. An equal number of 44.0 per cent of males have very narrow and narrow types of MHB. Only 12 per cent of males have medium head breadth. In Table 2.7, narrow types are given as the mean of MHB.

Table: 2.8 shows that the mean value of Maximum Head Length (MHL) of females is 18.5 under the long Category. The majority of the females comprising 40 per cent have the medium type of MHB in Table 2.2 and it is similar to the mean type of value 14.3 cm (Table 2.8)

Regarding the mean and standard deviation values of the Cephalic Index (C.I.) of the Andro, males fall under the Dolicocephalic head form while the females possess the Mesocephalic head form in Tables 2.7 and 2.8.

Table 2.3: Frequency Distribution of Nasal Height (NH) among the Andro

Sl. No.	Class	Male			Female		
		Range	F	P.C	Range	F	P.C
1	Very Short	X-3.9			X-3.9		
2	Short	4.0-4.4			4.0-4.4	22	44.0
3	Below Medium	4.5-4.9	23	46.0	4.5-4.9	25	50.0
4	Medium	5.0-5.4	25	50.0	5.0-5.4	3	6.0
5	Above Medium	5.5-5.9	2	4.0	5.5-5.9	2	4.0

The majority of the Andro males have the medium type of Nasal Height (NH) with 50.0 p.c. and the females in the Below Medium with the same p.c. 50.0 are shown in Table 2.3. The mean values of both male and female NH fall on medium with 5.0 cm in Table 2.7 whereas females fall on Medium, for male with 4.5 cm (Table 2.8)

Table 2.4: Frequency Distribution of Nasal Breadth (NB) among the Andro

Sl. No.	Class	Male			Female		
		Range	F	P.C	Range	F	P.C
1	Narrow	X-2.4			X-2.4		
2	Below Medium	2.5-2.9			2.5-2.9		
3	Medium	3.0-3.4	5	10.0	3.0-3.4	16	32.0
4	Above Medium	3.5-3.9	25	50.0	3.5-3.9	29	58.0
5	Large	4.0-X	20	40.0	4.0-X	5	10.0

Both sexes have above medium types of Nasal Breadth (NB), 50 per cent for males and 58.0 per cent for females (Table 2.4). The mean value of Nasal Breadth of the males is 3.9 c.m. (Table 2.8).

Table 2.5: Frequency Distribution of Height Vertex (HV) among the Andro

Sl. No.	Class	Male			Female		
		Range	F	P.C	Range	F	P.C
1	Very Short	130-149.9			121-139.9		
2	Short	150-159.9	27	54.0	140-148.9		
3	Lower Medium	160-163.9	20	40.0	149-152.9	9	18.0
4	Medium	164-166.9	2	4.0	153-155.9	22	44.0
5	Upper Medium	167-169.9	1	2.0	156-158.9	12	24.0
6	Tall	170-175.9			159-167.9	7	14.0
7	Very Tall	180-199.9			168-186.9		
8	Giants	200			187		

Table 2.6: Frequency Distribution of Cephalic Index (CI) among the Andro

Sl. No.	Class	Male			Female		
		Range	F	P.C	Range	F	P.C
1	Hyperdolichocephalic	X-70.9			X-71.9		
2	Dolichocephalic	71-75.9	30	60.0	72.0-76.9	30	60.0
3	Mesocephalic	76-80.9	19	38.0	77.0-81.9	12	24.0
4	Bracycephalic	81-84.9	1	10.0	82.0-86.4	4	8.0
5	Hyperbracycephalic	85-90.9			86.5-91.9	4	8.0
6	Ultrabraccephalic	91.0-			92.0-		

Table 2.7: Mean values and Standard Deviation of Five Somatometric traits and two indices of male Andro.

Characters	x (cm)	S.E. of x $\bar{\sigma}$	(cm) $\bar{\sigma}$	S.E. of $\bar{\sigma}$	Classification
MHL	18.8	± 0.04	± 0.28	± 0.03	Long
MHB	14.2	± 0.06	± 0.46	± 0.05	Narrow
NH	5.0	± 0.04	± 0.28	± 0.03	Medium
NB	3.9	± 0.05	± 0.37	± 0.04	Above Medium
HV	159.5	± 0.44	± 3.12	± 0.31	Short
CI	75.5	± 0.30	± 2.10	± 0.21	Dolichocephalic
NI	78.0	± 0.87	± 6.16	± 0.62	Mesorrhine

Table 2.8: Mean values and Standard Deviation of Five Somatometric traits and two indices of female Andro.

Characters	x (cm)	S.E. of x $\bar{\sigma}$	(cm) $\bar{\sigma}$	S.E. of $\bar{\sigma}$	Classification
MHL	18.5	± 0.08	± 0.54	± 0.05	Long
MHB	14.3	± 0.09	± 0.71	± 0.07	Narrow
NH	4.5	± 0.04	± 0.26	± 0.03	Medium
NB	3.5	± 0.04	± 0.26	± 0.03	Above Medium
HV	155.1	± 0.40	± 2.83	± 0.28	Short
CI	77.6	± 0.63	± 4.43	± 0.44	Dolichocephalic
NI	80.0	± 0.92	± 6.16	± 0.65	Mesorrhine

Both sexes have Mesorrhine type of Nasal index (NI). The NI of the male is 78.0 while that of the female is 80.0. (Table 2.7 and 2.8)

The frequency distribution of the Height Vertex (stature) of both sexes is given in Table 2.5. Males have 54.0 percent falls on short stature whereas females have medium stature with 44.0 percent. The mean values of the stature of both males and females are 159.5 cm. (Table 2.7) and 155.1 cm (Table 2.8).

Several studies revealed marked differences exist in cranial shape between males and females (Borman *et al*, 1999; Pietrus, Ewsky M., 1990), head length of males being larger than that of females. The present Andro study is similar to the earlier studies. The racial and ethnic morphometric differences in nasal ergonomics in the world population have been the focus of investigation (Farkas *et al*, 1986). The study conducted by Milgrim (1996) also showed that there racial differences in nasal breadth. They found the mean

Nasal breadth of white females was 31 mm and South American females 34.4 mm.

The nasal length of Rai females (42.02 mm) and Limbu females (42.67 mm) (Shrestha *et al*, 2009) are found similar values like South Americans (42mm), Caribbeans (39 mm) and Central Americans (39.5 mm) (Milgrim *et al*, 1996).

4. CONCLUSIONS

As mentioned earlier, the people of Andro village are categorized as one of the Scheduled Caste group of Manipur included in the Chakpa group and known as 'Loi' under the studied two hamlets, there are 126 males and 91 females represent a total population of 217 in Awang Leikai whereas in Makha Leikai 44 males and 42 females represent with a total population of 86.

Physically, the studied village Andro, they are similar to a mongoloid character. According to the data collected, the stature of Andro people started from short to medium type. Their cranial size was represented by medium in frequency distribution and lowering towards to very large and narrow type. The landmark of nose size also represented by medium type in higher frequency Cephalic Index (CI) of Males is Dolichocephalic whereas Mesocephalic for females. Both the male and female have the same Nasal Index (NI) i.e. Mesorrhine.

Traditionally, most of the Caste groups of Manipur inhabited different parts of Manipur, they were the practice of brewing wine or liquor. Therefore, the people of Andro also practice this method and they can earn some amount from these products. The majority of the family reared poultry, piggery, etc. Some womenfolk made pottery and they earned money. Most of the people are hard-working.

ACKNOWLEDGEMENTS

The authors express their heartfelt thanks to the local participants from Andro village for their

willingness to share invaluable insights that shaped their survey. They are grateful to Prof. Kh. Mohon Singh, Editor-in-Chief, Thambal Marik College Research Journal (TMCJR) for his unwavering guidance and insightful suggestions throughout the preparation of the paper. The authors are also indebted to Dr. Th. Sharatchandra Singh, Managing editor, Thambal Marik College Research Journal for his constructive suggestions and encouragement in preparing this paper. The authors are also thankful to the anonymous reviewer to whom the paper was submitted for their valuable comments that improved the quality of the paper.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

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ABO Blood Group Polymorphism among the Tellis of Tellipati Village, Manipur

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ABSTRACT

Though the study of ABO blood group polymorphism is relevant as selective forces that favour gene frequencies, it is less frequent in the Manipur context. ABO is the blood group that can inherit a pattern of multiple alleles at one locus. The present study attempts an academic investigation of ABO blood group polymorphism among the Tellis who is one of the earlier migrants from Bihar by selecting a sample of 200 individuals which comprises 100 couples from Tellipati village in Imphal East district. The findings reveal that the maximum frequency of blood groups occurs in 'B' type thereby constituting 40 per cent while the least frequency is found in blood groups 'A₂' and 'A₂B' that comprise below one per cent. Out of two per cent of the Tellis possessing Rh-negative blood group, two females are evident in the blood group 'O' while one female is in the blood group 'B' type. In the case of males, there is only one individual in 'O' with Rh-negative blood group. In comparison with other ethnic groups of the state, the gene frequencies, *p*, *q*, and *r* of the Tellis of Manipur are nearest to the Muslim 1 (0.150 for *p*) and the Meitei (0.199 for *q*), and (0.541 for *r*). Regarding χ^2 -the value and comparison of its gene frequencies with different populations, the closest relationship is observed with the Muslim 1 (8.92) and the farthest distance is observed with the Tarao (87.93). The study reflects the benefit of discovering gene frequencies separately for parental and offspring generations of the same population and it will be more meaningful in the realm of micro-evolutionary studies.

Keywords: Tellis, Tellipati, A₁A₂BO blood group, gene frequency

1. INTRODUCTION

ABO blood group as the best-established series of multiple alleles in man results in the existence of systematic and significant differences in blood group frequencies between different populations of the world (Mckusick, 1968; Hirzfeld and Hirsfeld 1919). ABO blood group system has become one of the most extensively used traits in search of human variation and evolution. The dissimilarities characterise gene frequencies or morphological characters or both. The on-going process corresponds to the micro-evolutionary changes through generations in various populations of different sizes (Kraus and White, 1956). Boettcher (1965) reported the

presence of blood group antigens on the sperms. In the ABO blood group, at least two or more phenotypes in respect of genetic polymorphism may occur simultaneously in the same habitat while two or more discontinuous forms of a species in such proportions cannot be maintained mainly by recurrent mutation" (Ford, 1940). In the ABO blood group, the selective forces act to maintain the observed frequencies of different ABO alleles in the human population and deal with the stability of polymorphism. Incompatibility in both the ABO and Rhesus (Rh) systems indicates an advantage over incompatibility in only one of the two. The principle is that when the Rh and

ABO-incompatible red cells of the foetus enter the mother's circulation, the cells will be immediately destroyed by the naturally present A or B antibody of the mother before stimulation of anti-Rh antibodies (Banerjee, 1980; Banerjee & Das, 1986). In India, although many studies have been reported so far from different parts of the country, still many populations have not yet been covered from north eastern part.

In Manipur, anthropologists have started research on the biological aspects of different populations since the 1960s. In 1986, K.S. Singh studied the ABO blood group as a genetic marker among the Meitei and Brahmins of Manipur. M. L. Shah and K. S. Singh (1986) reported their findings on the ABO blood group among the Muslims of Manipur Valley. L. R. Singh (1986) completed his doctoral thesis on Physical variation between the two sections of the Kabuis of Manipur and their ethnic position which also included studies on the ABO blood group. In 1990, M. L. Shah conducted a study on ABO blood groups among the Muslims of Manipur as a part of his doctoral thesis on the Bio-Anthropology of the Muslims of Manipur. Moreover, M. L. Shah (1994) continued his studies on the ABO blood group among the Tarao tribe of Manipur while T. S. Singh (1995) studied ABO blood group polymorphism among different populations of Manipur. Moreover, Shah and R. K. R. Singh studied the ABO blood group of two ethnic groups of Manipur - the Koireng and the Chiru in 1996 and 1997 respectively.

Though certain biological studies on the different populations of Manipur have been carried out, studies on A_1A_2BO blood groups among the Tellis of Manipur have yet taken up. The present study on blood group polymorphism has been focussed on the Tellis at Tellipati village in Porompat Sub-division of Imphal East district, Manipur who are believed to have emigrated from Bihar during World War -II (1939-1944).

2. MATERIALS AND METHOD

A total sample of 100 couples was collected from the Tellis of Tellipati village in Manipur. Blood samples were obtained from the fingers through

the open slide method by using Anti-A, Anti- A_1 , Anti-B and Anti-D sera. Gene frequencies are calculated using the formula of Bernstein (1930). Compatible and incompatible blood groups have been worked out as well as a comparison of the blood groups based on χ^2 tests done with other populations of the state.

3. RESULTS AND DISCUSSION

In the frequency distribution of the A_1A_2BO blood group among the people of Tellipati village, the highest frequency of 'B' blood type is observed in both sexes with 40% (Table 1). Among the females, A_2 and A_2B blood groups occur in the lowest frequency with 0.05%. However, among the male individuals, the two blood groups are absent while Blood group O follows B as the dominant blood group. Two per cent of the Tellis are observed to have an Rh-negative blood group. Of them, three females are found with Rh-negative – two in the blood group 'O' and one in the blood group B type. Besides, one male with 'O' blood type encounters Rh-allele. Very low percentages of recessive Rh-ve individuals are reported among the Meitei (0.48%), Brahmin (1.99%) and Muslim (1.98%), and 0% among the Kabui (Meitei *et al.*, 2010).

The frequency of compatibility between each couple among the Tellis of Tellipati village reveals that the highest degree of compatibility lies in a couple of the blood group 'B' types of each sex where it shows 25.35 per cent. It is succeeded by the couples of the blood group type 'O' and 'A' with 23.90 per cent (Table 2).

Table 3 depicts the frequency of incompatibility of the ABO blood group in the Tellis population. It is observed that couples of blood group 'B' and 'O' show the highest frequency (37.93%) in compatibility. It is followed by the couples of the blood group 'B' and 'A' (31.03%), 'AB' and 'B' (13.79%), 'A' and 'O' (10.34%), while the couple of 'A' and 'B', and that of 'AB' and 'A' share the same frequency (3.45%).

A comparative frequency distribution of the ABO blood group among the different populations

of Manipur is produced in Table 4. It reveals that the highest incidences of ABO*O are found among the Muslims, the Koirang, and the Chiru. ABO*A allele among the Meitei, the Brahmins, the Kabuis, and the Taraos as well as the presence of this allele among other peoples of Manipur conforms to the occurrence of the allele among the peoples of Northeast India (Bhasin & Walter 2001). The highest frequency of ABO*B among the Tellis may interpret a more or less genetic distance from the people of the state.

In the occurrence of ABO*‘B’, the highest frequency is observed among the Telli of Tellipati (40%) followed by the Muslim 1 (27%), Meitei (22.86%), Muslim 2 (22.67%), Chirus (22.17%), Kabui (21.5%), Brahmin (18.35%), Koirang (15.28%), and Tarao (4.96%). Regarding A, the highest frequency is evident among the Tarao (56.03%) and followed by the Brahmin (40.37%), Meitei (32.38%), Kabui (31.5%), Muslim 2 (25.33%), Muslim 1 (21.5%), Tellis (18%), and the Chorus (16.98%). In the case of AB, a moderate incidence of the allele is seen among the Meities (13.33%), the Kabui (12.5%), Brahmin (11.98%), and Tellis (10%). The highest frequency of ABO, O is found among the populations of Chiru (53.77%) while more or less high frequencies are obtained among the Koirang (51.3), Muslim 2 (45.33%), Muslim 1 (43%), Meitei (41.43), Taraos (38.30%), Kabui (34.5%), Telli (32%), and Brahmin (29.36%).

Gene Frequency: The genetic frequencies of the ABO blood group among the Telli of Tellipati village are taken into account for comparison with other different populations of Manipur. It is

observed that the gene frequencies of p , q and r are found to be 0.150, 0.290 and 0.560 respectively among the Tellis. (Table 4).

In the comparison of the p -gene frequency with the above-selected populations, it is revealed that the highest degree of frequency is found among the Tarao population which attains 0.350. It is followed by the populations of Brahmin (0.307), Meitei (0.260), Kabui (0.228), Koirang (0.180), Muslim 2 (0.166), Muslim 1, Telli (0.150), and the Chorus (0.120).

The dominant q -gene frequency is found among the Tellis (0.290) which is followed by the populations such as Meitei (0.199), Muslim 1 (0.180) Brahmin and Kabui (0.163), Muslims 2 (0.152), Chiru (0.150), and Tarao (0.040).

In the gene frequency of r , it may be interpreted that the Chiru population is found to have the highest frequency of 0.730 while other populations mark its presence –Koirang (0.720), Muslims 2 (0.682), Muslims 1 (0.670), Tarao (0.610), Kabui (0.609), Telli (0.560) Meitei (0.541) and Brahmin (0.530).

While χ^2 -test has been applied (d. f. 2) between each pair of Tellis and available data of the eight different populations of Manipur to see the degree of closeness among them, the closeness is observed in the pair of Muslim 1 (8.92), Meitei (9.23), Kabui (13.62), Chiru (22.66), Brahmin (26.23), Muslim 2 (27.1), and the Koirang (40.45, Table 5). However, each pair of Telli and other populations show significant differences in the present study.

Table 1: Frequency distribution of A₁ A₂ BO blood group among the Tellis

Blood group	Male		Female		Total	
	f	p.c.				
O	39	39.00	25	25.00	64	32.00
A ₁	14	14.00	21	21.00	35	17.50
A ₂	-		1	1.00	1	0.50
B	41	41.00	39	39.00	80	40.00

A1B	6	6.00	13	13.00	19	9.50
A2B	-	-	1	1.00	1	0.50

Table 2: Frequency distribution of compatible ABO blood group of the Telli couples.

Blood group compatible		Number of couples	
Male	Female	<i>f</i>	p.c.
O	O	11	15.49
O	A	17	23.90
O	B	13	18.30
O	AB	8	11.26
A	A	5	7.04
A	AB	2	2.81
A	B	3	4.22
B	AB	3	4.22
B	B	18	25.35
AB	AB	1	1.40
		71	99.99

Table 3: Frequency distribution of incompatible ABO blood group of the Telli couples.

Blood group incompatible		Number of couples	
Male	Female	<i>f</i>	p.c.
A	O	3	10.34
A	B	1	3.45
B	O	11	37.93
B	A	9	31.03
AB	O	-	-
AB	A	1	3.45
AB	B	4	13.79
		29	99.99

Table 4: Distribution of frequency percentage and gene frequencies of ABO blood group among the different populations of Manipur

Populations	Blood group				Gene frequency				Sources
	N	A	B	AB	O	<i>p</i>	<i>q</i>	<i>r</i>	
Mulsmi 1	200	21.50	27.00	8.50	43.00	0.150	0.180	0.670	Shah M.L. and K.S.Singh (1990)
Muslim 2	300	25.33	22.67	6.67	45.33	0.166	0.152	0.682	Shah M.L. (1990)
Meitei	105	32.38	22.86	13.33	31.43	0.260	0.199	0.541	Singh K.S. (1986)
Brahmin	109	40.37	18.35	11.98	29.36	0.307	0.163	0.530	Singh K.S. (1986)
Kabui	200	31.50	21.50	12.50	30.50	0.228	0.163	0.609	Singh L. R. (1986)
Tarao	141	56.03	4.96	0.71	38.30	0.350	0.040	0.610	Shah M.L. (1994)
Koireng	144	31.95	15.28	1.39	51.39	0.180	0.100	0.720	Shah M.L. and R.K.R. (1996)

Chiru	212	16.98	22.17	7.08	53.77	0.120	0.150	0.730	Singh R.K. R and M.L. Shah (1997)
Tellis	200	18.00	40.00	10.00	32.00	0.150	0.290	0.560	Present study

Table 5: χ^2 - Values for each pair of Tellis and other available populations of Manipur

Population	d. f.	-value	Population as p	Results
Muslim 1 \times Tellis	2	8.92	$0.02 > p > 0.01$	Significant
Muslim 2 \times Tellis	2	27.1	$p < 0.001$	Significant
Meitei \times Tellis	2	9.23	$0.01 > p > 0.001$	Significant
Brahmin \times Tellis	2	26.23	$p < 0.001$	Significant
Kabui \times Tellis	2	13.62	$0.01 > p > 0.001$	Significant
Koireng \times Tellis	2	40.45	$p < 0.001$	Significant
Chiru \times Tellis	2	22.66	$p < 0.001$	Significant
Tarao \times Tellis	2	87.93	$p < 0.001$	Significant

4. CONCLUSIONS

In the frequency distribution of A_1 , A_2 , B, and O blood groups among the Tellis of Tellipati village, the maximum frequency is found in blood group 'B' with 40 per cent while the least frequency is found in blood groups 'A₁' and 'A₂B' thereby comprising below one per cent. After considering the blood group types A_1 and A_2 as blood group 'A' in the ABO blood group compatibility among the couples of the Tellis, it is observed that the mating between blood group 'B' type for each sex lies at the highest frequency where it attains 25.35 per cent whereas the lowest frequency is observed in the couples of blood group types 'AB' consisting of only 1.40 per cent. In the incompatibility of ABO blood groups, the highest frequency is observed among the couples of blood group 'B' and 'O' types (37.93%) while mating between blood group 'AB' and 'O' types is found to be absent at the random data. However, mating between blood groups 'A' and 'B', and 'AB' and 'A' are found in one case each.

2 (two) per cent of the Tellis are observed to have Rh negative blood group. Of the three females found with Rh-negative – two females have blood group 'O' and one possesses blood group 'B'. In the case of males, one individual with blood group 'O' is observed to face Rh-ve type.

In the case of gene frequency p , Tellis (0.150) is found to be nearest to the Muslim1 population (0.150) which depicts the same gene frequency whereas the greatest difference is observed among the Tarao (0.350). For the frequency of q , Tellis (0.290) is found to be closer to the Meitei (0.199) with a difference of only 0.091 while a greater distance is observed among the Tarao (0.40) with a difference of 0.25. For the gene frequency r , the closeness of the Tellis (0.560) is observed with the Meitei (0.541) with a difference of only 0.019 and a greater distance is observed to the Chiru (0.730) with a difference of 0.189.

From the point of χ^2 value and comparison of its gene frequencies with other populations of Manipur, the closest relationship is observed to the Muslim 1 (8.92) and the greatest distance is observed to the Tarao population (87.93); nevertheless, both the values show significant differences in each pair of populations.

The highest occurrence of ABO, B among the Tellis may indicate the difference of the people from the mongoloid stocks of Manipur. The genetic nearness of Brahmins who are again of another origin to the peoples of the state may be due to the frequent incidences of their affinal relationship with the Meiteis. Thus, the above study reflects the benefit of discovering gene frequencies of populations and it will be more meaningful in the

realm of micro-evolutionary studies.

ACKNOWLEDGEMENTS

The authors would like to thank the participants of Tellipati village, Imphal, Manipur, who were willing to provide their personal information while conducting the survey. The authors express their gratitude to Prof, Kh. Mohon Singh, Editor-in-Chief, Thambal Marik College Research Journal (TMCRJ) for his constant guidance and suggestions. They are also thankful to the anonymous reviewer to whom the paper was submitted for their valuable comments that improved the quality of the paper. Dr Thokcom Sharatchandra Singh, Managing Editor, Thambal Marik College Research Journal (TMCRJ) is highly acknowledged for his constructive suggestions in preparing the paper.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

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The Role and Status of Women in Aimol Society

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ABSTRACT

The tribal population of India comprises 8.081% (67,758,380) of the total population census of 2001. These tribal populations in India inhabit widely varying ecological and geo-climatic conditions in different socio-economic backgrounds, which have a profound impact on their demographic structure. The role and position of women in the tribal society of India vary from tribe to tribe. In many cases, the female gender is discriminated against in their society due to the age-old traditional practices. Fieldworks for the present study were conducted from 2009 to 2010 in various villages of Aimol inhabited hill districts of Manipur Chandel, Churachandpur, and Senapati districts. The Aimols are the Indigenous tribes living in north-eastern India with distinctive cultural traditions, customs, beliefs social systems, songs, arts etc. The present study, therefore, aims at a comprehensive understanding of the role and status of Aimol women through their demographic structure, division of labour, social process, education, marriage, dissolution of marriage, participation in decision-making, participation in socio-political and religious spheres, and right in land property. The results of the study indicate that there is a clear division of labor between a man and a woman in their society. The Aimol women have many vital roles in socio-economic life. 93.23% of the Aimol people lived in nuclear families which support their traditional culture. The majority of the males were engaged in cultivation and a low percentage of males were found in the high profession group (0.49%). The mean age of first marriage was observed to be 23.62 years. The mean menopause age has been estimated to be 46.93 years.

Keyword: Female Education, Status, Role

1. INTRODUCTION

The member of feminine gender in India and third-world developing countries is taken into consideration as of secondary status in traditional male-dominated societies. However, women are struggling to survive and their discrimination has reached more alarming levels. This situation arises due to the complete social and economic dependence on males and a stress on their reproductive role that is inimical to their interest (Chhabra and Basn 1980; Youssef 1974). The girl child is often neglected in feeding, health care and elementary education. The Fourth World Conference on Women in Beijing in 1995, aimed to establish a definitive link between women's poverty and gender inequality (Lotha, 2003). A woman has to play many important roles in the

course of her life. Each of these roles expects some duties from her. It is only with the help of education that she would be able to do them successfully. Women must be good daughters, to be good wives and to be good mothers. The mother exercises every great influence over the lives of her children. Anthropologists have long been interested in the study of women in tribal societies (Srinivas 1997). In anthropological and sociological literature, there are multiple observations on the concept of status.

In this regard, Malinowski (1920) stated that a correct definition of status can be given only after taking into consideration all-natural duties between the sexes, and the safeguards provided for the

protection of each sex against the high-handedness of the other. The role and status of women in tribal societies is not uniform. It varies from tribe to tribe and within the tribal society based on time and space. There are some factors like pattern of descent and residence, laws of inheritance, marriage system, degree of acculturation, urbanization and education development that play a vital role in this variation. Within tribal societies, women hold extensive and essential roles (Mitra, 2008). Despite comprising approximately half of the population, their prominence arises from their diligent work and central role in managing the family economy (Bhattacharya & Murmu, 2019). Elwin (1969) observed that tribal women are fundamentally the same as other women. They share similar circumstances, affections, uncertainties, and a comparable dedication to their homes, husbands and children. They also exhibit similar strengths and weaknesses.

The Aimols inhabit three districts in Manipur. According to the Aimol Tribe Union's estimation in 1995, their population was approximately 3,300. However, the 1981 census indicated a population of 1,862. The Aimols are primarily concentrated in the Chandel district of the state, occupying foothill areas that border the valley in the southeastern part. The villages where Aimols are predominantly distributed in Manipur include Unapal, Satu, Kumiei, Chingnunghut, Aimol Tampak, Kodamphai, Ngarong Aimol, Chandonpokpi and Soibong (Khudengthabi) in the Chandel district. Apart from Chandel district, Aimols are distributed at Kha-Aimol and Luichungbam villages in the Churachandpur district. Unlike occupying a well-defined territory, the Aimol tribe has historically shifted their settlement sites from one place to another. Ethnically, the Aimols are closely connected to neighbouring tribes in the southern part of Manipur, bordering Myanmar and the Lushai region. Many writers classify them as part of the Kuki-Chin-Mizo (Lushai) group.

2. MATERIALS AND METHOD

Fieldworks for the present study were conducted from 2009 to 2010 in the various villages

of Aimol inhabited hill districts of Manipur, with a view covering the entire Aimol village.

To collect requisite information, a village-level household survey was conducted. Information data has been collected from among the currently married women by using pre-structured questionnaires, schedules, interviewing informants and occasionally through observations. A total sample of 325 currently married couples representing 228 from the Chandel district, 66 from the Churachandpur district and 31 from the Senapati district have been collected. The collected data were analyzed for various social-cultural factors such as age type of marriage, type of family, ethnographic aspect, inheritance pattern, demographic aspect of female education and socialization of girl child and division of labour.

3. RESULTS AND DISCUSSION

3.1. Ethnographic Aspect: The Aimol tribe is one of the recognized scheduled tribes of Manipur. They show a trend of population fluctuation over the last 8 decades since 1931. According to the 1991 census, the estimated population was 2,108 individuals and 2,529 individuals in 2001. A portion of the Aimol population lives in urban and city areas for their livelihood and education. These people are integrated, aware and alert to preserving their age-old culture and tradition. These people are one of the progressive tribes in Manipur working in educational institutions, research organizations, government offices, and hospitals. Thus, they are working in both organized and unorganized sectors. They have also taken advantage of the new socio-economic atmosphere in the present situation. They have a mythological history of their origin. The Aimol people prefer to live in plain agricultural land. Except for felling trees, especially for jhum cultivation, agriculture is otherwise a joint venture of the males and females in the Aimol society. Right from the beginning of sowing up to harvesting, the wife provides a helping hand besides her usual household duties. Linguistically, they are categorized under the old Kuki division of the Kuki section and the Burmese Division of the Sino Tibetan Language. However,

the Aimols prefer to live independently of any affiliation and prefer to maintain a distinctive identity of their own. To safeguard its own identity and to promote solidarity, the Aimol Tribe Union embraced all the villages they formed in 1991. The women take good care of the houses. They are by habit non -non-vegetarian. However, their food also comprises rice with dal and vegetables. Almost every family possesses some agricultural land on which they grow paddy through traditional plough cultivation for their consumption. The household utensils of the Aimols are made up of non-metal and metal (i.e., iron brass aluminium). The Aimol society is patrilineal and patriarchal. Their society is divided into 5 main clans, further subdivided into sub-clans. The clans are 1. Chongom (with 3 sub-clans). 2. Laita (3 sub-clans). 3. Lanu (4 sub-clans). 4. Chaitu (no sub-clan). 5. Shonthn (2 sub-clans). They practice clan exogamy but marriage is tribe endogamy. Each village has an elaborate traditional, political and religious council called panchayat. Every village has its headman. If the chief dies and his sons are not responsible enough, then, the chief is selected from near kins of the same lineage. However, in case, the hereditary chief had violated the perennial customs and traditions of the people, he might be removed from office. The Aimols of Manipur are divided into two moieties without specific names. Each moiety is further divided into two phratries and each phratry has two clans or sib. Moieties are exogamous and one of them is considered superior to the other. The superior moiety reserves all the posts of the village organization including that of the priest. Both the moieties perform specific religious rites and ceremonies of the tribe, separately. Each has some special performances too. But ceremonies involving higher social status are performed only by the members of the superior moiety. The social structure of Aimols is thus typical with two moieties, four phratries and eight clans.

3.2. Inheritance Pattern: The Aimol tribe has a wide range of customs in inheriting the property. The rule of Primogeniture operates regarding succession to office with the immovable property being shared among the sons, except the original

home, which is retained by the youngest son. This is because the youngest son is the one who is yet to establish his own home while the elder siblings, during the lifetime of the father, had already established their permanent homes under his direction (Narendra, 1995). The eldest son gets the lion's share. The daughter gets immovable property.

3.3. Socialization of Girl Child and Division of Labour: The Aimol people have adapted themselves to the ecology of their habitat. Though they have a poor economy, they are hard-working. The girl child has many important roles to play in their society. They learn all sorts of domestic and economic activities from their early childhood in the society. She assists her parents in household work and economic activities. Division of labour is not the biological criterion in the Aimol society but it is also related to their social organization and is also often a direct reflection of physiological differences between males and females. The ploughing and levelling are exclusively done by the male folk only, while other agricultural works like sowing a collection of seedlings from s seed bed, carrying the seedling, plantation, weeding, manuring, irrigation, harvesting, threshing, storing of crops are shared by the both male and female. The teenage girl performs routine duty from dawn to dusk, from courtyard to working field, house to market and kitchen to school.

Moreover, the girls in Aimol society look after youngsters and in some cases; they carry the infant brother/sister to a working mother's place for breast-feeding. The female fetches water, and fodder, washes the cloth and utensils, husk paddy in the dhenki or shuk and shumbal (Mortar and pestle husking machine), cooks food and serves among the family members. Sometimes the females carry and sell the vegetables and eggs in the local market and purchase the daily commodities. The girl child learns the traditional songs and dances from the female members of the society.

3.4. Demographic Aspect: A total sample of 325 currently married couples, representing 228 from the Chandel district, 66 from the

Churachandpur district and 31 from the Senapati district have been collected. The female literary percentage is only 69.24%, lower than the male 73.2%. The life expectancy is almost equal in both genders. Early marriage is commonly found in females, work participation rate of the females is the same as that of the males in the Aimol society.

3.5. Marriage and Bride Price: Women are considered essential and useful in the Aimol family for procreation, rendering of domestic as well as economic duties and overall procreation of the domestic life. It is traditionally the groom's party that first enquires about the suitable bride through kin members in the society. The people still practice giving the bride price as a traditional custom. In early times, they practiced marriage by service and the groom performed manual labour for a period, at they would be in law's place if they were unable to pay a fixed amount of bride price in cash as well as kind. On the other hand, bride wealth is not just an economic transaction, but it involves a whole gamut of kinship relations between two families for life. After the marriage, she thinks of herself as a wife and a prospective mother and she performs her routine duty from dawn to dusk in earnest and vigour in all spheres of socio-economic and religious life.

3.6. Differentiation: The male and female populations are very cooperative and help each other in whatever way they can. There is no show of contempt towards the unfortunate like orphans, widows and the unable they are given the main priority. The widows are even allowed to remarry. The people do not try to interfere in domestic matters. In the case of events like divorce or the birth of an illegitimate child, they leave it to the family to solve by themselves. The status of the aged is unquestionable in Aimol, they are regarded with respect and dignity.

3.7. Widowhood and Old Age: A widow remarriage is permissible, if she is young and industrious. The widow contributes to the economy of the respective family in terms of participation in agricultural activities, preparation of rice, collection of forest products, domestic

works, and thus can have an income of her family or own. The digression of old age is closely related to the ageing process. An aged lady and widow try to adjust to her family and as well as with society.

3.8. Right in Property of Land: The settled agriculturist Aimol does not have a well-established concept of inheritance of landed property to the next generation. Their lineage consists of descendants in the male line (landed property). A wife has no right to land property. Remarriage is possible for a woman of childbearing age; the man has to give her land for maintenance. After the death of the husband, his widow becomes the head of the family automatically.

3.9. Education of Female: Margaret Mead (1943) defines education as "the cultural process, how each new-born human infant is transformed into a full member of a specific human society." The traditional culture of the Aimols has been transmitted from generations through the cultural process and they learn many things as essential parts of life in an informal way from the society. The Aimols are generally apathetic towards girls' formal education due to many factors like traditional culture, poor economic conditions, lack of suitable environment and infrastructure facilities, etc. The parents are very practical in their view regarding the education of girls. They think that a girl child is not a permanent member of her parental residence. Besides, it is difficult to find a suitable educated groom for an educated girl. Parents are more interested in training the girl child in all sorts of domestic work since childhood than in encouraging her in education.

3.10. Participation in Decision Making: The male people make major and vital decisions at the family level due to the dominance of males, as is practiced in a patriarchal society. But there are some exceptions too. An educated and service-holder woman places her opinion and takes part in decision-making in her family. Her participation in decision-making is the result of modern education, awareness as well as the impact of neighbouring Meitei culture.

4. CONCLUSIONS

The girl child in Aimol society is more dependent on her mother from whom she learns all sorts of domestic work, through the socialization process. There is a clear division of labour between a man and a woman. Women have many vital roles in socio-economic life. But they are discriminated against in many other spheres of life like education, property rights, religion and politics. Further, there are many taboos associated with their socio-religious life. The gender composition of the Aimol society reflects their positive social orientation. A female child is taken as an economic aspect of the family. The early marriage of the Aimol female hurts their health, economy and education. Their fertility rate indicates better health and economic condition, equal life expectancy indicates the positive aspect of women's position and the work participation of the women indirectly shows the positive impact of their position. The Aimol society acknowledge the contribution of women to the welfare of the family and the smooth functioning of the house. There are some changes, which have taken place in their traditional culture due to the impact of modernity and neighbouring cultures. Viewing the overall observation, the study concludes that the Aimol women play a significant role in the economy and have considerable freedom in social matters.

To sum up, the Aimol women enjoy freedom in inmate selection, divorce, widow marriage, bride price, participation in rituals, rites, ceremonies and festivals, privilege she has about inheritance of property in a few situations can be conveniently placed in the paradigm of positive indicator to her social status. The negative indicators are taboos, participation in decision-making and the political sphere are the strong minus points in their status. A change is observed in the life of women in Aimol society and it, in turn, would bring a change in the views and attitude of men towards their women.

ACKNOWLEDGEMENTS

The Author expresses her sincere thanks to Prof. Kh. Mohon Singh, Editor-in-Chief, Thambal Marik College Research Journal (TMCRJ) for his constructive suggestions in preparing this paper. She is also thankful to the anonymous reviewer to whom the paper was submitted for their valuable comments that improved the quality of the paper.

CONFLICT OF INTEREST STATEMENT

The author declares no conflict of interest.

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Paris polyphylla Smith., The Wonder Herb

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ABSTRACT

An extensive and intensive field survey was conducted to find out the extent of availability of the medicinal plants in 37 villages of Senapati District, Manipur. Altogether 176 medicinal plants have been collected. Out of 176 medicinal plants collected it has been observed that *Paris Polyphylla* is one of the very rare and internationally known medicinal plants and their bio-active molecules have been identified. The plant especially the rhizome possesses anti-tumor and many healing properties. It is also used in the treatment of other diseases such as Japanese encephalitis, ulcers, dysentery, snake bites, diphtheria, tonsillitis, etc. Rhizome paste is applied in fracture. It is found in China, East Asia, and the Eastern Himalayan ranges. In Manipur, it is reported to be found in the Ukhrul, Tamenglong, and Senapati districts. The economic importance of the plant lies in its potential for high medicinal value if the cultivation of this herb will boost the economic status of the tribal people of the district and their sustain of livelihood. GPS was used to record the precise location of the plants during the survey. The satellite location ranges of the identified plants, their therapeutic applications, their bioactive compounds, and the habitat and location where the plants are grown naturally will all be highlighted in the paper.

Keywords: *Paris polyphylla*, Database, Manipur.

1. INTRODUCTION

Paris polyphylla Smith., one of the most significant 24 perennial herbaceous species on the planet, the wonder herbs are considered a gift from God to humanity in general and the people of Manipur in particular (Yunheng *et al.*, 2006). It can cure the dreaded cancer in addition to treating tonsillitis, ulcers, dysentery, snake bites, diphtheria, and Japanese B encephalitis (Anonymous, 2002). The herb grows throughout Eastern Asia and Europe, especially in the Himalayan Mountain ranges. This herb has been used traditionally in Chinese medicine to treat cancer. In vitro investigation by. Polyphyllin A, B, D, gracillin, glycosides, and saponins are the six compounds that have been shown by Chinese scientists and pharmaceutical researchers to possess medium to significant inhibitory properties against the growth

of cancer cells (Anonymous, 2002).

Systematic position of *Paris polyphylla* (*Daiswa polyphylla*) :

Kingdom: Plantae

Order: Liliales

Family: Melanthiaceae

Genus: *Paris*

Species: *Polyphylla*

2. MATERIALS AND METHOD

A data-basing field survey was carried out in 6 sub-divisions, namely Mao Maram (inhabited by Nagas), Paomata (inhabited by Naga) Purul (inhabited by Naga), Kangpokpi (inhabited by Kuki), Saikul (inhabited by Kuki), SaituGamphazol (inhabited by Kuki) of Senapati District, Manipur. Each sub-division consisted of six survey teams,

each team comprising two persons one village elder (a local expert) and a field assistant who did the write-up. These teams visited the natural habitats and assessed the extent of availability of the medicinal herbs with the help of GPS and then took photographs of the plants in their natural habitat. The information was collected and documented including traditional uses of plants along with plant parts used and from literature the chemical composition and active principles were documented. The collected medicinal plants are identified with the help of a taxonomist.

3. RESULTS AND DISCUSSION

Melanthiaceae family, Paris is found in eastern Asia and Europe, and its maximum height can reach one meter. It has extremely strange flowers with long, yellow anthers that radiate outward. The word "pars," which describes the symmetry of the plant, is the source of the genus name. 'Phyla' means leaves, and 'poly' means many (Anonymous, 2002). It is referred to as Pekhepoh in Paumei and Singpan in Manipuri dialect.

The herb has whorled leaves with smooth margins that are 6-7 inches long, slender, pointed, and green. It also has smooth, erect, aerial herbaceous stems with a rhizome. Venation lanceolate, reticulate, parallel. There is a yellow-green flower that resembles a spider above this whorl of foliage. There is no leaf sheath protecting the lone terminal inflorescence. Regular bisexual flower with two perianth series, three, four, or five tepals, and outer and inner smaller and larger sepals. Androecium 6–11, stamen-free. Gynoecium: three pistils, one carpel. syncarpous superior ovary. The months of July and August are when Paris blooms. The flower can last for up to three months before giving way to spherical, ½-inch green capsules that split open to reveal shiny red seeds in late summer when they are ripe. An adult fruit has between 50 and 60 seeds.

For those who are interested in alpine, this rhizomatous plant is of rare occurrence. Originating in the cold mountainous areas of China, India, and the Himalayas. This perennial herb prefers the woodland areas, especially the streamsides, thickets,

and forests. It grows well in full or partial shade in light, sandy, moist, humus-rich soil. Sometimes a plant's above-ground components take a year to emerge. At elevations between 100 and 3500 meters above mean sea level, it grows well.

The rhizome is the most useful and often utilized portion of the plant, though the entire plant is used medicinally. While the rhizome has numerous medicinal qualities, including antiphlogistic, antispasmodic depurative, anti-tussive, narcotic, and analgesic effects, the entire plant can be used as a febrifuge. A rhizome decoction is employed to treat poisonous snake bites, epidemic Japanese B encephalitis, boils and ulcers, and diphtheria. The rhizome has demonstrated antimicrobial activity against hemolytic streptococci, Meningococci, E. Coli, B. typhi, B. paratyphi, Bacillus dysenteriae, and typhi. It eliminates heat, neutralizes toxins, reduces swelling, eases pain, and stops convulsions. Photographs of the plant and its parts have been attached to the Plate-I

3.1. Anti Tumour Action: Chinese researchers studying biotechnology and pharmaceuticals have extracted and examined anti-tumour active ingredients from Paris polyphylla rhizome. Column chromatography was used to separate the anti-tumor active ingredients from Paris polyphyllavar. yunnanensis's rhizome. The following six compounds were "obtained: pennogenin - 3 - 0 - alpha - L arabinofuranosyten - 3 - 0 - beta - D - glycopyranoside (3), ethyl - alpha - D Fructofuranoside (4), pennogenin -3- rhamnopyranisyl (1-->2) - beta - D - glycopyranoside (5), and pennogenin-3-0-a I pha - L - rhamnopyra [alpha-L-rhamnopyranosyl (1-->2)]. glycopyranoside -beta-D- (6). Yu *et al.* (2007). "Hemostatic" drugs such as Paris polyphylla var. yunnanensis has been utilized. According to reports, this herb's crude medication coagulates more quickly than Paris polyphylla var. chinensis (Zhou, 1989). All six of the compounds have been shown to exhibit medium to significant inhibition through in vitro research. China has made extensive use of Paris polyphylla Smith var. yunnanensis (TSSP), a total steroidal

saponin, to treat abnormal uterine bleeding (AUB). Total Spirostanol Saponins demonstrated contractile activity in the myometrium and pennogenin - 3 - O - β - L - arabinofuranosyl (1-4) [β -L-rhamnopyranosyl (1-2)] through bioassay-guided separation. It was determined that 1- β -D glucopyranoside (PARG) was the active component of TSSP (Guo *et al.*, 2008). Strong, actively contracting uterine muscles were demonstrated by saponins 6 and 7. These two saponins have been effectively used to treat gynaecological haemorrhage (Zhou, 1989). The herb's rhizome has been shown to contain antileishmanial and tyrosinase inhibitory constituents. According to research from the Department of Biochemistry in Hong Kong, human breast cancer cell growth is inhibited by podophyllin D, a steroidal saponin found in *Paris polyphylla*. It was discovered that applying polyphyllin D to specific tumour cells caused a dose-dependent reduction in viability and an increase in apoptosis. China's Nanjing Pharmaceutical University has reported that this plant / herb has analgesic and sedative properties.

This herb has been used as a primary treatment for cancers of the liver, stomach, nose, and throat, as well as a secondary treatment for lung cancer, by Chinese traditional medical healers or practitioners. Mechanistically, the plant's polyphyllin D dissipates the membrane potential and mitochondria, causes the expression of pro-apoptotic Bax to increase and anti-apoptotic Bcl-2 to decrease, and activates caspase-9. The findings implied that mitochondrial dysfunction is the mechanism by which polyphyllin D induces apoptosis. This further offers new evidence that polyphyllin D may be a viable treatment option for breast cancer (Anonymous, 2002).

3.2. Bioactive Compounds Present in the Plant: The primary bioactive ingredients in this miraculous herb have been identified as oligosaccharides, periphyllin A, B, and D, and gracillin (Anonymous, 2002). Glycosides and saponins (C-27 steroid hemostatic saponins) are additional significant components. From the rhizome, two new steroidal saponins have

been isolated: furastanol steroidal saponins and spirostanol steroidal saponins, which together comprise polyphyllin A–H (Rastogi and Mehrotra, 1993).

3.3. Economic Importance: Senapati sells the rhizome for Rs 500–600 per kilogram, while Moreh charges much more. On the global market, it might even be higher. Paris is the only other medicinal plant with such a high market value. Thus, the villagers and traders in the area will be amazed by the widespread cultivation and production of this miracle herb, as well as by its subsequent legal marketing. The people of Manipur will benefit greatly if the plant is grown widely and trade is controlled.

3.4. Current Availability of the Plant in Manipur: Maram (N 25°25'379", E 094°05'015", Elevation 1828.8m) and Hengbung (N 25°14.075', E 094°00.187', Elevation 1213m) are two locations where the plant can be found growing. Purul (N 25°22.465', E 094°13.810', Elevation 1668m) and Makui (N 25°07.871', E 093°49.133', Elevation 1253.64m). The research team has visited a number of the district's villages and observed the extent to which these amazing herbs are available. Still, there might be some locations that the team is currently unable to access. The proposal to investigate the unreached villages is being considered and will be investigated in the coming days.

4. CONCLUSIONS

Local traders and villagers are profiting financially from the wonder herb's exploitation in its natural habitat, and if the current illegal trading trend continues without conservation as well as mass production approach, the herb risks extinction. The current and pressing goal for scientists, researchers, NGOs, locals, and government agencies is to protect the plant in its native environment. Alongside government agencies with scientific and technical know-how, villagers, non-governmental organizations, and government agencies will plant this miracle herb extensively. Pharmaceutical companies are required to extract the bioactive compounds from

the herb, and the relevant authorities may pursue legal action to patent both the herb and its bioactive compounds.

PLATE-1



PARIS LOWER



PARIS FRUIT



PARIS RHIZOME

ACKNOWLEDGEMENTS

The authors would like to express their profound gratitude to the inhabitants of the region who offered important ethnobotanical information for the survey, as well as the NRDMS, DST Ministry of Science and Technology, Government of India for their financial support. They are also thankful to the anonymous reviewer to whom the paper was submitted for their valuable comments that improved the quality of the paper. They are also express their gratitude to Prof, Kh. Mohon Singh, Editor-in-Chief, Thambal Marik College Research Journal (TMCRJ) for his constant guidance and suggestions.

CONFLICT OF INTEREST STATEMENT

The author declares no conflict of interest.

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“Enhanced Properties and Potential Applications of Polyvinyl Alcohol/Na⁺-Montmorillonite Nanocomposites”

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ABSTRACT

Nanocomposites of polyvinyl alcohol (PVA) and sodium montmorillonite are new hybrid materials that show promise due to their improved characteristics and wide range of possible uses. In this study, we investigate these nanocomposites and their potential uses, properties, and production. In fields such as food packaging, pharmaceutical packaging, and environmental remediation, where the preservation of product freshness and extension of shelf life is of utmost importance, the barrier properties of PVA/Na⁺ montmorillonite nanocomposites provide advantages. This research aimed to create and characterize nanocomposites of polyvinyl alcohol with sodium montmorillonite (Na⁺-MMT). After being utilized as a polyvinyl alcohol charge, the montmorillonite underwent a series of tests, including thermo gravimetric analysis (TGA) and X-ray diffraction (XRD). The isotherm-based results of a volumetric CO₂ adsorption experiment at room temperature (RT) suggested that PVA modification of MMT-PVA could increase its CO₂ adsorption capacity. These findings establish that nanocomposites are formed by MMT intercalation and that the interlayer distance increases with increasing MMT concentration. The capacity of Na⁺-MMT to absorb CO₂ is lower than that of Nanocomposite. In conclusion, the vast possibilities offered by PVA/Na⁺ -montmorillonite nanocomposites as adaptable materials for various industrial uses are brought to light in this research study, opening the path for novel and environmentally friendly solutions.

Keywords: Nanocomposites, Characterization, Material, Application, Alcohol

1. INTRODUCTION

A noteworthy development in the realm of polymer materials can be seen in the nanocomposites of polyvinyl alcohol (PVA) and sodium montmorillonite. This nanocomposite material combines the best features of sodium montmorillonite with polyvinyl alcohol, making it useful in many different contexts. PVA is a synthetic polymer that is soluble in water, has great film-forming capabilities, is biodegradable, and is very flexible. In contrast, the layered clay mineral sodium montmorillonite has a high cation exchange capacity and a sizable specific surface area. Sodium montmorillonite nanoparticles dispersed inside a

polyvinyl alcohol matrix are the building blocks of PVA/Na⁺-montmorillonite nanocomposites. To ensure that the nanoparticles are evenly distributed and intercalated throughout the polymer matrix, this dispersion process is vital. Hydrogen bonding and van der Waals forces allow PVA chains and montmorillonite surfaces to interact, allowing a suitable nanocomposite structure to be formed. When sodium montmorillonite nanoparticles are mixed with polyvinyl alcohol (PVA), the mechanical strength, thermal stability, barrier characteristics, and biodegradability of the material are vastly improved over pure PVA.

Polymer chains can be intercalated and exfoliated into montmorillonite's layered structure, which improves the material's mechanical characteristics. Nanocomposites enhanced with montmorillonite nanoparticles are thermally stable, making them useful in high-temperature environments.

The wide range of possible industrial applications is one of the main benefits of PVA/Na⁺montmorillonite nanocomposites. Because of their improved gas and moisture barrier qualities, these nanocomposites find application in packaging materials. Their mechanical characteristics and biocompatibility make them useful in biomedical applications like tissue engineering scaffolds. The enhanced permeability and selectivity of PVA/Na⁺montmorillonite nanocomposites make them useful in membrane technology for water purification. PVA/Na⁺-montmorillonite nanocomposites are an exciting new material class with versatile, tailor-made characteristics. Materials with the ability to solve problems in fields as diverse as packaging, healthcare, and environmental remediation are gaining interest because their production parameters and nanocomposite composition can be precisely controlled.

1.1. Sodium montmorillonite: This layered clay mineral, sodium montmorillonite, is a member of the smectite family. A tetrahedral sheet separated by two octahedral sheets forms the basis of each successive layer in its multi-layered structure. Sodium montmorillonite's molecular formula is as follows:

1.1.1. Tetrahedral Sheet: In a hexagonal lattice, silicon (Si) and oxygen (O) atoms form the tetrahedral sheet. In tetrahedral units four oxygen atoms around each silicon atom. The oxygen atoms at the corners of these tetrahedra form a continuous sheet.

1.1.2. Octahedral Sheets: The structure contains two varieties of octahedral sheets:

1.1.2.1. Aluminum Octahedral Sheet: In this sheet, an octahedral arrangement of six oxygen atoms coordinates with aluminium (Al) atoms.

While in a perfect world, all of the aluminium atoms would be replaced with magnesium (Mg) or iron (Fe), this is not always the case in natural samples of montmorillonite.

1.1.2.2. Magnesium or Iron Octahedral Sheet: A mixed-layer structure can occur in naturally occurring montmorillonite when magnesium or iron ions replace some of the aluminium ions in the octahedral sheet.

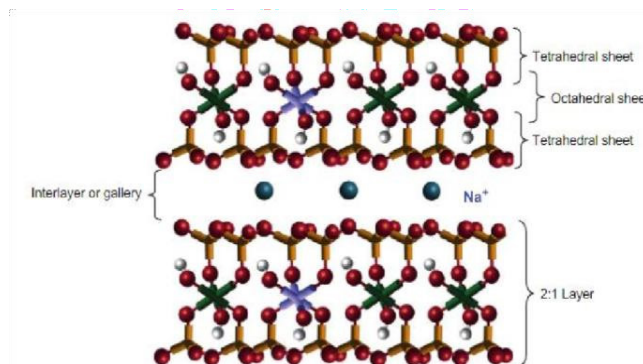


Figure 1 Structure of sodium montmorillonite

1.1.3. Interlayer Space: There is an interlayer space between the stacked tetrahedral and octahedral sheets. The clay layers' negative charge is balanced by exchangeable cations, which occupy this area. Examples of such cations are sodium (Na), calcium (Ca²⁺), and magnesium (Mg²⁺). Sodium is the most abundant exchangeable cation in sodium montmorillonite.

1.1.4. Charge Balance: Because aluminium is isomorphically substituted with lower valence cations, the tetrahedral and octahedral sheet layers have a negative charge. In the interlayer space, there are exchangeable cations that balance the charge on the layers, resulting in a mineral with no charge at all.

1.1.5. Water Absorption: Another distinguishing property of montmorillonite is the existence of water molecules in the interlayer region. A clay mineral's swelling behaviour and cation exchange capacity are affected by the water molecules that can be exchanged with other polar molecules or ions.

Sodium montmorillonite has an octahedral and tetrahedral sheet configuration with room

between the sheets for exchangeable cations. The mineral's structure gives it unique qualities that make it desirable in industrial and environmental applications. These properties include a large surface area, cation exchange capacity, and swelling behaviour.

1.2. Potential Applications of Polyvinyl Alcohol (PVA)/Na⁺ Montmorillonite Nanocomposites: Nanocomposites of polyvinyl alcohol (PVA) and sodium montmorillonite have several desirable characteristics, which make them potential materials for use in a wide range of industries. The following are examples of possible uses:

1.2.1. Packaging Materials: High-performance packing materials can be made using PVA/Na⁺-montmorillonite nanocomposites. Food and pharmaceutical packaging, as well as other uses requiring prolonged product freshness or biodegradability, might benefit from their increased mechanical strength, barrier characteristics, and biodegradability.

1.2.2. Biomedical Applications: Nanocomposites made of biocompatible polyvinyl alcohol and nanoparticles of montmorillonite, which may have antibacterial effects, show great potential for use in the medical field. Implant coatings, wound dressings, tissue engineering scaffolds, and drug delivery systems can all benefit from their ability to promote tissue regeneration through the controlled release of pharmaceuticals or bioactive substances.

1.2.3. Textile Industry: Textiles can have their characteristics improved by using PVA/Na⁺-montmorillonite nanocomposites. Manufacturers may create long-lasting and versatile textiles by combining these nanocomposites with fabric, which enhances mechanical strength, thermal stability, and moisture resistance.

1.2.4. Coatings and Films: Nanocomposites of PVA and Na⁺-montmorillonite are perfect for use as coatings or films due to their barrier qualities and thermal stability. A few examples of their potential uses include making high-performance films for use in electronics, solar cells, and flexible

displays, as well as corrosion-resistant coatings for use on metal substrates

1.2.5. Environmental Remediation: Research on the possible uses of montmorillonite nanoparticles in water purification and soil remediation has been conducted as part of environmental remediation efforts. Montmorillonite, when combined with PVA matrices, has the potential to improve the performance of filtration membranes and adsorbents, which in turn could help clean up water and soil systems by removing pollutants and contaminants.

1.2.6. Construction Materials: The construction industry has the potential to use PVA/Na⁺-montmorillonite nanocomposites to improve the qualities of building materials. Concrete, mortar, and other building materials can have their mechanical strength, fire resistance, and durability enhanced with their help, resulting in safer and more environmentally friendly infrastructure solutions.

1.2.7. Electronics and Energy Storage: Potential possibilities for usage in electronics and energy storage devices include PVA/Na⁺-montmorillonite nanocomposites due to their unique features, which include thermal stability and mechanical strength. They have the potential to enhance the performance and dependability of electronic components, capacitors, batteries, and energy storage systems by being integrated with them. There is a vast array of potential uses for PVA/Na⁺-montmorillonite nanocomposites due to their adaptable characteristics. These uses include packaging, biomedicine, textiles, coatings, environmental remediation, building, and electronics. Further investigation into this area is likely to reveal even more creative uses for these cutting-edge materials.

2. REVIEW OF RELATED STUDIES

Barman Milan *et al.*, (2022). Out of all the nanocomposites that are now available, biopolymer nanocomposites stand out as the most valuable. Nanocomposites made of biopolymers

are inexpensive, environmentally benign, and biodegradable. Because of these characteristics, biopolymer nanocomposites are a great alternative to nanocomposite materials made from petroleum in many different contexts. Because of their better size distribution and dispersion, as well as their dispersion at varied sizes, clay-polymer nanocomposites have desirable physical, chemical, and mechanical properties in comparison to pure polymers. Though Earth is home to a variety of biopolymers, starch is by far the most common. It is a significant natural polymer due to its physical and chemical characteristics.

Karimi Ali & Daud Wan, (2016). Using a freeze-thaw technique, a novel class of nanocomposite cryogels was created, consisting of polyvinyl alcohol and 0-10% of unmodified hydrophilic natural Na-montmorillonite (Na-MMT). The research was conducted at 37°C to determine the optimal nanoscale content by examining the effects of sonication on the shape and thermomechanical characteristics, equilibrium water content (EWC), and water vapour transmission rate (WVTR) of nanocomposite films. Additionally, the study examined the nanocomposites' water sorption and desorption kinetics. Nanocomposite cryogels' swelling properties and water vapour transmission rate might be enhanced by using (Na MMT) as a co-crosslinker, according to the results. Additionally, they demonstrated that the ideal nano clay critical concentration for achieving the desired sorption and desorption properties, along with WVTR and EWC, was within the permissible range for use in skin and wound dressings.

Raheel Muhammad *et al.*, (2014). Graphene oxide-montmorillonite(GO-MMT)nanocomposites based on poly (vinyl alcohol) (PVA) can be easily and efficiently prepared in water using a green technique. The GO-MMT nanohybrid is created by mixing GO and MMT in water without the use of any agents to reduce or stabilize the mixture. The effects of hydrogen bonding and crosslinking cause the development of the GO-MMT nanohybrid. When GO sheets and MMT platelets

are crosslinked, it is because of the sodium ions contained in the MMT sheets. To define the final nanocomposites, many analytical tools are used, including mechanical testing, thermogravimetric analysis (TGA), scanning electron microscopy (SEM), differential scanning calorimetry (DSC), and X-ray diffraction (XRD). As a consequence of the nano additives' strong interfacial adherence to the PVA matrix, PVA nanocomposites exhibit improved mechanical characteristics and thermal stabilities as compared to pure PVA. In comparison to PVA/GO and PVA/MMT nanocomposites, the GO- MMT hybrid exhibits superior mechanical qualities and higher tensile strength and modulus due to the strong contact between PVA chains and multilayer GO-MMT.

Sapalidis A. A. *et al.*, (2012). An efficient method for producing high-loaded, well-dispersed PVA/bentonite nanocomposites with enhanced characteristics via nanoscale interactions is detailed in this work. Consequently, a battery of tests including atomic force microscopy, transmission electron microscopy, X-ray diffraction, water sorption, oxygen and water permeability, and mechanical and thermal studies were conducted on a series of nanocomposites made of poly (vinyl alcohol) and bentonite clay using the solvent casting technique. The use of XRD and microscopic methods uncovered very structured areas. A high degree of exfoliation was achieved in nanocomposites with a clay concentration of up to 10%. In addition, samples with 20% filler content showed well-organized intercalated regions in addition to the delaminated areas. The nanocomposites maintained their transparency while showing improved mechanical, thermal, and gas barrier capabilities. The oxygen permeability was reduced by approximately seven times and the Young's modulus was enhanced by 193 times in the sample that contained 20% clay compared to the neat polymer. Using nanoscale phenomena as a foundation, the results showed that the organized structures and intercalated regions on heavily loaded samples are caused by the competitive effect of weaker polymer-polymer interactions compared to stronger polymer-clay ones.

Yeum Jeong, (2011) For the first time, nanocomposite microspheres made of poly (vinyl alcohol) (PVA) and montmorillonite (MMT) clay were created using suspension polymerization and heterogeneous saponification. Researchers looked at how MMT affected the rate of saponification in PVAc microspheres. The inclusion of MMT particles was observed to considerably boost the saponification rate of PVAc. Purified PVA manufactured under the same conditions has a higher molecular weight than PVA recovered from PVA/MMT. The presence of clay platelets intercalated inside the polymer matrix was demonstrated by TGA, TEM, and XRD analyses.

3. RESEARCH METHODOLOGY

3.1. Preparation of Sodium Montmorillonite (Na⁺-MMt) for Nanocomposite Synthesis: The production of Na⁺-MMt, with NaCl as the cation source, was accomplished through the ion exchange method. Twenty grams of MMT were heated to 105 degrees Celsius for 20 minutes using the same crushing and drying conditions and time frame as our earlier reported investigation. Adding 500 ml of a 1 M NaCl solution and stirring the mixture magnetically at room temperature for three hours, or until saturation is obtained, is the process for treating the powder. To eliminate any leftover Cl, the mineral is dried at 105 degrees Celsius and then rinsed with distilled water.

3.2. Preparation of Polyvinyl Alcohol/Na⁺-MMt: The MMT-PVA nanocomposites were synthesized using an MMT/water suspension as the precursors and dissolved PVA as the reactants. First, after dissolving Na-MMT in water at a 25% weight concentration, we sonicated a solution in distilled water for approximately 2 hours. To dissolve the polyvinyl alcohol (PVA), the mixture was heated to 90 degrees Celsius, sonicated for an extra hour, and then let to sit for another 24 hours. Following a day of heating to 60 degrees Celsius, the castings were allowed to cool to room temperature before being preserved for subsequent analysis. The compositions were supplemented with sodium montmorillonite in weight percentages ranging from 1% to 15%, with the polymer content remaining constant.

3.3. Characterization Techniques Adopted: At room temperature, X-ray diffraction measurements were taken across a temperature range of 2.0-80°C using a Bruker D8 Advance X-Ray Diffractometer (40 kV, 30 mA) and CuK radiation ($k=0.154$ nm) at a rate of 2 min⁻¹ for 2 hours. Furthermore, thermogravimetry (TG) was conducted using 51 pieces of Shimadzu Thermogravimetric Analysis (TGA) equipment in an atmosphere with 50 millilitres of air per minute, with temperatures ranging from 0 to 900 degrees Celsius at a rate of 10 degrees Celsius per minute. The total mass of the sample was 5.0 0.5 mg. The ASAP 2020 V4.01 apparatus from Micromeritics was used to construct CO₂ adsorption isotherms at 0 °C. We put 100 milligrams of the nanocomposite sorbent into the sample cell after weighing it. Outgassing the nanocomposites in a vacuum at 170 degrees Celsius eliminated the contaminants bound to the adsorbate. Low pressures (5-760 mmHg) were utilized in the adsorption process, which made use of very pure CO₂ (99.999%).

4. RESULTS AND DISCUSSION

The atomic structure of a nanocomposite containing different concentrations of MMT in a PVAmatrix was investigated using X-ray diffraction (Figure 2). In comparison to the unmodified clay, the DRX spectra of Na⁺-exchanged MMT reveal a displaced base peak at $d_{001}=11.87$ (d_{001} , derived by Bragg's rule, $d_{001}=\lambda/2 \sin \theta$). The basal spacing has changed as a result of the presence of water molecules in the interlayer area. The watered galleries for this are to blame.

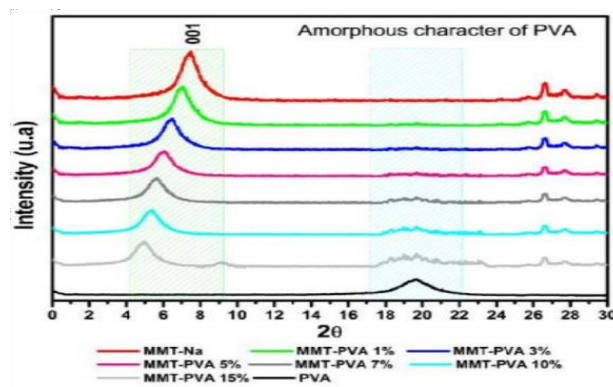


Figure 2: Nanocomposite MMT-PVA using XRD patterns

When looking at the XRD pattern of MMT-PVA nanocomposites, you can see that the base peak 001 is distant from the centre, unlike in Na-MMT. For MMT-PVA nanocomposites with 1, 3, 5, 7, 10, and 15% by weight, the interlayer distance is 12.54 nm, 13.73 nm, 14.58 nm, 15.78 nm, 16.64 nm, and 17.77 nm, correspondingly. The interlayer gap has shrunk because polymer chains have intercalated between the clay layers.

Although the volume was larger for the nanocomposite with a lower MMT content (10% wt), the peak for this sample (MMT-PVA, or 15%) was different because the clay particles' crystal structure had been altered. At $2\theta = 19.54^\circ$, the produced MMT-PVA nanocomposites displayed varying intensities, a result of the amorphous nature of PLA.

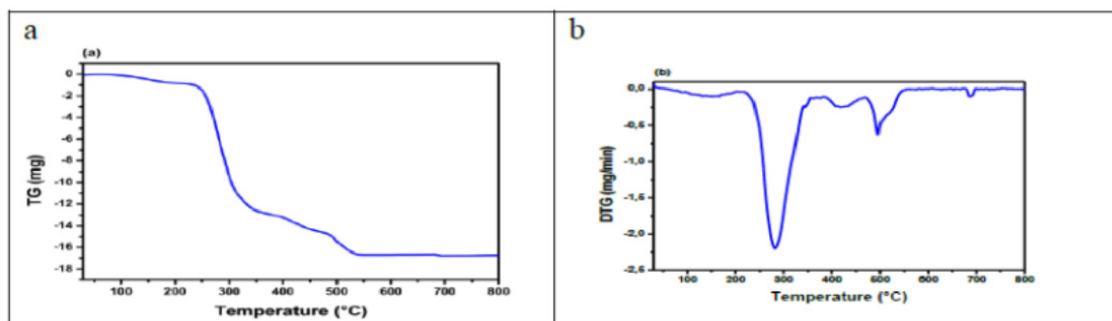


Figure 3: TGA/DTG analysis curves for MMT-PVA

Nanocomposite MMT-PVA (15%) has its thermal stability window determined by thermogravimetric analysis (TGA). It is seen in Figures 3a and b. Consistent with earlier results, the TGA curve for the 15% MMT-PVA nanocomposite shows three separate phases of mass loss. The results show that at temperatures between 30 and 200 degrees Celsius, physisorbed water degrades, and at temperatures between 220 and 390 degrees Celsius, PVA degrades as well, resulting in net mass loss. This is in agreement with the results from DRX and FTIR. Strawhecker and Manias also noticed this behaviour.

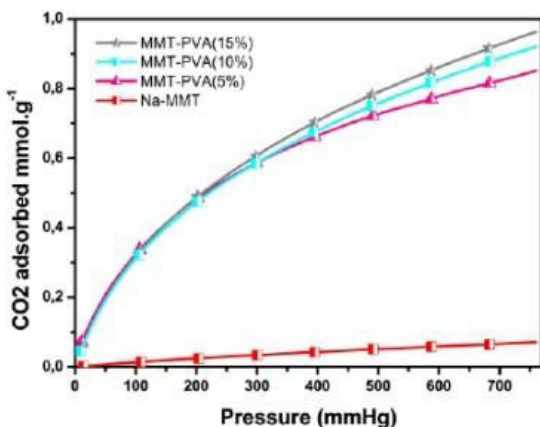


Figure 4: Sorption isotherms of CO₂ on the nanocomposite MMT-PVA at 0°C.

At 5, 10, and 15% saturation, the isotherms for CO₂ adsorption by Na-MMT and MMT-PVA are shown in Figure 4. With a CO₂ adsorption capacity of only 0.07 mmol g⁻¹, the cation exchange-modified clay stands in stark contrast to layered materials like Kanemite and Smectite. Because these materials have low surface basicity, their CO₂ adsorption behaviour is uniform across surfaces. Some research suggests that nanocomposites can enhance CO₂ adsorption; for example, adding 5% MMT-PVA increased CO₂ adsorption by 0.85 mmol.g⁻¹, 10% by 0.92 mmol.g⁻¹, and 15% by 0.96 mmol.g⁻¹ respectively. This transition relies heavily on the chemical and structural properties of the nanocomposite used since OH groups are thought to be active sites for CO₂ molecular collection. Weak interactions with carbon dioxide and hydroxyl groups may also help to support water molecules that have been physisorbed into the nanocomposite structure. The interlayer distance is one of the variables that affect the efficiency of carbon dioxide (CO₂) adsorption. Increases in the interlayer gap between nanocomposite layers may lead to increased CO adsorbed into these structures.

5. CONCLUSIONS

Ultimately, research into nanocomposites made of polyvinyl alcohol (PVA) and sodium montmorillonite has shown a plethora of useful improved characteristics and exciting new possibilities for use in many different industries. These nanocomposites have exhibited impressive mechanical strength, thermal stability, and barrier properties thanks to their painstaking synthesis and characterization. To better understand the improved properties and possible uses of Polyvinyl Alcohol/Na⁺-Montmorillonite (Na⁺-MMt) nanocomposites, this work set out to generate and characterize such materials. To evaluate the performance of the nanocomposites, a battery of experiments was carried out using montmorillonite as a charge for polyvinyl alcohol. These tests included thermogravimetric analysis (TGA) and X-ray diffraction (XRD). The results of the volumetric CO adsorption at room temperature (RT) were quite instructive, showing that the addition of PVA to MMT-PVA did increase its CO adsorption capacity. With a noticeable rise in interlayer distance as the MMT concentration increases, these results demonstrate that MMT intercalation is crucial to the creation of nanocomposites. It is worth mentioning that when comparing the nanocomposite with Na⁺-MMt, it becomes clear that the latter has a lower capacity for CO₂ absorption. These findings demonstrate that modifying Na⁺-MMt nanocomposites with PVA improves their characteristics, which opens up possibilities for their use in several fields like packaging, biomedicine, and environmental cleanup. Sustainable and novel materials with varied capabilities are about to be developed, thanks to the promising results of this research. These materials will tackle urgent problems in many different industries.

ACKNOWLEDGEMENTS

The authors would like to express their heartfelt thanks to all those who have contributed to the successful completion of this research paper.

They are also thankful to the anonymous reviewer to whom the paper was submitted for their valuable comments that improved the quality of the paper. They also express to thank Asem Indrakumar and Oinam (O) Surnolata Devi and their family members for their support in preparing the paper. Finally, they extend their appreciation to Prof. Kh. Mohon Singh, Editor-in-Chief, Thambal Marik College Research Journal (TMCRJ) and Dr. Vinesh Kumar, Associate Professor, RCPs University, Roorkee for their constructive suggestions.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

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Phytochemical Evaluation of the Rhizome of *Kaemferia Rotunda*

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ABSTRACT

Many plants have medicinal properties due to their presence of biologically active phytonutrients content. Phytonutrients are harmless plant chemicals and form the basis of many modern drugs used to treat various diseases in our daily lives. The main objective of the present work is to carry out the phytonutrient analysis of the rhizome of *Kaemferia rotunda* along with the determination of phenolic and saponin content. Among the solvents used for our study, distilled water was found to contain the highest percentage i.e., 20.50%, whereas petroleum ether extract contained the lowest percentage, 5.20, acetone, methanol, and ethanol were found to contain 15.10, 12.50 and 16.50 respectively. Ethanol and methanol extract contain the same phytochemicals (alkaloid, saponin, flavonoid, tannin, cardiac glycoside, terpenoid, phytosterol, gum, and coumarin); Acetone extract contains flavonoid, tannin, terpenoid, steroid, phytosterol, gum, and coumarin; Chloroform extract contains alkaloid, cardiac glycoside, terpenoid and gum; Petroleum ether extract contains saponin, terpenoid, phytosterol and gum; Distilled water extract contains alkaloid, saponin, terpenoid and gum respectively. Phenolic content was expressed in mg GAE /gm. sample extract and the result was found as 9.42, 14.24, 21.05, and 26.03 for distilled water, chloroform, methanol, and petroleum ether respectively. Lipid content was expressed in gm. /100gm of the powdered sample and found to be content 2.0.

Keywords: *Kaemferia rotunda*, Phytochemicals, Qualitative, Quantitative.

1. BASIC PRINCIPLES

Medicinal plants provide a basis for many useful drugs and are also a good choice for the discovery of new molecular products (G.S. Savige, *et al*, 2001). According to the World Health Organization, 80% of the population in developing countries still relies on folk medicine especially herbs, for important medical treatment needs. From one generation to another generation, many cultural traditions are passed down and spread throughout society. Folk medicine is an important part of the healthcare systems in both developed and developing countries around the world. Folk knowledge systems on medicinal plants have become accepted tools for the discovery of new drugs and nutritional products (Merina Paul Das *et al* 2013). Plants provide important medicinal

properties in most treatments and herbs are becoming increasingly popular in human medicine worldwide due to their beneficial effects (M. Syed Muzammil *et al* 2013). Folk medicines have the potential to be effective in herbal medicine, which has the potential to treat many diseases without intervention, unlike today's synthetic medicine (T. Aiswarya *et al* 2014).

Kaempferia rotunda (family-Zinziberaceae), a fragrant herb with a tuber-like rhizome up to 3 feet long found all over India, in Manipuri, this herb was known as leibaklei also known as *bhuichampaka*, *bhuchampa* and blackhorm in Sanskrit, Hindi, and English respectively (Gurung B., 2002). Rhizomes are taken internally to remove coagulated blood from the body and are also used

in abdominal pain and gastric troubles. Rhizome/root is used as an indigenous hair lotion; applied in swelling and healing of fresh wounds. Local people of Manipur administered the rhizome on tumours. Flowers are used as an ornament.

2. DOCUMENTS AND PROCEDURE

2.1. Selection of Study Material: The mature and physically fit rhizome of *Keamferia rotunda* was grouped in January between Kangmong Village, Imphal West District, Manipur, India, and identified by a taxonomist. At first, the rhizomes were washed two/three times with running water and then the impurities were removed with distilled water. It was then cut into thin slices shaded and dried roughly for about 7 days. Turn the dry sample into a fine powder with a mechanical grinder; then place it in a glass container shielded tightly for later use.

2.2. Extract Making: Extract 100g of the fine powder extracted from each of 500 mL of Petroleum ether, Chloroform, Ethanol, Methanol, and Distilled water in order of polarity and shake occasionally in cool air for 5 days. The solvent was removed from the entire extract by filtration and evaporated to dryness at a low temperature. This crude extract was used for phytochemical analysis.

2.3. Investigation Test: Phytochemical analyses were performed using standard methods used by Harborne J.B. *et al* 1973; Kokate C.K. *et al* 1997; Karunkar Hegde *et al* 2010; Safowara *et al* 1997.

Test for Alkaloids by Hager's test: Mix 6 mL of concentrated extract in a test tube with 2mL of HCl and heat the contents slowly for about 20 minutes, cooling then filter and the filtrate is used for alkaloids analysis. 0.1g of picric acid was dissolved in 10 mL of distilled water and treated 1mL of the plant extract, presence of alkaloid was shown by yellow-colour ppt.

Test for Saponin: Mix 6mL plant extract and 24 mL distilled water in a conical flask, and shake vigorously for about 15 minutes. Develop of foams shows the presence of saponin.

Test for Flavonoid: In a test tube 1mL of

the plant extract was taken to add little drops of dilute NaOH. The intense yellow colour shows the presence of flavonoids.

Test for Tannin: Mix 6mL of plant extract with some drops of 1% lead acetate soln. in a test tube if yellow ppt. shows the presence of tannin.

Cardiac Glycoside: Mix 4 mL glacial acetic acid containing some drops of FeCl_3 solution with plant extract. The brown colour ring shows the presence of cardiac glycoside

Terpenoids: Mix 0.4g of the plant extract with 4 mL of CHCl_3 . Carefully pour conc. H_2SO_4 from the side of the test tube. A reddish-brown colour at the junction of two liquids shows the positive test of terpenoid.

Steroid: 1mL of extract of the plant sample was mixed with 10mL of chloroform, looking closely at the side of the test tube, an equal amount of conc. H_2SO_4 is pure. The top layer turned red and the H_2SO_4 layer turned yellow with green fluorescence showing the presence of steroids.

Phytosterol: Apply chloroform to the plant extract and filter. Add a few drops of conc. H_2SO_4 was to filtrate, strain and shake well, let it sit, golden red colour shows the presence of phytosterol.

Gum: In a test tube mix 3mL each of the plant extract and conc. H_2SO_4 . Add Molisch's reagent to this mixture. The reddish violet ring between the junctions of the two layers shows a positive result.

Coumarin: Add 3mL of 10% NaOH to 2mL of the aqueous extract taken in a test tube; the yellow colour shows a positive sign of coumarin.

2.4. Quantitative Analysis of Lipid: Using the Folch method (J. Folch *et al* 1956), mix 2 g of the dried powder sample and 20 mL 2:1 of chloroform: methanol mixture in a conical flask. Cover the content tightly with aluminium foil and leave at room temperature for one day. Use Whatman no. 1 filter paper to filter the content put the filtrate in a pre-weighed bowl and dry it. Weighing the bowl, the difference between lipid accumulation and the weight was taken as the lipid content.

2.5. Determination of Total Phenolic

Contents: Prepare a solution of 5 mg Gallic acid in 100 mL distilled water in a flask. Transfer from this solution, 0.1, 0.2, 0.3, 0.4, and 0.5 ml into a 25 ml capacity flask. Make the volume 1.5 mL by adding distilled water followed by adding 0.5 mL of Folin-Ciocalteu reagent. Leave out 5 min., then 1 ml sodium carbonate (1M). In parallel way make a solution of crude extract by dissolving 100mgs in 5 mL DMSO. 10 μ L of this solution is mixed with the above reagents. A blank was also made by adding the above reagents. Keep it 1 minute in a hot water bath, at 650 nm record the absorbance; plot a calibration curve for Gallic acid based on absorbance vs. concentration. The quantity of phenolic content can be measured from this curve (C. Rekha *et al* 2012).

3. RESULTS AND DISCUSSION

The result of the phytochemical analysis of crude extract for the rhizome of *Kaemferia rotunda* is shown in Table 1. In our study, it was determined that petroleum ether, chloroform and distilled water contained 4 phytochemicals. Acetone, methanol, and ethanol extract contain the same number of phytochemicals, 8 phytochemicals each. Terpenoids and gum are contained in all the extracts. Table -2 shows the percentage of yield for different solvents. Distilled water extract was found to contain the highest percentage, 20.50%, whereas petroleum ether extract contained the lowest percentage, 5.20, acetone contained 15.10 %, methanol contained 12.50 %, and ethanol contained 16.50 %. Table No.3 indicates the amount of phenolic content in

different solvent extracts expressed in mg GAE / gm. sample extract and lipid content expressed in g /100g of the powdered sample on the rhizome of *Kaemferia rotunda*. Lipid content was found to be 02.0 g. per 100g of the powder samples. Phenolic content for different solvent extracts is in decreasing order as petroleum ether extract > methanol extract > chloroform extract > distilled water extract and the values are 26.03, 21.05, 14.24, and 09.421 mg GAE /gm. sample extract respectively. Fig.-1 represents the Calibration curve of standard Gallic acid while Fig.-2 represents the Bar graph of crude yield. Different parts of *Kaemferia rotunda* (a) Flower (b) Rhizome (c) Plant were shown in Table 3.

Terpene compounds can be used in the treatment of diseases related to oxidative stress due to their strong antioxidant properties (Sies H. *et al* 2000). They have anti-cancer and therapeutic, anti-inflammatory, and anti-hyperglycaemic properties (Sultana N., *et al* 2008; Bhahwal Ali Shah *et al* 2009). Flavonoids have been shown to have antimicrobial, enzyme inhibition, and oestrogenic activities and also have strong antioxidant properties (Tapas A. *et al* 2008; Okwu, D. E. *et al* 2004).

4. CONCLUSIONS

From our investigation, it is concluded that *Kaemferia rotunda* is also a good medicinal plant among the traditionally used medicinal plants. Thus, this study provides some biochemical basis for traditional medicinal use and contributes to knowledge of medicinal plants that will be useful to researchers in the field of ethnopharmacology.

Table - 1: Result of phytochemical screening of *Kaemferia rotunda*

Phytochemical test	Petroleum ether	Chloroform	Acetone	Ethanol	Methanol	Distilled water
Alkaloid	-	+	-	-	-	+
Saponin	+	-	-	+	+	+
Flavonoid	-	-	+	+	+	-
Tannin	-	-	+	+	+	-
Cardiac glycoside	-	+	-	+	+	-
Terpenoid	+	+	+	+	+	+
Steroid	-	-	+	-	-	-
Phytosterol	+	-	+	+	+	-

Gum	+	+	+	+	+	+
Coumarin	-	-	+	+	+	-

+ = Positive, - = Negative

Table 2: Percentage of crude yield.

Name of solvent used	Percentage yields
Petroleum ether	5.20
Chloroform	6.50
Acetone	15.10
Ethanol	12.50
Methanol	16.50
Distilled water	20.50

Table 3: Estimation of phenolic and lipid content on the rhizome of *Kaemferia rotunda*

Phenolic content expressed in mg GAE /gm. sample extract				Lipid content expressed in gm./100gm of the powdered sample
ME	PE	CL	DW	2.0
21.05	26.03	14.24	9.421	

Note: GAE = Gallic acid equivalent, PE = Petroleum ether, CL = Chloroform, ME =Methanol, DW = Distilled water

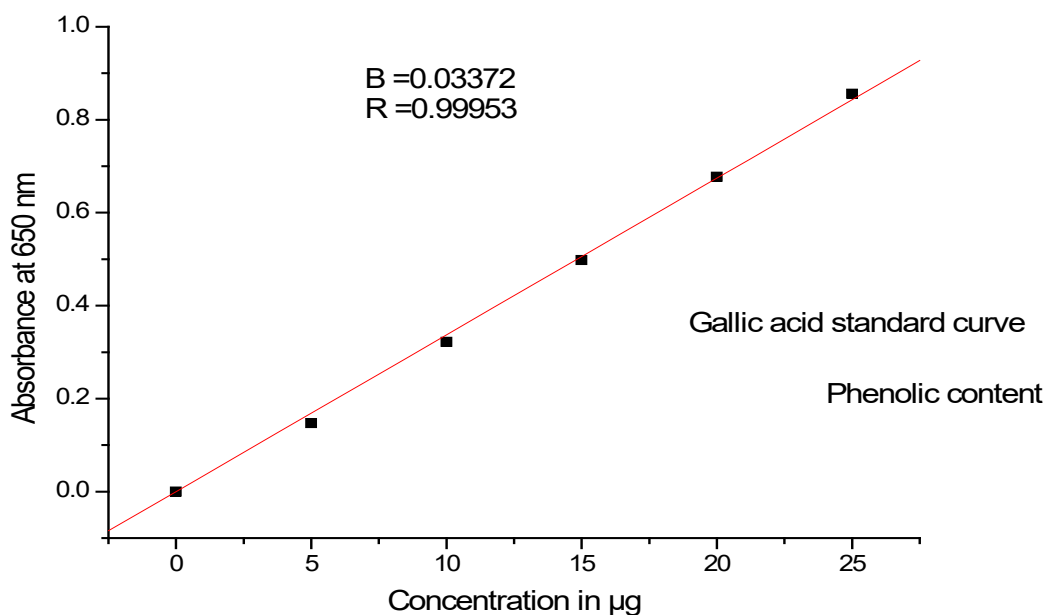


Fig.-1: Calibration curve of standard Gallic acid

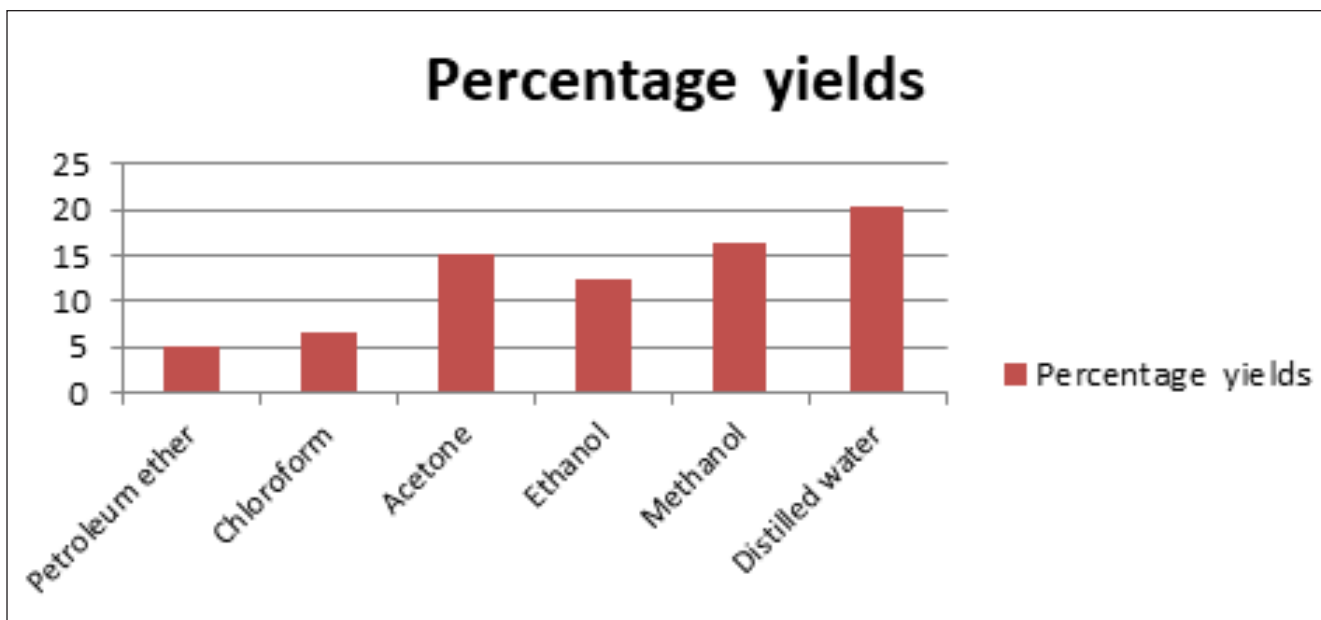


Fig.-2: Bar Graph for Percentage of Crude Yields



Fig – 3: Showing different parts of *Keamferia rotunda* (a) Flower (b) Rhizome (c) Plant

ACKNOWLEDGEMENTS

The author is indebted to all those who have contributed to this research work. He would also like to show appreciation to the Director, ICAR, lamphepat, North Eastern Region for providing Lab. facility. Thanks are due to my teacher Dr I. T. Phucho, Associate Professor, Nagaland University, Lumami, Nagaland, India for his continuous support throughout the preparation of the paper. The author is thankful to the anonymous reviewer to whom the paper was submitted for their valuable comments that improved the quality of the paper. Lastly, the author extends his heartfelt gratitude to Prof. Kh. Mohon Singh, Editor-in-Chief, Thambal Marik College Research Journal (TMCRJ) for

publishing his paper in the College Journal.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

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Phytosociological Study of Riparian Woody Plant Communities along the Thongjaorok River Manipur, North-East India.

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ABSTRACT

Riparian woody plant communities play a pivotal role in maintaining the ecological balance and biodiversity of the riverine ecosystem. Phytosociology aims to describe the vegetative environment of a given territory empirically. When applied to riparian woody plant communities, it involves analyzing the vegetation along riverbanks and streams, focusing on woody plants such as trees and shrubs. The present study deals with the phytosociology of riparian woody plant communities in two riparian sites: Thongjaorok Leikai and Chingningkhul stone excavation of Thongjaorok River Manipur northeast India. This study recorded 25 species- 12 families and 21 genera in Thongjaorok leikai, 21 species- 11 families and 19 genera in Chingningkhul stone excavation. In Thongjaorok Leikai, *Bambusa vulgaris* dominated the woody layer, and in the Chingningkhul stone excavation village, *Pinus Kesia* was found more abundantly. The tree density was higher at Thongjaorok leikai than at Chingningkhul stone excavation village (1090 & 670 individuals ha⁻¹) respectively. Using the Evenness Index, the study demonstrated a more consistent distribution of species at Thongjaorok Leikai. Shannon's Species Diversity Index was almost similar in both sites at 2.868 and 2.809. The dominant concentration of tree species was relatively higher at the riparian site of Thongjaorok Leikai than at the Chingningkhul stone excavation village.

Keywords: Phytosociology, riparian, excavation, Thongjaorok River.

1. INTRODUCTION

Phytosociology studies the groups of plant species that are usually found together (Wikipedia, 2024). It focuses on the study of plant communities, including their composition, structure, and distribution. The description of the vegetation leads any person to draw an overall picture of an area and then ultimately classify it into its different units. A critical component of understanding plant dynamics is the periodic fluctuations in the vegetational composition and structure, primarily driven by the interactions with environmental variables (Tansley 1935). Riparian areas serve as vital connectors between terrestrial and aquatic ecosystems, bridging land and water environment

gaps (Gregory *et al.*, 1991, Weins, 2002). Indeed, extensive research has focused on grasping the structural and functional roles of woody plant species within riparian zones. Riparian habitats play an important role in preserving water quality, also supporting the overall river ecosystem health. When these habitats are disrupted or destroyed due, to mining, soil erosion, and agricultural expansion, it can significantly impact the biodiversity and overall ecological balance. Ishida *et al.* (2010) have highlighted the importance of maintaining health. The Thongjaorok River, vital to the Meitei community in Manipur, faces anthropogenic pressures from bathing, garbage disposal, and

stone excavation. Investigating the link between riparian vegetation and human disturbance, this study aims to understand the river's health.

2. STUDY AREA

Thongjaorok, a rain-fed river, originates from the Laimaton-Lokcheng Hill Ranges (1669m above sea level) on the western side of the Imphal valley, between Bishnupur and Oinam. Due to its tributaries originating from the western side of the hill ranges, it serves as a notable example of an asymmetrical basin. The catchment area, spanning approximately 28.55 sq. km, is situated between Longitudes 93°42' to 93°49' E and Latitudes 24°36' to 24°43' N. Approximately 15.75 sq. km of the total catchment area are situated in hill areas, with remaining 12.8 sq. km in the plain. The watershed area of the river is around 3334 sq. km which includes the villages of Parengba, Bungte Chiru, Nungsai Chiru, Ngariyan Nungan etc. The river passes through the hill areas for a distance of about 5 km before draining finally into the Loktak Lake through Bishnupur and Khoijuman.

3. MATERIALS AND METHOD

Data was collected from the Thongjaorok River of Bishnupur district of Manipur, North—East India at two sites located around Thongjaorok and Chingningkhul stone excavation village Bishnupur, where the two villages were exposed to a disturbance in anthropogenic activities. The riparian zones for Thongjaorok village are slightly disturbed (40%) and greatly disturbed at Chingningkhul stone excavation village (70%). The disturbance index was calculated by comparing the cut stumps number to the total number of standing trees on the site. 10 permanent quadrats (10m X 10m) were randomly laid for phytosociological examination, and the woody layer has been studied by lying transect (500m length x 10m width) in both sites. The basal area of all individuals 10cm, Diameter at Breast Height (DBH), at 1.37m from the ground layer was listed and calculated.

Local names are used to identify plants. Quantitative analysis for vegetative data for density, frequency, and abundance, following the approach by Curtis & McIntosh (1950). Determination of the individual species- Importance Value Index (IVI), relative value density, frequency, and abundance were calculated based on the method presented by Philips (1959), and Jose (2012). The Shannon-Weiner index (H) (Shannon and Weiner, 1963); Simpson index (Cd) (Simpson, 1949); Marglef index (SRI) (Marglef, 1958), Pielou index (E) (Pielou, 1975), Sorensen similarity index (S) (Sorensen, 1948) of tree species were determined using the formula given below (Nayak & Sahoo, 2020):

1. Shannon–Weiner diversity index, (H')

$$H' = -\sum_{s=1}^s pi \ln pi$$

pi = (ni/N) i.e. individuals proportion in the i^{th} species

2. Simpson Dominance Index, (Cd)

$$Cd = -\sum_{i=1}^n pi^2$$

pi = proportion of individuals in the i^{th} species.

3. Marglef richness index, (SRI)

$$SRI = \frac{S-1}{\ln(N)}$$

S = total number of species

N = number of individuals

4. Evenness index, (E)

S = total species

5. Sorensen's similarity index, (S)

A = sample A, species

B = sample B, species

C = species number (both samples)

The forest ecosystem and the subsequent impact on local communities by human activities were evaluated. This data was gathered directly from the villagers during field surveys.

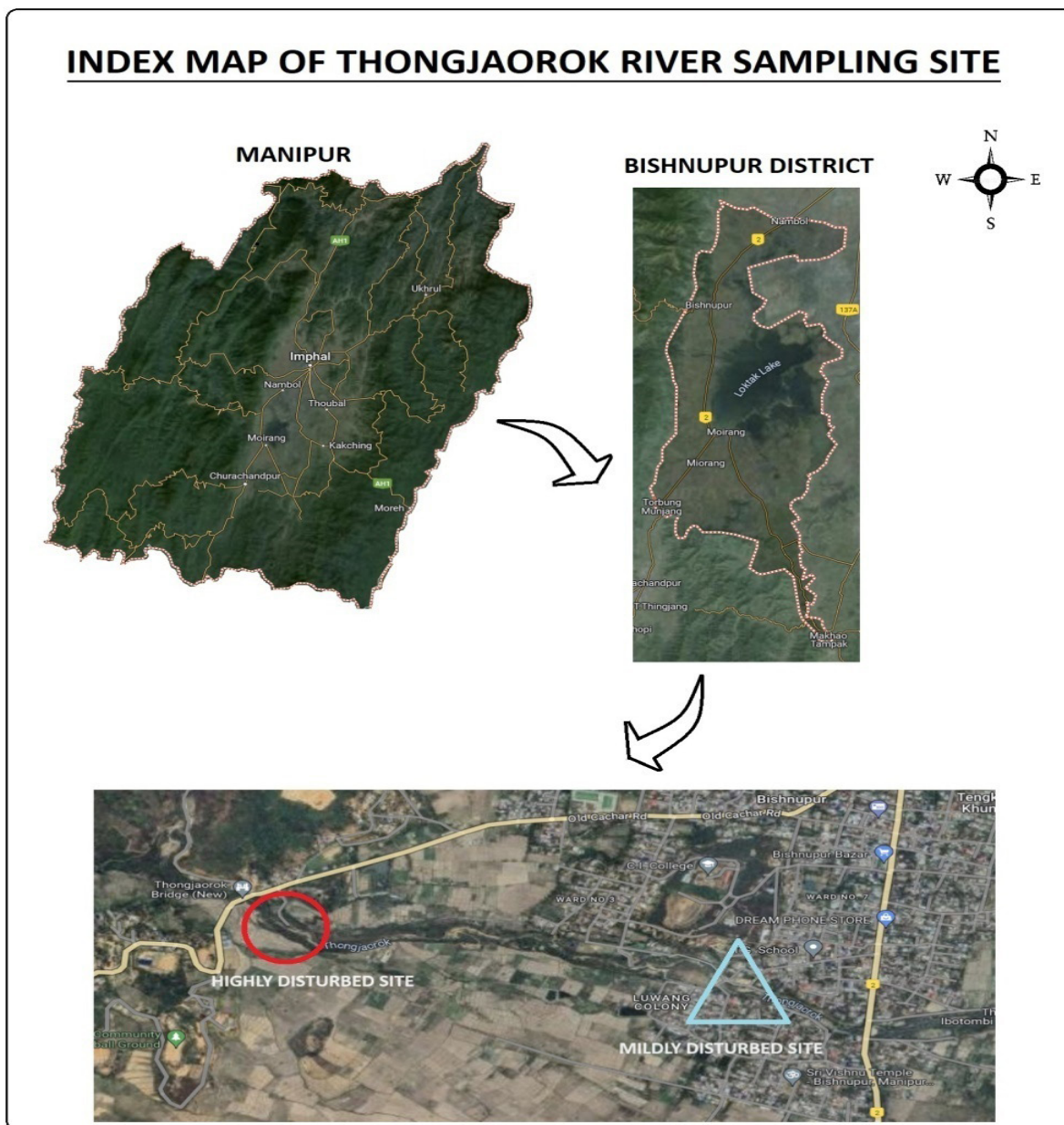


Figure: Index map of Thongjaorok River showing the study sites

4. RESULTS

4.1. Floristic Composition of Woody Layer:

At the Thongjaorok Leikai, 25 tree species of 21 genera belonging to 12 families were recorded. Meanwhile, the Chingningkhul stone excavation village had 21 tree species of 19 genera which belong to 11 families. Evergreen and deciduous broad-leaved trees constituted the woody layer in both sites, with a peak of 25 meters. *Bambusa vulgaris* dominated Thongjaorok Leikai, while *Pinus kesiya* was prevalent in the Chingningkhul

stone excavation village. *Parkia roxburghii* was also present in both locations (Table 1)

Thongjaorok leikai established the density of tree height which was higher in its woody layer than the Chingningkhul stone excavation stand (1090 & 670 individuals ha^{-1}) respectively. The dominance of concentration is slightly higher in the riparian site of Thongjaorok leikai than in the Chingningkhul site. Peilou's Evenness index reveals that Chingningkhul stone excavation

site, a slight increase in consistency was seen in the distribution of species (Table 2). According to the species diversity index of Shannon Weiner, the Thongjaorok site exhibited relatively greater diversity ($H' = 2.868$) compared to the Chingningkhul site ($H' = 2.809$). The richness of species is higher in Thongjaorok than in Chingningkhul. Fabaceae (5 species), followed by Moraceae (4), Lauraceae (3), Lamiceae (2), Magnoliaceae, Rutaceae Dipterocarpaceae, Proteaceae Fagaceae, Pinaceae Rhamnaceae respectively, were the families that showed the number of species which was highest in Thongjaorok Leikai. Fabaceae and Moraceae (4), followed by Lauraceae (3), Fagaceae, Lamiaceae, Pinaceae,

and Rutaceae were the highest number of family species in the Chingningkhul stone excavation site. The *Aegle marmelos* had the highest relative abundance (17.09%) and which was followed by *Ficus religiosa* and *Ficus benghalensis* had a relative abundance of 10.92% and 10.65% respectively in the riparian site of Thongjaorok Leikai and in the Chingningkhul village, the *Pinus Kesia* had the highest relative abundance (19.4%) (Figure-1). Dominance diversity relationship made a continuous progression from rare to intermediate to dominant species. These curves are believed to express different patterns of competition among the various forms of species communities (Figure 2).

Table 1: Thongjaorok River's species composition, basal area (BA) (m^2ha^{-1}) and density (D) (ha^{-1}), important value index (IVI) of woody plant communities in the two riparian sites, Manipur, north-eastern India.

Species	Thongjaorok leikai				Chingningkhul stone excavation village			
	BA	D	IVI		BA	D	IVI	
<i>Aegle marmelos</i>	9.47	1.43	30	9.24	0.67	0.09	20	9.25
<i>Albizia lebbeck</i> (L.) Benth.	4.97	1.12	40	16.98	6.22	1.38	30	31.69
<i>Albizia chinensis</i>	1.02	0.14	20	1.84	-	-	-	-
<i>Artocarpus lakoocha</i>	3.58	0.48	20	11.24	3.18	0.42	20	16.39
<i>Artocarpus heterophyllus</i>	2.37	0.32	20	9.05	2.11	0.28	20	13.34
<i>Bambusa vulgaris</i>	0.48	0.02	250	28.41	-	-	-	-
<i>Bauhinia purpurea</i> L.	0.76	0.07	10	5.30	3.05	0.49	40	23.35
<i>Bombax ceiba</i> L.	-	-	-	-	0.78	0.10	20	9.55
<i>Callicarpa arborea</i> Roxb.	0.68	0.09	20	5.99	0.46	0.06	20	8.64
<i>Castanopsis hystrix</i>	-	-	-	-	0.52	0.05	10	5.15
<i>Cinnamomum zeylanicum</i>	3.78	0.26	30	12.44	0.21	0.02	10	4.26
<i>Dipterocarpus tuberculatus</i>	0.18	0.02	10	2.72	0.35	0.05	20	8.33
<i>Emblica officinalis</i>	1.87	0.02	20	8.15	1.23	0.28	40	13.82
<i>Erythrina suberosa</i>	0.2	0.02	20	5.13	0.09	0.01	10	3.94
<i>Ficus semicordata</i>	-	-	-	-	1.12	0.11	10	6.86
<i>Ficus religiosa</i>	6.05	0.80	20	15.68	-	-	-	-
<i>Ficus benghalensis</i> L.	5.9	0.78	20	15.42	-	-	-	-
<i>Ficus racemosa</i>	-	-	-	-	7.56	1.67	30	34.01
<i>Gmelina arborea</i>	4.12	1.52	70	17.98	2.44	0.54	30	19.43
<i>Grevillea robusta</i>	2.29	0.35	20	8.91	-	-	-	-
<i>Litsea polyantha</i>	0.92	0.24	50	10.51	0.57	0.12	30	10.44

<i>Lithocarpus pachyphyllus</i>	0.37	0.11	60	11.91	0.28	0.08	40	11.12
<i>Michelia champaca</i>	0.26	0.3	30	7.62	-	-	-	-
<i>Magnolia champaca</i>	0.43	0.14	60	10.47	-	-	-	-
<i>Mangifera indica</i>	-	-	-	-	-	-	-	-
<i>Parkia roxburghii</i>	3.03	1.41	80	16.86	0.2	0.04	50	16.72
<i>Phoebe hainesiana</i>	0.24	0.05	30	6.06	0.18	0.03	20	5.68
<i>Pinus kesiya</i>	0.19	0.04	50	10.73	0.78	0.47	130	30.31
<i>Zanthoxylum acanthopodium</i>	0.44	0.14	70	12.87	-	-	-	-
<i>Ziziphus mauritiana</i>	1.70	0.29	40	12.77	-	-	-	-

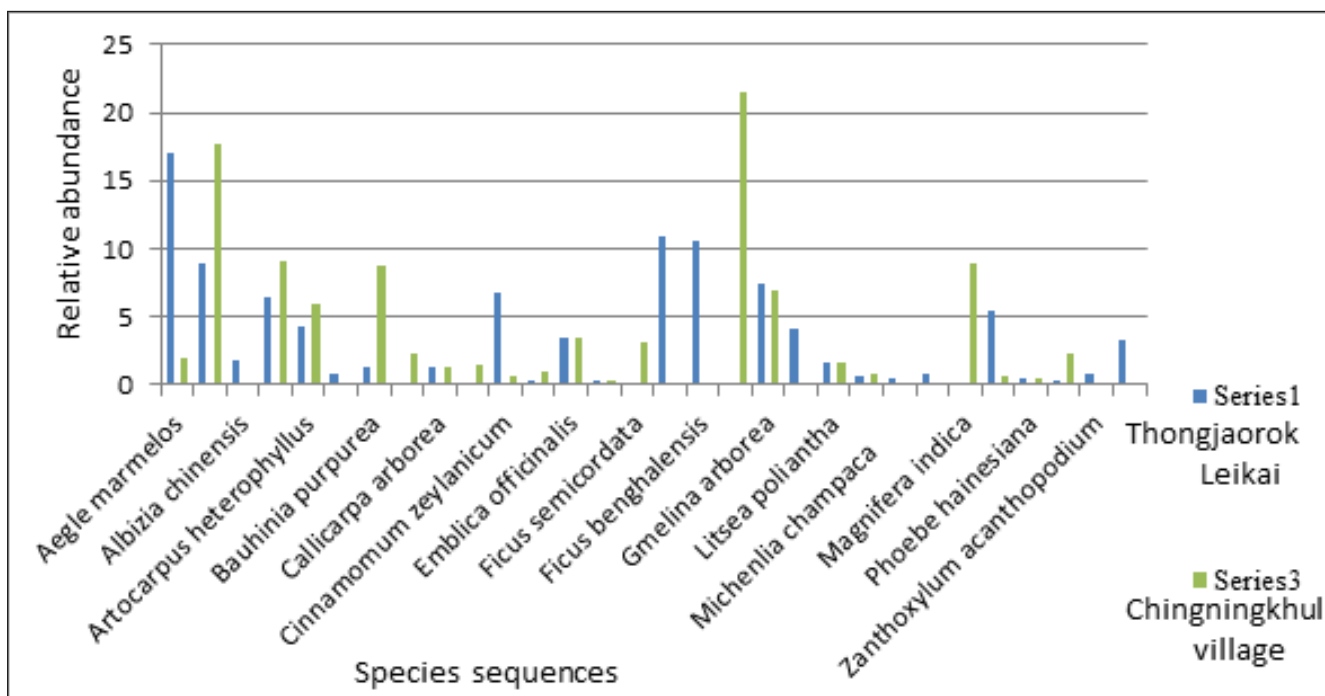


Figure 1: Relative abundance of plant families in the riparian sites of Thongjaorok Leikai and Chingningkhul stone excavation village.

Table 2: Thongjaorok River's details on the Shannon-Weiner Index, Simpson Index, tree species density in the two riparian sites, Manipur, North-eastern India.

Parametersw	Thongjaorok Leikai	Chingningkhul Stone excavation
Number of Families	12	11
Genera	21	19
Total Species	25	21.0
Density	1090	670
Simpson Index	00.11103	00.075
Shannon-Weiner Index	02.753	02.832
Evenness Index	00.662	00.739
Marglef Index	8.907	6.884

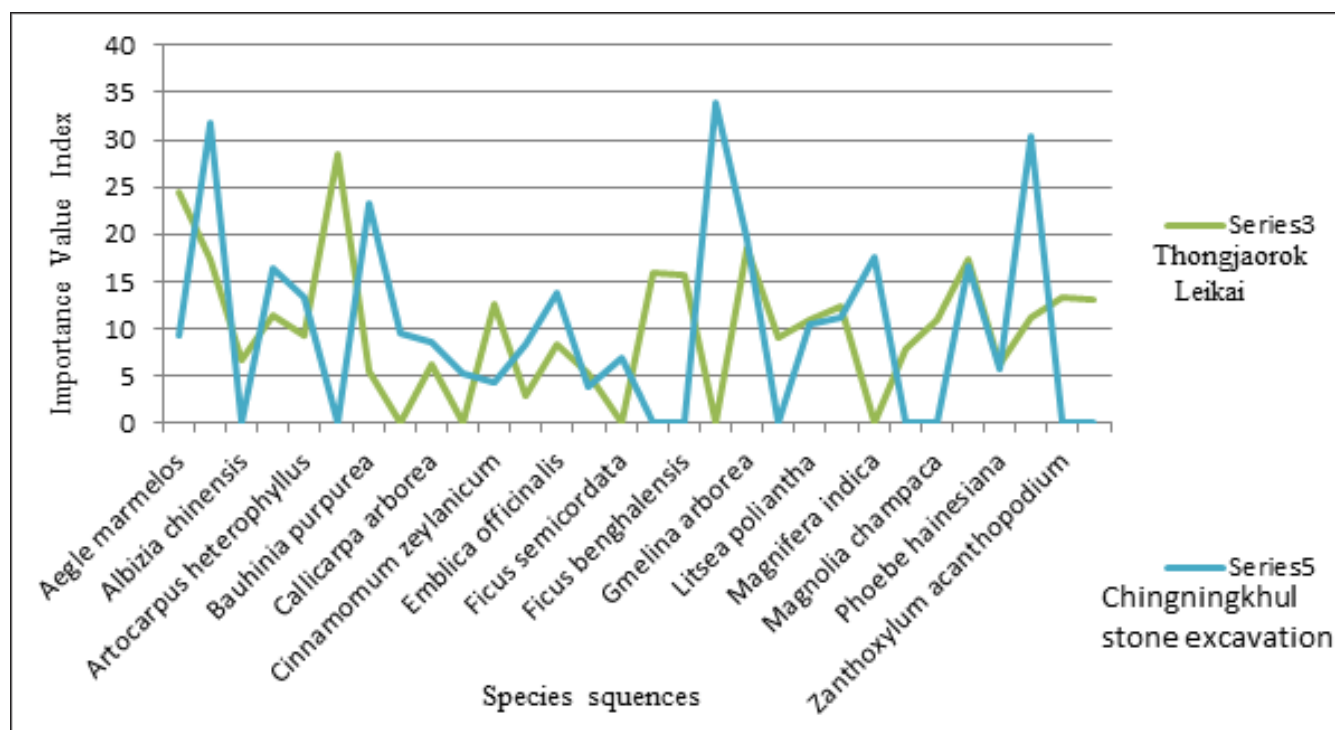


Figure 2. Dominance diversity curve for riparian tree species at Thongjaorok leikai and Chingningkhul stone excavation.

5. DISCUSSION

The composition of plant species in both riparian sites exhibits slight variation. As anticipated the Thongjaorok Leikai riparian site had a relatively higher number of tree species, likely influenced by local disturbances resulting from the tree felling. The locality factors play a very important role in bringing change to community composition (Majumdar & Dalta, 2015; Panitsa *et al.*, 2010; Theoharides & Dukes, 2007; Parmesan & Yohe, 2003; Walther *et al.*, 2002). The site was disrupted by human-induced activities, resulting in the formation of distinct niches where tree seedlings can establish and grow. The concentration of dominance and richness had a higher tendency in the riparian site of Thongjaorok leikai and on the contrary, species diversity and Pilou's evenness index were higher in the riparian site of Chingningkhul stone excavation as compared to the Thongjaorok leikai site I. The uncontrolled lopping and tree felling for purposes such as fuel wood, fodder, grazing, and light conditions significantly impact the diversity

of species (Kumar & Sahoo, 2004).

When assessing tree density among the two riparian sites, the findings ranged from 670-1090 trees ha^{-1} having $\geq 30\text{cm}$ dbh. Kumar *et al.*, (2006), studies of tropical evergreen forests align with the estimated range in our study (294-1173 trees ha^{-1}). The density recorded in this present study was also close to the floristic composition of semi-evergreen forests within India (685-820 trees ha^{-1} Devi and Yadava, 2006; 483-782 trees ha^{-1} Lilabati *et al.*, 2018; 338-5452 ha^{-1} Bhuyan *et al.*, 2003). The tree density in the present study falls between the values observed in Andaman evergreen forests 1137 trees per hectare, as seen in the study by Padijala *et al.*, (2004), and the lower values documented by Biswas & Misbahuzzaman, (2008); Nath *et al.*, 1998; Hossain *et al.*, (1997); and, in Bangladesh ranging from 369 to 384 stems per hectare. It's important to note that tree density varies based on factors such as forest community type, age, species composition, and site conditions. Studies conducted in tropical forests outside India

have also shown a wide range of tree densities with a diameter greater than 30 cm at breast height (dbh), a study by Clark & Clark, (2000); Clark *et al.*, (2015) in Panamanian equatorial insular forests showed a range from 98 trees per hectare (Itow, 1986) to as high as 1720 trees per hectare in tropical Amazonian rainforests. The density observed in the present area of study aligns favourably with the documented values from other tropical rainforests. The present study in tree species exhibited similar values across disturbance levels as calculated. Specifically, the diversity index showed a range from 2.868 and 2.808 in slightly disturbed and greatly disturbed areas. These values are comparable to those reported for the semi-evergreen forest of the Ngariyan hill range in Manipur, which had indices of 2.91364 and 2.82724 (Lilabati *et al.*, 2018). The value of the diversity index observed in our study site falls in the reported range of 0.83 to 4.1 as indicated by Singh *et al.*, 1984, suggesting a high level of tree diversity.

6. CONCLUSIONS

The habitat structure is influenced by several factors, including land use within the river areas, types of river sediments, flow velocity, and human activities. Carlos *et al.*, (1986) & Soseak, (2002) emphasized the important determinants of the distribution, and have been identified as availability of light, characteristic of substrate and morphology, and water column nutrient concentration. The study of the Thongjaorok River revealed a change in biological communication reflected in the reduction of the downstream flow. This was due to the riparian land use and other anthropogenic interference such as stone excavation. Increased abundance, diversity of emergent species, and richness are led by the reduced water velocity in the river which impacts the biological community structure. The proliferation of emergent species suggests an increase in eutrophication, which, in turn, points to the influence of various human anthropogenic activities.

7. FURTHER STUDIES

The health of the river system in a

particular area is indicated by the growth of floral communities along the riparian land. Further studies in the Riparian Vegetation Index (RVI) to estimate the health of the riparian habitat. Planning for the restoration of degraded habitats can also be suggested based on riparian studies. More survey sites which could not be sampled can be surveyed based on the results of the study. All these could be incorporated into the assessment of a complete biodiversity profile of the Thongjaorok River.

ACKNOWLEDGEMENTS

The authors express their deepest gratitude to Prof. Kh. Mohon Singh, Editor-in-Chief, Thambal Marik College Research Journal (TMCRJ) for his unwavering encouragement and support throughout the preparation of this article. The authors extend special thanks to the local communities along the Thonjaorok River, Manipur for their assistance in the field work. They are also thankful to the anonymous reviewer to whom the paper was submitted for their valuable comments that improved the quality of the paper.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

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Physico-Chemical Analysis of Water Quality at Thongjaorok River, Bishnupur, Manipur.

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ABSTRACT

An investigation was performed to check the water characteristics of two different sites along the catchment areas of Thongjaorok River, Bishnupur. The study was done for one year (April 2022- May 2023). The rivers render many useful services to the people living nearby such as commercial (stone excavation and sand digging from the river basin) and domestic utilization. The parameters namely temp, pH, TDS, EC, and DO were analyzed at monthly intervals and results are computed on a seasonal basis. The temperature was recorded highest in July (27.35 °C) at the HD site. The minimum value of 20.37 °C was found in December in the MID area. The water is slightly alkaline (6.82-8.12) during the research. The value of EC ranged from 272.24 μS to 65.27 μS in the respective sites. The DO content was higher (8.81 ppm) at a mildly disturbed site compared to a highly disturbed site (5.51 ppm). The addition of dissolves in the disturbed sites results in a higher concentration of TDS. It is now confirmed that water deteriorates to some extent, therefore governments as well as NGOs should take proper management strategy to save the river. Also, the people should take the initiative to protect the water from being polluted.

Keywords: Physico-chemical characteristics, anthropogenic activities, stone excavation.

1. INTRODUCTION

Man-made activities result in the addition of many pollutants such as sewage, agricultural waste, domestic waste, and plastic waste into the river resulting in pollution. Excessive removal of raw material from nature leads to environmental pollution in many ways.

Thongjaorok is a rain-fed river originating from the Laimaton Lokching Hill ranges (1664 meters). It has coordinates between longitude 93°42' to 93° 49'E and latitude 24° 36' to 24° 43'N. The total catchment area (28.55 sq. Km) is divided into hilly terrain (15.75 sq.km.) and plain (12.8 sq.km.).

The Thongjaorok River has 3334 sq. km. of watershed area. It comprises the villages of Parengba, Bungte, Chiru, Ngariyan Nungan and ultimately reached the Loktak Lake.

2. METHODOLOGY

2.1 Area of Study: Two villages namely Chingningkhun and Thongjaorok were surveyed for the study. In these villages, two study sites were selected representing the highly disturbed sites (HD) and mildly disturbed sites (MID).

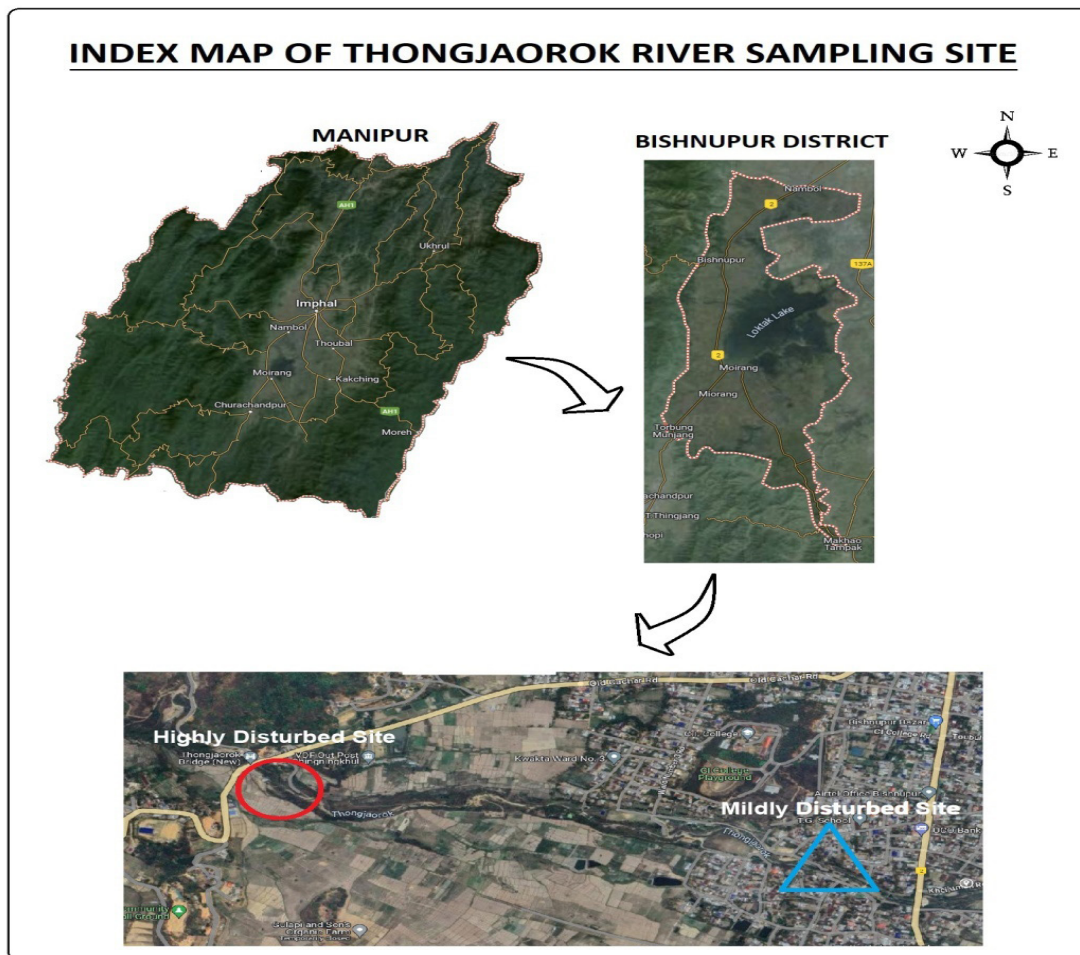


Figure: Index Map of Thongjaorok River showing different study sites.

2.2. Analysis of water: The samples were collected in triplicates every month for performing the analysis. The parameters studied were temperature (thermometer), TDS (filtration and evaporation method), electrical conductivity, D O (Winkler method with azide modification), and pH (Digital pH meter). APHA, 2005 was adopted for the analysis.

3. RESULTS AND DISCUSSION

3.1. Temperature: The temperature was highest in July (27.35 °C) in the Chingningkhun village. Whereas a lower value (20.37 °C) was obtained in December in the Thongjaorok village. Most of

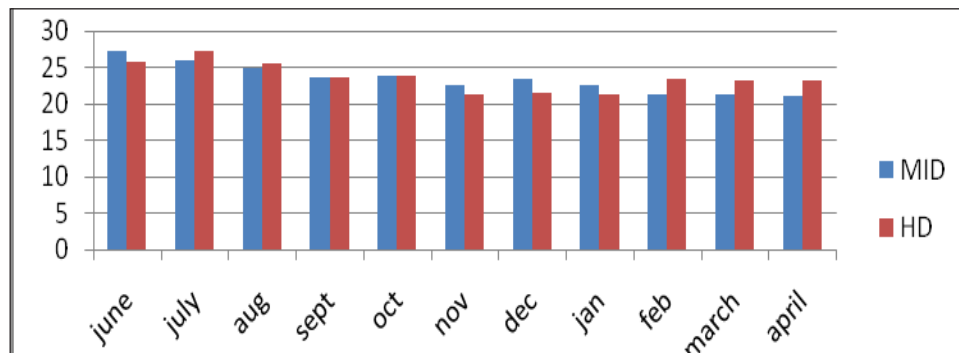


Fig.1. Bar diagram showing temperature variation.

the water quality parameter is characterized by temperature suggesting that temperature has a great effect on dissolved oxygen. The study showed that the temperature was higher in the rainy season. It may be due to the difference in ambient temperature (Das *et al* 2003; Bharali *et al*, 2008). Also, the surface runoff from the surroundings increased the water temperature. Mishra and Tripathi, (2000, 2001, 2003) Abel-Satar (2005) Zafar and Sultana (2008), and Umavati and Logankumar (2010) also found similar observations.

3.2. pH: The pH varies from 6.82 to 8.12 along the disturbance gradient. From the study, it was observed that the river was slightly basic. The deposition of impurities from the excavation site may be the reason for a higher value. Puttaih and Somashekar (1985) also had the same findings.

Table 1 Table showing the mean value \pm SD of different water quality parameters along a disturbance gradient

Parameters	MID	HD
Temp	24.08 \pm 2.10	24.24 \pm 2.17
pH	7.52 \pm 0.28	7.5 \pm 0.28
EC	128.74 \pm 58.15	143.45 \pm
TDS	71.96 \pm 20.17	78.91 \pm 26.03
DO	6.33 \pm 0.29	5.82 \pm 0.23

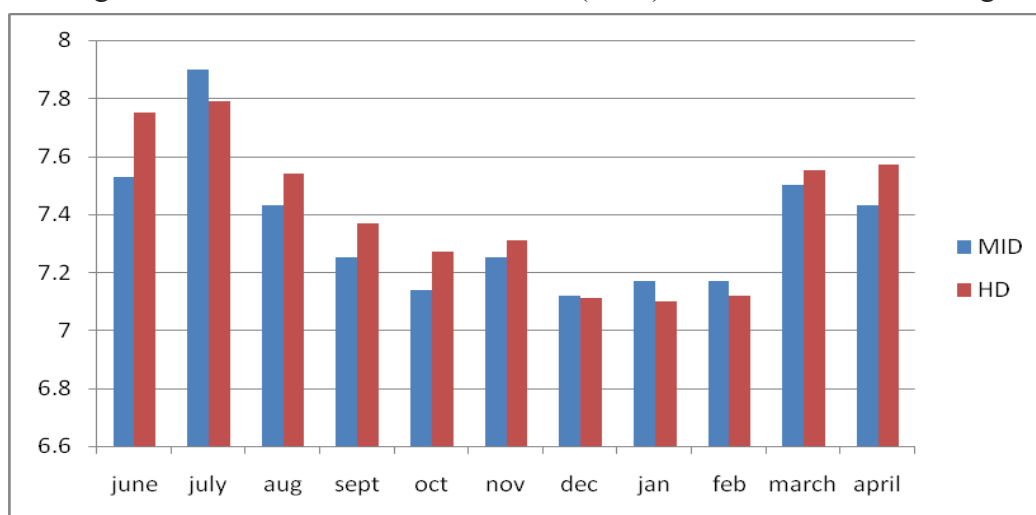


Fig.2. Monthly variation in pH of the given water sample.

3.3. Electrical Conductivity: This parameter showed more value in Thongjaorok village, unlike the other two parameters.

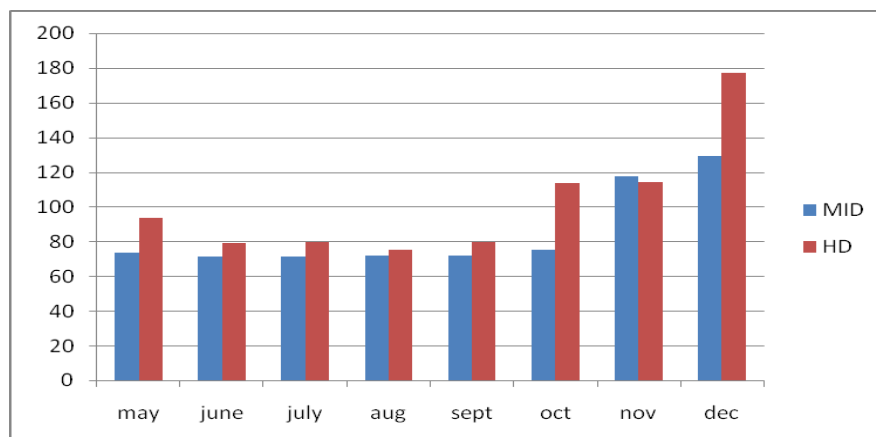


Fig. 3. EC data in two study sites.

During the rainy season, the water volume is high as a result the EC content decreases. On the contrary lower volume of water in winter comprises more dissolved solids.

3.4. Dissolved Oxygen: The DO content was high in mildly disturbed areas while it was low in the other disturbed areas. Warmer temperatures, turbid water and high total dissolved solids enhance the lower DO content of the river water. The findings were supported by Rajkumar *et al*, 2004; Umavati and Longkumar, 2010.

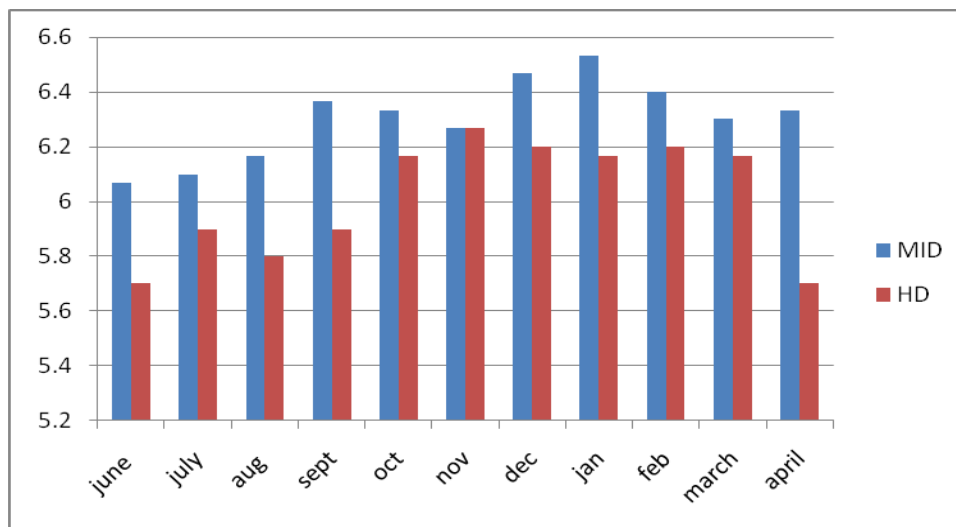


Fig. 4 DO content in the water sample.

3.5. Total Dissolved Solid: The total dissolved solids were found at 130.16 ppm during the rainy season in the areas where there is stone excavation at present. The reason may be surface runoff from the surroundings thereby making the water more salty and alkaline in nature.

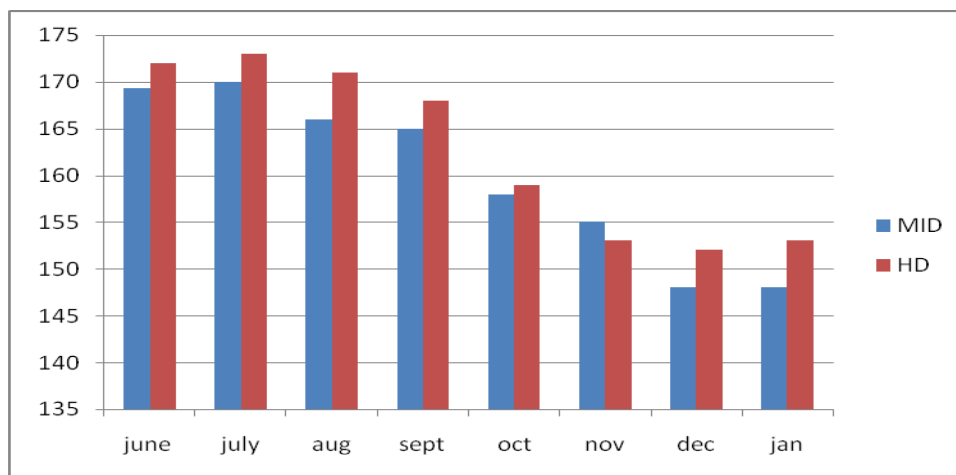


Fig. 5 Data showing TDS value in the river water.

4. CONCLUSIONS

After a year of study, the results interpreted that among the two study sites namely Thongjaorok and Chingningkhun village, the latter one was more polluted than the prior. It was evident from the fact that continuous excavation of stones and

other anthropogenic activities made the river water more contaminated. The people thriving near the catchment areas were directly and indirectly dependent on the river for their livelihood. Such consumption and utilization of untreated water may

be hazardous. As a result, proper management and remedial measures should be taken immediately.

ACKNOWLEDGEMENTS

The authors express their profound gratitude to Prof. Kh. Mohon Singh, Editor-in-Chief, Thambal Marik College Research Journal (TMCRJ) for his unwavering encouragement and constructive suggestions throughout the preparation of this article. The authors express special thanks to the local communities along the Thonjaorok River, Manipur for their assistance in the field work. They are also thankful to the anonymous reviewer to whom the paper was submitted for their valuable comments that improved the quality of the paper.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

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Study of Frequency, Abundance, and Density of Plant Species of Thambal Marik College, Oinam, Bishnupur District, Manipur

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ABSTRACT

This research experiment highlights the characteristics of the vegetation of the Thambal Marik College campus area. The extensive study survey was done from October 2023 to January 2024. The quadrat method was applied for the study of vegetation analysis. A quadrat of 50 x 50 cm size is taken for sampling the species. The species which occurred in each quadrat were noted down. Repeated quadrat sampling was done, which led to the occurrence of 38 species with their frequency, abundance, and density. During the investigation, it was recorded that altogether 38 plant species belong to 23 families. Among the 38 plant species documented, the maximum number of species belonged to the Asteraceae family (8), followed by the Amaranthaceae family (5), Poaceae family (3), Euphorbiaceae family (2), Lamiaceae family (2), Apiaceae family (1), Cyperaceae family (1) and Mimosaceae family (1). The analytical characteristics such as the values of abundance, density and frequency were studied using Raunkiaer's vegetation classification. Raunkiaer's frequency classification formula $A < B > C > D < E$ was adopted with the observed frequency values. Quantitative analysis of plant species revealed that *Cynodon dactylon* was found to be high density (6.5) while *Ageratum conyzoides*, *Plantago major*, and *Oxalis corniculata* were the most frequent species (100 %). Thus, the present research finding showed a diverse vegetative composition within the college campus.

Keywords: Abundance, Density, Frequency, Manipur, Vegetation,

1. INTRODUCTION

Manipur, a state in northeastern India lies under biodiversity hotspots. The state is known for its rich biodiversity i.e., a wide variety of plants and animals are found. Grassland vegetation occupies roughly 19 per cent of the earth's surface (Sharma, 2005). It is necessary to study the vegetation characteristics to understand the surrounding biosphere. Ecological characteristics studies on the grassland communities of India are found to be limited to particular areas only. Few remarkable research studies have been carried out in the grassland ecosystem of Manipur, India by Devi and Singh (2011). The quadrat method and line transect method were used to study the analytical

characteristics of vegetation (Mahajan and Fatima, 2017). The quadrat method was the most widely used method to determine the population density, abundance and frequency of species in a particular vegetation community. Density is considered to be one of the most commonly used methods in vegetation study (Askari *et al.*, 2013). Vegetation cover is characterized by a certain analytical characteristic in a community to identify its dominant species (Alftisi *et al.*, 2019). The analysis of the frequency, abundance, and density of plant species is essential for understanding the ecological dynamics and biodiversity of a particular area. Thambal Marik College, located in Oinam,

Bishnupur District, Manipur is a unique ecosystem that protects a diverse range of plant species. A comprehensive investigation into the frequency, abundance, and density of plant species within the college premises can provide valuable insights into the local flora composition, distribution patterns, and ecological relationships. The vegetation characteristic information is important for effective conservation and sustainable management strategies to preserve the rich biodiversity of the campus. Various scientists have made their contributions to ecological diversity (Cadott *et al.*, 2002; Devi and Singh, 2011; Sharma, 2003; Saima and Azra; 2016); Haruna, *et al.*, 2018; Dwivedi *et al.*, 2017). Therefore, the present research experiment has been carried out to investigate the various vegetation characteristics of plant species in the college campus, through extensive field surveys and data analysis.

2. MATERIALS AND METHOD

The survey experiment was conducted on the campus of Thambal Marik College, Oinam,

Bishnupur District, Manipur to find the types of vegetation on the campus. A quadrat method is adopted for the vegetation sampling analysis to be studied (Cain and Castro, 1959). A quadrat of 50 x 50 cm size is taken for sampling the species. The species occurring in all the quadrat samplings were recorded. The experiment was carried out from October 2023 to January 2024. The information collected from the study helps in the identification of the most dominant species on the campus area. All the statistical analyses were carried out using Microsoft Excel, 2007.

The quantitative vegetation characters such as abundance, density and frequency of plant species were estimated, using the following formula given by Mishra (1968):

Abundance is expressed as the study of the number of individuals of a given species per unit area (quadrat) of occurrence in a habitat. It is estimated as follows:

$$\text{Abundance} = \frac{\text{Total number of individuals of the species in all the quadrats}}{\text{Number of quadrats in which the species occurred}}$$

Density represents an expression of the number of organisms per unit area in the community. It shows the concept of the degree of competition among the species. It is represented as below:

$$\text{Density} = \frac{\text{Total no. of individuals of a species}}{\text{Total no. of quadrats studied}}$$

Frequency may be defined as the degree of dispersal of species. It indicates the number of segments (quadrats) in which a particular species occurs. It is represented as a percentage.

$$\text{Frequency (\%)} = \frac{\text{Total no. of segments (quadrats) in which species occurred}}{\text{Total no. of segments (quadrats) studied}} \times 100$$

Table 1: Frequency, Density and Abundance of plant species in October 2023- January 2024

Sl no	Name of the species	Density	Frequency %	Abundance
1.	<i>Ageratum conyzoides</i> L.	3.4	100	3.4
2.	<i>Artemesia vulgaris</i> L.	0.7	50	1.4
3.	<i>Amaranthus viridis</i> L.	0.8	60	1.333
4.	<i>Achyranthes aspera</i> L.	0.5	30	1.666
5.	<i>Asclepias curassavica</i> (L.) Kuntze	0.6	40	1.5

6.	<i>Alternanthera philoxeroides</i> (Mart.)	4.1	90	4.555
7.	<i>Blumeopsis falcata</i> DC.	1.2	70	1.714
8.	<i>Centella asiatica</i> L.	1.1	60	1.833
9.	<i>Cynodon dactylon</i> L.	6.5	100	6.5
10.	<i>Costus speciosus</i> (Koenig.) Smith	0.4	30	1.333
11.	<i>Coix lacryma-jobi</i> L.	0.5	20	2.5
12.	<i>Cardamine hirsute</i> L.	0.9	40	2.25
13.	<i>Cyperus rotundus</i> L.	0.3	20	1.5
14.	<i>Commelia bengalensis</i> L.	1.2	70	1.714
15.	<i>Chenopodium album</i> L.	1.7	100	1.7
16.	<i>Dactyloctenium aegyptium</i> (L.) Willd.	3.9	90	4.333
17.	<i>Dicropephala integrifolia</i> (L.) O. Kuntze	2.7	80	3.375
18.	<i>Desmodium gyrans</i> DC.	0.5	20	2.5
19.	<i>Eupatorium birmanicum</i> DC.	0.4	30	1.333
20.	<i>Euphorbia hirta</i> L.	0.9	70	1.285
21.	<i>Fumaria parviflora</i> Lam.	0.5	40	1.25
22.	<i>Frageria indica</i> L.	0.8	70	1.142
23.	<i>Gnaphalium indicum</i> L.	1.3	90	1.444
24.	<i>Gynura bicolor</i> DC.	2.5	90	2.777
25.	<i>Gomphrena celosoides</i> Mart.	0.5	50	1.00
26.	<i>Hedyotis Auricularia</i> L.	0.7	60	1.666
27.	<i>Impatiens balsamina</i> L.	0.6	30	2.0
28.	<i>Lindernia ciliata</i> (Colsm.) Pennell	0.2	20	1.00
29.	<i>Leucas aspera</i> (Willd.) Link	1.0	60	1.666
30.	<i>Mimosa pudica</i> L.	2.2	90	2.444
31.	<i>Oxalis corniculata</i> L.	3.1	100	3.1
32.	<i>Parthenium hysterophorus</i> L.	1.0	30	3.333
33.	<i>Plantago major</i> L.	3.8	100	3.8
34.	<i>Phyllanthus niruri</i> L.	1.0	60	1.666
35.	<i>Rumex crispus</i> L.	1.1	90	1.222
36.	<i>Scutellaria assamia</i> L.	1.5	80	1.875
37.	<i>Stellaria media</i> (L.) Vill.	0.7	50	1.4
38.	<i>Sida rhombifolia</i> L.	0.5	40	1.25

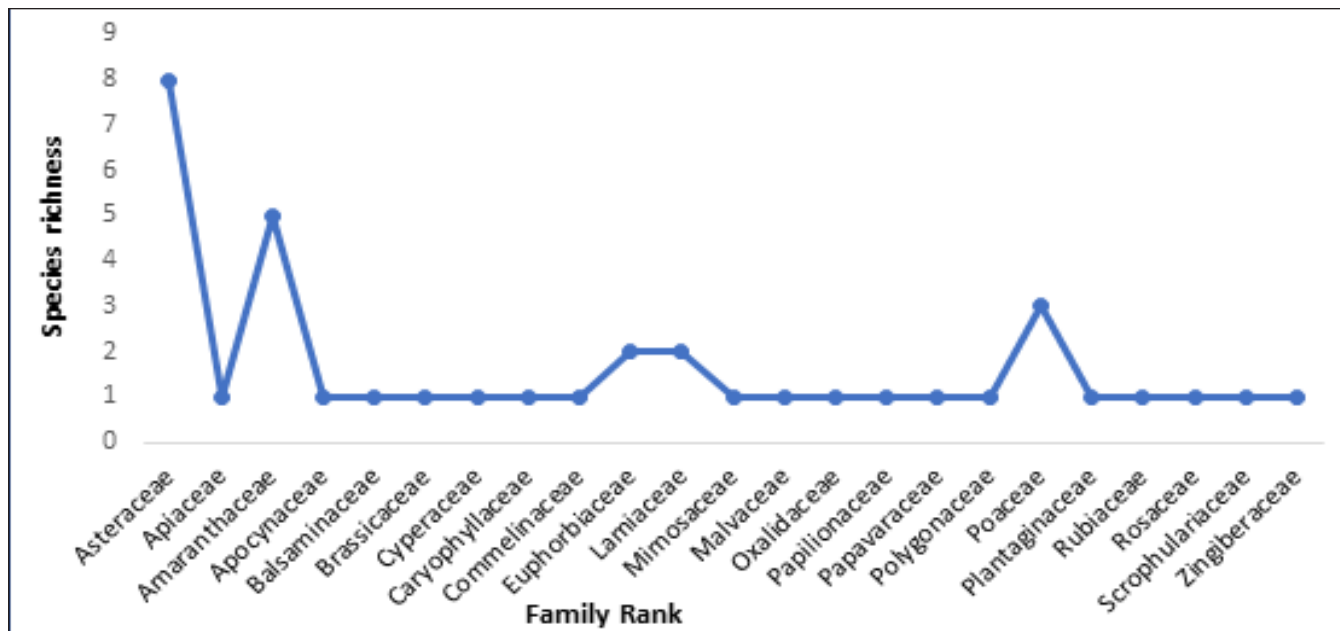


Fig.1: Family Dominance curve of the species

Table 2: Raunkiaer's (1934) frequency classification table of a community

Frequency %	Class
0-20	A
21-40	B
41-60	C
61-80	D
81-100	E

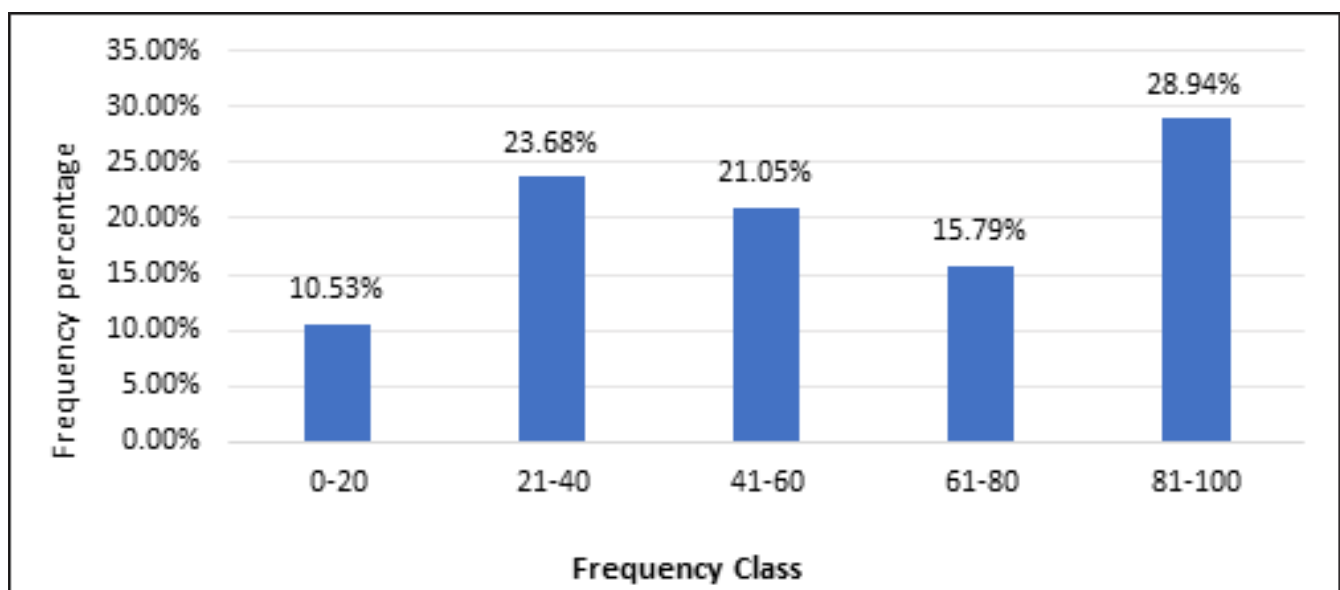


Fig. 2: Frequency Class of Vegetation

3. RESULTS AND DISCUSSION

A field survey was carried out in the Thambal Marik College campus, Oinam, Bishnupur District, Manipur. Altogether 38 plant species were documented which belong to 23 families. Among families are, the Asteraceae family (8 species), Amaranthaceae (5 species), Poaceae (3 species), Euphorbiaceae, and Lamiaceae (2 species each). Apiaceae, Apocynaceae, Brassicaceae, Cyperaceae, Mimosaceae, Oxalidaceae, Polygonaceae, and Zingiberaceae were represented only by one species each. (Figure 1).

Results depicted in Table.1 revealed that the highest density was obtained by *Cynodon dactylon* (6.5) and *Lindernia ciliata* showed the lowest density (0.2). The most frequent species were found as *Ageratum conyzoides*, *Cynodon dactylon*, *Oxalis corniculata*, and *Plantago major* (100 %) while the lowest value of frequency (20 %) was found for *Coix lacryma*, *Cyperus rotundus*, *Desmodium gyrans*. *Cynodon dactylon* showed the highest value of abundance (6.5) followed by *Alternanthera philoxeroides* (4.555) and *Dactyloctenium aegyptium* (4.333) whereas the least abundance was found in the case of *Lindernia ciliata* (1.00) followed by *Rumex crispus* (1.22).

The highest value of abundance found for *Cynodon dactylon* was also reported by Saima and Azra (2016). Similarity with the present investigation also showed that 100 % frequency was observed for *Cynodon dactylon* and *Trifolium pratense* in July and August in their study.

Dwivedi *et al.* (2017) reported that *Leucoagaricus* sp. was found with maximum density (8.83) while *Ganoderma lucidum* was observed to be the most frequent species (86.87 %) and the most abundant species (42.83) was found to be *Termitomyces heimei* in his study. The research findings are partially similar to the results observed in the vegetation study of Mahajan and Fatima (2017).

Raunkiaer's classification system (1934) was considered to be a widely accepted system of vegetation analysis in comparative studies

of a community. In this survey experiment, the classification of the vegetation was done by Raunkiaer's frequency classification (Table: 2). The percentage distribution of the vegetation is presented in Figure 2. The highest frequency percentage (28.94 %) was observed in class E (81-100) whereas the lowest frequency percentage (10.53 %) was in class A (0-20).

4. CONCLUSIONS

The present study revealed that out of 38 species, 23 families were recorded from the college campus. The present analytical characteristics study indicated that the type of vegetation found on the college campus is heterogeneous. Thus, the present research study is carried out in an attempt to provide a vast idea of the vegetation characteristics of the college campus. This rich vegetation occurrence required further exploration to enhance the medicinal base research study on medicinal herbs through conservation and sustainable use. However, this study is a preliminary survey of the college campus as the study area has never been ecologically studied before. Hence, there is a need to be properly documented and conservation for future generations.

ACKNOWLEDGEMENTS

The authors are thankful to M. Bharat Singh, HOD Department of Botany, Thambal Marik College, Oinam for his kind support in the identification of plant species during the field survey. They are also thankful to Prof. Kh. Mohon Singh, Editor-in-Chief, Thambal Marik College Research Journal (TMCRJ), for his moral support and financial assistance for the field work. They are also thankful to the anonymous reviewer to whom the paper was submitted for their valuable comments that improved the quality of the paper.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

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Relationship between Women's Educational Status and Age at Marriage

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ABSTRACT

Girls used to get married within a few years of attaining puberty in the traditional society of Manipur. However, women's age at marriage has risen nowadays with the spread of education. The paper examines the differences in the different educational statuses of women in their age at marriage and also the relationship between the educational status of the wife and the age at the marriage of the husband. For this purpose, 1008 married Meitei women in the age group 35 – 59 years residing in Imphal West District, Manipur have been selected randomly as the sample of the study. A predesigned semi-structural schedule is used as the tool of the study. The personal Interview method is adopted for data collection. The educational status of women has been classified into illiterate, under matric, matric, undergraduate, graduate, and postgraduate. The results show that the age of marriage varies significantly between the various educational status groups, with better-educated women marrying later than illiterate or less-educated women. It is also found that there is a difference in the mean age at marriage of the husband over the educational status of the wife. Illiterate women have corresponded with the low age at marriage of husbands while the husbands of better-educated women have married late. The findings indicate a significant correlation between age at marriage and educational status.

Keywords: Educational status, marriage, illiterate, age.

1. INTRODUCTION

Early and universal marriage contributes to high reproduction rates. Age at marriage has come under scrutiny from different sections of society encompassing educationists, academicians and politicians. In India, most marriages still take place at considerably younger ages than intended, despite what appears to be intense efforts, including laws against child marriage. The Child Marriage Act, of 1978 was recently amended, and it now states that 18 is the least age at which a female must marry in India. However, in many states, the average age of marriage is still far below this legally mandated minimum even today. Changes in current marital behaviour and encouragement of late marriages are necessary to effectively address the pressing issues of slowing down India's population growth

rate and achieving the socioeconomic uplift of women. This is because marriage represents an early assumption of domestic and childcare responsibilities and the cessation of education for girls.

Despite a gradual increase since the mid-1900s, India's female marriage age is still relatively low when compared to the majority of nations with low fertility. In addition, there is a significant difference in the age of marriage between Indian states, particularly between the northern and southern states, as well as within states between tribes, castes, and other socioeconomic strata. State-specific variations in the degrees of socioeconomic and cultural factors

could be the cause of the variation in the age at which women marry. A few empirical research have looked into the main factors that influence a woman's age at marriage. The majority of the research findings show that women's educational status has the biggest impact on when they marry (Sheela and Audinarayana, 2000). Keeping all of these factors in mind as well as the investigator's interest to probe into this issue in the changing trends, the study has been conducted to determine the association between women's educational status and age at marriage.

2. OBJECTIVES

The objectives of the study are as follows:-

- » To examine whether there is any difference among the women of different educational status in their age at marriage.
- » To examine if there is any relationship between the educational status of the wife and the age at marriage of the husband.

3. HYPOTHESES

The following hypotheses have been formulated for the study:-

- » There is no difference in the age of marriage among women of different educational statuses.
- » There is no difference in age at the marriage of the husband concerning the educational status of the wife.

4. METHODOLOGY

4.1 Study Area: It was not an easy task to cover the whole area of the state in dealing with such a study. So, the geographical area to be covered by the study was identified Accordingly, Imphal West District of Manipur was selected as the work was planned to be carried out at the micro level.

4.2 Sample: Married women who belonged to the Meitei community in the age group 35 – 59 years were considered in the selection of the sample. 1008 women selected randomly from Imphal West District were involved in the study.

4.3 Study Tool: A pre-designed semi-structural interview schedule was used as the tool for data collection.

4.4 Data Collection: The personal interview method was adopted for data collection.

4.5 Analysis and Interpretation of Data: The data entry and processing were done through Excel with statistical software – SPSS after checking and scrutinizing. To achieve the objective of the study F-test was applied and accordingly, interpretation was made. For analysis purposes, educational status has been classified into six categories – illiterate, under matric, matric, undergraduate, graduate, and postgraduate.

5. RESULTS AND DISCUSSION

Age at marriage of a girl constitutes an important factor for population growth which is connected with her education also. As early marriage may create several problems like rapid increase in population, illiteracy, etc. so delayed marriage has been regarded as the expected norm of society today (kakati, 1996)

In traditional society, girls used to get married within a few years of attaining puberty. That was the norm of the traditional system of marriage among the Meitei women (Sircar, 1984). However, nowadays with the spread of education, the enactment of legislative measures like the Child Marriage Restraint Act of 1978, and awareness created through mass media about the hazards of early marriage in their health front, helped in raising the marriage age of girls (Mann, 1987).

Education tends to increase the age of marriage of both males and females. Considering this perspective into consideration, an effort has been made to determine the disparities in the age of marriage of the husband and the wife from various educational backgrounds. Tables 1 and 2 show the correlation between the age of the wife and her husband at marriage and her educational status.

Table –1: Educational status of wife and age at marriage (self)

Educational status	Age (year)						Remark
	N	Mean	S.D.	F-Value	d.f	P-Value	
Illiterate	208	22.65	12.78	24.000	5,1002	0.000	Very highly significant
Under matric	250	22.46	4.45				
Matric	115	24.44	4.94				
Undergraduate	110	25.10	4.97				
Graduate	200	27.33	4.73				
Postgraduate	125	29.19	3.73				
Total	1008	24.81	7.49				

Table- 1 deals with the distribution of mean and standard deviation of age at marriage of wife in years concerning her educational status. It is found that age at marriage increases as educational status advances except in the case of under-matric. Under-matric has a little bit lower mean than that of illiterate.

According to the current study, women who are illiterate or below the grade level typically marry at the age of 22, but women with Master's degrees typically marry at the age of 29. The very highly significant value of $F=24.000$; $P=0.000$ indicates that the wife's age at marriage and educational position are shown to be highly relevant.

The above findings as revealed by the present study indicated that there is a significant difference in age at marriage among the different educational status groups considered as better-educated women who got married later than illiterate or less-educated women.

This outcome is consistent with other researchers' earlier findings. Education was found to have a high positive correlation with age at marriage by Naik (1969). Singh (1978) demonstrated that in comparison to the illiterate and less educated groups, the married age was later for educated boys and girls. Women with education married two to five years later than women without education in practically all of South Asia, according to Cleland and Jejeebhoy (1996). Research by Sivakumar (1999) showed that women with greater levels of education married at slightly older ages than women with lower levels of education.

However, Pathan (1986) documented the early marriage customs of literate Muslims living in rural areas. Mutharayappa (1993) also found that education had a strong negative association with age at marriage.

Table -2: Educational status of wife and age at marriage (husband)

Educational status	Age (year)						Remark
	N	Mean	S.D.	F-Value	d.f	P-Value	
Illiterate	208	26.12	5.47	37.057	5,1002	0.000	Very highly significant
Under matric	250	27.21	5.35				
Matric	115	28.74	5.20				
Undergraduate	110	27.60	5.40				
Graduate	200	31.42	5.01				
Postgraduate	125	32.12	4.40				
Total	1008	28.65	5.64				

Table 2 illustrates how the wife's educational status and the husband's mean age at marriage differ. It is discovered that these differences between the wife's educational status and the husband's average age at marriage are extremely important. The table also shows that the age at marriage of the husband rises in direct proportion to the wife's educational status. While post-graduate women's spouses are typically wedded later, illiterate women's husbands typically marry at a younger age. As a result, it subtly demonstrates the substantial correlation between educational status and marriageable age.

6. CONCLUSIONS

The age at marriage rises with higher educational status, except for under-matriculated students. The mean under matriculation is lower than the illiterate's. Women without formal education and below Matric married at about age twenty-two years, while women with Postgraduate degrees married at age twenty-nine. Better-educated women married later than illiterate or less educated women, as indicated by the very highly significant test value, which shows that there is a considerable difference in age at marriage among spouses of different educational statuses.

Additionally, the average age of the husband upon marriage differs from the wife's educational status. Illiterate women have corresponded with the low age at marriage of husbands while the husbands of post-graduate women have married late. In other words, husbands of less-educated women married earlier than husbands of better-educated women. Thus, the findings indicate a substantial correlation between age at marriage and educational status.

ACKNOWLEDGEMENTS

The authors are grateful to Prof. Kh. Mohon Singh, Editor-in-Chief, Thambal Marik College Research Journal (TMCRJ) for his constant encouragement and valuable suggestions in preparing this paper. They express sincere thanks to the anonymous reviewer to whom the paper was submitted for comprehensive tips on how to

complete this paper. Further, They would like to express gratitude to Dr Th. Sharatchandra Singh, Managing Editor, Thambal Marik College Research Journal (TMCRJ) for his active support and constructive suggestions. They are also thankful to the Institutional Research Committee of Thambal Marik College, Oinam for publishing the paper in the first issue of the Research Journal.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

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Common Fixed Point Theorems For Biased Type (R_s)

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ABSTRACT

A fixed point of a function $T: X \rightarrow X$ is an element x in X such that $T(x) = x$. Again, given a nonempty set X and F , a nonempty collection of self-maps on X , a common fixed point of the maps in F is an element x of X such that $x = f(x)$ for every $f \in F$. The theorems concerning fixed points and properties are known as fixed point theorems. Fixed point theory, as a branch of mathematics, thus searches for self-maps that preserve at least one element's invariance. One well-known fixed point theorem comes from Brower's fixed point theorem, published in 1910. Many different types of fixed-point theorems and mappings were subsequently published. These days, the field and its applications are vast; examples include numerous applications in economic theories, fluid flow, epidemics, pure and applied mathematics, etc. This paper discusses the common fixed point theorem under the biased type for different mappings. In this work, two other common fixed point theorems of biased type (R_s) are to be established. The first theorem takes into account three mappings, while the second takes into account four. Our results expand upon a few earlier findings in the literature.

Mathematics Subject Classification: 47H10, 54H25.

Keywords: Compatible mappings, Biased type (R_s) , Common fixed point, Metric space.

1. INTRODUCTION

In 1986, Jungck generalized commuting mappings to introduce the idea of compatible mappings. Compatibility maps of type (A) were first introduced by Jungck, Murthy, and Cho (1993). Compatible mappings of type (P) are a novel class of compatible mappings that were first proposed by Pathak, Chang, and Cho (1994). Pathak and Khan, (1995) introduced the idea of compatible mappings of type (B), by fractionating the definition of a compatible map of type (A), Pathak and Khan (1997) introduced the idea of A-compatible and S-compatible maps. A common fixed point theorem for A-compatible and S-compatible maps on complete metric spaces was

also obtained. Various types of compatible maps are characterized and compared in terms of the continuity of the map. Combining the definitions of compatible and compatible mappings of type (P), Rohen and Singh (Rohen, *et al* 2004) introduced the idea of compatible mappings of type (R). Afterwards, Rohen and numerous others expound upon it. Over the past ten years, several authors have examined various aspects of compatible mappings of type (R) (Rohen, 2010; Rohen *et al.*, 2012; Rohen & Mr, 2008; Umesh Raj Opadhyaya and K. Jha, 2020; Jungck, and Pathak; 1995) introduced the concept of “biased

maps,” which are compatible maps that have been generalized. Additionally, “biased maps of type (A),” a generalization of compatible mappings of type (A), were presented by Pathak, *et al.*, (1998). Fisher and Murthy (1999) also introduced biased maps of type (A_r) or type (A_s). Awnish and Koti (2019) used biased maps in implicit

relations. Hakima Bouhadjera *et al* (2022) applied occasionally weakly biased maps in b-metric-like spaces

The purpose of this paper is to prove some common fixed point theorems of biased type (R_s) in metric spaces.

The following is a list of the several compatible mapping types.

Definition 1.1: Assume that S and T are mappings from a complete metric space X into itself. The compatibility of the mappings S and T is claimed, if $\lim_{n \rightarrow \infty} d(STx_n, TSx_n) = 0$ whenever $\{x_n\}$ is a sequence in X such that $\lim_{n \rightarrow \infty} Sx_n = \lim_{n \rightarrow \infty} Tx_n = t$ for some $t \in X$.

Definition 1.2: Assume that S and T are mappings from a complete metric space X into itself. The mappings S and T are claiming to be compatible with type (A) if $\lim_{n \rightarrow \infty} d(TSx_n, SSx_n) = 0$ and $\lim_{n \rightarrow \infty} d(STx_n, TTx_n) = 0$ whenever $\{x_n\}$ is a sequence in X such that $\lim_{n \rightarrow \infty} Sx_n = \lim_{n \rightarrow \infty} Tx_n = t$ for some $t \in X$.

Definition 1.3: Assume that S and T are mappings from a complete metric space X into itself. The mappings S and T are claimed to be compatible with type (P) $\lim_{n \rightarrow \infty} d(SSx_n, TTx_n) = 0$ whenever $\{x_n\}$ is a sequence in X such that $\lim_{n \rightarrow \infty} Sx_n = \lim_{n \rightarrow \infty} Tx_n = t$ for some $t \in X$.

Definition 1.4: Assume that S and T are mappings from a complete metric space X into itself. The mappings S and T are claimed to be compatible with type (R) if

$$\lim_{n \rightarrow \infty} d(STx_n, TSx_n) = 0 \text{ and } \lim_{n \rightarrow \infty} d(SSx_n, TTx_n) = 0$$

whenever $\{x_n\}$ is a sequence in X such that $\lim_{n \rightarrow \infty} Sx_n = \lim_{n \rightarrow \infty} Tx_n = t$ for some $t \in X$.

We present the subsequent definition.

Definition 1.5 Assume that S and T are mappings from a complete metric space X into itself. The S and T mappings are claimed to be biased type (R_s) if

$$\begin{aligned} \lim_{n \rightarrow \infty} d(SSx_n, TTx_n) &\leq \lim_{n \rightarrow \infty} d(TSx_n, STx_n) \\ \& \lim_{n \rightarrow \infty} d(STx_n, TSx_n) &\leq \lim_{n \rightarrow \infty} d(TTx_n, SSx_n) \end{aligned}$$

Whenever $\{x_n\}$ is a sequence in X such that $\lim_{n \rightarrow \infty} Sx_n = \lim_{n \rightarrow \infty} Tx_n = t$ for some $t \in X$.

2. MAIN RESULTS

The subsequent assertions are essential to our primary theorem.

Proposition 2.1: Assume that S and T are mappings from a complete metric space (X, d) into itself. If a pair $\{S, T\}$ is biased type (R_s) on X and $Sz = Tz$ for $z \in X$, then $STz = TSz = SSz = TTz$.

Proposition 2.2: Assume that S and T are mappings from a complete metric space (X, d) into itself. If a pair $\{S, T\}$ is biased type (R_s) on X and $\lim_{n \rightarrow \infty} Sx_n = \lim_{n \rightarrow \infty} Tx_n = z$ for some $z \in X$, then we have

- (i) $d(TSx_n, Sz) \rightarrow 0$ as $n \rightarrow \infty$ if S is continuous,
- (ii) $STz = TSz$ and $Sz = Tz$ if S and T are continuous at z .

We now demonstrate the subsequent theorem.

Theorem 2.3. Assume that A, B and S are self-mappings of a complete metric space (X, d) that satisfy the following:

- (i) $A(X) \cup B(X) \subseteq S(X)$
- (ii) $d^2(Ax, By) \leq \alpha \max\{d(Sx, Sy)d(Sx, Ax), d(Sx, Sy)d(Sy, By)\} + \beta\{d(Sx, By)d(Sy, Ax)\}$
for all $\alpha, \beta > 0, \beta < 1$ and $x, y \in X$
- (iii) The pair (A, S) or (B, S) is biased type (R_s)
- (iv) If S is continuous

then A, B and S have a unique common fixed point.

Proof: Assuming $x_0 \in X$ arbitrary. Construct a sequence $\{Sx_n\}$, in this manner

$$Sx_{2n+1} = Ax_{2n}; Sx_{2n+2} = Bx_{2n+1};$$

and $n = 0, 1, 2, 3, \dots$ from condition (ii) we have

$$\begin{aligned} d^2(Sx_{2n+1}, Sx_{2n+2}) &= d^2(Ax_{2n}, Bx_{2n+1}) \\ &\leq \alpha \max\{d(Sx_{2n}, Sx_{2n+1})d(Sx_{2n}, Ax_{2n}), d(Sx_{2n}, Sx_{2n+1})d(Sx_{2n+1}, Bx_{2n+1})\} \\ &\quad + \beta\{d(Sx_{2n}, Bx_{2n+1})d(Sx_{2n+1}, Ax_{2n})\}, \\ &= \alpha \max\{d(Sx_{2n}, Sx_{2n+1})d(Sx_{2n}, Sx_{2n+1}), d(Sx_{2n}, Sx_{2n+1})d(Sx_{2n+1}, Sx_{2n+2})\} \\ &\quad + \beta\{d(Sx_{2n}, Sx_{2n+2})d(Sx_{2n+1}, Sx_{2n+1})\}, \\ &= \alpha \max\{d(Sx_{2n}, Sx_{2n+1})d(Sx_{2n}, Sx_{2n+1}), d(Sx_{2n}, Sx_{2n+1})d(Sx_{2n+1}, Sx_{2n+2})\}, \\ d^2(Sx_{2n+1}, Sx_{2n+2}) &\leq \alpha d(Sx_{2n}, Sx_{2n+1}) \max\{d(Sx_{2n}, Sx_{2n+1}), d(Sx_{2n+1}, Sx_{2n+2})\}, \\ &\leq \alpha d(Sx_{2n}, Sx_{2n+1}) \max\{d(Sx_{2n}, Sx_{2n+1}), d(Sx_{2n+1}, Sx_{2n+2})\}. \end{aligned}$$

If $\max\{d(Sx_{2n}, Sx_{2n+1}), d(Sx_{2n+1}, Sx_{2n+2})\} = d(Sx_{2n}, Sx_{2n+1})$

then $d(Sx_{2n+1}, Sx_{2n+2}) \leq k_1 d(Sx_{2n}, Sx_{2n+1})$ where $k_1 = \alpha^{\frac{1}{2}}, k_1 < 1$ (2.1)

If $\max\{d(Sx_{2n}, Sx_{2n+1}), d(Sx_{2n+1}, Sx_{2n+2})\} = d(Sx_{2n+1}, Sx_{2n+2})$

then $d(Sx_{2n+1}, Sx_{2n+2}) \leq k_2 d(Sx_{2n}, Sx_{2n+1})$ where $k_2 = \alpha, k_2 < 1$ (2.2)

From (2.1) and (2.2) we have

$$d(Sx_{2n+1}, Sx_{2n+2}) \leq kd(Sx_{2n}, Sx_{2n+1}) \text{ where } k = \max\{k_1, k_2\}$$

In general $d(Sx_{n+1}, Sx_n) \leq k^n d(Sx_0, Sx_1)$.

Thus $\{Sx_n\}$ is a Cauchy sequence. Since X is complete, there exists $z \in X$ such that $Sx_n \rightarrow z$. It follows that the sequences $\{Ax_{2n}\}$ and $\{Bx_{2n+1}\}$ also converge to z . First suppose that the pair (A, S) is biased type (R_s) . Then from condition (ii) we have

$$d^2(ASx_{2n}, Bx_{2n+1}) \leq \alpha \max \{d(SSx_{2n}, Sx_{2n+1})d(SSx_{2n}, ASx_{2n}), \\ d(SSx_{2n}, Sx_{2n+1})d(Sx_{2n+1}, Bx_{2n+1})\} + \beta d \{(SSx_{2n}, Bx_{2n+1})d(Sx_{2n+1}, ASx_{2n})\}.$$

Since S is continuous, $SSx_{2n} \rightarrow Sz$, $ASx_{2n} \rightarrow Sz$ as $n \rightarrow \infty$, the pair (A, S) is biased type (R_s) , then $ASx_{2n} \rightarrow Sz$ as $n \rightarrow \infty$.

Letting $n \rightarrow \infty$ and we get

$$d^2(Sz, z) \leq \alpha \max \{d(Sz, z)d(Sz, Sz), d(Sz, z)d(z, z)\} + \beta \{d(Sz, z)d(z, Sz)\} \\ = \beta d(Sz, z)d(Sz, z) \\ \Rightarrow d(Sz, z) \leq \beta^{\frac{1}{2}} d(Sz, z). \text{ Let } \beta^{\frac{1}{2}} = k \text{ \{since } \beta < 1 \text{ therefore } k < 1\} \\ \Rightarrow (1-k) d(Sz, z) \leq 0 \text{ but } k = 0. \text{ Therefore } Sz = z.$$

Again from (ii) we have

$$d^2(Az, Bx_{2n+1}) \leq \alpha \max \{d(Sz, Sx_{2n+1})d(Sz, Az), d(Sz, Sx_{2n+1})d(Sx_{2n+1}, Bx_{2n+1})\} \\ + \beta \{d(Sz, Bx_{2n+1})d(Sx_{2n+1}, Az)\}.$$

Letting as $n \rightarrow \infty$ we have

$$d^2(Az, z) \leq \alpha \max \{d(z, z)d(Az, z), d(z, z)d(z, z)\} + \beta \{d(z, z)d(z, Az)\} \\ d(Az, z) \leq 0. \text{ But } d(Az, z) \geq 0.$$

Therefore $d(Az, z) = 0$ and hence $Az = z$.

Again from condition (ii), we have

$$d^2(Ax_{2n}, Bz) \leq \alpha \max \{d(Sx_{2n}, Sz)d(Sx_{2n}, Ax_{2n}), d(Sx_{2n}, Sz)d(Sz, Bz)\} \\ + \beta \{d(Sx_{2n}, Bz)d(Sz, Ax_{2n})\}$$

Letting as $n \rightarrow \infty$ we have

$$d^2(z, Bz) \leq \alpha \max \{d(z, z)d(z, z), d(z, z)d(z, Bz)\} + \beta \{d(z, Bz)d(z, z)\} \\ \Rightarrow d(z, Bz) = 0.$$

Hence $z = Bz$. Thus $z = Bz = Az = Sz$.

Demonstrating that z is a common fixed point of A , B and S . Similarly we can prove that z is a common fixed point of A , B and S when the pair (B, S) is biased type (R_s) .

Let z and w be two common fixed points of A , B and S . This means that $z = Az = Bz = Sz$ and $w = Aw = Bw = Sw$. This proves the uniqueness of the fixed point, condition (ii), gives us

$$d^2(Az, Bw) \leq \alpha \max \{d(Sz, Sw)d(Sz, Az), d(Sz, Sw)d(Sw, Bw)\} \\ + \beta \{d(Sz, Bw)d(Sw, Az)\} \\ = \alpha \max \{d(z, w)d(z, z), d(z, w)d(w, w)\} + \beta \{d(z, w)d(w, z)\} \\ \Rightarrow (1 - \beta) d^2(z, w) \leq 0 \\ \Rightarrow d(z, w) < 0 \text{ is a contradiction, hence the proof.}$$

Theorem 2.4 Assume that A , S , T and B are four self-mapping of a complete metric space (X, d) into itself that satisfy the following conditions:

- (i) $A(X) \subseteq T(X), B(X) \subseteq S(X)$
- (ii) $d^2(Ax, By) \leq \alpha \max \{d(Sx, Ty)d(Sx, Ax), d(Sx, Ty)d(Ty, By)\} + \beta \{d(Sx, By)d(Ty, Ax)\}$, for all $\alpha, \beta > 0, \alpha + \beta < 1$ and $x, y \in X$
- (iii) one of A, S, B and T is continuous
- (iv) the pairs (A, S) and (B, T) are biased type (R_s) .

then A, S, B and T have a unique common fixed point.

Proof: Assuming x_0 in X is arbitrary. Define sequence $\{x_n\}$ and $\{y_n\}$ in X .

$$y_{2n} = Ax_{2n} = Tx_{2n+1} \text{ and } y_{2n+1} = Bx_{2n+1} = Sx_{2n+2},$$

Condition (ii), allows us to have

$$\begin{aligned} d^2(y_{2n}, y_{2n+1}) &= d^2(Ax_{2n}, Bx_{2n+1}) \\ &\leq \alpha \max \{d(Sx_{2n}, Tx_{2n+1})d(Sx_{2n}, Ax_{2n}), d(Sx_{2n}, Tx_{2n+1})d(Tx_{2n+1}, Bx_{2n+1})\} \\ &\quad + \beta \{d(Sx_{2n}, Bx_{2n+1})d(Tx_{2n+1}, Ax_{2n})\} \\ &\leq \alpha \max \{d(y_{2n-1}, y_{2n})d(y_{2n-1}, y_{2n}), d(y_{2n-1}, y_{2n})d(y_{2n}, y_{2n+1})\} \\ &\quad + \beta \{d(y_{2n-1}, y_{2n+1})d(y_{2n}, y_{2n})\} \\ &= \alpha \max \{d(y_{2n-1}, y_{2n})d(y_{2n-1}, y_{2n}), d(y_{2n-1}, y_{2n})d(y_{2n}, y_{2n+1})\} \\ d^2(y_{2n}, y_{2n+1}) &\leq \alpha d(y_{2n}, y_{2n+1}) \max \{d(y_{2n}, y_{2n-1}), d(y_{2n}, y_{2n+1})\} \end{aligned}$$

If $\max \{d(y_{2n}, y_{2n-1}), d(y_{2n}, y_{2n+1})\} = d(y_{2n}, y_{2n-1})$

then $d(y_{2n}, y_{2n+1}) \leq k_1 d(y_{2n}, y_{2n-1})$ where $k_1 = \alpha^{\frac{1}{2}}$, $k_1 < 1$ (2.3)

If $\max \{d(y_{2n}, y_{2n-1}), d(y_{2n}, y_{2n+1})\} = d(y_{2n}, y_{2n+1})$

Then $d(y_{2n}, y_{2n+1}) \leq k_2 d(y_{2n}, y_{2n-1})$ where $k_2 = \alpha$, $k_2 < 1$ (2.4)

From (2.3) and (2.4) we have

$$d(y_{2n}, y_{2n+1}) \leq k d(y_{2n}, y_{2n-1}) \text{ where } k = \max \{k_1, k_2\} \text{ and } k < 1$$

In general $d(y_{n+1}, y_n) \leq k^n d(y_0, y_1)$.

$$\begin{aligned} \text{Also } d(y_n, y_{n+m}) &\leq d(y_n, y_{n+1}) + d(y_{n+1}, y_{n+2}) + \dots + d(y_{n+m-1}, y_{n+m}) \\ &\leq (1 + k + k^2 + \dots + k^{m-1}) d(y_n, y_{n+1}) \leq \left(\frac{1}{1-k}\right) k^n d(y_0, y_1). \end{aligned}$$

This means that $d(y_n, y_{n+m}) \rightarrow 0$ as $n \rightarrow \infty$. Thus $\{y_n\}$ is a Cauchy sequence in X and since X is a complete metric space, the sequence $\{y_n\}$ converges to a limit z in X . Hence the sub-sequences $\{y_{2n}\} = \{Ax_{2n}\} = \{Tx_{2n+1}\}$ and $\{y_{2n+1}\} = \{Bx_{2n+1}\} = \{Sx_{2n+2}\}$ also converge to the limit point z . Suppose that the mapping S is continuous, then $SSx_{2n} \rightarrow Sz$ and $Sx_{2n} \rightarrow Sz$ as $n \rightarrow \infty$. Since the pair (A, S) is biased type (R_s) we get $ASx_{2n} \rightarrow Sz$ as $n \rightarrow \infty$. Now by (ii)

$$\begin{aligned} d^2(A^2x_{2n}, Bx_{2n+1}) &\leq \alpha \max \{d(SAx_{2n}, Tx_{2n+1})d(SAx_{2n}, AAx_{2n}), \\ &\quad d(SAx_{2n}, AAx_{2n})d(Tx_{2n+1}, Bx_{2n+1})\} + \beta \{d(SAx_{2n}, Bx_{2n+1})d(Tx_{2n+1}, Tx_{2n+1})\} \end{aligned}$$

Letting $n \rightarrow \infty$, using the biased type (R_s) of the pair (A, S) we get

$$\begin{aligned} d^2(Sz, z) &\leq \alpha \max \{d(Sz, z)d(Sz, Sz), d(Sz, z)d(z, z)\} + \beta \{d(Sz, z)d(z, Sz)\} \\ &= \beta d(Sz, z)d(Sz, z) \\ \Rightarrow d(Sz, z) &\leq \beta^{\frac{1}{2}} d(Sz, z). \text{ Let } \beta^{\frac{1}{2}} = k \{ \text{since } \beta < 1 \text{ therefore } k < 1 \} \end{aligned}$$

$$\Rightarrow (1-k) d(Sz, z) \leq 0.$$

$$d(Sz, z) = 0$$

$$\text{i.e. } Sz = z.$$

Further

$$d^2(Az, Bx_{2n+1}) \leq \alpha \max \{d(Sz, Tx_{2n+1}) d(Sz, Az), d(Sz, Tx_{2n+1}) d(Tx_{2n+1}, Bx_{2n+1})\} \\ + \beta \{d(Sz, Bx_{2n+1}) d(Tx_{2n+1}, Az)\}.$$

As $n \rightarrow \infty$ we get

$$d^2(Az, z) \leq \alpha \max \{d(z, z)d(z, Az), d(z, z)d(z, z)\} + \beta \{d(z, z)d(z, Az)\} \\ \Rightarrow d(Az, z) \leq 0$$

so we have $d(Az, z) = 0$ and hence $Az = z$. Thus $Az = Sz = z$.

Since $A(X) \subseteq T(X)$, there is a point $z \in X$ such that $z = Az = Tz'$. Now we prove that $Tz' = Bz'$. Now by (ii)

$$d^2(Az, Bz') \leq \alpha \max \{d(Sz, Tz')d(Sz, Az), d(Sz, Tz')d(Tz', Bz')\} \\ + \beta \{d(Sz, Bz')d(Tz', Az)\} \\ = \alpha \max \{d(z, z)d(z, z), d(z, z)d(z, Bz')\} + \beta \{d(z, Bz')d(z, z)\} \\ \Rightarrow d^2(z, Bz') \leq 0. \text{ This implies } Bz' = z, \text{ hence } z = Tz' = Bz'.$$

Take $y_n = z'$ for $n \geq 1$, then $By_n \rightarrow Bz' = z$ and $Ty_n \rightarrow Tz' = z$ as $n \rightarrow \infty$.

Since the pair (B, T) is biased type (R_s) we get $BB = TTz'$, hence $Bz = Tz$.

Now

$$d^2(Az, Bz) \leq \alpha \max \{d(Sz, Tz)d(Sz, Az), d(Sz, Tz)d(Tz, Bz)\} + \beta \{d(Sz, Bz)d(Tz, Az)\} \\ = \alpha \max \{d(z, Bz)d(z, z), d(z, z)d(Bz, Bz)\} + \beta \{d(z, Bz)d(Bz, z)\} \\ = \beta \{d(Bz, z)d(Bz, z)\} \\ \Rightarrow d(Bz, z) \leq \beta^{\frac{1}{2}} d(Bz, z). \text{ Let } \beta^{\frac{1}{2}} = k \text{ but } \beta < 1. \text{ Therefore } k < 1 \\ \Rightarrow (1-k) d(Bz, z) \leq 0.$$

Thus, $d(Bz, z) = 0$ meaning that $z = Bz$ and $z = Bz = Tz$. Hence z is a common fixed point of A , S , T and B . When continuity of S is assumed, to prove that z is a common fixed point of A , S , T and B is similar. When T is continuous and assuming that A is also continuous, then $AAx_{2n}, ASx_{2n} \rightarrow Az$ as $n \rightarrow \infty$.

So by (ii)

$$d^2(ASx_{2n}, Bx_{2n+1}) \leq \alpha \max \{d(SSx_{2n}, Tx_{2n+1})d(SSx_{2n}, ASx_{2n}), \\ d(SSx_{2n}, Tx_{2n+1})d(Tx_{2n+1}, Bx_{2n+1})\} + \beta \{d(SSx_{2n}, Bx_{2n+1})d(Tx_{2n+1}, ASx_{2n})\} \\ \Rightarrow d^2(Az, z) \leq \alpha \max \{d(Az, z)d(Az, Az), d(Az, z)d(z, z)\} + \beta \{d(Az, z)d(z, Az)\} \\ \leq \beta d(Az, z)d(Az, z). \\ \Rightarrow d(Az, z) \leq \beta^{\frac{1}{2}} d(Az, z). \text{ Let } \beta^{\frac{1}{2}} = k \text{ but } \beta < 1. \text{ Therefore } k < 1 \\ \Rightarrow (1-k) d(Az, z) \leq 0.$$

Hence $d(Az, z) = 0$ i.e. $Az = z$. $A(X) \subseteq T(X)$, there is a point $u \in X$ as such $z = Az = Tu$.

Now by (ii)

$$d^2(ASx_{2n}, Bu) \leq \alpha \max \{d(SSx_{2n}, Tu) d(SSx_{2n}, ASx_{2n}), d(SSx_{2n}, Tu)d(Tu, Bu)\} \\ + \beta \{d(SSx_{2n}, Bu)d(Tu, ASx_{2n})\},$$

Letting $n \rightarrow \infty$ we have

$$d^2(z, Bu) = d^2(Az, Bu) \leq \alpha \max \{d(z, z)d(z, z), d(z, z)d(z, Bu)\} + \beta \{d(z, Bu)d(z, z)\}. \\ \Rightarrow d(z, Bu) = 0 \text{ and hence } z = Bu. \text{ Hence } z = Bu = Tu.$$

Let $y_n = u$, then $By_n \rightarrow Bu = z$ and $Ty_n \rightarrow Tu = z$. Since (B, T) is biased type (R_s) , $d(BBy_n, TTy_n) = 0$. This gives $Bz = Tz$. Further

$$d^2(Ax_{2n}, Bz) \leq \alpha \max \{d(Sx_{2n}, Tz)d(Sx_{2n}, Ax_{2n}), d(Sx_{2n}, Tz)d(Tz, Bz)\} \\ + \beta \{d(Sx_{2n}, Bz)d(Tz, Ax_{2n})\},$$

Letting $n \rightarrow \infty$ we have

$$\Rightarrow d^2(z, Bz) \leq \alpha \max \{d(z, Bz)d(z, z), d(z, Bz)d(Bz, Bz)\} + \beta \{d(z, Bz)d(Bz, z)\} \\ = \beta d(z, Bz)d(z, Bz). \text{ Let } \beta^{\frac{1}{2}} = k \text{ but } \beta < 1. \text{ Therefore } k < 1 \\ \Rightarrow (1-k) d(Bz, z) \leq 0.$$

Hence $d(Bz, z) = 0$ i.e. $Bz = z$. Hence $z = Bz$ and $z = Tz = Bz$.

Since $B(X) \subseteq S(X)$, There is a point $v \in X$ like that $z = Bz = Sv$. Now we prove $Av = z$

$$d^2(Av, Bz) \leq \alpha \max \{d(Sv, Tz)d(Sv, Av), d(Sv, Tz)d(Tz, Bz)\} \\ + \beta \{d(Sv, Bz)d(Tz, Av)\} \\ \leq \alpha \max \{d(z, z)d(z, Av), d(z, z)d(z, z)\} + \beta \{d(z, z)d(z, Av)\} \\ \Rightarrow d(Av, z) \leq 0 \text{ and } Av = z.$$

Take $y_n = v$ then $Ay_n \rightarrow Av = z$, $Sy_n \rightarrow Sv = z$. Since (A, S) are biased type (R_s) we get $\lim_{n \rightarrow \infty} d(SSy_n, AAy_n) = 0$. So $Az = z$ is implied. Consequently, z is a common fixed point of A, S, T and B when A is continuous.

Similarly, it can be proved that z is a common fixed point of A, S, T and B when B is continuous.

Assume that A, S, T and B have two common fixed points, z and w i.e. $z = Az = Sz = Bz = Tz$ and $w = Aw = Sw = Bw = Tw$.

To prove the uniqueness in the case of fixed-point

From condition (ii)

$$d^2(Az, Bw) \leq \alpha \max \{d(Sz, Tw)d(Sz, Az), d(Sz, Tw)d(Tw, Bw)\} + \beta \{d(Sz, Bw)d(Tw, Az)\} \\ = \alpha \max \{d(z, w)d(z, z), d(z, w)d(w, w)\} + \beta \{d(z, w)d(w, z)\} \\ = \beta \{d(z, w)d(w, z)\} \\ \Rightarrow (1-k) d(z, w) \leq 0. \\ \Rightarrow d(z, w) = 0 \\ \text{i.e., } w = z.$$

‘ Z ’ is therefore the unique common fixed point.

ACKNOWLEDGEMENTS

The authors are grateful to Prof. Kh. Mohon Singh, Editor-in-Chief, Thambal Marik College Research Journal (TMCRJ) for his generous and insightful comments and suggestions in preparing this paper. They are also thankful to the anonymous reviewer to whom the paper was submitted for their valuable comments that improved the quality of the paper. The authors also acknowledge UGC, New Delhi for granting a Minor Research Project No. F 5 – 349 / 2014 – 15 / MRP / NERO / 2280.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

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Experimental Study of Transport Mechanisms of Carriers in Photocurrent Growth and Decay in Molar-Dependent nCdS Thin Films

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ABSTRACT

Investigation in Nano-structural, optical and photoelectrical phenomena and applications of nanocrystalline materials synthesised by different growth techniques has been a key interest in science and technology worldwide in recent decades. The basic reason is that the size-dependent nature of the grown particles in the materials exhibits dominant factors in the manifestation of efficient thin film electronic devices and applications. The present paper is an endeavour to study the silent features of localization of discrete distributions of charge carriers and recombination effects in carriers in the growth and decay photocurrent in the nanocrystalline nCdS thin films. Molar-dependent nCdS thin films in the range (0.05- 0.20) M were deposited onto ultrafine micro-glass slides by CBD (Chemical Bath Deposition) at pH value 10 of the solutions. Silver electrodes were vacuum deposited across the nCdS thin films to fabricate Ag/CdS/Ag gap-type cell configuration with inter-electrode spacing of 5mm. The films were successively illuminated constantly with white light intensities under fixed applied bias in vacuum pressure~2.67Pa inside a continuously sealed evacuated vacuum glass jacket. The rise and decay photocurrents were measured after intervals of 5 minutes in 30 minutes. and analysed as a function of time of illumination. The analysis revealed the presence of various distributions of discrete traps and recombination centres in the transport mechanisms of carriers in the band gap of nCdS thin films.

Keywords: Cadmium sulphide, CBD, photocurrent, traps.

1. INTRODUCTION

Nano science and nanotechnology has become a most fascinating field of research in all branches of material science, biological science and other branches of sciences worldwide during the last decades. Particles with a diameter of 1-100nm are called nanomaterials which may have varied structures like globular, rode-like, plate-like, flower-like, leaves-like or more complex structures. Spherical particles with a size <10nm are called clusters or quantum dots. In the nanoscale, the diameter of materials is of the order of de-Broglie wavelength of the electron wavefunction. (Email Roduner, 2006.) Therefore, the electronic and optical properties of matter are changed and

new properties are produced quite different from those of bulk materials.

Photoconductivity in a material is the manifestation of photo-electrical conductivity caused by the interaction of light quanta with the material which results in the production of free mobile carriers on suitable absorption of quantum of energy. Under a suitable applied electric field, a constant photocurrent is generated in the external circuit. This photo-electrical process finds several applications in the electronic industry and research (Nikhil Rastogi *et al.*, 2002). Cadmium Sulphide is one of the II-VI classes of bulk compound semiconductors. With a direct band gap of 2.4eV,

this compound semiconductor in thin film forms finds technological applications for fabrications of low-cost and high-efficiency thin film solar cells, (K. Kunjabali Singh *et al.*, 2010; Panda S K *et al.*, 2004; Rincon M E, *et al.* 2003; Balakrishnan K S *et al.* 1988; Entinu G *et al.*, 1981) laser diodes, (Panda SK *et al.*, 2004), photochemical Cells, (Rincon ME *et al.*, 2003; Balakrishnan KS *et al.*, 1988) X-ray detectors (S A Vanalakar *et al.*, 2010) and I R detectors (Yi Zeng *et al.*, 2024). A variety of physical and chemical routes for the deposition and synthesis of CdS semiconducting thin films have been reported by several research workers during the last decades for achieving good quality thin films. Therefore, a systematic approach to the selection of a method is necessary for the synthesis and deposition of semiconducting thin films. In the present study, the Chemical Bath Deposition (CBD) technique is used for the synthesis of CdS nanocrystalline thin films relative to less time consumption and less economic.

2. EXPERIMENTAL DETAILS

Cadmium Sulphide nano-composite thin films were synthesized using the CBD method onto free contaminated micro-glass slides at different molar solutions in the range 0.05M, 0.10M, 0.15M and 0.2M for which A R grade CdSO_4 , $\text{CS}(\text{NH}_2)_2$ and NH_3 solution were used. For 0.05M (CdS) thin films, 3.8gm of CdSO_4 was dissolved in 100 ml of de-ionized (DI) water. The precursor was stirred thoroughly for 20 min. Then, the NH_3 solution was added drop-by-drop to the precursor till the solution turned into an alkaline white turbid. Excess NH_3 - solution was added till the solution became clear to produce $\text{Cd}(\text{NH}_3)_4^{2+}$ ions in the solution. The p^{H} of the solution was adjusted to 10 with the help of a digital p^{H} meter. Now, 0.05M (thiourea) was prepared into 100ml of DI water at RT and stirred for 20 min and then added to the alkaline CdSO_4 precursor solution in the ratio 1:4 with continued stirring for 1.30 hr at 70°C . The hot solution was cooled down at RT. The ultra-cleaned substrates were dipped vertically into the reaction bath for 24 hrs using a suitably designed properly clamped substrate holder. The substrates were

gently removed from the bath when we obtained CdS thin films deposited, which were then kept for half an hour, washed several times with running DI water after which were crystallized in an oven at 50°C for 24hrs. Similarly, we synthesized 0.1M (CdS), 0.15M (CdS) and 0.20M (CdS) films by dissolving an appropriate amount of CdSO_4 and $\text{Cs}(\text{NH}_2)_2$ in DI water. The details of structural and optical reports were published in an earlier paper (M. Dinendra Singh *et al.*, 2016).

For good ohmic contacts for photoconductivity measurements, photo grade purity Ag electrodes of $4.0 \times 10.0 \text{ mm}^2$ sizes were uniformly vacuum deposited over CdS thin films using properly designed mica-masks inside HINDHIVAC 12 A 4 vacuum Coating Unit under vacuum pressure $1.33 \times 10^{-4} \text{ Pa}$ to achieve Ag/CdS/Ag gap type cell configuration with inter-electrode spacing of 5mm. The samples were successively mounted on a suitably designed mica sample mount and then suspended vertically inside a continuously evacuated air-sealed glass jacket using thin enamelled copper wires under vacuum pressure $\sim 2.67 \text{ Pa}$ for which a double-stage rotary pump was used. A suitably designed optical arrangement was made in a dark background to illuminate the sample uniformly with white light intensity for 30-40 minutes. The light was obtained from a tungsten halogen lamp (250W-24V) light source attached to a parabolic focusing mirror. An APLAB-Luxmeter (model 5011S) was used to measure the intensity of the incident light inside high ambient temperatures achieved using a resistive heater connected to a stabilized power supply. During the period of optical excitation, photocurrent (I_{ph}) started growing exponentially to reach the steady state, and the currents were recorded after 5 mins. The light was cut –off using a mechanical shutter for the next 15 minutes when the photocurrent started to decay exponentially to reach the initial dark current value. The dark currents and the currents under illumination were measured after 5 minutes with the help of high input impedance ($\sim 10^{14} \Omega$) ECIL Electrometer Amplifier under different d.c. bias voltages obtained from several dry cells of emf 9 volts each connected in series.

The thickness of the films was measured with the help of the Multiple Beam Interferometry Method (Tolansky technique).

3. RESULTS AND DISCUSSION

3.1. Effect of molarity on the growth and decay of photocurrent: The dark current (I_D) and the current under illumination (I_L) are related to photosensitivity in a sample under photo-excitation. The photosensitivity under consideration, is an effective optical parameter in measuring photoconductivity defined as

$$S = (I_L - I_D) / I_D = I_{ph} / I_D \quad (1)$$

where $I_{ph} = (I_L - I_D)$ is the photocurrent. The variation of photocurrent growth and decay as a function of time of illumination under different intensities of WL of CdS thin films at molarities $x = 0.05M$, $0.10M$, and $0.15M$ have been shown in Figs (1,2 & 3).

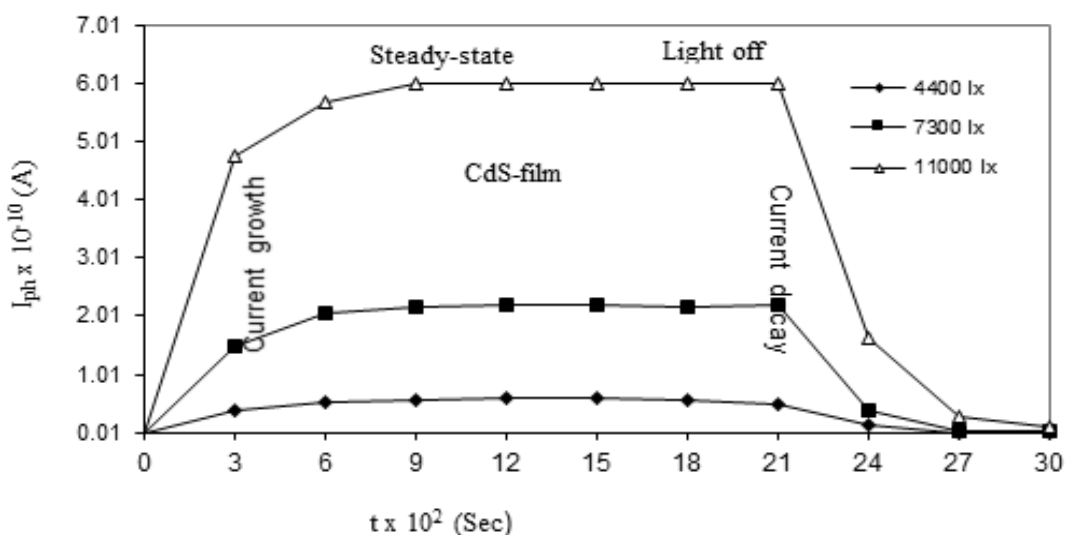


Fig.1. Photocurrent growth and decay vs. time in 0.05M (CdS) films

On exposition to external illumination of WL with sufficient photon energy $h\nu \geq E_g$, photocurrent increases exponentially to reach the maximum steady state within some fractions of a second. The time interval to reach the steady state is growth time (τ_g). In this process, new carriers are generated accompanied by their recombination. Photocurrent, therefore, requires some time to grow and reach the maximum value. As the density of excess carriers' increases, the recombination rate between carriers (electrons and holes) is also enhanced. However, after a lapse of time from the start of illumination of the sample, the concentration of electron-hole reaches equilibrium and is maintained as long as photon excitation remains unchanged. The photoconductivity in this situation is known as steady-state photoconductivity (Z Paroda *et*

al., 1980; S M Ryvkin, 1964). Once the steady state is maintained, there must be electron-hole recombination at the same rate at which they were generated and the density of electrons and holes attain some constant value. If the excitation light is turned off, the excess carriers recombine thereby decreasing the free lifetime time which results in a decrease in photoconductivity exponentially to reach the initial dark value within some finite time called decay time (τ_d).

3.2. Effect of molarity on trap depths in CdS films: The critical study of photoconductivity growth and decay characteristics in the CdS thin films reveals the presence of various electron-hole trap distributions, trapping levels; trap cross-sections etc. within the forbidden energy gap.

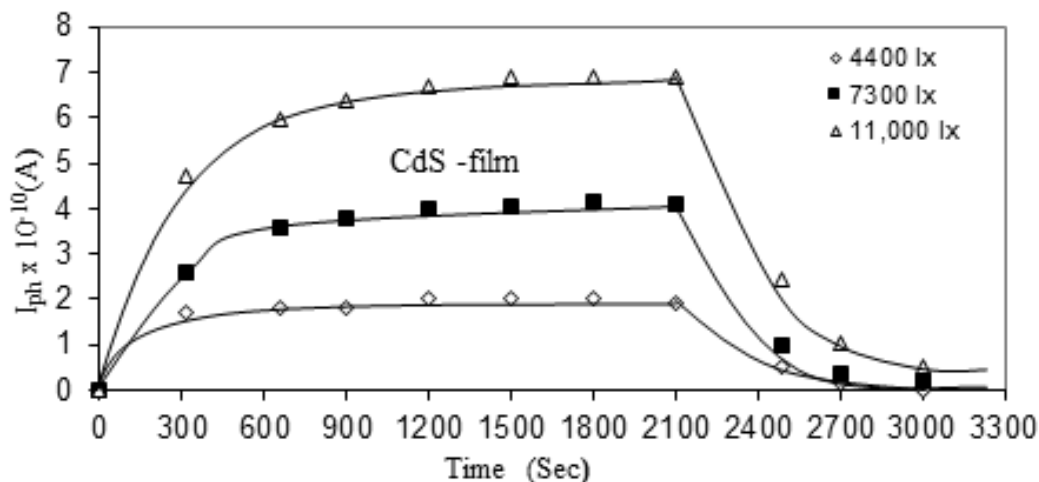


Fig.2. Photocurrent growth and decay vs. time 0.10M(CdS) films

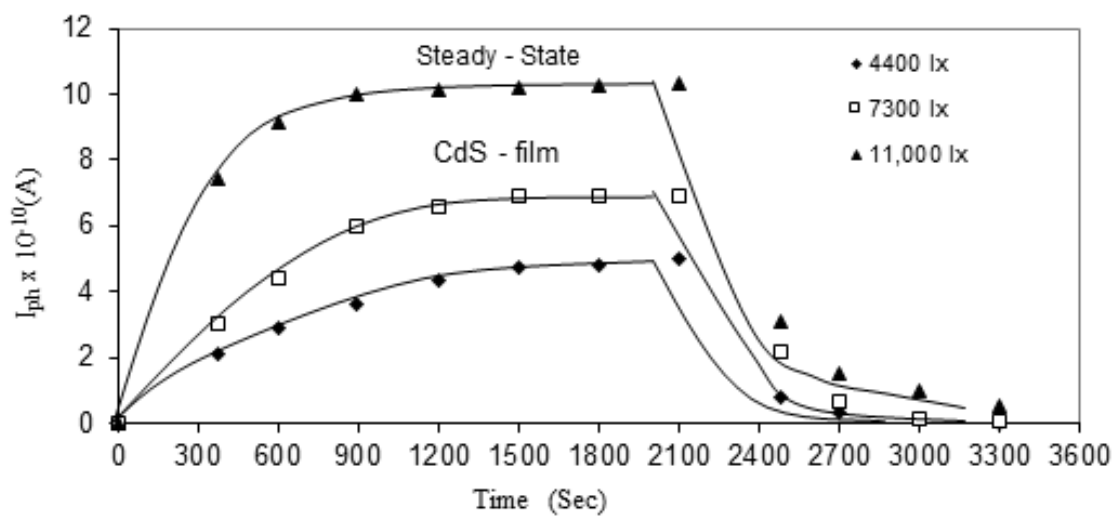


Fig.3. Photocurrent growth and decay vs.time in 0.15M(CdS) films.

Table-1. Growth and decay time at different levels of illumination

Induced molarity (M)	Thickness (Å)	Applied bias (36V)		
		Intensity (Ix)	τ_g (min)	τ_d (min)
0.05	1500	4400	10	2.50
		7300	5.0	1.67
		11000	5.0	1.25
0.10	2000	4400	5.0	2.30
		7300	4.6	1.17
		11000	4.2	0.75

0.15	2500	4400	4.9	2.25
		7300	4.5	0.83
		11000	4.1	0.50

Table-2. Discrete trap depths in CdS nanocrystalline thin films

Induced molar (M)	Trap - depths under levels of WL illumination		
	4400 Ix	7300 Ix	11000 Ix
0.05	0.75	0.74	0.73
0.10	0.74	0.75	0.74
0.15	0.75	0.74	0.75
0.20	0.75	0.76	0.73

The sub-linear behaviour of the characteristics shows the inter-relationship between traps and recombination centres in the films. Table -1 show the observed values of growth time (τ_g) and decay time (τ_d) of the films at different induced molars and intensities of illumination. It is observed that in each set of the films, a decrease in τ_g and τ_d with the rise in intensity of excitation resulted. The reason is that the concentration of free carriers for photoconduction is much above the number of carriers trapped, and hence electrons recombine with holes without disturbing the trapping process. The values of τ_g and τ_d for the films are also found to decrease with increasing molars, and the decay times for each intensity of illumination of the film are less than the corresponding growth times of photocurrent.

Further, the traps which have been filled with carriers during the excitation of the host material will be emptied when the excitation is removed depending on the capture cross-section and their ionization energies. If the re-trapping of carriers from traps is negligible, then exponential photocurrent decay is expected in the samples. The trap depth E in the energy gap can be calculated using the relation (Sadhana Devi *et al.*, 1992).

$$E = kT \left[\ln S - \ln \frac{h(I_o/I_t)}{t} \right] \quad (2)$$

where I_o is the photocurrent at $t=0$, I_t is the photocurrent at time t after switching on a light, S is the frequency factor equal to 10^{10} per

second, k is the Boltzmann constant and T the room temperature. The values of trap depths at different molars and levels of excitation in CdS nano-crystalline films were calculated from the exponential photocurrent decay curves and have been shown in Table 2. The estimated observed trap depth values are found in the range (0.73 – 0.75) eV.

4. CONCLUSIONS

The experimental analysis of molar-dependent photocurrent growth and decay times in the host CdS thin films are observed significantly dependent on the density of Cd^{+2} and S^{-2} ions, applied bias and intensities of excitation radiation. The growth and decay times of photocurrents are observed to decrease with the increase of molars and intensity of illumination. Various discrete traps and recombination of carriers are observed in the forbidden energy gap in the chemically synthesized nCdS thin films.

ACKNOWLEDGEMENTS

The authors are grateful to Prof. Kh. Mohon Singh, Editor-in-Chief, Thambal Marik College Research Journal (TMCRJ) for his kind suggestions in preparing this paper. They are also thankful to the anonymous reviewer to whom the paper was submitted for their valuable comments that improved the quality of the paper. The authors also acknowledge UGC, New Delhi for granting a Major Research Project No.F34-19/2008(SR) dated 29th Dec., 2008.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

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Effect of Vanadium Substitution in $YBa_2Cu_3O_{7-\delta}$ High-Temperature Superconductor

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ABSTRACT

Superconductivity is a low-temperature phenomenon associated with the complete disappearance of electrical resistivity and expulsion of magnetic fields initially passed through it when cooled below its transition temperature T_c . High-temperature superconductors are those superconducting materials whose T_c is above liquid nitrogen temperature. High-temperature superconductors are synthesized under different techniques. In this present study, we prepared high-temperature superconducting samples of $Y(Ba_{1-x}V_x)_2Cu_3O_{7-\delta}$ ($x=0, 1\%, 3\%$, and 5%) by usual ceramic method with partial substitution of vanadium in the Ba site. Characterization of the samples was done by taking an XRD pattern and from the scanning electron micrograph we studied the surface morphology. Using liquid nitrogen as a coolant, resistance-temperature measurement was done using the four probe method. From the XRD pattern, we calculate lattice parameters, and it reveals that the orthorhombicity phase decreases with the increase in vanadium concentration. From the microstructure analysis of the scanning electron micrographs, the approximate grain size ranges from $2\mu m$ to $6\mu m$. It is observed from the resistance temperature measurement and a.c susceptibility measurement, that the superconducting transition temperature T_c is depressed from about 92K to 83K due to vanadium substitution in the Ba site.

Keywords: Superconductivity, transition temperature, a.c.susceptibility, Orthorhombic

1. INTRODUCTION

At the time of the discovery of superconductivity by H. K. Onnes of Leiden University in 1911, superconductivity was observed at a few degree kelvins only for some elements and compounds. Researchers all over the world studied substitution and doping carried out at low transition temperature superconductors or even in non-superconducting materials. They hope that the substitution studies might pave the way for the discovery of new superconductors which can show superconductivity at higher T_c . It may further increase the T_c of the material and also the mechanism responsible for this phenomenon may be known. In 1986, Georg Bednorz and K.A Muller,

researchers of IBM discovered a superconductor with T_c around 35 K in $La_{2-x}Ba_xCuO_4$ compound (Bednorz *et al* 1986; A.Reller *et al* 1987). In 1987 this new type of superconducting compound was modified (Wu *et al* 1987) and replacing La with Y they prepared $YBa_2Cu_3O_{7-\delta}$ superconducting compound and got a transition temperature of 93K. The present work aims to study the vanadium substitution in the barium site of the $YBa_2Cu_3O_{7-\delta}$ superconductor. We prepared pure and substituted samples of $Y(Ba_{1-x}V_x)Cu_3O_{7-\delta}$ (where $x=0\%, 1\%, 3\%$ and 5%) by conventional solid-state reaction method. The samples were characterized by taking XRD patterns and scanning electron

micrographs (SEM). We used the conventional four-probe method for resistance temperature measurements and magnetic measurement was made by a. c. susceptibility measurements.

2. SAMPLE PREPARATION

Samples of nominal composition $Y(Ba_{1-x}V_x)_2Cu_3O_{7-\delta}$ with partial substitution of vanadium in barium site and $x = 0\%, 1\%, 3\%$ and 5% were prepared by conventional solid-state reaction method (Romen *et al* 1994). For the preparation of bulk superconducting materials, stoichiometric amounts of high-purity CuO , Y_2O_3 , $BaCO_3$, and different percentages of V_2O_5 were taken and ground in agate mortar and pestle. Grinding of the sample was continued till a homogenous coloration was obtained. The mixed powders were cold pressed separately and the pellets thus obtained were loaded in alumina boats and kept inside a furnace for calcination. First-time and second-time calcination of the samples were carried out at $910^\circ C$ and $920^\circ C$ respectively for 24hrs each with intermediate grinding. The pellets were finally ground well and rectangular bar shape samples were prepared using a rectangular bar shape die. The samples were inserted in a quartz tube placed inside a tube furnace and heated at $930^\circ C$ for 24 hours in an oxygen environment. The temperature of the furnace was reduced to $500^\circ C$ kept for another 12 hours and allowed to cool slowly in the same oxygen environment. The samples thus prepared were used for characterization and measurement.

3. EXPERIMENTAL RESULT

3.1 Characterization of Samples:

Characterization of the sample was done by taking an X-ray Diffraction (XRD) pattern using a powder X-ray diffractometer (Semen's FRG-500) with a diffracted monochromatic beam and high-resolution diffractometer of 401mm diameter. For surface morphology examination of $Y(Ba_{1-x}V_x)_2Cu_3O_{7-\delta}$ system, the scanning electron micrograph was taken using SEM(Joel, Japan, JSM-35CF). The wavelength of the focused electron beam is of the order of 0.006nm and the magnification of the instrument is from 10 to 1, 80,000 finally Focused images are displayed at the CRT, and photographs were taken using a camera (Cannon, Japan).

3.1.1 X-ray Diffraction Pattern (XRD): The X-ray diffraction patterns for pure and vanadium substituted samples for $2\theta=10^\circ$ to 70° are shown in Figure 1 (a-d). The pure sample Fig.1 (a) has nine well-defined peaks. The corresponding (hkl) values are indexed in the figure. These peaks correspond to pure $Y(Ba_{1-x}V_x)_2Cu_3O_{7-\delta}$ powder data as explained by Reller *et al* (1987). The V substituted sample($x=1\%$) yields four extra peaks corresponding to (002), (010), (004), and (115) directions Fig 1(b). Increasing the concentration of V ($x=3\%$ and 5%) does not show a major change in the intensity of the XRD peaks (Fig. 1(c) and 1(d)). In all cases, the maximum intensity is along the (110) direction. This indicates that there are no preferred orientations of the crystallites and the samples are polycrystalline. From the XRD pattern, we calculate the lattice parameters of the samples.

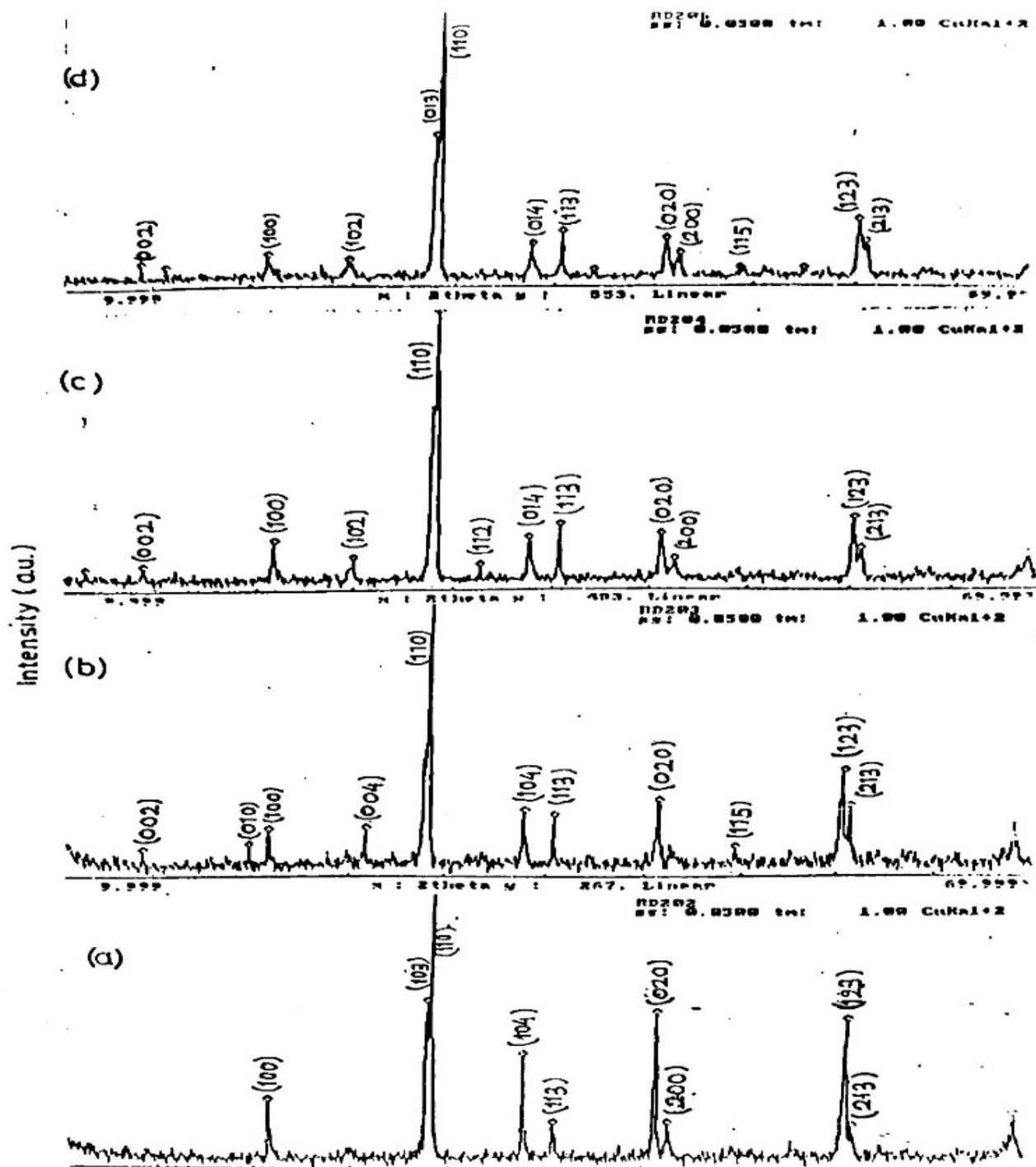


Figure 1(a-d) XRD pattern for $Y(Ba_{1-x}V_x)_2Cu_3O_{7-x}$ ($x=0\%, 1\%, 3\%$ and 5%)

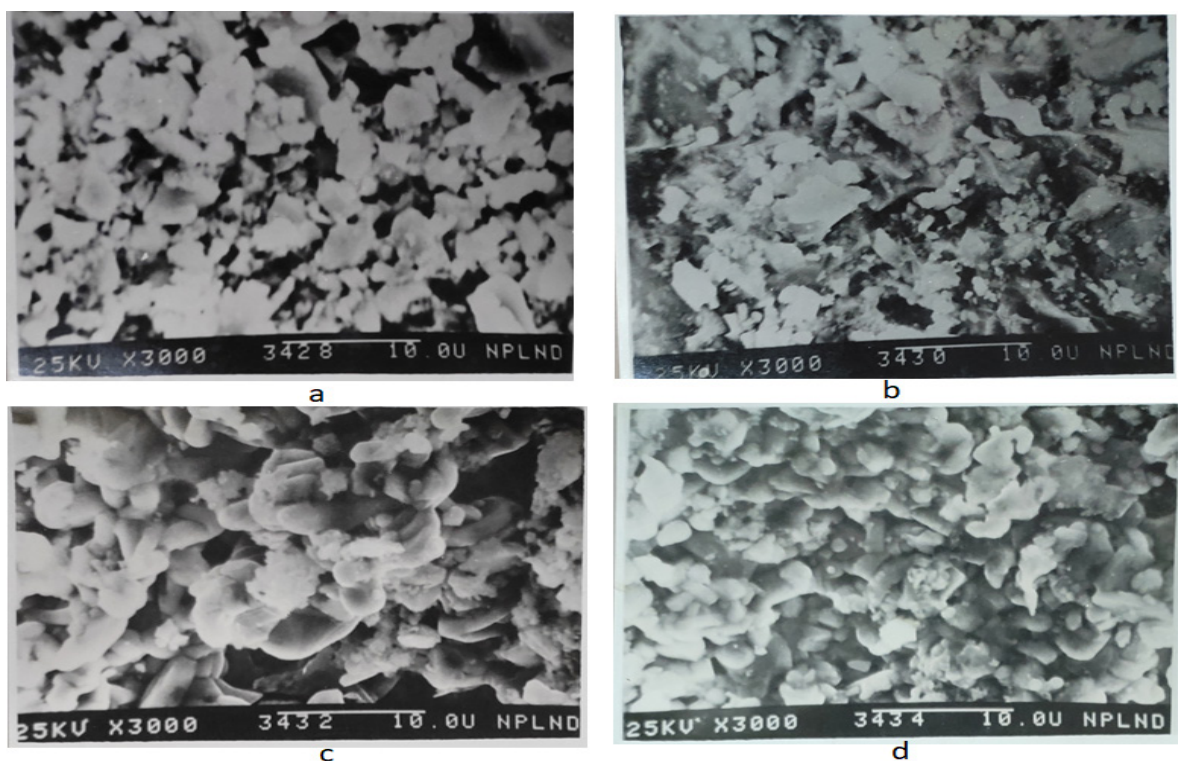
Table 1 shows the lattice parameters, cell volume, and orthorhombicity as defined by $\epsilon=2(b-a)/(b+a)$ of the samples. From the table, it is noted that the values of 'a', and 'b' show a slight

increase with V concentration while 'c' shows a linear increase. The decrease in the orthorhombicity indicates that the sample approaches the tetragonal phase with the increase in V concentration.

Table 1: Lattice parameters of $\text{Y}(\text{Ba}_{1-x}\text{V}_x)_2\text{Cu}_3\text{O}_{7-\delta}$ ($x=0\%, 1\%, 3\%$ and 5%)

Sample No.	Compositions	aÅ	bÅ	cÅ	Cell volume	Orthorhombicity
1	$x=0.00$	3.8130	3.8843	11.6235	172.1538	0.01853
2	$x=0.01$	3.8190	3.8836	11.6385	172.6160	0.01672
3	$x=0.03$	3.8209	3.8839	11.6570	172.7898	0.01611
4	$x=0.05$	3.8249	3.8838	11.683	173.5527	0.01642

3.1.2 Scanning Electron Microscopy (SEM): Figure 2(a-d) shows the scanning electron micrographs for pure and vanadium substituted samples with $x=0\%$, 1% , 3% and 5% . It may be noted that the packing density shows a systematic increase with the increase in the vanadium concentration. The uniformity and average grain size were also found to increase with vanadium concentration. From the SEM micrograph, it may be noted that the average grain size of the samples ranges from about 2 to $6\mu\text{m}$.

**Figure 2(a-d) SEM micrograph for $\text{Y}(\text{Ba}_{1-x}\text{V}_x)_2\text{Cu}_3\text{O}_{7-\delta}$ ($x=0\%, 1\%, 3\%$ and 5%)**

3.2 Measurement of the Sample: Resistance-temperature (RT) measurement of the samples was done using a four-probe technique with liquid nitrogen as a coolant. In this measurement technique, four sharp lines are drawn on the superconducting sample using aluminium paste. A constant current is sent to the outer two lines and the voltage developed in the two inner lines is measured by a digital Nano voltmeter. A

programmable current source (Keithley, USA 224) was used to supply a constant current to the sample. This source has an output current ranging from $\pm 50\text{nA}$ to $\pm 101\text{mA}$ with automatic increment and decrement. A programmable digital Nano voltmeter (Keithley USA, 181) with 10nV sensibility and $10\text{V}/^\circ\text{C}$ stability was used for measuring the voltage developed. The sample fitted on a rod with the sensor of a platinum resistance thermometer

was inserted inside a liquid nitrogen flask and the temperature was measured by a digital multimeter (Keithley, USA 195A). The measurement system consisting of the constant current source, digital multimeter, and digital Nano-voltmeter has an IEEE-488 interfacing facility to interface data with a computer. All these were hooked up to an HP216 system controller for automatic data acquisition and control. A.C. susceptibility measurement has been used quite extensively in the study of magnetic properties. The real component of the A.C susceptibility which is in phase with the applied magnetic field is represented by χ' and the imaginary component which is out of phase with

the applied field is represented by χ'' . We used a Lakeshore a.c. Susceptometer (Model 7000) for a.c susceptibility measurement of our samples.

3.2.1 Resistance versus Temperature: It has been observed that the sintering temperature besides the calcination temperature is a crucial factor in deciding the properties of the final product. In the present study, the pure and vanadium substituted samples were prepared under the same technique and environmental conditions. The first and second calcinations were at 910°C and 920°C for 24hrs each with intermediate grindings and this is followed by sintering in an oxygen environment.

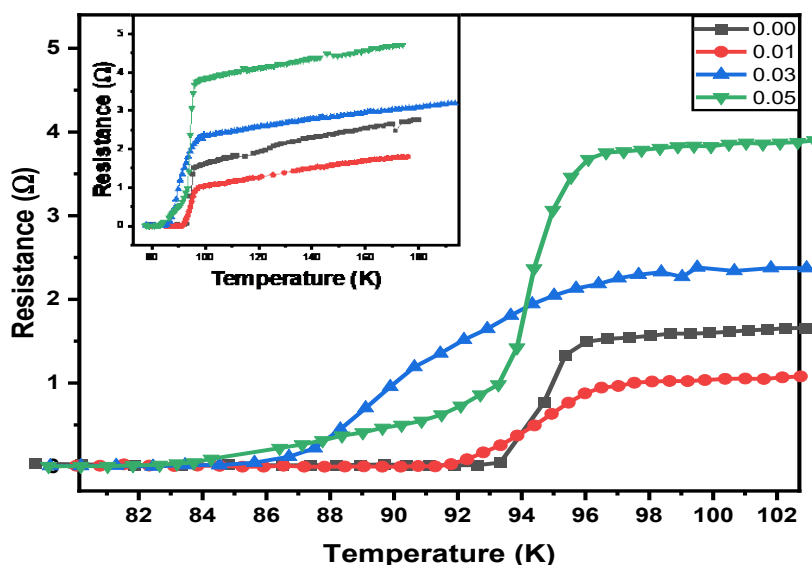


Figure 3 Resistance vs Temperature behavior of $Y(Ba_{1-x}V_x)_2Cu_3O_{7-\delta}$ ($x = 0\%, 1\%, 3\%$ and 5%)

The transition temperature and superconducting properties also depend on the concentration of the substituent. To study this, four samples with partial substitution of vanadium in the barium site under identical conditions were synthesized. The resistance versus temperature behaviour of the pure and substituted samples is shown in Figure 3. The 1st sample ($x=0\%$) has a sharp transition, and the value of T_c ($R=0$) is 92.62K. The transition temperature T_c for the 2nd sample ($x=1\%$) is 91.79K. The transition temperature for the 3rd $x=3\%$ and 4th ($x=5\%$) samples are 85.625 and 83.725K respectively. Thus, it was observed that the T_c is depressed by

the substitution of vanadium in the barium site.

3.2.2 A.C susceptibility Measurement: A.C susceptibility (ACS) experiment is a non-contact measurement technique widely used for physical properties investigation of superconductors. ACS data namely χ' and χ'' with temperature for different vanadium concentrations are shown in Figure 4(a-d). The data were taken under the same field with the temperature ranging from 77K to 120 K. The transition temperatures recorded from a.c susceptibility measurement are in agreement with those of resistance versus temperature measurement.

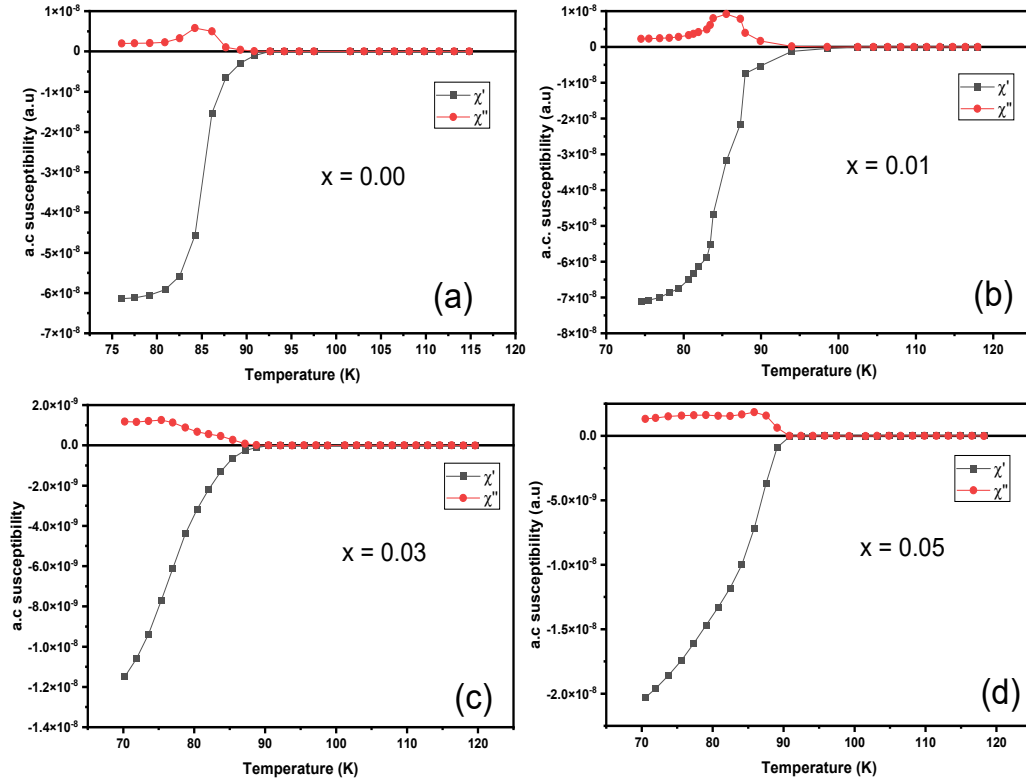


Figure 4: A.C Susceptibility vs Temperature for $Y(Ba_{1-x}V_x)_2Cu_3O_{7-\delta}$ ($x = 0\%, 1\%, 3\%$ and 5%)

4. RESULTS AND DISCUSSION

Substitution at the barium site in general has a large effect in lowering T_c . Various rare earth substitutions have been attempted at the barium site of the $YBa_2Cu_3O_{7-\delta}$ superconductor (Suzuki *et al*, 1988). Relatively small changes in T_c and invariance of orthorhombic lattice parameters were reported in the Y compound. However, La and Pr substitution beyond 15% induce orthorhombic to tetragonal change but superconductivity persists at a reduced T_c in the tetragonal state as reported (Tokiwa *et al*, 1988, Agarwal *et al*, 1987). Either yttrium or barium is replaced by divalent or tetravalent impurities viz Ca, Ce, Sn, and Pb (Agarwal *et al* 1987) on the T_c of $YBa_2Cu_3O_{7-\delta}$ and reported coexistence of two superconducting phases of 100K and 82K. A substantial improvement of superconducting properties was reported due to substitution in barium by Sr (P.R Slater *et al* 1993). An increase of the normal state resistivity, decrease in T_c , and structural change from orthorhombic to tetragonal with an increase of Mo content was

reported in the $Y_{1-x}Mo_xBa_2Cu_3O_{7-\delta}$ ($0 \leq x \leq 0.2$) system. Depression of T_c in the $YBa_2Cu_3O_8$ (Y-124) system due to the substitution of Cu by Zn and Ga was reported by S.P Pandey *et al* (1993). P Schwab *et al* (1993) synthesized single-phase thin superconducting films of $YBa_{2-x}Sr_xCu_3O_{7-\delta}$ ($0 \leq x \leq 1.8$) by pulsed laser deposition method and reported a decrease of T_c from 91K to 57K with a decrease of c-axis from 11.68 \AA to 11.45 \AA with an increase of x from 0 to 1.8.

Mn was substituted in place of Cu in $YBa_2Cu_3O_{7-\delta}$ by Indu *et al* (1994) and reported additional phases of $YBa_2Cu_3O_5$ and $Ba_3Mn_2O_8$ along with broadening of transition temperature with an increase of the Mn content. Azuma *et al* (1992) prepared $(Ca_{1-x}Sr_x)_{1-y}CuO_2$ ($y=0.1$), the T_c of the sample was observed at 110K. The influence of Sr content $YBa_{2-x}Sr_xCu_3O_{7-\delta}$ ($0 \leq x \leq 1$) was studied by E Oliver *et al* (1994) who reported a decrease of T_c and decreases in the lattice parameters, as Sr content increased. This may give rise to oxygen atom rearrangement in the basal plane resulting in

the decrease of T_c (P. Karen *et al* 1991). An increase in superconducting transition temperature from 81.3K to 89.9K was reported by Pedro *et al*(1994) in the samples of nominal compositions ($Y_{1-x}Ca_x$) $Ba_2Cu_4O_8$. D W Murphy *et al* (1987) reported that some compounds of $RBa_2Cu_3O_{7-\delta}$ oxides system (R=Ce, Pr, Tb), do not show superconductivity. S Srinivasan *et al* (1991) prepared samples of nominal composition $YBa_2Cu_{2.97}Fe_{0.3}O_x$ and reported no appreciable change in the lattice parameters a,b, and c. Ram Bilas (1993) studied the superconducting properties of $YBa_{2-x}Bi_xCu_3O_{7-\delta}$ ($0 \leq x \leq 0.5$) samples and observed a decrease in the orthorhombic phase thereby resulting in the lowering of the transition temperature.

B.W Veal *et al* (1987) reported conflicting results in $YBa_{2-x}Sr_xCu_3O_{7-\delta}$, especially for $x>1$, T_c decreases as impurity concentration x increases and for $x>1$, the compound loses its superconductivity and they also found a tetragonal structure for $x=2$ with T_c of 80K and on the other hand P R Slater *et al* (1993) found T_c of 90.5K in $Y_{1-x}Sr_xCuO_{3-\delta}$. M. K. Wu *et al* (1988) reported the onset of T_c at 92K and zero resistivity at 85K in $YSrCuO$. The single-phase samples of the composition $Ho(Ba_{2-x}Sr_x)Cu_3O_{7-\delta}$ ($x \leq 1.2$) system were studied by M.F Tai *et al* (1989) and reported a decrease of T_c from 94K for $x=0.0$ to 81K for $x=1.2$. When various impurities are introduced to replace the Cu atoms in the system, the transition temperature T_c generally suffers a sharp decrease if the impurity atoms enter the Cu-O basal plane as reported by Y. D. Yao *et al* (1989). The change in T_c is not necessarily associated with an orthorhombic-tetragonal structural transition (G. Xiao *et al*, 1988 and T Siegrist *et al* 1987). R J Cava *et al* (1987) reported the oxygen concentration in high T_c superconductors has a controlling effect on their transition temperature. Roman *et al* (1994) reported the degradation of T_c from 90K to 80K after keeping ten months in a desiccator in $YBa_{2-x}Bi_xCu_3O_{7-\delta}$ superconductors with ageing.

From the above experiment, the transition temperature is to decrease with V concentration. As suggested by M. A. Beno *et al* (1987), the decrease

in T_c may be due to the increase of oxygen content δ . N. S.s Raman *et al* (1993) also reported a similar observation that the increase of Sr content in the $YBa_2Cu_3O_{7-\delta}$ system decreases the superconducting transition temperature.

5. CONCLUSIONS

$Y(Ba_{1-x}V_x)_2Cu_3O_{7-\delta}$ superconductors with x values (x=0%,1%,3% and 5%) were synthesized by the usual ceramic method. From the XRD pattern, the lattice parameters are calculated and reveal that the orthorhombicity phase decreases with the increase of vanadium concentration. The approximate grain sizes of all the samples range from 2 μ m to 6 μ m. The superconducting transition temperature is depressed from about 92K to 83K due to substitution. A.C susceptibility measurement also confirmed the depression of transition temperature.

ACKNOWLEDGEMENTS

The authors are grateful to Dr A.V. Narlikar, Head, Superconductivity Group, XRD Section and SEM Section of National Physical Laboratory, New Delhi, India for the entire work. such as synthesis, characterization, and measurement. They also express their gratitude to Prof. H. Nandakumar. Sharma, Former Vice-Chancellor, of Manipur University, Canchipur, Imphal for his constructive suggestions in preparing the paper. They are grateful to Prof. Kh. Mohon Singh, Editor-in-Chief, Thambal Marik College Research Journal (TMC RJ) for his unwavering guidance and insightful suggestions throughout the preparation of the paper. The authors are also thankful to the anonymous reviewer to whom the paper was submitted for their valuable comments that improved the quality of the paper.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

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An Optimal Certainty Contribution of a One Sided Neighbour Balanced Design

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ABSTRACT

A specific kind of design for the sided neighbor effect has been proposed by Bailey and Druilhet (2004) which is of concerned of the one-sided neighbor effect only. When conducting agricultural experiments with allied subjects or when a treatment which has been applied to an experimental plot might have an impact on the response of neighboring plots as well as the treated plot itself, this design can be particularly helpful. The applications of such design lie in the experiment of sunflower and cereal crops, where tall varieties can shade a plot next to them and change the plot response. The effect of the previous plot treatment might happen to the subsequent plot. For example pesticide or fungicide experiments where spores from the untreated plots may spread to the neighboring plot immediately downwind. By under such condition, created a design focus on the investigation of the one-sided neighbor effects. A new class of One-Sided Circular Neighbor Balanced Universally Optimal designs is presented in this paper. As in the case of pesticide or fungicide experiment where some position of the treatment applied may spread to the neighbouring plot immediately downwind and spores from the untreated plots, one- sided neighbor effect of the preceding plot- treatment may occurs to the following plot. The linear ridge is the form of the blocks of such design, the design where the plots are in 1-dimension and 2-dimension is studied. It gives a circular neighbour balanced design with $(t-1)$ blocks of size t or t blocks of size $(t-1)$, where t is the number of treatments

AMS subject classification: Primary (62K 05) and 62K 10.

Keywords: One-Sided Circular, Universally Neighbor Balanced design, Optimal, Equivalence class of sequences

1. INTRODUCTION AND PRELIMINARIES

Bailey op. cit. suggested a specific type of design for the sided neighbor effect that limits the investigation of the one-sided neighbor effect to allied subjects or agricultural experiment design, where treatments which have been applied to one experimental plot may influence the response on that plot along with the neighboring plots. An application of such design lies in the experiment on sunflower and cereal crops, where tall varieties can shade neighbouring plots and change the response

of the neighboring plot. Similar to pesticide or fungicide experiments, where spores from the untreated plots and some of the administered therapy which might spread to the neighboring plot immediately downwind, a one-sided neighbor effect of the previous plot treatment may occur to the subsequent plot. In this kind of design that focuses at plots in both one and two dimensions, the blocks have a shape known as the linear ridge, according to “Welham *et al.* (1996). With $t-1$ blocks

of size t or t blocks of size $t-1$, here t represents the number of treatments. Azais, Bailey, and Monod (1993) offer a library of circular neighbor balanced designs. There are many valuable additions to the literature from (Smart et al., 1994, David and Kempton 1996, Langton 1990). Bailey and Druilhet (2004) subsequently extended by the research of Bailey by considering the influence of the block and the treatment on "plot in question. Circular Neighbor Balanced design is the general term used to study both these 1-dimensional as well as 2-dimensional designs. Kumam and Meitei have contributed a construction technique of this type (2006).

Let's associate the reference to the paper's text with a few definitions, v treatment are arranged in b linear blocks of size k (which need not be distinct) in the One-Sided Circular Neighbor Balanced design. This ensures that (i) a treatment get replication r times, (ii) concurrence μ of distinct treatment pairs, and (iii) a treatment is followed by another treatment λ times, assigning that the last plot of a block is followed by the left plot of the same block.. The visual cue for it is provided by a One-Sided Circular Neighbor Balanced design (v, b, r, k, μ, λ).

This type of design is pairwise balanced, indicating that each pair of various "treatments has concurrence μ , and neighbor balanced, indicating that each treatment which has been then followed by every other treatment λ times. Obviously, $vr =$

bk. These designs turn circular after suggesting—presuming that the treatment applied to the" final plot is also applied to this border plot having a border plot prior to each block's initial plot. The responses coming from the border plots are used in the analysis. Obtaining the treatment neighbor effect from the border plot to the final plot is the only goal. Therefore, practically the design planning requires blocks is of size $k+1$ in order to conduct an experiment on the basis of these designs of block size k . Bailey and Druilhet (2004) proposed on page 1657 that the estimation of the total effect becomes Universally Optimal if

1. Each block only has a limited number of distinct treatment "options.
2. Out of $n_1+n_2 = s$ of the remaining n_2 treatments occurs $m+1$ times in the block, and each of the other remaining n_1 treatments repeating m times, out of s .
3. Every treatment in a block needs to occur in a single series of neighboring plots (which could include both the final plot and the initial plot).

Universally Optimal One-Sided Circular Neighbour Balanced design ($v, b, r, k, s, m, n_1, n_2, \mu, \lambda$) indicates" the design for use in the sequel in the future. Clearly, $bs = v(v-1)\lambda$, $n_1=s-n_2$, and $n_2=k-sm$. Each block contributes a certain amount to the total concurrences of all possible treatment pairs, which "equals $Q/2$ where

$$\theta = n_1(n_1-1)m^2 + n_2(n_2-1)(m+1)^2 + 2n_1n_2m(m+1).$$

$$= sm(m+1) + k(k-2m-1).$$

Consequently, $b = v(v-1)$. A design D is considered Universally Optimal if it is part of a class Δ of competing designs and its information matrix C_D which has been the completely symmetric, meaning that $\text{trace}(C_D) \geq \text{trace}(C_d)$ for all $d \in \Delta$. Bailey and Druilhet, *op. cit.*, provide the equivalency class of the sequence l on block u of the 'd' design, and if we denote this, then 2 sequences of treatments on a block which have been equivalent if one could be attained from the other by the relabeling" treatments.

$$C(\xi) = \text{trace}(C_{du}).$$

$$= (k - \frac{2}{k} \sum_{i=1}^v g_i^2 + \sum_{i=1}^v h_i) / 2,$$
 "where g_i represents the number of occurrences of treatment i in the sequence l & h_i represents the number of times treatment i is on the left-hand side of itself in sequence l .

2. CONSTRUCTIONS

In this paper as a new dimension in the sphere of construction of Universally Optimal One Sided Circular Neighbour Balanced design, a lemma of Praphullo and Meitei (2006), using difference sets will be recalled such hereafter.

Given a set S of size k i.e. $\{i_1, i_2, \dots, i_k\}$, the forward and the backward differences arising from this set are defined as follows:

$$F = (i_2 - i_1, i_3 - i_2, \dots, i_k - i_{k-1}, i_1 - i_k) \text{ and}$$

$$B = (i_1 - i_2, i_2 - i_3, \dots, i_{k-1} - i_k, i_k - i_1) \text{ respectively. Clearly, } B_k = -F_k.$$

Lemma 2.1: Let M be a module of v elements. Consider t be the initial blocks each containing k elements (not necessarily distinct) of M . These t blocks when developed module v generate an Universally Optimal One Sided Circular Neighbour Balanced design with the parameters $v, b = tv, r = kt, k, s, m, n_1, n_2, \mu, \lambda$, if the following conditions are satisfied:

- i. there are only s different types of treatments in every initial block,
- ii. each of n_1 out of these s treatments occurs m times and each of the remaining $s - n_1 = n_2$ (say) occurs $(m+1)$ times in the block,
- iii. all the occurrences of a treatment in every initial block is in a single sequence of adjacent plots (assuming the last plot and the first plot are neighbour),
- iv. among the totality of forward (or backward) differences arising from the t initial blocks, every non-zero element of M occurs exactly λ times,
- v. among the totality of differences arising from the t initial blocks, every non-zero element of M occurs exactly μ times.

For, $v=4t-1$, be a prime or a prime power and let x be the primitive elements of $GF(v=4t-1)$, then $x^{v-1}=x^0=1$, i.e. $x^{4t-1-1}=x^0=1$, i.e. $x^{4t-2}=1$, i.e. $x^{4t-2}-1=0$

i.e. $(x^{2t-1}+1)(x^{2t-1}-1)=0$ then $x^{2t-1}=-1$, since x is primitive element.

$$C_1 = \{x^0, x^2, x^4, \dots, x^{4t-6}, x^{4t-4}\} \quad \dots (2.1)$$

$$C_2 = \{x^1, x^3, x^5, \dots, x^{4t-5}, x^{4t-3}\} \quad \dots (2.2)$$

Consider the initial block as shown in (2.1), then the differences arising from this block can be exhibited as follows :

$$1\text{st type} : \pm(x^2-x^0), \pm(x^4-x^2), \dots, \pm(x^{4t-4}-x^{4t-6}),$$

$$2\text{nd type} : \pm(x^4-x^0), \pm(x^6-x^2), \dots, \pm(x^{4t-4}-x^{4t-8}),$$

$$\vdots \quad \vdots \quad \vdots \quad \vdots \quad \dots \quad \vdots$$

$$i\text{th. type} : \pm(x^{2i}-x^0), \pm(x^{2i+2}-x^2), \dots, \pm(x^{4t-4}-x^{4t-(2i+4)}),$$

$$\vdots \quad \vdots \quad \vdots \quad \vdots \quad \dots \quad \vdots$$

$$t\text{th. type} : \pm(x^{2t}-x^0), \pm(x^{2t+2}-x^2), \dots, \pm(x^{4t-4}-x^{4t-(2t+4)}),$$

$$\vdots \quad \vdots \quad \vdots \quad \vdots \quad \dots \quad \vdots$$

$$[2t-(i+1)] : \pm(x^{2[2t-(i+1)]-x^0}), \pm(x^{2[2t-(i+1)]+2-x^2}), \dots, \pm(x^{4t-4}-x^{4t-[2\{2t-(i+1)\}+4]}),$$

$$(2t-4)\text{th type} : \pm(x^{4t-8}-x^0), \pm(x^{4t-6}-x^2), \pm(x^{4t-4}-x^4),$$

(2t-3) th type: $\pm(x^{4t-6}-x^0), \pm(x^{4t-4}-x^2),$

(2t-2) th type : $\pm(x^{4t-4}-x^0),$

Let, $x^{2i}-x^0=x^{q_i}$, for some q_i , combining the i th type differences with the $\{2t-(i+1)\}$ th type differences, $i=1, 2, \dots, (t-1)$, remembering $x^{2t-1}=-1$.

Now, [i th type differences; $\{2t - (i+1)\}$ th type differences]

$\pm(x^{2i}-x^0), \pm(x^{2i+2}-x^2), \dots, \pm(x^{4t-4}-x^{4t-(2i+4)}); \pm(x^{2\{2t-(i+1)\}}-x^0),$

$\pm(x^{2\{2t-(i+1)+2\}}-x^2), \dots, \pm(x^{4t-4}-x^{4t-2\{2t-(i+1)\}+4})$

i.e. $\pm(x^{2i}-x^0), \pm(x^{2i+2}-x^2), \dots, \pm(x^{4t-4}-x^{4t-2i-4}); \pm(x^{4t-2i-2}-x^{4t-2}),$

$\pm(x^{4t-2i-2+2}-x^2), \dots, \pm(x^{4t-4}-x^{4t-4+2i+2-4})$

i.e. $\pm(x^{2i}-x^0), \pm(x^{2i+2}-x^2), \dots, \pm x^{4t-2i-4}(x^{2i}-x^0); \pm x^{4t-2i-2}(x^{2i}-x^0),$

$\pm x^2(x^{4t-2i-2}-x^0), \dots, \pm x^{4t-4}(x^0-x^{-4t+2i+2})$

i.e. $\pm x^{q_i}, \pm x^{q_{i+2}}, \pm x^{q_{i+4}}, \dots, \pm x^{q_{i+4t-2i-4}}; \pm x^{q_{i+4t-2i-2}}, \pm x^{q_{i+4t-2i}}, \dots, \pm x^{q_{i+4t-4}} \dots (2.3)$

All the positive terms from (2.3)

$x^{q_i}, x^{q_{i+2}}, x^{q_{i+4}}, \dots, x^{q_{i+4t-2i-4}}; x^{q_{i+4t-2i-2}}, x^{q_{i+4t-2i}}, \dots, x^{q_{i+4t-4}} \dots (2.4)$

And all the negative terms can be exhibited from (2.3)

$(-1)x^{q_i}, (-1)x^{q_{i+2}}, \dots, (-1)x^{q_{i+4t-2i-4}}; (-1)x^{q_{i+4t-2i-2}}, (-1)x^{q_{i+4t-2i}}, \dots, (-1)x^{q_{i+4t-4}}.$

i.e. $x^{q_{i+2t-1}}, x^{q_{i+2t+1}}, \dots, x^{q_{i+6t-2i-5}}; x^{q_{i+6t-2i-3}}, x^{q_{i+6t-2i-1}}, \dots, x^{q_{i+6t-5}} \dots (2.5)$

Similarly all the possible differences arising from (2.2) can be written as follows.

$\pm x^{q_{i+1}}, \pm x^{q_{i+3}}, \dots, \pm x^{q_{i+4t-2i-3}}; \pm x^{q_{i+4t-2i-1}}, \pm x^{q_{i+4t-2i+1}}, \dots, \pm x^{q_{i+4t-3}}, \dots (2.6)$

All the positive terms from (2.6)

$x^{q_{i+1}}, x^{q_{i+3}}, \dots, x^{q_{i+4t-2i-3}}; x^{q_{i+4t-2i-1}}, x^{q_{i+4t-2i+1}}, \dots, x^{q_{i+4t-3}}, \dots (2.7)$

and all the negative terms can be exhibited as follows.

$(-1)x^{q_{i+1}}, (-1)x^{q_{i+3}}, \dots, (-1)x^{q_{i+4t-2i-3}}; (-1)x^{q_{i+4t-2i-1}}, (-1)x^{q_{i+4t-2i+1}}, \dots, (-1)x^{q_{i+4t-3}},$

i.e. $x^{q_{i+2t}}, x^{q_{i+2t+2}}, \dots, x^{q_{i+6t-2i-4}}; x^{q_{i+6t-2i-2}}, x^{q_{i+6t-2i}}, \dots, x^{q_{i+6t-4}}, \dots (2.8)$

From (2.3) and (2.6), it is learnt that every non-zero elements of $GF(4t-1)$ occurs exactly twice in (2.3) and occurs exactly twice in (2.6) as $i=1, 2, \dots, t-1$, among the totality of all possible differences arisen from C_1 and C_2 every non-zero elements of $GF(4t-1)$ exactly occurs $2(t-1)$ times.

Let $x^p = x^2 - x^0$, for some p , the forward differences arisen from the C_1 and the C_2 are given as follows.

F.D. $= (x^2 - x^0), (x^4 - x^2), \dots, (x^{4t-4} - x^{4t-6}), (x^0 - x^{4t-4}).$

i.e. $x^p, x^{p+2}, \dots, x^{p+2t-6}, x^{p+4t-4}. \dots (2.9)$

Similarly the forward differences arisen from C_2

we get, $x^{p+1}, x^{p+3}, x^{p+5}, \dots, x^{p+4t-5}, x^{p+4t-3} \dots (2.10)$

Combining the forward differences arisen from the C_1 and the C_2 by using (2.9) and (2.10) can be exhibited as follows,

$$x^p, x^{p+1}, x^{p+2}, x^{p+3}, \dots, x^{p+4t-6}, x^{p+4t-5}, x^{p+4t-4}, x^{p+4t-3} \dots (2.11)$$

From (2.11), we clearly seen that the forward differences are the power of primitive element x , which are increasing from p to $p+4t-3$. All the $2t-2$ differences are nothing but all $2t-2$ non-zero elements of $GF(4t-1)$. Thus among the totality of the forward or backward differences arising out of the C_1 and the C_2 every non-zero elements of $GF(4t-1)$, occurs exactly once. Thus $\lambda=1$, developing the initial blocks C_1 and C_2 under the reduction modulo of $GF(4t-1)$, the Universally Optimal One Sided Circular Neighbour Balanced design given in the following theorem can be constructed.

Theorem: 2.1. Developing the (2.1) and the (2.2) Under mod (v), where x is a primitive element of $GF(v)$; $v=4t-1$, prime for some t) a construction of Universally Optimal One Sided Circular Neighbour Balanced design with parameters $v=4t-1$, $b=2v$, $r=2(2t-1)$, $k=2t-1=s=n_1$, $m=1$, $n_2=0$, $\mu=2(t-1)$, $\lambda=1$ is always guarantee.

Proof: Obviously, all the $(2t-1)$ elements in C_1 and $(2t-1)$ elements in C_2 are distinct. Hence, $k=s=2t-1=n_1$, $m=1$, $n_2=0$.

Example: 2.1. An illustrative example for a construction of Universally Optimal One Sided Circular Neighbour Balanced design is made here below with parameters $v=4t-1$, $b=2v$, $r=2(2t-1)$, $k=2t-1=s=n_1$, $m=1$, $n_2=0$, $\mu=2(t-1)$, $\lambda=1$, when taking $t=3$, since the primitive element of 11 is 2, from the C_1 and the C_2 , we get,

$$C_1 = \{x^0, x^2, x^4, \dots, x^{4t-4}\} = \{2^0, 2^2, 2^4, \dots, 2^8\} = \{1, 4, 5, 9, 3\}$$

$$C_2 = \{x^1, x^3, x^5, \dots, x^{4t-3}\} = \{2, 2^3, 2^5, \dots, 2^9\} = \{2, 8, 10, 7, 6\}, \text{ as } i=1, 2, \dots, (t-1).$$

Developing C_1 and C_2 under the reduction modulo of 11, a solution of an Universally Optimal One Sided Circular Neighbour Balanced design with the parameters becomes, $v=11$, $b=22$, $r=10$, $k=5=s=n_1$, $n_2=0$, $m=1$, $\mu=4$, $\lambda=1$.

$$\begin{aligned} & (1, 4, 5, 9, 3), (2, 5, 6, 10, 4), (3, 6, 7, 0, 5), (4, 7, 8, 1, 6) \\ & (5, 8, 9, 2, 7), (6, 9, 10, 3, 8), (7, 10, 0, 4, 9), (8, 0, 1, 5, 10), \\ & (9, 1, 2, 6, 0), (10, 2, 3, 7, 1), (0, 3, 4, 8, 2), (2, 8, 10, 7, 6) \\ & (3, 9, 0, 8, 7), (4, 10, 1, 9, 8), (5, 0, 2, 10, 9), (6, 1, 3, 0, 10), \\ & (7, 2, 4, 1, 0), (8, 3, 5, 2, 1), (9, 4, 6, 3, 2), (10, 5, 7, 4, 3), \\ & (0, 6, 8, 5, 4), (1, 7, 9, 6, 5). \end{aligned}$$

ACKNOWLEDGEMENTS

The author is deeply indebted to Prof. Kh. Kumarchand Singh, Manipur University, Imphal for his constant inspiration in carrying out such research work. He is also grateful to Prof. Ng. Ibohal and Prof. I. Tomba Singh, Department of

Mathematics, Manipur University, Imphal for their constructive suggestions and thoughtful ideas during the period of research work. He is grateful to Prof. R. A. Bailay, Professor Emerita of Statistics in the School of Mathematical Science at

Queen Mary University of London who extended cooperation during his research work. He is deeply indebted to Prof. Kh. Mohon Singh, Editor-in-Chief, Thambal Marik College Research Journal (TMCRJ) who inspires him for doing good research work. He is also thankful to the anonymous reviewer to whom the paper was submitted for their valuable comments that improved the quality of the paper.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

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Perception towards COVID-19 among the People Living in Chikim Village, Manipur, India

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ABSTRACT

On February 11, 2020, the coronavirus disease (COVID-19) was formally declared as a new disease causing many consequences on both animals and human beings all over the world. The disease is caused by a virus called severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The global COVID-19 epidemic has had a profound impact on all countries, resulting in enormous harm to human lives worldwide. The study aimed to evaluate the perception regarding COVID-19 among individuals aged 15-59 years, who are economically active, and residing in a village near the town of Moreh in Manipur. A descriptive cross-sectional survey study was conducted, wherein data was gathered from a sample of 50 participants. A purposive sampling technique was used for selecting the study sample. A pre-designed and pre-tested proforma was used for collecting the bio-demographics and perceptions towards COVID-19 from the selected study population. Twenty-nine years is the average age of the respondents. Males outnumbered the females in the present study. Hindus accounted for 30% of the respondents. The number of individuals who were not married exceeded the number of those who were married. The mean scores of perception were 4.52 ± 1.56 . More than half of the respondents had positive perceptions (56%) while 44% had negative perceptions towards COVID-19. The reduction of both the case fatalities as well as the number of positive cases of the disease COVID-19 can only be achieved through the modification of the behaviour exhibited by individuals of various age groups residing close to the border town of Moreh in Manipur.

Keywords: COVID-19, Perception, Pandemic, Virus

1. INTRODUCTION

The recent virus disease COVID-19 emerged in a city named Wuhan, China at the end of December 2019. The first case of COVID-19 was a student at Wuhan University. It occurred on January 30, 2020. It spread rapidly to the rest of the world in March 2020. On March 31, 2020, the number of confirmed cases worldwide reached 823,626, which is more than nine times more than before (Zhu *et al.*, 2020). Consequently, WHO officially announced a PHEIC ("Public Health Emergency of International Concern) on 30 January 2020 and on 11 March 2020; it categorized the epidemic

as a pandemic (<https://www.who.int/europe/emergencies/situations/covid-19>). The initial instance of COVID-19 in India was documented in Kerala on January 27, 2020 (Bhattacharya *et al.*, 2022). Gradually, the pandemic extended its reach to multiple states and union territories, including Manipur. The initial instance was documented in the state of Manipur on March 24th, 2020 (https://en.wikipedia.org/wiki/COVID-19_pandemic_in_Manipur).

2. MATERIALS AND METHOD

A community-based cross-sectional study was conducted from March 2022 to August 2022 in Chikim village, which is near the international border town Moreh of Manipur. The study population consisted of 50 individuals who were in the economically productive age group of 15 to 59 years. Only one individual from each household surveyed was selected by using a purposive sampling technique. A self-developed proforma was used to interview the respondents. There were 08 test items on the bio-demographic characteristics of the respondents and 08 items on perceptions towards COVID-19. The face, content, and construct validity of the tool were done with the help of previous similar studies conducted in many countries and India, collecting information published by “World Health Organization, CDC (Centre for Disease Control), Ministry of Health and Family Welfare, Government of India. An assessment of internal consistency was conducted using Cronbach’s alpha test. Descriptive statistics like frequencies and percentages were performed for the” analysis of qualitative variables. Results for quantitative data were reported in mean \pm SD. Scores of less than and equal to the average score of 4 were coded as 0 which indicates a negative perception and a score of 5 and above was considered as having a positive perception towards COVID-19 in the present study. Coding of the data was done and then the whole data was put into a Microsoft Excel spread sheet. SPSS (Statistical Package for the Social Sciences, version 16.0) was performed for analysing the data.

Concise Oxford Dictionary (1999:1049) defined the term “perception” as the manner in which something is regarded, understood, or interpreted.

3. RESULTS

The socio-bio demographic features of the study population are displayed in Table No. 1.

Table no.1: Socio-bio demographic characteristics of the study population (n= 50)

Variable	Frequency	Per cent
Age (years)		
15 - 19	15	30.0
20 - 24	9	18.0
25 - 29	5	10.0
30 - 34	10	20.0
35 - 39	1	2.0
40 - 49	4	8.0
50 - 59	6	12.0
Gender		
Male	29	58.0
Female	21	42.0
Religion		
Hindu	15	30
Muslim	8	16
Christian	12	24
Meitei	15	30
Marital Status		
Married	19	38.0
Unmarried	29	58.0
Widow	1	2.0
Divorced	1	2.0
Educational level		
Below metric	5	10.0
Matriculation	2	4.0
Higher Secondary	23	46.0
Graduation	20	40.0
Occupation		
Housewife	1	2.0
Government service	7	14.0
Private job	8	16.0
Self-employed	6	12.0

Students	20	40.0
Others	8	16.0

The mean age of the respondents was 29.06 \pm 12.24 years. Among 50 participants, 29 (58%) were males and 21(42%) were females. Hindus and Christians constituted (30%) each of the total respondents. Most of the respondents were unmarried 29 (58%) followed by married persons 19 (38%). There was 1 respondent from each category of widow and divorcee in the present study. Forty-six per cent (n = 23) of the respondents had completed higher secondary level and 40% (n = 20) had completed graduation. It was observed that 40% of the respondents were students.

Table no.2 shows the different statements that have been used to assess the perception towards COVID-19 among the study population.

Table no.2: Assessment of perception of COVID-19 among the study population (n = 50)

Perception statements	Responses	n	%
Myth about COVID-19	Positive	36	72
	Negative	14	28
COVID-19 vaccination is harmful to health	Positive	35	70
	Negative	15	30
Who is responsible for getting infection from the disease	Positive	25	50
	Negative	25	50
Health care providers and police personnel help to spread the disease	Positive	18	36
	Negative	32	64

Frequent use of hand sanitizer is not good for the health.	Positive	30	60
	Negative	20	40
Coughing or sneezing is a sign that a person is suffering from COVID-19	Positive	15	30
	Negative	35	70
Government should provide free essential items during COVID-19	Positive	46	92
	Negative	4	8
No drug can ever cure the disease	Positives	23	46
	Negative	27	54

It was observed that more than half of the respondents had positive perception related to the test items that COVID-19 is a contagious respiratory disease caused by infection (72%), COVID-19 vaccination would not be harmful to health in the future (70%) and 60% stated that frequent use of hand sanitizer would not be harmful to health. It was observed almost all the respondents (92%) opined that the government should provide free essential items during COVID-19 as they were not allowed to move out from home during COVID-19 lockdown periods.

Table no.2 also revealed that 20% of the respondents believed that COVID-19 was a man-made disease; a disease spread from animals to man and a disease created by God and 30% of the residents perceived that COVID-19 vaccination was harmful to health. It was observed that 50% of the respondents stated that it is people's fault if they get COVID-19 while 50% also stated that it was not the people's responsibility to get the disease's infection.

Table 2 also highlighted that 64% of the participants also stated that healthcare providers and police personnel did not help to spread the disease in the community and 40% had the negative perception that frequent use of hand sanitizer was harmful to health. Seventy per cent of the respondents perceived that coughing or sneezing was not a sign that a person was suffering from COVID -19 while 30% opined that it was a sign that a person was suffering from COVID-19.

Table no.2 also revealed that more than half (54%) of the study population positive perception that there could be a drug that can be developed to cure the disease COVID-19 while 46% expressed that no drug can be developed to cure the disease. It was observed that the mean score for perception was 4.52 ± 1.56 . In overall, 28 (56%) individuals had positive perceptions towards COVID-19 and 22 (44%) had negative perceptions towards COVID-19 in the present study.

4. DISCUSSION

The novel coronavirus (2019 - nCoV, or COVID-19) epidemic first broke out in Wuhan and has been spreading in whole China and the world. Wuhan has implemented closed management of communities. Inhabitants are not allowed to go out of their communities and they are very supportive of this regulation (Zhu *et al.*, 2020).

The results of the current study indicate that the overall proportion of individuals with a favourable perception was 56%, with an average score of 4.52 ± 1.56 (ranging from 0 to 8). In a study conducted in Pakistan (Mahmood *et al.*, 2020), it was shown that the majority of Pakistani people (85.6%, $n = 1027$) had a positive opinion “of COVID-19, with an average score of 4.29 ± 0.82 (range: 0–5)”. This score was higher than the findings of the present study.

Overall, more than half of the respondents (56.0 %) individuals had a positive perception of COVID-19 which is similar to the finding of the right perception (57.6%) in the study of Narayana *et al.*, (2020). In the present study only 30% believed that COVID-19 vaccination is harmful

to health and the majority of them (70%) think that it was not harmful to health which is similar to the finding of a similar study (Priya *et al.*, 2021; Sriranth Kumar Barigela, *et al.*, (2022). According to a study by Kishor *et al.* (2021), 29.55% of respondents were reluctant to receive the COVID-19 vaccination, whereas 70.44% of respondents indicated a readiness to do so. Just 49.4% of respondents thought the vaccine might protect people.

In the present study, 70% of the respondents opined that coughing or sneezing is not a sign that a person is suffering from COVID-19. It was found by Pervez *et al.* (2023) that 81.6 per cent of the participants identified COVID-19 as a disease caused by the virus, which transmits through droplets of coughing and sneezing as well as making close contact with other individuals (90.8 per cent). Nonetheless, Gurbuzet *et al.* (2022) survey study from 2021 on how people from various countries perceived COVID-19 risks found statistically significant variations in participants’ opinions of the virus causing the disease COVID-19.

5. RECOMMENDATION

Based on the findings of the present study it is recommended that since the community is the backbone of a society it is very important to understand their perception and behaviour patterns so that any programs and policies will be successful if it is based on the basic needs of the people of its society. Therefore, It is suggested that further research study can be conducted by taking a representative sample of the population by using a more valid and reliable tool so that their finding can be generalized to a larger population.

6. LIMITATION OF THE STUDY

The study has the following limitations:

It is a cross-sectional study. Therefore, the causality of the study could not be determined.

Selection bias was there as the researchers had used a non-random sampling technique in the selection of the present study population.

ACKNOWLEDGEMENTS

The authors acknowledge with thanks to the Honorary Director, Indian Council of Social Science Research (ICSSR), North Eastern Regional Centre, NEHU Campus, Shillong: 793022, Meghalaya, and his staff for technical and financial support. The authors express thanks sincere to all the participants of the study for their cooperation, as well as the surveyors for their valuable contribution in making the research work successful. The authors express their gratitude to Prof. Kh. Mohon Singh, Editor-in-Chief, Thambal Marik College Research Journal (TMC RJ) for his constant guidance and suggestions. They are also thankful to the anonymous reviewer to whom the paper was submitted for their valuable comments that improved the quality of the paper.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

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Current Economic Landscape of Weaving Co-operative Societies in Bishnupur District, Manipur

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ABSTRACT

Bishnupur District is the smallest valley district of Manipur and it has an identity of its own in the history of Manipur, the culture and the history of Moirang and its neighbouring villages forming an integral part of the history of the district. The proportion of the rural population is 63.1 percent whereas 36.9 percent live in urban areas. Senapati and the Imphal West District border the district from the southwest, north, and northeast, respectively, with Churachandpur. Situated 828 meters above mean sea level, the district spans 530 square kilometres and is situated between 93.43° E and 93.53° E longitude and 24.18° North and 25.45° N latitude. The handloom census conducted in 1997–1998 found that there are 53069 weavers in the district of Bishnupur. Small-scale industries include the handloom sector. Handloom is a labour-intensive, rural industry. Therefore, rural industrialization is a crucial necessity through industry and it makes rural people economically independent. Hand-woven clothes of Manipuri women with their artistic beauty and utility are very much in demand both in domestic and foreign markets. Enhancing the level of satisfaction among handloom customers is imperative. So, in this connection, a sample of 30 weaving co-operative Societies has been randomly selected from three sub-divisions of Bishnupur District to study their present economic scenario faced by the weaving co-operative societies. Lastly, to extend the knowledge and suggestive measures for improving the Weaving Co-operative Societies.

Keywords: Handloom, Self-employed Weaver, Co-operative Societies.

1. INTRODUCTION

Co-operatives originated in Manipur like singlup, thashi marup, purnima marup, leikai marup, etc. It is a kind of movement of the people by the people for the people. A Weaving Co-operative society is not a new concept. The human race with perception invented so many things that handloom plays a major role in the civilized modern world. In the Indian cooperative movement, Weaving Cooperative Societies play a significant role. Indian handloom industry is the largest of all cottage industries which ranks next to agriculture and provides employment opportunities to unemployment problems, especially in women. Manipur's handloom sector began as a modest home-based business (Surjit *et al.*, 2019). Almost all housewives could weave all the clothing their

family needed. The fact of using various types of clothes has been found in the handwritten 'Puyas' (manuscript), the oral traditions of the Meitei such as legends, folk tales, etc. Better brides, according to our traditional society, were those who could weave.

2. LITERATURE REVIEW

In 2012, Prof. Kuldeep Singh and Monica Bansal analyzed the features of the handloom industry, which employs over 65 lakh people directly through weaving and related activities. This industry significantly increases export revenue and accounts for close to 19% of the nation's total cloth production.

Ricky Rani Boruah, and Satvinder Kaur (2015), analysed the declining characteristics of weavers of Weaver's Co-operative Society day by day to improve the socioeconomic circumstances of weavers and offer various state and federal incentive programs. In the chosen handloom, Denthilkumar (2014) and Rizwana M. (2014) examined the organizational issues and profile of the co-ops of handloom weavers. The majority of handloom societies face a major organizational challenge in the form of outdated loom equipment and production techniques. The study area is one of the major handloom markets. The richness, exquisiteness, variety, and fine quality of handlooms were examined by Sbipra Banerjee and Savita Choudhary (2016), and several weaving cooperative societies were established to advance the handloom sector and support weavers.

3. OBJECT OF THE STUDY

To research the current situation of a few chosen cooperative societies and handloom weavers in the Bishnupur district.

To recommend the best course of action for the district of Bishnupur's handloom weaver cooperative societies to expand.

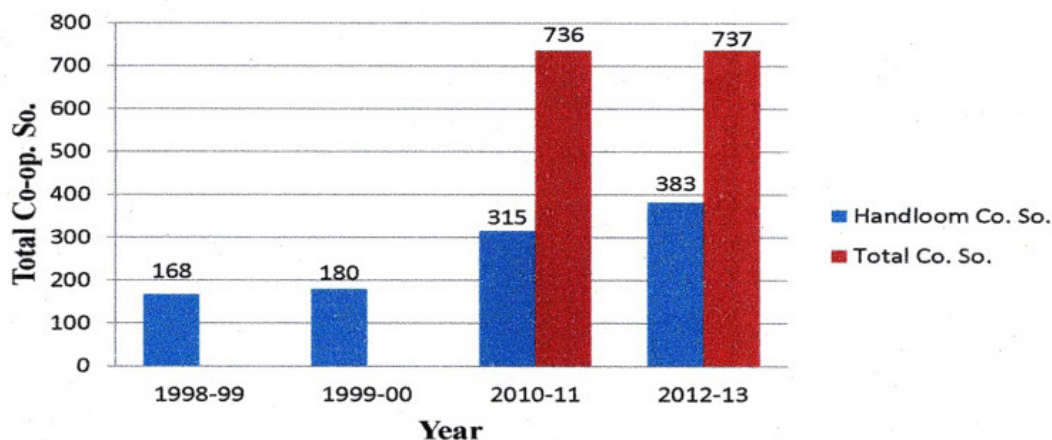
4. METHODOLOGY

Data from primary and secondary sources have been gathered to assess the difficulties cooperative weaving societies face and to expand our understanding of potential solutions. Direct

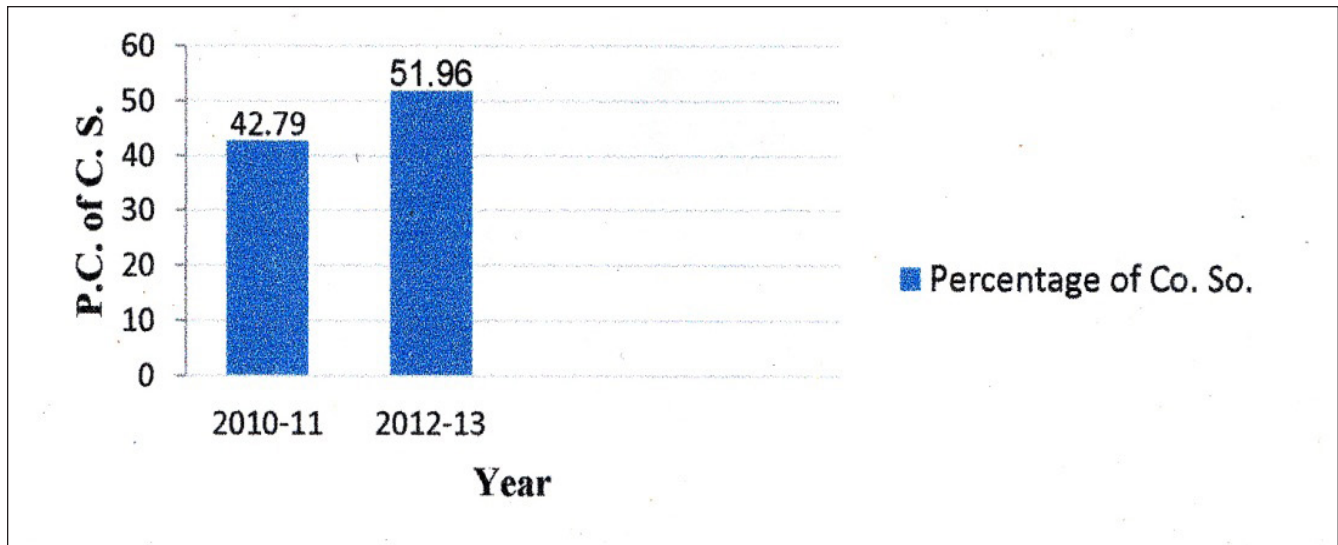
primary data collection from respondents was done using a questionnaire based on random sampling from 30 weaving co-ops in the district of Bishnupur. The Co-operative Department, Industries Department, Handloom Census Report, Annual Report of the Directorate of Information and Public Relations, Manipur government, internet, etc. were among the sources from which secondary data was gathered.

5. FINDING A DISCUSSION

The state's biggest cottage industry is the handloom sector. Especially in rural areas, this traditional cottage industry provides employment opportunities to the people. The majority of handloom weavers in the state work for themselves as independent craftspeople, completing their pre- and post-loom tasks in their homes with family members' help. The Weaving Co-operative Society (WCS) and other handloom sector development initiatives led to a 2.3 lakh increase in weavers in the valley area, according to the 1988 handloom census. The leaders of the community were typically the well-educated, well-off, and skilled weavers, who oversaw all of the WCS that was managed and operated by women. Almost all societies used fly shuttle looms, loin looms, or combinations of the two. Using a semi-automatic loom was a privilege enjoyed by very few societies. Because weaving was done by hand, weavers were unable to produce large quantities.



Graph 1. Handloom Co-operative Societies the Total Co-operative Societies in Bishnupur District.



Graph 2. Percentage of Handloom Co-operative Societies to total co-operative societies in Bishnupur District.

The above graph shows that the two consecutive years 1998-99 and 1999-2000 showed a rise in total Co-operative Societies. However, 2010-11 and 2012-13 mentioned that handloom co-operative societies are twice that of total Co-operative Societies (Statistical Yearbook of Bishnupur district, Manipur, 2015). We observed the increasing percentage from 2010-11 to 2012-13, the absolute number amounted to 422 is greater than half of the total, and the sharing percentage was 51.96. Again, the growth of handloom weavers co-operative in Bishnupur District from 1998-99 to 2012-13, an increasing trend has been observed in terms of registration of weavers co-operative during this period during this period 1999-00 to 2010-11, the member of weavers' co-operative society has been increased 135. During this period members were given more awareness and the societies received financial support from National Co-operative Development Corporation. All the facilities given by the Central/State government schemes are often manipulated by the middle man and financial assistance does not reach the genuine weavers. Master weavers typically hold a sizable share of institutional credit and are in charge of multiple cooperatives. Since master weavers keep the largest shares of schemes for their gain and the majority of weavers are located outside of

cooperative folds, the credit needs of this industry have not been met.

Recommendation:

- A strong Monitoring Committee must be established by the state government to investigate this address issue.
- Awareness about existing schemes needs to be spread among artisans so that they can benefit from those initiatives.
- Training and education on how to produce is essential. Proper education regarding the use of materials used for production is necessary.
- Weavers need to be provided with market linkages for them to earn a sustainable living from the craft.
- To provide new technical assistance and sophisticated design and distribute reasonable wages regularly and on time.

6. CONCLUSIONS

Increasing the living standards of all Americans is our aim in this endeavour. Both reducing poverty and improving the working conditions for handloom weavers are the goals and objectives. The Ministry of Textile has chosen to concentrate on several programs and initiatives. In addition to improving life insurance

and health care under welfare programs, weavers can increase their income and standard of living.

NOTE:

Singlup = is an asocial institution developed at the leikai / ward level.

Thasi Marup = a group of collected members who are collecting their money once in a month

That was on a dark moon.

PurnimaMarup = a group of collected members who collect their money once a month that was on full moon.

Leikai Marup = a small group of members who are residing in the same ward/ sectors.

ACKNOWLEDGEMENTS

The authors would like thank to Prof. Kh. Mohon Singh, Editor-in-Chief, Thambal Marik College Research Journal (TMCRJ) for his constructive suggestions. The authors are thankful to Dr. Naorem Sharat Singh, Associate Professor, Department of Statistics, DMU, Imphal for appreciating and continuous advice. They acknowledged the District Co-operative Officer; Weaving Section District Industries Center, Bishnupur, Government of Manipur and their subordinate staff for giving related documents. They are also thankful to the anonymous reviewer to whom the paper was submitted for their valuable comments that improved the quality of the paper.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

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Fish Diversity of Oinam Lake, Bishnupur District, Manipur, India

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ABSTRACT

The goal of the current project was to find out the freshwater exotic and indigenous fish fauna found in Oinam Lake (locally called Oinam pat), Bishnupur District, Manipur during 2014-2015 to evaluate the status, diversity and distribution for a conservation plan. Fish are the main exploitable resources of aquatic ecosystems, and they provide the cheapest source of animal protein for our health. Fishes are one of the important elements in the economy of many nations as they have been a stable food item for many people. In Manipur, fish are the main item of daily food in day and night. 32 (thirty-two) fish species were found in the study, representing 21 (twenty-one) genera of 13 (thirteen) families and 5 (five) orders. The maximum number of fish species belonged to the order Cypriniformes with 15 (fifteen) species of fish followed by Perciformes with 9 (nine) species of fish, Siluriformes with 5 (five) species of fish, Osteoglossiformes with 2 (two) species of fish and Synbranchiformes with 1 (one) species of fish. *Puntius* species demonstrated the highest yield during the study period followed by *Channa punctatus*, *C. striatus*, *Anabas testudineus*, *Trichogaster fasciata*, *T. labiosa*, *Amblypharyngodon mola*, *Heteropneustes fossilis* and *Mystus* sp. etc. There were fewer native fish species recorded during the study period as a result of the development of artificial fish farms and the localization of exotic fish culture throughout the study period; no new fish species were recorded.

Keywords: Fish fauna, Oinam Lake, Animal protein, Manipur, India.

1. INTRODUCTION

The lake under the present study is one of the threatened lakes. An analysis of the distribution and diversity of the fish fauna in the lake has been attempted. Oinam pat is a semi-terrestrial shallow water lake located at Oinam, Bishnupur district, Manipur at a distance of 22 km to the southwest of Imphal. It is situated at the intersection of latitudes 24°25' to 24°40' N and longitudes 93°45' to 93°55' E, at an elevation of 782 m above mean sea level. The lake is roughly 1.538 square kilometers in size. Manipur's freshwater fish have been focused on by many workers. Kar (2007) conducted a thorough investigation of the ichthyofauna and limnology

of the water bodies of Northeastern India (NE) including fish diseases. In a 2007 study, Kar and Sen systematically enumerated and distributed the fish biodiversity in the Mizoram, Tripura and Barak drainage regions of Northeast India. Kar *et al.* (2008) investigated the fish biodiversity panorama in a few Manipur wetlands and rivers. In 2000a and 2000b Vishwanath and Kosygin reported the discovery of two new Manipur-born cyprinid fish. The authors conducted a study in 2014-2015 to examine the fish fauna of Oinam Lake.

2. MATERIALS AND METHOD

With the assistance of fishermen, the fishes were collected from the study area using traps, gill nets, cast nets, dip nets and other indigenous gear for catching fish. After being gathered, the fish were preserved in a 10 per cent formalin solution and brought to the lab for more study. Fishes were identified by Vishwanath (2002) & Jayaram (1999). Finding out the distribution, diversity of fish fauna and condition of the lake is the aim of this study.

3. RESULTS & DISCUSSION (Study of fish fauna)

During the study period, 32 fish species were

collected from this lake. They are members of 5 orders, 13 families and 21 genera. Among these *Chanda nama*, *Esomus danricus*, *Puntius sarana sarana*, *Notopterus notopterus*, *Lepidocephalus guntea*, *Lepidocephalus berdmorei*, *Mystus bleekeri*, *Mystus cavasius*, *Channa orientalis* and *Clarias batrachus* have been collected in very less number. *Puntius* species generally showed the highest yield, followed by *Channa punctatus*, *Anabas testudineus*, *Trichogaster fasciata*, *T. labiosa*, *Amblypharyngodon mola*, *Heteropneustes fossilis* etc.

Table I. List of the fishes found in Oinam Lake, Manipur.

Sl. No.	Name of the fish(Scientific name or Zoological name)	Order	Family	Local name (in Manipuri)
1.	<i>Labeo rohita</i> (Ham-Buch)	Cypriniformes	Cyprinidae	Rou
2.	<i>Labeo gonius</i> (Ham-Buch)	Cypriniformes	Cyprinidae	Kuri rou
3.	<i>Cyprinus carpio</i> (Linnaeus)	Cypriniformes	Cyprinidae	Puklaobi
4.	<i>Cirrhinus mrigala</i> (Ham-Buch)	Cypriniformes	Cyprinidae	Mrigal
5.	<i>Hypophthalmichthys molitrix</i> (Valenciennes)	Cypriniformes	Cyprinidae	Silver carp
6.	<i>Ctenopharyngodon idella</i> (Valenciennes)	Cypriniformes	Cyprinidae	Napi chabi (Grass carp)
7.	<i>Catla catla</i> (Hamilton)	Cypriniformes	Cyprinidae	Catla
8.	<i>Amblypharyngodon mola</i> (Ham-Buch)	Cypriniformes	Cyprinidae	Muka nga
9.	<i>Esomus danricus</i> (Ham-Buch)	Cypriniformes	Cyprinidae	Ngasang
10.	<i>Puntius chola</i> (Ham-Buch)	Cypriniformes	Cyprinidae	Phabounga
11.	<i>Puntius sophore</i> (Ham-Buch)	Cypriniformes	Cyprinidae	Phabounga
12.	<i>Puntius sarana sarana</i> (Ham-Buch)	Cypriniformes	Cyprinidae	Ngahou
13.	<i>Puntius manipurensis</i> (Menon, Rema & Vishwanath)	Cypriniformes	Cyprinidae	Ngakha meingang-bi
14.	<i>Puntius ticto</i> (Ham-Buch)	Cypriniformes	Cyprinidae	Ngakha
15.	<i>Puntius stoliczkanus</i> (Day)	Cypriniformes	Cyprinidae	Phabounga
16.	<i>Anabas testudineus</i> (Bloch)	Perciformes	Anabantidae	Ukabi
17.	<i>Chanda nama</i> (Ham-Buch)	Perciformes	Chandidae	Ngamhai
18.	<i>Trichogaster fasciata</i> (Schneider)	Perciformes	Belontiidae	Ngapemma
19.	<i>T. labiosa</i> (Schneider)	Perciformes	Belontiidae	Ngapemma
20.	<i>Glossogobius giuris</i> (Ham-Buch)	Perciformes	Gobiidae	Nailongamu
21.	<i>Oreochromis mossambica</i> (Peters)	Perciformes	Cichlidae	Tunghanbi
22.	<i>Channa punctatus</i> (Bloch)	Perciformes	Channidae	Ngamu bogra

23.	<i>C. striatus</i> (Bloch)	Perciformes	Channidae	Porom
24.	<i>C. orientalis</i> (Bloch & Schneider)	Perciformes	Channidae	Meitei ngamu
25.	<i>Clarias batrachus</i> (Linnaeus)	Siluriformes	Claridae	Ngakra
26.	<i>Heteropneustes fossilis</i> (Bloch)	Siluriformes	Heteropneustidae	Ngachik
27.	<i>Ompok bimaculatus</i> (Bloch)	Siluriformes	Siluridae	Ngaten
28.	<i>Mystus bleekeri</i> (Day)	Siluriformes	Bagridae	Ngasep
29.	<i>Mystus cavasius</i> (Ham-Buch)	Siluriformes	Bagridae	Ngasep
30.	<i>Monopterus albus</i> (Zuiew)	Synbranchiformes	Synbranchidae	Ngaproom
31.	<i>Notopterus notopterus</i> (Pallas)	Osteoglossiformes	Notopteriidae	Ngapai
32.	<i>Notopterus chitala</i>	Osteoglossiformes	Notopteriidae	Ngapai

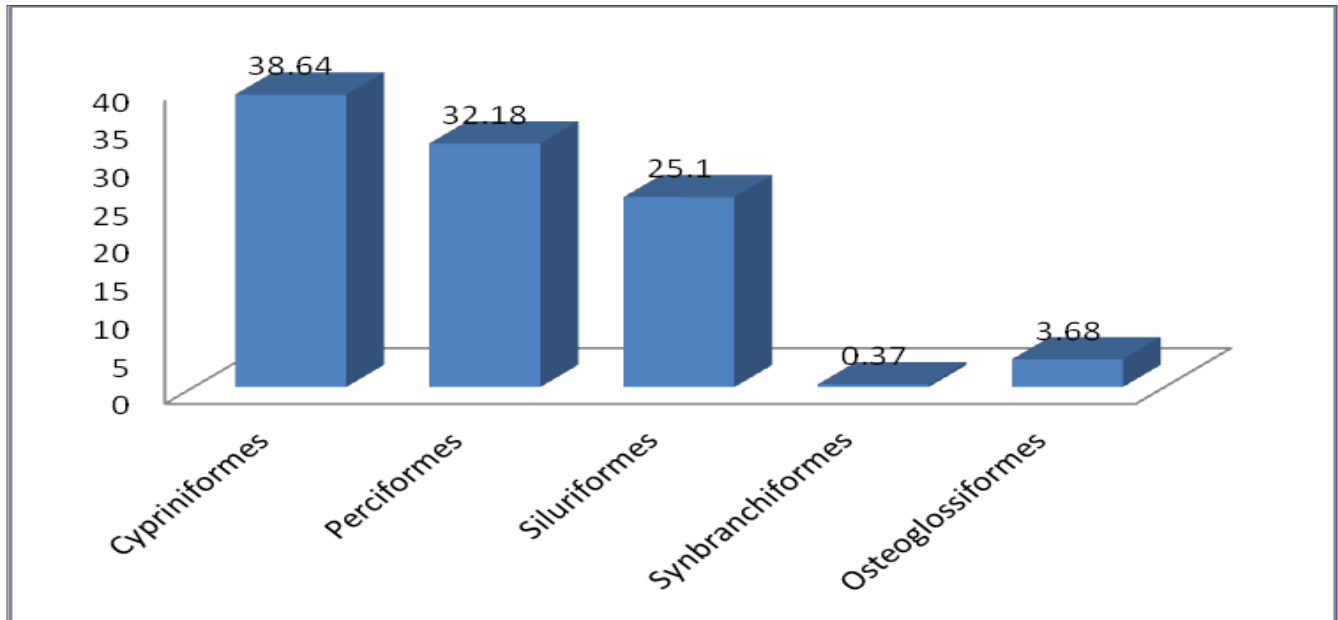


Fig. 1 Graphical depiction of the proportion of five distinct fish orders that are found in Oinam Lake, Manipur.

Fish from the Cyprinidae family dominated the current study. Table I lists the fish that can be found in Oinam Lake, Bishnupur District, Manipur. A graphical depiction of the frequency of five different fish orders in Oinam Lake can be found in Fig.1. The maximum number of fish species belonged to the order Cypriniformes (38.64%) followed by Perciformes (32.18%), Siluriformes (25.1%), Osteoglossiformes (3.68%) and Synbranchiformes (0.37). The Nambol River

and Loktak Lake are Oinam Lake's primary sources of fisheries. The majority of fish species are available all year round. Fishes were caught primarily during winter and dry seasons only. It is not possible to go fishing in the lake during the rainy season due to the extremely high water level. During the inquiry, no new fish species were discovered.

4. CONCLUSIONS

Oinam Lake is the lifeline of the people inhabiting the lake. By studying the fish fauna of the lake under the present study, it can be concluded that indigenous fishes are very less due to artificial fish farming and the culture of exotic fishes in the area. The present situation needs a work plan to maintain a balance between the demand for fish resources, its generation, maintenance of the environment and biodiversity conservation.

ACKNOWLEDGEMENTS

The authors are indebted to Prof. Kh. Mohon Singh, Editor-in-Chief, Thambal Marik College Research Journal (TMCRJ) for his constructive suggestions, and HOD, Department of Zoology, Thambal Marik College, Oinam for providing necessary laboratory facilities and granting leaves of absence for the study period. They are also like to show appreciation to the Ministry of Science & Technology, SERB, DST, and Government of India for funding this work. Thanks are due to Prof. A. N. Jha, Retired Professor of Zoology Department, BRA Bihar University, Muzaffarpur for his continuous advice. They are also thankful to the anonymous reviewer to whom the paper was submitted for their valuable comments that improved the quality of the paper.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

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A Micro-level Study of Workforce Participation in The Bishnupur District, Manipur (2001 - 2011)

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ABSTRACT

Understanding the composition of the working population is a valuable tool for future development plans and strategies. A nation's economic growth relies heavily on the active participation of its people in different sectors. An increase in the workforce participation rate in the different sectors of the economy signifies progress in the economic development of a country because a comprehensive study of the workforce participation rate in the Bishnupur District of Manipur has been taken for investigation and analysis. The objectives of this study are to gauge the shift in workforce participation rate, the distribution of workers in the broad industrial categories and the transition of workforce participation from agriculture to other sectors between the 2001 and 2011 censuses. By using census data from the 2001 to 2011 censuses and data available from different sources, this study enhances the understanding of the factors that influence the employment patterns of Bishnupur District, Manipur, and it will provide valuable information to the policymakers, and stakeholders. Therefore, the main focus of this paper is to examine how the workforce participation rate has changed in the different sectors of the economy in the Bishnupur District of Manipur between the 2001 and 2011 censuses.

Keywords: Census, Change, Participation, Sectors, Workforce

1. INTRODUCTION

Workforce participation in a country or region refers to the allocation of the population across various sectors. Understanding the composition of the working population is a valuable tool for future development plans and strategies. A nation's economic growth relies heavily on the active participation of its people in different sectors. Labour is a powerful instrument of economic regeneration (Awasthi, G. D & Sachdeva, A. N., 2012). As a primary factor of production, the size of the labour force is vital to a country's economic activity (Gaurav Datt & Ashwani Mahajan, 2016). A country's or region's labour force participation is influenced by several economic, regional and technical variables. Among the many variables that influence it, the emergence of the availability of natural resources, the amount of per capita income, specialization and productive forces possess

greater significance. The occupational structure of a country means the distribution of the workforce in different occupations or industries of the country (Agrawal, A. N., 2010). Various occupations in economic theory have been classified into three categories:

1. Primary: agriculture, forestry and logging, fishing.
2. Secondary: mining and quarrying, manufacturing, electricity, gas and water supply, construction.
3. Tertiary: trade and commerce, transport-storage and communication, banking, insurance, real estate, community services, personal services and other services (Puri, V. K & Misra, S. K., 2014).

A sizable section of the populace works in agriculture and related fields in comparatively undeveloped nations. On the other hand, in developed nations, the agricultural sector has declined relative to the growth of the service sector and the growth of industries. Generally, productivity in the services sector is as high as in the industrial sector. Hence, the transfer of workforce participation from agriculture to industry and eventually to services is considered a reliable index of economic progress.

Currently, many developing countries face challenges such as poverty, unemployment, poor health, and economic stagnation. These issues often result in food shortages and reliance on imported grains, which impede any shift in the occupational structure. This stagnation hinders economic development and makes it difficult for such economies to progress. Therefore, based on the above discussion, it is essential to examine the changes in the workforce participation rate in specific regions to understand economic development trends. For instance, studying the workforce participation rate in the Bishnupur District of Manipur from 2001 to 2011 censuses can provide insights into the region's workforce participation rate and economic progress.

2. OBJECTIVES

The following are the study's objectives:

1. To highlight the changes in workforce participation from the 2001 to 2011 censuses.
2. To gauge the change in workforce participation from agriculture to non-agriculture sectors.
3. To evaluate the decadal of workers in broad industrial categories (2001 – 2011).
4. To assess the working and non-working population (2001-2011).

3. STUDY AREA

The Bishnupur District is situated in the southwest of Manipur. It is located between 93°45' and 93°52' East Longitude and between 24°45' and 24°45' North Latitude. Its borders are

as follows: Senapati to the east, Churachandpur District to the west and south, Thoubal District to the east, and Imphal West District to the north. This district has a total area of 496 square kilometres and a population of 2, 37,399 in the 2011 Census, compared to 2, 08,368 in the 2001 Census. As per the 2001 Census, the working population made up 43.05% of the district's total population, with 48.09% of the population being male and 37.97% being female. In contrast, the 2011 Census found that 46.31% of the working population was male and 52.90% of the population was female. Loktak Lake and Keibul Lamjao National Park, the world's only floating wildlife sanctuary and the original home of the Brow Antler Deer, Sangai, is two of the district's most remarkable and charming locations. The largest freshwater lake in Manipur and the Northeastern Region of India is Loktak Lake. Loktak Lake's cultural history is captivated by Manipur's. The state's single greatest source of fish is the lake. It offers a means of subsistence to the residents of multiple nearby villagers.

4. METHODOLOGY

The study relies on secondary data that was gathered from Census of India publications. The District Census Handbook of Bishnupur District, the Final Total Population, and General Population Tables comprise the census data gathered between 2001 and 2011. Additionally, information from a variety of sources, including books, newspapers, and reports from governmental and non-governmental organizations, has been consulted.

5. RESULTS & DISCUSSION

5. 1. Working & Non-working Population of Bishnupur District, Manipur: In the study of workforce participation, it is necessary to examine the working Population (main + marginal) and the non-working population. The number of workers involved in different economic activities is a direct reflection of the Bishnupur District's degree of social and economic development. According to the 2001 census, the working population (main + marginal workers) to the total population in the study region was 43.05% and 56.95% of the non-working population, while 46.31% of the working

population and 53.69% of the non-working population as per the 2011 census. It shows that the working population increased by 3.26%, and declined by 3.26% of the non-working population from 2001 to 2011.

According to the 2001 census, 43.05% of the population was employed. While the working population was 46.31% in the 2011 census, of the 43.05% of the population that was employed, 26.66% were primary workers, and the remaining 16.39% were marginal workers. Of the 46.31%

of the working population, 32.19% were main workers and 14.12% were marginal workers. The report revealed that the main workers increased by 5.53% and decreased by 2.27% of marginal workers. Therefore, it shows an increase in the number of main workers, a decrease in marginal workers, and a high percentage of dependable and non-working populations during the study period. The number of working and non-working populations in the district in the 2001 and 2011 censuses is shown in Table No.1.

Table No.1 Distribution of Workers and Non-workers to the Total Population in Bishnupur District, Manipur

(Percentage to the total population)

Categories	2001			2011		
	Male	Female	Total	Male	Female	Total
Main Workers	37.57	15.68	26.66	44.75	19.61	32.19
Marginal Workers	10.52	22.29	16.39	8.13	20.12	14.12
Total Workers	48.09	37.97	43.05	52.88	39.73	46.31
Non-workers	51.91	62.03	56.95	47.12	60.27	53.69

- Sources:**
1. Government of Manipur (2015): Statistical Yearly Book of Bishnupur District, Manipur: Directorate of Economics & Statistics.
 2. Government of Manipur (2022): Economic Survey of Manipur: Directorate of Economics & Statistics.

5.2. Workforce Participation in Broad Industrial Categories: After independence, India embarked on a series of economic measures aimed at diversifying its economy. The Indian economy has undergone major changes in recent years with significant expansion of the secondary and tertiary sectors. These changes have reduced the proportion of people who are cultivators or engaged in agriculture. In the Bishnupur District of Manipur, the broad industrial categories of workers in the 2001 census indicate that the proportion of cultivators to total workers was 28.09%. This percentage of cultivators increased to 31.25% of the total workers in the 2011 census. Even the proportion of agricultural labourers indicates a downward trend. It declined from 25.73 % in the

2001 census to 13.75% in the 2011 census.

Negative trends in the percentage of workers in household industries were also evident. The percentage of workers employed in household industries was 12.70% in the 2001 census and dropped to 10.52% in the 2011 census.

Even the proportion of other workers shows an upward trend from 2001 to 2011. The proportion of other workers had a contribution of 43.48% to the total workers in the 2001 census. The percentage of other workers rose to 44.48% in the 2011 census. Thus, the broad industrial categories of workers during 2001-2011 indicated that the percentage of cultivators increased by 3.16% during 2001-2011, followed by agricultural labourers declined by 1.98%, the rate of household

industries decreased by 2.18%, and other workers increased by 1.00% during the same period. The distribution of workforce participation by the broad industry categories is shown in Table No. 2.

Table No.2. Distribution of Workers by Cultivators, Agricultural Labourers, Household Industries and Other Workers in Bishnupur District, Manipur

As per the 2001, and 2011 census

(Percentage to the total workers)

Sl. No.	Categories	2001 Census	2011 Census
1	Cultivators	28.09	31.25
2	Agricultural Labourers	15.73	13.75
3	Household Industries	12.70	10.52
4	Other Workers	43.48	44.48

Sources:

1. Government of Manipur (2004): Economic Survey of Manipur (2002-03): Directorate of Economics & Statistics.
2. Government of Manipur (2007): Economic Survey of Manipur (2006-07): Directorate of Economics & Statistics.
3. Government of Manipur (2022): Economic Survey of Manipur (2021-22): Directorate of Economics & Statistics.

5.3. Status of Agricultural Workers & Non-Agricultural Workers: The size of the working force and its division into different economic activities is a clear indicator of the social status of a country or region. The change in the number of workers and their proportions in the various types of work show the change in the working pattern of a country or region. Table No. 3 shows that the percentage of agricultural workers, including cultivators and agricultural labourers in the 2001 census was 43.82%, and 45.00% of the agricultural workers in the 2011 census in the district. It increased by 1.18% of the agricultural workers during the period. On the other hand, the

percentage of non-agricultural workers, comprising household industries and other workers decreased by 1.18% during the period. These trends indicate a lack of substantial movement from agricultural to non-agricultural sectors within the workforce.

Table No. 3. Agricultural Workers and Non-Agricultural Workers in Bishnupur District, Manipur as per the 2001 and 2011 Censuses

(Percentage to the total workers)

Sl. No.	Categories	2001	2011
1	Agricultural Workers	43.82	45.00
2	Non-Agricultural Workers	56.18	55.00

Sources:

1. Government of Manipur (2007): Economic Survey of Manipur (2006-07): Directorate of Economics & Statistics.
2. Government of Manipur (2022): Economic Survey of Manipur (2021-22): Directorate of Economics & Statistics.

6. CONCLUSIONS

The above discussion showed that the working population of Bishnupur District, Manipur has increased, and the non-working population decreased from 2001 to 2011. Specifically, the percentage of the working population rose from 43.05% in 2001 to 46.31% in 2011, while the percentage of the non-working population decreased from 56.95% in 2001 to 53.69% in 2011. This indicates a 3.26% increase in the working population and a corresponding 3.26% decrease in the non-working population over the decade.

In 2001, the working population constituted 43.05% of the total population. Of this, 26.66% were classified as main workers, with the remaining 16.39% falling under the category of marginal workers. By 2011, the working population had risen to 46.31%, with 32.19% categorized as main workers and 14.12% as marginal workers. This data reveals a 5.53% increase in main workers and a 2.27% decrease in marginal workers. The findings suggest an overall rise in main workers, a

decline in marginal workers, and a notable presence of dependable and non-working populations throughout the study period.

Analyzing the broader industrial categories of workers from 2001 to 2011, it is evident that the percentage of cultivators among total workers increased by 3.16%. However, agricultural labourers decreased by 1.98% and workers in household industries declined by 2.18% during the same period. These trends indicate a lack of substantial movement from the agricultural to non-agricultural sectors within the workforce. Consequently, the study reveals that there was consistently a lower percentage of the working population compared to the non-working population, and the state government needs to take several steps and measures aimed at creating more employment opportunities across various sectors of the economy to enhance workforce participation rates in the district.

ACKNOWLEDGEMENTS

The authors express their profound gratitude to all those who have contributed to the research work on “A Micro-Level Study on Workforce Participation in the Bishnupur District, Manipur (2001 – 2011)”. The authors are also thankful to the Directorate of Economics & Statistics for providing access to the data and resources for their research. Lastly, the authors extend their heartfelt gratitude to the Thambal Marik College, Oinam for publishing their paper in the College Journal. The authors are grateful to Prof. Kh. Mohon Singh,

Editor-in-Chief, Thambal Marik College Research Journal (TMCRJ) for his generous and insightful comments and suggestions in preparing this paper. They are also thankful to the anonymous reviewer to whom the paper was submitted for their valuable comments that improved the quality of the paper.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

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The Influence of the Vedas on Ancient Indian Literary Tradition

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ABSTRACT

Ancient Indian Knowledge is rich and vast. The Vedas are ancient and foundational inscriptions of Indian civilization, depicting a unique and subtle body of wisdom that offers perception into the spiritual, philosophical, and social aspects of ancient Indian Society. They are known for their meticulous poetic beauty, with hymns and verses rich in imagery, metaphor, and symbolism. The language of the Vedas is highly refined making it not just a medium of expression but an art form. The hymns, rituals, and prayers are deep philosophical teachings based on Hindu beliefs. The Vedas written in an ancient form of Sanskrit known as Vedic-Sanskrit are unique in their linguistic and literary qualities. They are composed in Chandas adding to the aesthetic appeal of the verses. The concepts of Brahman, Atman, and Karma are the Vedic-Sanskrit philosophy. They provide knowledge into the nature of the divine and guide for a successful life. According to Hindu Philosophy, the concepts of Dharma (Duty), Artha (Wealth), Karma (Desire) and Moksha (Liberation) contribute to a comprehensive structure for living a balanced and fruitful life. These principles reinforce ethical conduct, moral values and spiritual growth, encouraging harmony between the spiritual and the material aspects of existence. The Vedas are the roots of Indian civilization. They are also essential in Indian cultural and historical documents.

The Vedic literature designs the foundation of Indian Literature, significantly influencing its development and richness. The Vedas introduced concepts like Dharma, Karma, and Moksha which penetrated various aspects of Indian literature. Moreover, Vedic literature's linguistic and poetic traditions laid the background for consecutive literary forms, including the epics Puranas and classical Sanskrit literature. Without the essential production of Vedic literature, Indian literature would certainly lack its deep philosophical depth, thematic heterogeneity, and sophisticated narrative styles. The Vedas' contribution reverberates through contemporary Indian literature, reinforcing their immortal pertinence and foundational role.

Keywords: Meticulous, Metaphor, Vedic-Sanskrit, Aesthetic, Karma.

1. INTRODUCTION

Ancient Indian knowledge comprises various fields of knowledge like Science, Mathematics, Medicine, Philosophy, Arts, Agriculture, and Literature etc. The precious Indian knowledge system continues to inspire the world. Understanding and analysing the Indian knowledge system regulates well the goals of the National Education Policy. The NEP emphasizes the importance of multi-disciplinary education

blending both traditional Indian knowledge systems and modern subjects. By studying the Indian knowledge system, can increase a deeper appreciation of cultural heritage and develop critical thinking skills. It promotes a more inclusive and diverse curriculum, reflecting the richness of India's intellectual inheritance. The literature from ancient India includes The Vedas, Upanishads, the Mahabharata, the Ramayana, and

various other scriptures, which include a wealth of knowledge and intellect. Studying these works can arouse a sense of pride and appreciation for the profound knowledge that our ancestors possessed. To fathom the richness of Indian literature, it is essential to assess its history. In Vedic times, Sanskrit was the dominant language for writing. Sanskrit is generally used in religious texts and has necessarily influenced most modern Indian languages. It is regarded as the foundation of Indian culture, similar to Latin's role in European culture. Latin remained the international communicative language even after the fall of Western Rome (Winternitz *et al*, 1922).

1.1. The Root of Literature: 'Literature' is derived from the Latin word 'litter', meaning letter or essentially writing. While some suggest the term could include oral forms, the main emphasis is on written forms. Oral literature, however, is an ancient human culture found globally. Modern archaeology has explained confirmation of human endeavour to preserve and transmit arts and knowledge. In ancient India, folklore, and mythologies, from various religions were transmitted orally and preserved carefully using evocative techniques. Early Buddhist texts are widely thought to have been primarily transmitted orally. The belief is supported by the extensive and reliable text which suggests they were not composed and transmitted orally over generations. Most of the Ancient Greeks and Romans were likely transmitted orally to some extent. The absence of surviving religious texts about Greek and Roman supports this view. Latin, an Indo-European language is derived from the "Latini", an Italic tribal group that settled around the 10th century B.C. in Latium, and the dialect is spoken by these people. It turned into the dominant language in the Roman Empire, communication, and literature. Latin converted from being used by small groups in the Mediterranean region around 3,000 years ago to becoming a widespread language. Latin arrived in England through the main channels.

To begin with, it was introduced as the Romans expanded their kingdom into Britain

bringing Latin as the language of rulers, trade, and governance. In addition, Latin spread among Christian missionaries who voyaged to Britain and took a critical role in converting the Anglo-Saxons. These missionaries used Latin as their preaching, contributing to its growth and influence in the region. Thus, it influenced Old English mostly through Christianity and the Roman conquest of Britain. European literature is an extensive term that encompasses the literary works created in Europe over numerous languages, centuries, and genres. It consists of some of the oldest literary traditions all over the world ranging from the epic poetry of ancient Rome and Greece to the modernist and postmodernist movements of the 20th century.

1.2. Ancient Indian Literature: It is rightly said that while Greek, Latin, and English literature, as well as European classical literature, are taught and analyzed all over the world, Indian literature has not received this kind of advantage. Recently, the National Education Policy 2020 in India has been formulated to encourage the analysis of Indian literature in different fields. The new syllabus emphasizes Indian heritage compared to previous years. It gives Indian literature given advantage in the education system. The Indian perspective is justifiable and plans for the welfare of all, it is essential to resurrect our extensive heritage of knowledge systems and exhibit to the world the unique way of Indians' various aspects of life. Ancient and immortal Indian knowledge and philosophy serve as leading convention. Indian knowledge systems (IKS) consist of Jnana (Knowledge), Vignana (Science), and Jeevan Darshan which have expanded from experience, observation, experimentation, and precise analysis. Thus tradition has had a strong influence on various fields of society such as astronomy, administration, agriculture, arts, astronomy, culture, education, health, history, philosophy literature, etc. It has also influenced classical and other languages of India, transmitted through textual, oral, and artistic traditions." knowledge of India" comprises intellect from ancient times, its achievement and future aspirations in different fields and all aspects of life.

Max Muller said,

“India has been conquered once, but India must be conquered again and that second conquest should be a conquest by Education” (Max Mueller, 1965).

1.3. The Importance of the Vedas:

Maharishi Dayanand said “God has given the Vedas to man for his welfare and to bring behavior in daily life”. To express the power of God many names are used in different parts. According to Indian tradition, it is, said that the Vedic hymns and preaching of the Vedas have three levels of meaning: metaphysical, meta-divine, and spiritual. Human history is found in the Vedas, which is not found in any other culture. In Vedas, the ideal person, brotherhood, selflessness, charity, and ideal systems have been described. The Vedas are the earliest Hinduism texts or scriptures (Dalal, 2014). In Indian literature, human intellect in the form of literature is seen in these scriptures. Like Latin, Sanskrit had a long historical background, of becoming the Vedic language. The Vedic age started with the coming of Indo-Aryans. Soon after the decline of the Indus Valley Civilization, the Vedic civilization started. The Vedic civilization took an integral part in ancient India. Their language was Sanskrit. The Vedas were written in archaic Sanskrit, which is now known as Vedic Sanskrit. It showed valuable insights into the literature and religious practices of the Vedic period. The Vedas meaning knowledge or human knowledge are dated by scholars from 6500 B.C. to 1500 B.C. The language used in these texts is Sanskrit. The texts had followed some grammatical rules of that time, Pratishakhya of Parsada. During this period, the Vedas (knowledge), Brahmana-Granthas (explanation of sacred knowledge, song, or verse), Aranyakas (ritual sacrifice), Upanishads (sitting near a teacher) and Vedangas (six auxiliary disciplines) came up. Veda Vyasa is the compiler of the Vedas. He is the grandson of the Muni Vasistha and the son of Rishi Parashar. His mother is Satyawati, a fisherwoman and the second wife of King Shantanu.

The difference between Vedic Sanskrit and

classical Sanskrit literature is that Vedic is based on piety, focusing on prayers, hymns, and rituals, and classical Sanskrit literature comprises more varied genres. The Vedic period (1500 B.C.E-600 B.C.E) is broadly divided into two: The early Vedic period (1500 BCE-1000 BCE), and the Later Vedic period (1000 BCE-600 BCE). The Vedic people are known as Aryans, Rig-Veda, the oldest Veda was composed in the Rig Vedic period. Rig Veda has been regarded as the best Veda. In this period, Indian culture was developed in the north-western regions of the Indian subcontinent but it shifted to the plains of the Ganges in the Later Vedic period. In the Early Vedic period, spiritual concepts like Maya (illusion), Atman (spiritual soul), Brahman (absolute truth), Karma (chain of actions and reactions), and Moksha (liberation) were developed, and it was the formative period of Hinduism or Vaishnavism. It matured in the later Vedic period when the emergence of Brahma, Vishnu, and Shiva was mentioned. The Early Vedic period was contemporaneous with the early Harappan phase of the Indus Valley civilization, Harappan culture contributed to the traditions of Hinduism. The ancient Sanskrit literature was orally transmitted over centuries before being written down. Vedic Sanskrit was basically, the comprehensive spiritual works of the Vedic religion. But classical Sanskrit was associated with other Indian religions, like Hinduism, Buddhism, and Jainism. Buddhist texts were composed in Buddhist Sanskrit (mixed Sanskrit).

The Vedas (sanatandharama or eternal path) instruct essential knowledge for existence. According to traditional belief, the Vedas are regarded as divine origin (Apauruseya). Apauruseya means they are not composed by humans but by humans, found as scriptures, heard or seen by ancient prophets (rishi) during deep meditation. The philosophical knowledge of the sages, gained from meditation was the chief source of Vedas. It is believed that Brahma dictated to talented men who finally wrote the Vedas down. Sacred texts of Hinduism are divided into two categories: Shruti and Smriti. Shruti means “what is heard” e.g., The Vedas Smriti means “what is

remembered, mainly chivalric tales. “The Vedas” is a collection of the four Vedas:

Rig Veda,
Samaveda,
Yajurveda,
Atharvaveda.

The combination of these components is known as “Ayurveda”. The Vedas is one of the fourteen texts of Yajnavalka Smriti. Every Vedic scripture has four styles of texts:

Samhitas,
Brahmanas,
Upanishads and
Aranyakas.

1.3.1. The Samhitas: Samhitas are referred to as methodical texts. In the context of Vedic literature, it refers to the earliest, archaic portion of the Vedas. These contain chants and invocations to various deities. The Samhitas are sometimes regarded to be part of the Karma-Kanda, or the ritual section of the Vedas.

1.3.2. Brahmanas: They are secondary portions, enclosed within each Veda; these texts consist of an explanation of Vedic ritual ceremonies, with their symbolic meanings and philosophical interpretations. They analyze performing rituals and sacrifices. The Vedic literature is broadly divided into two parts – Karma Kanda and Jnana Kanda.

1.3.3. Aranyakas: (forest text): These texts are planned for hermits living in the forest meditating and contemplating. They are part of the Vedas; including rituals, discussion on symbolic meta-rituals, and philosophical speculations. But not uniform in styles, mixing up instructions and ideas, with some including chapters of the Upanishads Aranyakas mainly based on allegorical interpretation. They emphasize the commentaries on ritual ceremonies and sacrifices (both karma and jnana kandas). In Vedic literature, they are considered a bridge between the ritual-based Brahmanas and the more philosophical Upanishads.

1.3.4. Upanishads: The Upanishads provide a philosophy of the nature of existence, the importance of self-realization, meditation, and spiritual enlightenment. These texts are philosophical and analyze the nature of reality, Atman (the self), and Brahman (the final reality). They are considered the summit of Vedic thought and are also known as Vedanta (end of the Vedas). They are identified as Jnana Khanda.

Each of the Vedas texts followed its own set of grammar rules, known as Pratisakhya (Vedic grammar), which describe pronunciation and recitation. Besides there are phonetic rules known as Shiksha (instruction), which administer the pronunciation of Vedic chants. Jaimini was an ancient Indian scholar who founded the Mimamsa of Hindu philosophy. The Mimamsa Sutra (aphorism) is a set of texts that analyzed the Vedic texts and rituals. The Nyaya Sutra by Aksapada Gautama and Vaisheshika Sutra are texts of Hindu philosophy that describe the rules of metaphysical and logic.

1.3.5. The Rig Veda (knowledge of the verses): It is the oldest and largest knowledge in Vedic Sanskrit scripture it consists of 1028 suktas and 10,600 verses. The Samhita was composed in the northwestern region of the Indian subcontinent. The text is divided into 10 mandalas. Out of 10, 1 and 10 are the youngest ones 1 mandala is the largest and 2-7 are the shortest known as Gotra. The 1 and 10 Mandala deal with philosophical questions and various virtues. Mandalas 2 and 9 deal with cosmology, ritual, and deities. The priests who are experts in chanting the hymns of Rigveda are known as Hotri [reciter]. These hymns or sukta are used in rituals and still used in, for example, marriage. One of the powerful Gayatri mantras included in the 3rd mandala is still in use. Sage Vishwamitra was the composer of this mantra. The king of God, Indra was the main God in this Veda.

They call him Indra, Mitra, Varuna, and Agni
and he is heavenly-winged Garman

To what is one, sages give many a little”.

Rigveda 1. 164, 46.

Transl: Klaus Klostermaler (Motilal Banarsidass).

1.3.6. Samaveda (knowledge of the chants):

It is the shortest Veda of the other four Vedas, consisting of 1875 hymns. It is known as the “Book of Song”, so it is sung not recited. It is closely related to the Rig Veda e.g., the eighth and ninth mandalas. The hymns are based on ceremonies of soma sacrifice. It is the Vedas of melodies and also a foundation of Indian classical music and dance. Samaveda Samhita contains chants, has been praised to different deities like Agni, Indra, and Soma, and also includes varied social customs. The main branches of Samaveda are preserved in three recensions:

Kauthuma,

Ranayaniya,

Gemini,

Kauhtuma is more popular. It includes two parts: Archika and Gana.

Archika is also divided into two: Purvarcika and Uttararcika

The first section includes,

Agneya – 114 hymns to Agni

Aindra –352 hymns to Indra

Pavamana—119 hymns to Soma Pavamana

Aranya –55 hymns to Indra, Soma, Agni, etc.

The Gana section is divided into two; Praktri Gana and Uha Gana

The Samaveda Upanishads known as Chandogya contain a very important sacred syllable ‘om’, used in rituals. In the Bhagavad Gita, Lord Krishna emphasized the importance of Samaveda as, “Of the Vedas, I am Sama”. Udgatri, headed the chanters are the expert priests, who perform melodic recitations of the hymns of Samaveda.

Agni

Vrittaani

Janghanand (Verse 4).

Agni (fire)

Destoys

The demons (veritas)

It is said that knowledge is capable of destroying the enemies (the passions), Kama, Krodha, Lobh, Moha, Mada Ahankar, and Matsarya. Ignorance (darkness) can be destroyed by self-knowledge. The supreme Gods will be attained through devotion and chanting.

1.3.7. The Yajurveda (knowledge of the sacrifice): The word ‘yajus’ means worship, so it is the ritual for worship. It instructs for religious rituals, composed in the form of prose. Adhvaryu are the experts of Yajurveda. The main deities in Yajurveda are Savita, Indra, Agni, Prajapati, and Rudra. This sacrificial prayer is divided into two kinds: the black or dark (Krishna), and the white or bright. The black signifies negative characteristics—an untidy and confusing collection of verses, on the other hand, white is the opposite of black, it is well-structured and lucid. The earliest layer of the Yajurveda Samhita consists of 1875 verses. Satapatha Brahmana is the middle layer, and the youngest layer comprises primary Upanishads. The Krishna Yajurveda has four recensions available:

Taittiriyaśamhita, Maitrayanisamhita, Katha samhita, Kapisthalasamhita.

Taittiriyaśamhita of Krishna Yajurveda is applied to the followers of sage Tittiri. The Maitrayanisamhita gives insight into rituals, philosophy, and spiritual practices.

1.3.8. Atharvaveda (knowledge of the fire Priest): It includes human conduct of life and daily duties. It contains 730 hymns or suttas, 6000 chants, and 20 texts. This Veda has a speciality in magic formulae and has three primary Upanishads, they are the Mundaka Upanishad, the Manduka Upanishad and the last one is Prashna Upanishad. The hymns are melodious, and mostly charm or magic spells for bringing benefit or profit to the person, Brahmins are the priests, chanting the melodious hymns of Atharvaveda.

Ignoring the Vedas would mean missing out on a significant phase of India’s unique heritage and the knowledge they offer. Vedic knowledge

is the root of arts and sciences. Its different knowledge provides a great advantage to the researchers and is used in practical applications. In literature, they are the foundation of all kinds of genres. In religion, lead the life on the way of religion, dharma, and salvation. The oldest layer of Sanskrit literature is neglected by the Indians. But, it is high time to honour the inherent part of Indian cultural heritage with self-recognition.

ACKNOWLEDGEMENTS

The authors would like express their deepest gratitude to all those who support to the construction of this research article. They are incredibly thankful to Professor Kh. Mohon Singh, Editor-in-Chief, Thambal Marik College Research Journal (TMCJR), for his invaluable guidance and support to the construction of their paper. The authors express sincere appreciation to Dr. Heigrujam Mitramalini Devi, Assistant Professor, Naorem Birahari College, Khundrakpam, for her continued encouragement and insightful discussions. They are also thankful to the anonymous reviewer to whom the paper was submitted for their valuable comments that improved the quality of the paper.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

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Global Warming: Causes, Effects and Remedies

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ABSTRACT

Global warming refers to the rise in global temperatures due mainly to the increasing concentrations of greenhouse gases in the atmosphere. Climate change refers to increasing climate measures over a long period including precipitation, temperature, and wind patterns. It is a long-lasting change in the weather arrays across the tropics to the poles. The world temperature has been increasing dramatically since the advent of the Industrial Revolution. Some of the warmest years in the past 125 years have occurred since 1990. From the 21st century onwards; global warming has become a great alarming concern and a subject of considerable debate. If unchecked and appropriate are not taken up in time, it may lead to many unwanted adverse effects on the ecosystem, environment, and mankind. As per the Intergovernmental Panel on Climate Change (IPCC) 2018 report, the world's temperature has risen 1.4°F since 1880 and 1.5 million square kilometres of forest have been lost between 2000 and 2012, 287 billion tonnes of land ice have been lost annually, the sea level is rising by 3.2 mm and the amount of Arctic ice has decreased by 13.3% per decade. A significant change in the climate system has raised the possibility of permanent changes, such as the extinction of some vulnerable species, such as aquatic birds, amphibians, sea turtles, and ocean corals; crop failures leading to famine in many East African countries; a reduction in the amount of drinkable water in the Mediterranean and Southern Africa; and a rise in the frequency as well as the intensity of extreme events of weather, like flooding, storms, and forest fires. An increase in temperature affects seasonal weather patterns, ocean currents, and climate. Deforestation decreases the carbon dioxide and intensifies the greenhouse effect. Several international governments and non-governmental organizations are supporting several mitigations, strategies including the use of green energy alternatives, a decrease in the utilization of fossil fuels, and the utilisation of techniques to decrease emissions of greenhouse gas, reforestation, afforestation, protection of existing agroforestry and forest reserves. This study is aimed to conceptually engineer how climate variability is deteriorating the sustainability of diverse sectors worldwide. Secondary data is used to identify sustainability issues such as environmental, social, and economic viability. This work is a worldwide sectorial assessment of climate change mitigation.

Keywords: Global warming, Climate change, Mitigation, Afforestation, Greenhouse.

1. INTRODUCTION

The phenomenon known as “global warming” is the average temperature of the earth progressively rising. Long-term modifications to weather patterns and ecosystems occur when the Earth's average temperature rises, leading to a shift in the climate. Whether certain gases,

known as greenhouse gases, that are released into the atmosphere have the potential to permanently change Earth's climate is at the heart of the global warming debate. The principal greenhouse gases are nitrogen oxide (made by burning fossil fuels and fertilizer), carbon dioxide (generated mostly

by burning fossil fuels), methane (produced by biological decay, animal waste, and burning biomass), and chlorofluorocarbons (created by industrial processes). Although it is another greenhouse gas, ozone is not thought to have a significant role in the warming phenomenon. Many scientists are concerned that greenhouse gasses would disrupt Earth's radiation cycle from the sun, leading to an Earth-wide warming trend. They worry that global warming may result in the mass extinction of plant and animal species, raise

sea levels, have a negative effect on agriculture, and intensify and occur more frequently as severe hurricanes, cyclones, and typhoons.

The Earth's annual temperature has been increasing steadily since the Industrial Revolution. It increased by 0.07°C (0.13°F) per 10yrs between 1880 & 1980. However, the pace of the rise has more than doubled since 1981. Over the past 40 years, it has been observed that every year global temperature has increased by 0.18°C , or 0.32°F , per decade.

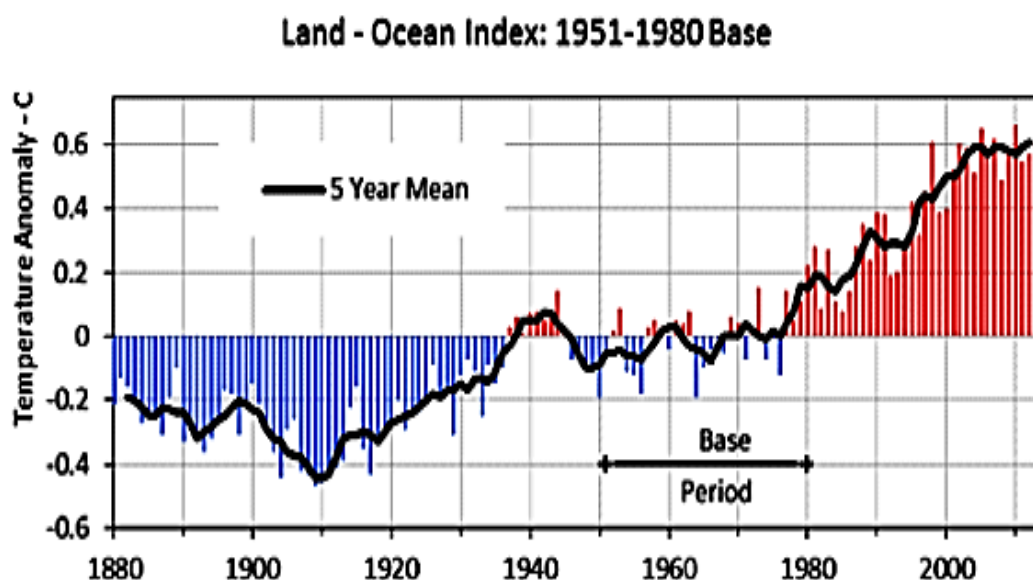


Figure 1: Global Temperature, 1880 – 2014

Source: Global Goddard Institute for Space Studies (GISS) and Climate Research Unit (CRU), Prepared by Process Trends.com updated by globalissues.com (Anup S,' 2015)

1.1. Causes: There are many factors responsible for the increase in global warming.

1.1.1. Deforestation: Human beings cut down trees and exploit forests on a large scale for rapid industrialization and development resulting in changes in global climate. Natural vegetation helps in regulating CO_2 from the atmosphere by absorbing it. The decline in forested areas hampers this process thereby increasing the temperature rise.

1.1.2. Fossil Fuels: Human beings use different forms of fossil fuels like petroleum oil,

natural gases, coal, etc. For rapid industrialization and sustainability, we use fossil fuels extravagantly and in large quantities increasing harmful levels of carbon dioxide and nitrous oxide in the air which in turn increases global warming. Additionally, plastics, solvents, detergents, lubricants, etc. include fossil fuels. Air pollution is produced at incredibly high levels when fossil fuels are burned.

1.1.3. Mining: For maximum utilization and rapid industrialization different ores are being extracted and processed from the earth's surface. However, utilization of such mineral ores produces

nearly 5% of greenhouse gas emissions globally. Another very important component of natural gas is methane, which is primarily responsible for more than 25 per cent of global warming. According to the methane emissions fact sheet, UNEP, methane has been 80 times more powerful pollutant from CO₂ for the last 2 decades when it is released and comes into contact with the atmosphere.

1.1.4. Intensive farming: For the rapid growth of the population and to support it, intensive farming is practised on a large scale which results in the emission of large amounts of harmful substances like nitrous oxide emissions from chemical fertilizers and methane from ever-increasing livestock.

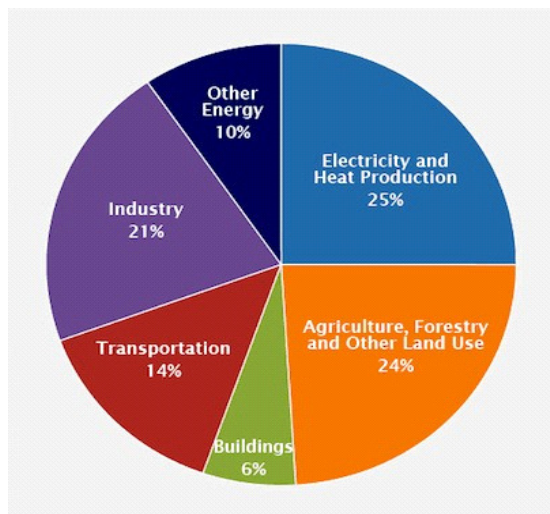


Figure 2: Harmful substances emitted by different agencies.

(Source: US Environmental Protection Agency)

1.1.5. Waste disposal: Due to great pressure exerted by the increasing population, and barren land, waste land is reclaimed through landfills and incineration resulting in the emission of greenhouse and toxic harmful gases. These in turn released directly into the atmosphere land and water contaminating them. It is important to note that the greatest source of ammonia emissions that cause air pollution is agriculture. People think that electricity is eco-friendly and it helps to protect nature but in fact, produces pollution and harms our environment. Microwave is also a source of hidden pollution known as radiation which in turn contributes to global warming.

1.1.6. Overconsumption: Lastly, overconsumption is a significant contributor to climate change. Due to the ever-increasing population, the existing natural resources are wildly and excessively exploited. And also from the different modes of transportation, it emits different harmful gases that contribute to the increase in global temperature. LPG cooking gas contributes to air pollution in a small amount. The method and setup used for extraction, purification, and transportation of petroleum products lead to global warming.

Table 1. Getting hotter

If carbon emissions continue unabated, by the 2080s, land and farm area temperatures will rise sharply...		
Base level	Land area	Farm area
Temperature ¹	13.15	16.20
Precipitation ²	2.20	2.44
By 2080s		
Temperature	18.10	20.63
Precipitation	2.33	2.51

... and agricultural productivity will tail off across the globe, but most sharply in developing countries. (per cent change in agricultural output potential)		
	Without CF ³	With CF ⁴
World		
Output- weighted	-16	-3
Population-weighted	-18	-6
Median by country	-24	-12
Industrial countries	-6	-8
Developing countries ⁵	-21	-9
Median	-26	-15
Africa	-28	-17
Asia	-19	-7
Middle East and North Africa	-21	-9
Latin America	-24	-13
Source: Clina (2007). ¹ Temperature is average daily in °C ² Precipitation is measured in millimetres per day. ³ Assumes no benefit to crop yields from increased carbon dioxide in the atmosphere(carbon fertilization, CF). ⁴ Assumes positive impacts on yields from carbon fertilization. ⁵ Exclude Europe		

Source: IMF: Global Warming and Agriculture, William R. Cline, March 2008

1.1.7. In the IPCC Special Report on Global Warming some of the consequences are highlighted and documented.

1.2. On biodiversity: Temperature increases and climatic fluctuations cause many changes, disrupting ecosystems and altering the circumstances and plant reproductive cycles. This caused a shift in the lifestyle habits of living things. Occasionally, it also results in the extinction of numerous threatened species. Biodiversity is somewhat impacted by global warming. The biodiversity's equilibrium is what's altered and in danger. A 1.5°C (34.7°F) average rise, as per the IPCC, may put 20–30% of species at extinction risk. A temperature increase of more than 2°C will make it difficult for most ecosystems to survive.

1.3. On Humans: Humanity and the world economy are also affected by changes in climate. In numerous regions across the globe, it has

already impacted health, social, and geopolitical equilibrium. When resources like food and energy become scarce, new conflicts emerge. Population movement is being driven by rising sea levels and floods. By 2050, 250 million people are expected to be refugees due to climate change.

1.4. On the Weather: For a considerable amount of time, meteorologists and climatologists from all around the world have been tracking the effects of global warming on the events of weather. The effects are massive: an increase in heat waves and droughts, an increase in precipitation, an increase in storms, hurricanes, floods, and wildfires, an extension of the frost-free season, etc.

1.5. On Oceans: Sea levels are rising at a rate never before seen due to the melting of permafrost and ice in the poles caused by global warming. The growth in a century was 18cm, with 6cm coming in the final 20 years. In the worst case, by 2100, there might be

a rise of up to 1 meter. The oceans' increasing acidity due to the massive amounts of CO₂ they absorb raises severe concerns for the adaptability of many marine creatures, including seashells and coral reefs.

1.6. Prevention: There are some measures we can take to minimize the increase in global warming and climate change.

1.6.1. Renewable Energies: The 1st step in halting change of climate is to utilize fossil fuels as little as possible. Rather, there should be a greater emphasis on raising public understanding of and using renewable energy sources like geothermal, biomass, wind, and solar.

1.6.2. Energy & Water Efficiency: It is necessary to use less expensive and equally important energy and water-efficient equipment to reduce our consumption of these resources.

1.6.3. Sustainable Transportation: Promoting the usage of electric and hydrogen vehicles as well as public transportation is necessary to combat global warming and cut CO₂ emissions.

1.6.4. Sustainable Infrastructure: Both new low-energy building construction and building renovations are required to lower CO₂ emissions from buildings, both residential and commercial.

1.6.5. Sustainable Agriculture & Forest Management: It is high time and a great priority that put a halt to massive deforestation, making agriculture greener and better utilization of existing resources more efficient.

1.6.6. Responsible Consumption & Recycling: People should be made aware of adopting more responsible consumption habits as well as recycling and reuse of resources to minimize wastage.

2. CONCLUSIONS

It is of great concern and worrisome to mankind due to the ever-increasing rise in global temperature and its effects on the one hand and the fast depletion of natural resources on the other. There

are many conventions, protocols, and submissions held in this regard to reduce and minimize emissions of harmful gases and substances. Mention may be made like Rio de Janeiro 1992 (Brazil), Kyoto Protocol 1997 (Japan) and Kigali Amendment 2016 (Rwanda). To this effect, some goals are set aside to achieve success like controlling greenhouse gases, developing energy-saving techniques, funding researchers, making mandatory green certificates, implementing an integrated territorial climate plan, etc.

ACKNOWLEDGEMENTS

The authors are grateful to Prof. Kh. Mohon Singh, Editor-in-Chief, Thambal Marik College Research Journal (TMC RJ) for his generous and insightful comments and suggestions in preparing this paper. They are also thankful to the anonymous reviewer to whom the paper was submitted for their valuable comments that improved the quality of the paper.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

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A Contribution of Urban Morphology and Functional Analysis: A Case Study of Bishnupur Town

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ABSTRACT

Bishnupur is a town in the Bishnupur District of Manipur in the Western Part of the Loktak Lake, Manipur. It derived its name from an ancient Vishnu temple located in the town, which was established in the 15th Century. It is a town that has grown unplanned. Its morphology is complex with the rapid growth of urbanization. Its functions had been changed in different ways with the changing of the occupation and structure of the people. Its main function was agriculture at the beginning, and presently it is placed at the function of works, services and professions. Bishnupur needs a thorough investigation for further sustainable urban development in the state. The main objective of the study is based on to analyze the morphological characteristics of Bishnupur town as a whole; and to analyze the functional characteristics of the townscape. The town has a rapidly growing population during past census years. It is a town grown in an unknown way. Bishnupur was a class (v) growing town in 1991 and a class (IV) town in 2011 within the Bishnupur. Urban development and planning have been utilized for a survey of the existing physical, economic, and cultural conditions of the townscape. Morphometric analysis and techniques are applied for the study. Such analysis is characterized by its historical and cultural significance, administrative structure and economic activities. The town's layout and architecture and influenced by its historical development and it serves as a hub for cultural and religious activities in Manipur.

Keywords: Cardinal Location, Central Geographical Core, Diversification, Lacustrine, Shape special Index, Urban Morphology.

1. INTRODUCTION

Urban morphology is considered as the study of urban tissue or fabric, as a means of decreasing the environment level normally associated with urban design. The major factors affecting urban morphology are topography, history economic and political environment which contribute to its complex spatial Phenomenon. Thus, urban morphology refers to the study of the physical arrangement or structure of a town. It may be defined as a study of the relationship of an urban landscape with it is occupies in terms of patterns and the distribution of socio-economic and the political activities. Hence, urban morphology is not only the study of the layout of buildings roads, institutions etc., but it is also significant in defining

the socio-economic and the political fabric of the urban landscape.

In function, the classification of towns is being made to classify urban centres according to their most important functions. Towns are multifunctional by nature, but they have one or more functions which give their distinctive characteristics (Maurya S.D., 2023).

2. URBAN MORPHOLOGICAL ANALYSIS

The urban morphology of Bishnupur town can be characterized by its historical and cultural significance with the town being a hub for cultural and religious activities in the state.

The study of Bishnupur urban morphology has been focused on the examination of urban structure, the identification of morphological, functional zones or regions and the processes that produce their distribution and interrelationships. Morphologically, the present picture of the Bishnupur town is an unplanned structure. There has not been a symmetrical growth since the beginning. It seems many changes in its morphological framework after the gradation of the Municipality.

3. ANALYSIS OF URBANIZATION AND PROBLEMS

Bishnupur town has rapid growth of urbanization. The town had a population growth of 8040 persons in 1991 to 12,167 in 2011. Urbanization is the process through which cities grow, and a higher and higher percentage of the population comes to live in the towns and cities. It is the concentration of population into towns and cities (<https://educational.nationalgeographic.org>).

The functional classification of the town indicates the town's role in terms of occupation, industrial type, economics, and religion, social and political issues. The functional classification of a town is the keynote to the growth of an urban centre in modern times (Singh H. H, 1972). The function of an urban centre changes with continuous growth and development. It is controlled by its physical and economic bases, and historical, socio-economic and political factors (Singh Nabakumar Th., 1998). Thus, towns can be classified into various categories on their functions like administrative towns, mining towns, industrial towns, tourist towns, commercial towns, cantonment towns, educational towns, religious towns, and cultural towns, etc. (Jagranjosh.com)

Functional classifications of the Bishnupur towns have been dealing with the structure and distributions of urban functions that abound in geographical literature and certain cognate fields like sociology and economics. The methods applied for the functional classifications of the Bishnupur town have been utilizing functional zones, Functional Zones:

Functional zones are the areas that area are designated for only one kind of activity. For example, industrial zones, residential zones, inner city or town zones, suburbs, rural, urban and central business districts. It may consist of a densely inhabited town and a less densely populated community zone whose labour market is highly integrated into the town or city.

Based on the pattern of the settlement developed, type of the business and residential houses, historical and socio-economic structure, land use pattern and their functions, the Bishnupur town can be divided into five distinct functional zones.

1. The Geographical Central Core (GCC) or Central Business District (CBD)
2. The Zone of Transition (Shopping/ Retail areas)
3. The Zone of Industrial Units
4. Residential areas
5. The Sub-Urban Zone/ Recreational areas.

4. THE GEOGRAPHICAL CENTRAL CORE (GCC) OR CENTRAL BUSINESS DISTRICT (CBD)

The geographical central core (GCC) forms the urban core of the Bishnupur. It occupies a small portion of the total area of Bishnupur town which has about 3 hectares of area. This main market centre meets about 90 per cent of the needs of consumable goods, not only of the town but also of the surrounding countryside. About three-fourths of the trade and commerce of the town is transected through it. The Geographical Central Core deals with the sole market. The present geographical Central Core (GCC or CBD) area is very congested and is not adequate to meet the present growing needs. The Bishnupur town also includes women's vendors or markets, which serve as the retailing outlet not only for the people of the town and its neighbourhoods but also for the people of Imphal and other places of the state. The present shape of the GCC or CBD is a Square shape, which can be examined by applying the Radial distance method for the shape index of the Central Business District (CBD), based on the

measurement of radial distances from a selected point to the circumference of the geometric form.

The formula is –

$$\text{Shape Index} = \sum_i^n \left(\frac{r_i^{100}}{R_n} - 100/n \right) \quad \text{where, } i = 1, 2, 3 \dots n.$$

n = Number of the radial axes.

R_n = Sum radial length

Table 1 Shape Index by Radial Distance Method

Radial from a selected point (r)	Direction of radials	Radial distance from the circumference to the GCC in meters (ri)	Shape index $\sum_i^n \left(\frac{r_i^{100}}{R_n} - 100/n \right)$
1.	North	700	(+) 11.76
2.	North East	200	(-) 5.57
3.	East	215	(-) 5.05
4.	South East	285	(-) 2.62
5.	South	695	(+) 11.59
6.	South West	225	(-) 4.70
7.	West	290	(-) 2.00
8.	North West	245	(-) 3.56
Total	$n = 8$	$R_n = 2855$	0.00

In computing the above formula in Table –1, it can be identified that the shape of the GCC or

CBD of Bishnupur is 0.00. The shape index “0” is exactly square; 12 are approximately square; 28 is approximately a rectangle. All the shapes form continua ranging from 0 to 175 for a circle as measured from the centre by a straight line. In the case of Bishnupur, the GCC or CBD shape index of 0.00 is square (Boyee, R.B.*et al*, 1964).

5. THE ZONE OF INDUSTRIAL UNITES

There are several industrial units located in Bishnupur town and its surrounding areas. There was a total of 79 registered industrial units in Bishnupur town with the majority being in the woodwork (14 units) handloom (8 units) and miscellaneous industries (52 units) sector.

Bishnupur town itself does not have a dedicated industrial zone, there are several industrial units spread across the town area, especially the metal, steel, textile and miscellaneous industries. However, Bishnupur has a co-industrial infrastructure.

6. FUNCTIONAL CLASSIFICATION OF BISHNUPUR

The function classification of Bishnupur town involved unique techniques of functional analysis; S.M. Rafiullah introduced an advanced method based on the weaver technique, enhancing functional classification. The approach, rooted in geography, aids in understanding the town's structure and dynamics.

Webb's Method:

Webb (1959) used the following method to determine the specialization indices and functional indices for the functional index in the analysis of the urban centre of Minnesota in the upper mid-western region of the unified state of America.

$$\text{Fn Index} = P/M_p \times P$$

Where, P = percentage of the employed population in a function.

M_p = the mean employment in the function

of the towns of urban complex.

A special Index (S.I.) is given by –

$$S. I. = \sum \left(\frac{p}{M_p} \times \frac{p}{100} \right)$$

As per the occupation structure of the 2011

census (the 2021 census report is not available due to no census operation had been done), the functional indices and specialization index have been working out for Urban Manipur as well as the Bishnupur town in Table 2.

Table 2 Functional Indices of Urban Manipur and Bishnupur

Occupation	Functional Indices	
	Urban Manipur 2011	Bishnupur 2011
I (Cultivator)	14.61	16.03
II (Agricultural Labourer)	7.03	3.90
V(a) (Household Industry)	9.79	4.56
III-V(b)-IX (Other Occupation, Services and professionals)	68.56	56.21
Specialization Index	1.00	0.66

Sources: Data base on Census of India 2011.

When the specialization index (S.I) of Bishnupur town is approaching 0.66, the degree of specialization is less than that of the urban Manipur 1.00 specialization index (Table 2). It means that it is primarily other occupations and services like Livestock, Fisheries, Manufacturing and repairing, Other than Household industries, Construction, Trade and commerce, transport and communication etc. It is followed by cultivators, household industries and agricultural labourers. To indicate the specific functional character of the Bishnupur town have arranged in descending order and ranked.

Table 3. Functional Classification of Bishnupur Town

Rank	Occupation/Functional Character
I	OWS (Other occupations, Workers and Services)
II	CL (Cultivator)
III	Mfh (Household Industries)
IV	AL (Agricultural Labourers)

Bishnupur can be identified as a town having five predominant functions primarily other occupations, workers and services, followed by cultivators, household industries and agricultural labourers. Thus, Bishnupur may be functionally

classified as a service town of various occupations like livestock, fisheries, plantation, and allied activities (Ls); manufacturing, servicing and repairing of other than household industries (Mf); construction, trade and commerce, transport, storage and communication (TSC); other services and professionals, as per nine classifications of occupations (Nelson, H.J, 1955). It is followed by the workers engaged in cultivators, household industry and agricultural labourers.

Nelson's Method:

Nelson in his "A Service Classification of American Cities" as per occupational structure used the standard deviation formula (A. Mohamood, 1985).

$$\bar{o} = \sqrt{Ed^2/n} \quad \text{where, } \bar{o} = \text{Deviation}$$

d = Difference from the standard

n = Number of occupations

In Bishnupur, while computing the above method, the number of populations in each nine-occupation group of urban Manipur has been taken as the standard and deviations for each occupation category have been determined in Tables 4 and 5. From Table 4, it can be realized that the specialization of the occupational structure of Urban Manipur based on 2011 in the

state is primarily cultivator, Agricultural Labourer, Household industries and other workers and services.

The Standard deviation of Bishnupur town

III = V(b) + IX = Av + ISD, re-termed as OWS

I = Av + ISD, Re-termed as CL

V(a) = Av + ISD, re-termed as Mfh

II = Av + ISD, re-termed as AL.

has been calculated with the average of the Urban Manipur as the standard deviation and from these standard deviations has been calculated and presented in Table 5. as

Table 4 Occupation Urban Manipur 2011

Sl. N0	Occupation	The total main Working Population	In Percent Of the total main Working Population	Difference (d) Actual 100/10	(d) ²	²	² /n	√ ² /n (S.D.)	SD +1 Average
1	Cultivator	50,494	14.61	(+) 4.61	21.25	21.25	21.25	4.61	5.61
2.	Agricultural Labourer	24,274	7.03	(-) 2.97	8.82	8.82	8.82	2.97	3.97
3.	Household Industries	33,838	9.79	(-) 0.21	0.04	0.04	0.04	0.21	1.21
4.	Others	2,36,843	68.56	(+) 58.56	3429.27	3429.27	571.55	23.90	24.90

Total main Working population 3, 45, 449

Marginal Workers 84, 768

Total Working Population 4, 30, 217

Non-Workers 4, 03, 937

Total Urban Population 8, 34, 154

Sources Data: Base on occupation structure; Census of India 2011; Primary Census Abstract, Manipur.

Table 5. Functional Classification Bishnupur Town 2011

Sl. No.	Occupation	The total main Working Population	In Percent of the total main Working Population (X)	Standard Deviation (Y)	Difference (d) (X-Y)	(d) ²	²	² /n	√ ² /n (S.D.)
1	Cultivator	939	16.03	5.61	(+) 10.42	108.58	108.58	108.58	10.42
2.	Agricultural Labourer	228	3.90	3.97	(-) 0.07	0.01	0.01	0.01	0.10
3.	Household Industries	267	4.56	1.21	(+) 3.35	11.22	11.22	11.22	3.35

4.	Others	3289	56.21	24.90	(+) 31.31	980.32	980.32	980.32	31.31
	Total main Working population			4,722					
	Total Marginal Workers			1,129					
	Total Worker			5,851					
	Non-Workers			6,325					
	Total Urban Population			12,176					

Data Base on Occupation Structure: Census of India 2011; Primary Census Abstract, Manipur.

This means it is primarily other workers and Services (V(b) + IX), followed by Cultivator, and Household industries. Agricultural Labourer is not considered, because the per cent of the function less than Av + ISD is not considered as significant, Av is the standard average. The towns which do not rank high in any occupation are considered as diversified or as not specializing in any services¹¹. From the above observation, Bishnupur can be classified as a service town mostly dominated by other occupations and services like Livestock, Fisheries, Manufacturing and repairing, Other than household industries, Construction, Trade and Commerce, Transport and Communication etc. and Cultivators and Household industries.

7. OBSERVATION AND FINDINGS

Bishnupur is a growing unplanned urban center. It has a rapid growth during the past decades. The morphology of the Bishnupur is complex. The present picture of the Bishnupur town is an unplanned structure. It has not had a symmetrical growth since the beginning. It has many changes in its morphological framework after the gradation of the Municipality. The functional classification of Bishnupur has diversification and is multifunctional. It is complex with the rapid growth and changes in the occupation structure of the inhabitants. Based on occupation structure Bishnupur may be classified as a service town.

ACKNOWLEDGMENTS

The authors are deeply indebted to Prof. Kh. Mohon Singh, Editor-in-Chief, Thambal Marik College Research Journal (TMCRJ), who

insists them and constant inspiration for doing good research work as a good academician. The authors are deeply indebted to anonymous reviewers whom the paper is sent for review for their constant inspiration of such research work. They acknowledge Prof. Amitkumar, Department of Geography, Sent John College, Agra, for his insightful guidance during the period of research work.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

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Merger Agreement and its Legacy on the Present Socio-Political Problems of Manipur

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ABSTRACT

History vividly shows that Manipur, a sovereign kingdom had been a gateway to South East Asian countries. In the course of history's ups and downs, though it had been subjugated, owing to the great efforts of courageous patriots, it could regain its independence. It can be said that since the British rule and since the merger into the Indian Union in 1949, the problems of disunity had begun its journey in the fields of politics and society. The divide-and-rule policy of the British divided the state into hill and valley areas on ethnic lines. The legacy of this policy has brought chaos and disorder in Manipur's politics and society. The historic 'Merger agreement' of 1949 marked the end of an era of the independent kingdom of Manipur. The integration of the Kingdom of Manipur into India is closely interlinked with the present socio-political development of Manipur. Consequently, this event caused political discontent among the youths of Manipur and aroused a revolutionary movement against the Indian government. Over time, many political parties came out on ethnic lines with different political agendas and tried to disintegrate the aged-long territorial integrity of Manipur. As Manipur has been facing many socio-political problems questions are raised and keeping an eye on the pre-merger status of Manipur. This paper is a humble attempt to high light the contemporary socio-political problems and its far reaching impact in the present context of Manipur. The study has relied on the primary and secondary sources particularly the local news papers, relevant books and other research articles.

Keywords: Geo-politics, refugee, separate administration, retrospection

1. INTRODUCTION

When Manipur merged into India, the political aspirations of the people were very high. If Manipur could become a state of India, it was believed that Manipur would be prosperous in every way. Contrary to this belief, she had been kept for a long time in Part- 'C' status. Once it had been an independent kingdom, a Sovereign Nation, having elected members under its constitution. But the level of Part 'C' State had clouded the minds of the masses. (N. Joykumar Singh, 2005). The Socio-political dignity that Manipur had enjoyed before the merger agreement was humiliated. The unemployment problem of youths was on the increase day by day (Lal Dena, 1991). The new

generation then had the idea that this gloomy condition was the result of the merger agreement. So, the latest generation started to demand the Pre-Merger Status of Manipur. Around the 1960s some organizations with militant character began to emerge in Manipur. With the emergence of these revolutionary organizations, the existing Socio-political condition of Manipur turned into a new dimension.

1.1. Post-merger political discrimination:

With the departure of the British from India on 14th August 1947, Manipur got its former sovereign status. It was sad to look back on the administrative condition of Manipur before it merged into the

Indian Union from 1947 to 1949. Before India became a democratic nation, Manipur had already a democratic government. This was proved by the political history very clearly. According to the provisions of the Manipur State Constitution Act, 1947, on 11th June 1948 election was held. At the 53rd Assembly constituencies, different political parties contested the election. Under the leadership of M.K. Priyobrata, a government was formed. However, due to a lot of factors, his government could not run smoothly. In a vast sub-continent like India, it is universally true that Manipur, a tiny state had enjoyed the experience of democracy. Its distinct example was that the election had been conducted by exercising the right of Universal Adult Franchise. However, after Manipur Merged into the Indian Union, the Indian government abolished all the democratic institutions of Manipur and its administration was kept under a bureaucratic officer. It resulted in the younger generation of Manipur beginning to think that the Indian government tried to subjugate the indigenous people of Manipur. Hence, the political developments of post-merger period, a grave psychological effect were seeded in the sensitive minds of educated youths. They started to raise their voices against the undemocratic attitudes of India. Such type of negative political stand of the government of India forced the people of Manipur particularly the younger generation to take a different political attitude against the Government of India. Manipur was put in the category of the part C state and Union Territory under the territorial council for many decades. This type of stepmother's treatment of the Government of India towards Manipur aroused the feeling of discontent among the people of Manipur. Therefore, the refusal to give democratic rights to the people of Manipur in time by the Indian government has laid the basic foundation for the emergence of different insurgency movements among the minds of the educated people of Manipur. (N. Joykumar Singh, 2005)

1.2. Emergence of Insurgency Movement:

The UNLF was established in 1964, next came PLA/RPF, PREPAK, KCP, etc. These insurgent

groups started their movement of armed revolution attacking the occupational forces of India and the state forces. They came forward to get back their freedom. This movement had a great impact on the minds of youth who were very eager for liberty. They began to study the theories of armed revolution. Many intellectuals also took part in the revolutionary movement (UNLF, 1996). Keeping faith in Marxism, Leninism, and Mao-Zedung, many leaders came out. They advanced in a great way with the ideology of armed revolution.

India is famous as the greatest democratic country in the world (Kabui, Gangmumei, 1981). However, within the periphery of Indian democracy, how far does the people of Manipur get the taste of democracy? This question is still asking in the minds of the people. Due to dark politics and a stagnant society, many youths are disheartened and fall into the oven of drugs. Besides, getting into intoxicated drugs, they are involved in many crimes and anti-social activities. Leaders of the government are increasing their involvement in corruption. To check such anti-social activities, as a part of the revolutionary movement, the insurgent groups took stern action against those who committed crimes. Corruption, nepotism, favouritism, and crimes are also the main concerns for the insurgent groups.

In this tiny state, many revolutionary groups are mushrooming. As they are not in the same line of ideology and activities, there have been conflicts among themselves. Instead of uniting themselves and establishing a united strength, they cannot go forward successfully (Arun M.C. 1993). But as an initiative step, early in the 1990s, the Revolutionary Joint Committee was established. However, significantly it can't render its service. After this, in the early part of 1999, the Manipur People's Liberation Front (MPLF) appears on the scene. This also can't function properly. Eventually, in 2012, the Coordination Committee (CORCOM) saw the light. This is, supposedly on the way to establishing a strong congregational force (The Sangai Express, Newspaper in English, 2023). A strong movement can't blossom out into

a fruitful stage. Except for releasing a Press note in the media as a calendar work, it doesn't seem to take up concrete work. Other ethnic insurgent groups of Naga and Kukis entered into the Peace Talk with the Indian Govt. as well as signed Suspension of Operation; the confrontation faced by valley-based insurgent groups is not becoming an easy matter. Different insurgent movements based on ethnic lines challenged the integrity of Manipur openly. Insurgent groups Naga and Kukis who are based in the hill areas, demand Greater Nagaland and a homeland in the name of a Separate administration. In their demand, there are no words to protect and safeguard the integrity of Manipur. As such, it becomes the cause of the breaking up of Manipur into pieces. In another way, behind the curtain of Peace Talk, and suspension of operation (SOO). Indian occupational forces are conspiring to eliminate the valley-based insurgent groups.

In every way, at present, valley-based insurgent groups face many aspects of confrontation. As they do not enter into a ceasefire agreement with India Govt. are taking asylum outside Manipur. As they remain fugitive in other countries it makes them alienated from the domain of the public. Even people forget to remember whether they are active or not. Their frontal organizations can't go closely with people. They are active in releasing press notes on the current issues only.

On the other hand, hill-based insurgent groups like NSCN(IM), NSCN(K), and several Kuki militant groups get their activities done freely within the state behind the screen of Peace Talk and Suspension of Operation (SOO) with Indian Govt. and State Govt. ((Lal Dena 1991). Even there have been events of their involvement in the counter-insurgency operation against the valley-based insurgent groups with Indian occupational forces. Such a situation has been becoming a great hurdle in the way of the insurgency movement. As of now the destination for their aged long struggle is far away from reality.

1.3. Legacy of British Rule: Before the British colonial rule of Manipur, both the valley and

hill had been under the rule of the king. However, after the 1891 Anglo-Manipur war, a great change came in the governance as Manipur was conquered by the British. Separate administrations had begun under the divide-and-rule policy of British colonialism. The Indian Independence Act was passed by the British parliament on 15th August 1947. Manipur could retain its status of being an independent Kingdom. This hour had been a crucial juncture in the governance of Manipur. With the changing pace of the world, governance of representatives elected by People came to Manipur. Election was held in June 1948. With this, the foundation of democracy was installed in Manipur (Lal Dena,1990). As no political party could gain an absolute majority, a non-congress coalition govt led by MK Priyobrata was formed. At this juncture, there emerged the movement of pro-integrationists who wanted to merge Manipur into the Indian union and also the movement of some political parties that wanted to keep Manipur as an independent nation. It caused political turmoil. Manipur State Congress party, a wing of the Indian National Congress supported the making of Purbanchal State. It fuelled the turmoil on a large scale. Coalition govt. could not stand on the firm stand. Even though Manipur got merged into the Indian Union, in every walk of affairs, the political condition of Manipur could not remain normal. During British rule, the administration of hills and valleys was run separately. So hill and valley did not come under one umbrella of administration (Johnstone, James, 1896). This type of colonial administration divided hills and valleys as a part of their divide-and-rule policy. British left Manipur but legacy continued. Indian govt. also did not take any measures to reform the outdated colonial policy. Because of this reason, Naga and Kuki groups who co-existed since the pre-colonial period began demanding on ethnic lines within the frame of the Indian constitution. It caused a great obstacle to the political integrity and threatened the territorial integrity of Manipur. On the other hand, political leaders are selfish enough to protect their office and power only instead of making decisions to protect and safeguard the political unity and

territorial integrity of Manipur with a farsighted vision.

1.4. Problems of External Aggression:

Other important factors which contributed to the present socio-political unrest in Manipur are external aggression and illegal immigrant issues (Barpujari, H.K., 1843) Manipur is facing in its unity and politics a great challenge because of the neighbouring country Myanmar. Myanmar can't retain democratic rule. Many armed revolutionary groups are waging war against the Junta Government. Myanmar army is taking action against Chin- Kuki-Zo who are residing in the Saigang region. Myanmar army is trying to drive the Chin-Kuki-Zo off on the ground that they are not citizens of Myanmar. Chin-Kuki-Zo of Myanmar has been trying to strengthen its foundation by collaborating with Manipur's Kukis for many years. A glaring example is that Manipuri Kukis as signed a Suspension of Operation (SOO) agreement with both the Indian Govt. and the Manipur Govt. so that Myanmar Kukis are getting the opportunity to run scot-free in the sphere of Manipur. Against the backdrop of this policy, the Indian Govt. is taking Geo-political mileage (The Sangai Express, Newspaper in English, Daily Newspaper in Manipur, 2023).

On the other hand, the Naga section is making a plot to fulfil its dream of Greater Nagaland. Forming the Naga People Front (NPF), they are sending their representatives to the Manipur Assembly and Parliament. In this line, Manipur Kukis also sent their representatives as emissaries of their political aspirations to the Manipur Assembly. Since they have been planning for many years, they are trying to materialize their political agendas into reality. A glaring example is that (10) ten Kuki MLAs are openly demanding separate administration. In such turmoil, the rest elected members of the Manipur Legislative Assembly remaining 50 members, concrete policies to settle the socio-political problems are still trackless. It means that they cannot touch the core of people's hearts who long for the territorial integrity and unity of Manipur.

Meanwhile, UNLF (Pambei Group) which has been for a long time in the political freedom struggle are coming in the line of Peace Talk with both India Govt. and Manipur Govt. following the cease-fire agreement. In one sense, it is a landmark whereas other revolutionary groups are still sticking to their demand for Pre-merger status. So they are not supporting the peace talk of UNLF (Pambei Group). They are not compromising with any political concession. Thus the present scenario of Manipur's socio-political condition is deeply rooted in the past. Despite many difficulties in highlighting the existing phenomenon of insurgency problem in the state, it should not be overlooked.

2. CONCLUSIONS

The people of Manipur, because of the emerging socio-political problems, are facing an uncertain dilemma. People are asking whether the sovereign status of Pre-merger Manipur can be achieved or how far both the Indian Govt. and Manipur Govt. can keep their promises to the people that the territorial integrity of Manipur and the boundary of the state would never be compromised. As Manipur has been facing many socio-political problems since the signing of the Merger Agreement in 1949, now a lot of questions are getting around looking into the provisions of the Merger Agreement. The present unending socio-political problems of the state are closely interlinked with the merger of the kingdom of Manipur into India. It has been a 75-year-long journey from the day of the agreement. The new generations need to view this long journey with retrospection.

ACKNOWLEDGEMENTS

The author would like to extend his deep gratitude to Prof. Kh. Mohon Singh, Editor-in-Chief, Thambal Marik College Research Journal (TMCRJ), for his insightful guidance. His inspiring encouragement has assured him the fullest confidence. The author would also like to thank the anonymous reviewer to whom his paper was submitted for their valuable comments and thoughtful suggestions which greatly enhance

the quality of the paper. The author extends his gratitude and sincere thanks to Dr. Th. Sharatchandra Singh, Managing Editor Thambal Marik College Research Journal (TMCRJ), for his relentless support and cooperation. He is highly indebted to Mr. S. Deba Singh, the Librarian and his subordinate staff for extending their immense help and support in providing relevant data and information for the completion of his research article. The author takes the opportunity to express his heartfelt gratitude and love to all teaching faculties of this college for their help and inspiration. He likes to render his humble respect and sincere regards to Dr. M. Dhaneshori Devi, Asst. Professor, HOD, and Department of History for encouraging him during the preparation of his research article.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

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The Correlation between Anthropometric and Motor Fitness Parameters of Indian Male Volleyball Players

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ABSTRACT

Shuttle Run, Highest block and highest spike reached by Volleyball players are the main important skills of the Volleyball game and it is very much related to the anthropometric parameters of the concerned Players. The purpose of the study is the Correlation between Anthropometric and Motor Fitness Parameters of Indian Male Volleyball Players. The study was limited to 80 (eighty) Senior National players from different states of India. The study was also delimited to senior Volleyball players of different states viz. Manipur, Tamil Nadu, Kerala and Haryana. The Motor Fitness selected for the study was the highest spike, block reached and Agility (10 X 4 m shuttle running) of Players. Selected Anthropometric parameters were age, height, weight, calf girth, leg length, arm length, sitting height, chest girth, standing reach height (with one and two hands), BMI, PI and Upper arm girth. For Manipur volleyball senior players, the test was conducted at Khuman Lampak Indoor Stadium with the help of the All Manipur Volleyball Association and also from the venue of the National Tournament. For Kerala, Haryana and Tamil Nadu the tests were taken with the understanding of the concerned states' Volleyball Associations at the venues of National Volleyball Championship, All India Inter University Volleyball Championships and Federation Cup. The classical statistical analysis used were mean, SD, ANOVA followed by post hoc test. It was concluded that the jumping ability of the volleyball players was found to be insignificant with the other anthropometric parameters but the volleyball players of Manipur had a better jumping ability than the other state. On the other hand, it was evident that the players had a significant positive regression weight to the motor fitness like Spike and block reach.

Keywords: Anthropometric, Motor fitness, Volleyball, Spike, Block reach.

1. INTRODUCTION

Volleyball is an intense anaerobic sport that alternates between aerobic and anaerobic activity. It's characterized by short periods of high-intensity actions, interspersed with low-intensity activities or passive recovery (Hank *et al.*, 2015; Lidor and Ziv, 2010a; Valladares *et al.*, 2016; Vlantes and Readdy, 2017). Volleyball has been one of the most popular competitive and recreational sports in the world. The actions involved in playing a game of Volleyball are fast,

exciting and energetic making it an exceptionally interest game for people. In 1895, Modern volleyball was invented by William G. Morgan, a Physical Education Director of the Young Men's Christian Association (YMCA) in Holyoke Massachusetts, USA, as one of the recreational sports. Morgan called the sport "mintonette," until a professor from Springfield College in Massachusetts noted the volleying nature of play and proposed the name "volleyball." The Federation Internationale de

Volleyball (FIVB) was organized in Paris in 1947 and moved to Lausanne, Switzerland, in 1984. In 1951, the Volleyball Federation of India (VFI) was formed and its first meeting was held in Ludhiana (Punjab), Mr. F.C. Aurora (Punjab) and Mr Basu (W.B.) were the first president and secretaries respectively.

Volleyball in Manipur, it has spread in Manipur during the progress of the Second World War. It is very important to study the physical and performance parameters and also its relationship among the different state volleyball players in India (Manipur State, Kerala, Tamil Nadu, and Haryana). Practically, in Mini (U-13), and sub-junior (U-15), the performance of Manipuri Volleyball players is always good in Comparison to other states. Sometimes, Mini and Sub-Junior Volleyball Team Stood in 1st, 2nd, 3rd and 4th position in National level Competition. Manipur Mini Boys Volleyball Team won the winner of the 26th Mini National Volleyball Championship for Boys and Girls 2018 under the aegis of the Volleyball Federation of India which was held at Mizoram. But start declines in performance from Junior (U-18) level national competition. In the youth (U-21) and Senior Level Volleyball National Competition, the Manipur state volleyball team could not win against any team outside the Northeast. Manipur players show their potential but with the shortage of height, it was in handicap. All these sources were from the office records of the All Manipur Volleyball Association.

2. METHODOLOGY

For the purpose of this present study, 80 (eighty) senior male national volleyball players from different states of India i.e. Manipur, Kerala, Haryana and Tamil Nadu were selected as subjects.

2.1. Variables: This study is mainly focused on two variables i.e. motor fitness and anthropometric parameters. In motor fitness, the variables like highest spike, block reached and agility are selected and in the case of anthropometric parameters, age, height, weight, calf girth, leg length, arm length, sitting height, chest girth, standing reach height (with one and

two hands), BMI, PI and Upper arm girth are selected as a variable of the present study.

2.2. Tools: Tests namely jumping (vertical jump), speed, jumping ability test and 10x4 mts shuttle run have been utilized for measuring motor fitness and the studeometer and skin fold calliper are also used to calculate the various aspects of anthropometric parameters (Sudhankaran G., 2017; Singh, Mukhwinder, *et al*, 2015)).

2.3. Source of Data: The data about this study was collected from 80 (20x4=80) male volleyball players from different states in India. The states are Manipur, Tamil Nadu, Haryana, and Kerala. The players are currently representing their respective states in the Senior National Level Volleyball Championship. Considering the players of these four states as subjects of this study, they are again divided into four groups consisting of 20 players each in the group comprising altogether a total of 80 players.

2.4. Data collection: To get maximum cooperation from the Players, Coaches and state secretary, the researcher had a meeting with the managers of each of the state's teams namely Kerala, Tamil Nadu, Haryana and Manipur. In the meeting, the purposes of the study were clearly explained to the players and Coaches of the four teams in order to ensure that there were no problems in bringing the study success.

Parameters, like Speed, Shuttle run (10x4m), Highest Spike and Block reached (Jumping ability test) were used to collect the necessary data on motor fitness. The selected Anthropometric parameters like age, height, body weight, standing reached height (one and two hands), chest guard, calf guard, sitting height, leg length, arm length and Upper arm girth were also measured through anthropometrical equipment. Anthropometric parameters are effective on vertical jumps in volleyball players, and they can vary by position and performance level (Fattahi Ali, *et al*, 2012). The data were collected at Khuman Lampak Sports Stadium for the team Manipur. Besides, the rest of the data were also collected from the different venues of the various tournaments namely the 67th

Senior National Volleyball Competition for Men and Women which was held in Chennai from 2nd to 10th January 2019 and the 32nd & 33rd Federation Cup held at Punjab from 27th September to 2nd October 2019.

2.5. Statistical Method used for data analysis: Data were analysed using statistical methods like Mean, Standard Deviation and ANOVA to test the significant difference of inter-group (level). The exact location of difference was identified by LSD (post hoc test). Besides, the following tests were also utilized to check the proposed hypothesis. The details of the tests are given below:

2.5.1. Analysis of variance: A composite procedure for testing simultaneously the difference between several sample means was known as the analysis of variance. It helped us to tell whether

The sample correlation coefficient between two variables x and y is denoted r or r_{xy} and could be computed as

$$r_{xy} = \text{Corr}(X, Y) = \frac{\text{Cov}(X, Y)}{\sqrt{\text{Var}(X) \cdot \text{Var}(Y)}}$$

Where, $\text{cov}(x, y)$ is the sample covariance of x and y ; it is computed as

$$\text{Cov}(X, Y) = \frac{1}{n} \sum_{i=1}^n (x_i - \bar{x})(y_i - \bar{y})$$

$\text{Var}(x)$ is the sample variance of x and is computed as

$$\text{Var}(x) = \frac{1}{n} \sum_{i=1}^n (x_i - \bar{x})^2$$

and $\text{var}(y)$ is the sample variance of y and is computed as

$$\text{Var}(y) = \sum_{i=1}^n (y_i - \bar{y})^2$$

2.5.5. Multiple Regression analysis: Further, Regression analysis is used to identify the linear combination between independent variables used collectively to predict the dependent variables (MILES and SHEVLIN, 2001). Regression

any of the differences between the means of the given samples were significant. The variance was the arithmetic average of the squared deviation from the mean.

2.5.2. Correlation: The relationship between two or more variables is called correlation.

2.5.3. Coefficient of Correlation: The degree of relationship quantitatively between two sets of measures or variables we usually take with the help of an index known as the Coefficient of Correlation.

2.5.4. Analysis of Covariance: ANCOVA means analysis of covariance. It is a combination of regression and ANOVA. This technique is used to adjust the dependent variable for some distracter variable (covariate).

analysis helps us understand how the typical value of the dependent variable changes when any one of the independent variables is varied, while the other independent variables are held fixed.

First, we fit the model given in equation (1) based on the various physical parameters of the selected volleyball players. The dependent variable y_i , is to observe the motor fitness parameters of the players. Step-wise selection technique is used for the selection of significant variables in multiple regressions. For testing the significance of individual variables selected in the model, the coefficients of variables are tested by t-statistic. The overall quality of the model fit has been tested by ANOVA specifically F and R² tests.

The fitted model is given by

$$Y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \varepsilon_i \quad I=1 \text{ to } 7 \quad (1)$$

Where, y_1 = Highest Spike reach (cm)

Y₂ = Spinal Flexibility

Y₃ = Shoulder Strength Endurance

Y₄ = Agility (10m) X₄

Y₅ = Grip Strength

Y₆ = Back and leg strength

x₁ = Age

x₂ = High

x₃ = Sitting Length

x₄ = Body Weight

x₅ = Arm Length

x₆ = Leg Length

x₇ = Standing one hand reached

x₈ = Standing Two hand reached

Table 1: Mean, SD, Minimum and Maximum of Anthropometric parameters of four states of volleyball male players (Manipur, Haryana, Kerala and Tamil Nadu).

State	Anthropometric Parameters	Age	Height	Sitting height	Body Weight	BMI	Ponderal Index	Arm Length	Leg Length	Calf Girth	Chest Girth	Upper Arm Girth	Standing one hand reached	Standing Two hand reached
Manipur	Mean	25.95	176.07	91.90	71.43	23.05	1.31	58.70	102.30	36.36	92.90	28.86	228.55	224.70
	Std. Deviation	5.15	5.58	2.65	7.60	2.32	0.15	2.81	5.11	2.47	6.15	2.41	8.27	8.82
	Minimum	19.00	166.02	87.00	58.00	19.16	1.08	54.00	94.00	33.00	82.00	25.00	208.00	201.00
	Maximum	39.00	186.00	96.00	85.00	27.87	1.63	64.00	111.00	41.00	102.00	33.00	245.00	241.00
Tamil Nadu	Mean	25.70	192.32	97.08	81.55	22.03	1.15	67.40	118.60	35.78	95.15	29.05	250.30	246.75
	Std. Deviation	4.32	9.19	3.97	7.89	1.23	0.10	3.87	6.76	2.90	6.18	3.58	10.33	10.71
	Minimum	19.00	172.00	85.00	67.00	19.51	0.95	60.00	106.00	28.00	85.00	20.00	227.00	223.00
	Maximum	34.00	205.00	105.00	96.00	24.31	1.35	75.00	135.00	39.00	106.00	33.00	268.00	265.00
Haryana	Mean	21.80	191.40	97.25	79.50	21.71	1.14	65.95	104.83	36.85	94.65	29.40	250.40	247.10
	Std. Deviation	3.07	6.16	1.77	6.56	1.61	0.10	4.83	6.70	1.63	3.41	2.39	8.52	8.21
	Minimum	16.00	180.00	93.00	70.00	18.74	0.96	53.00	88.00	34.00	88.00	25.00	232.00	230.00
	Maximum	29.00	203.00	100.00	94.00	24.16	1.29	74.00	115.00	41.00	100.00	36.00	266.00	262.00
Kerala	Mean	25.60	191.80	87.75	79.70	21.62	1.13	65.50	114.05	36.45	70.03	30.50	251.33	247.38
	Std. Deviation	2.84	5.80	11.16	8.40	1.45	0.07	4.06	4.26	2.68	30.50	2.14	9.95	9.76
	Minimum	21.00	182.00	74.00	67.00	19.11	1.00	59.00	107.00	33.00	36.00	28.00	236.00	234.00
	Maximum	32.00	204.00	102.00	98.00	24.50	1.23	73.00	120.00	41.00	103.00	36.00	271.50	266.50

3. DATA ANALYSIS AND RESULTS

The relationship between anthropometric and motor fitness parameters of national-level male volleyball players has been statistically analysed through relevant data and the result obtained has been incorporated here. The relationship between anthropometric and motor fitness parameters has been compared among the players of these four states by using the ANOVA method. The relationship between anthropometric and motor fitness parameters among the volleyball players has been assessed using multiple regression analysis. The inferences from the data collected which have been assessed by adequate statistical tools have been compiled under the following Sections:

Table 2 ANOVA for Different Anthropometric parameters of four Different states of Volleyball players

Parameter	F	Sig.	Remark
Age	5.014	.003	Significant at 1% level
Height	26.659	<0.001	Significant at 1% level
Sitting height	11.064	<0.001	Significant at 1% level
Body Weight	6.961	<0.001	Significant at 1% level
BMI	2.965	.037	Significant at 5% level
Ponderal Index	12.889	<0.001	Significant at 1% level
Arm Length	19.188	<0.001	Significant at 1% level
Leg Length	34.877	<0.001	Significant at 1% level
Calf Girth	.645	.589	Not significant at 5% Level
Chest Girth	11.591	<0.001	Significant at 1% level
Upper Arm Girth	1.494	.223	Not significant at 5% Level
Standing one hand reached	28.276	<0.001	Significant at 1% level
Standing Two hand reached	28.219	<0.001	Significant at 1% level

From the above Table, it can be inferred that most of the Anthropometric parameters have significantly high values except Calf Girth and Upper Arm Girth. In order to identify the exact location of difference for different parameters with higher F-values, the statistical test of least significant difference (LSD) was conducted as a post hoc test as shown in the following table 3.

Table 3 Descriptive statistics of selected motor fitness I parameters of volleyball players

State		Jumping Ability	HSR (cm)	HBR (cm)	Ag (10m)X4
Manipur	\bar{x}	93.1	321.65	292.25	9.79
	S.D	5.96	10.91	17.19	0.45
	Min.	82	293	230	9.4
	Max.	108	343	320	11.28
Tamil Nadu	\bar{x}	90.7	341	324.5	11.27
	S.D	8.81	14.88	12.31	0.54
	Min.	73	310	300	9.59
	Max.	107	360	340	11.8

Haryana	\bar{x}	82.25	332.5	317.3	11.39
	S.D	12.22	16.83	15.51	0.78
	Min.	60	293	285	8.7
	Max.	101	357	337	12
Kerala	\bar{x}	90.33	341.65	326	10.99
	S.D	6.88	10.48	9.84	0.74
	Min.	78	320	305	8.69
	Max.	102	361	340	11.59

With regard to Motor Fitness parameters, a difference was observed in the mean values of male volleyball players from these four states. One way ANOVA method was used to test whether there are variations in the motor fitness parameters among the players of four state volleyball players as shown in the following table 4.

Table 4 ANOVA for Different motor fitness parameters of four Different states of Volleyball players

Parameter	F	Sig.	Remark
Jumping ability	6.238	<0.001	Not Significant at the 5% level
Highest Spike Reach (cm)	9.525	<0.001	Significant at 1% level
Highest Block reach (cm)	25.336	<0.001	Significant at 1% level
Agility (10m) X 4 (Shuttle running Sec)	25.612	<0.001	Significant at 1% level

From the above table, it can be observed that there is a statistically significant difference in all parameters among the players of four different states.

Least Significance Difference (LSD) was conducted as a post hoc test in order to identify the Motor fitness parameter with higher values to an exact location among the male volleyball players of India (Manipur, Tamil Nadu, Haryana and Kerala). Table 5 shows the result.

Table-5 LSD for identifying the exact location of different among mean values in different parameters

	Manipur	Tamil Nadu	Haryana	Kerala	Mean Difference	Sig.
Jumping ability	93.1000		82.1000		11	.000
		90.7000	82.1000		8.6	.002
			82.1000	90.3250	8.225	.003
Highest Spike Reach (cm)	321.6500	341.0000			19.35	.000
	321.6500		332.5000		10.85	.013
	321.6500			341.6500	20	.000
			332.5000	341.6500	9.15	.036

Highest Block reach (cm)	292.2500	324.5000			32.25	.000
	292.2500		317.3000		25.05	.000
	292.2500			326.5000	34.25	.000
			317.3000	326.5000	9.2	.041
Agility (10m) X 4 (Shuttle running Sec)	9.799	11.270			1.471	.000
	9.799		11.395		1.5965	.000
	9.799			10.994	1.195	.000

From Table 5 above, it can be seen that players from Manipur had significantly lower motor fitness in Spike reach as compared to players from the other three states. However, no statistically significance difference was found among the players of Tamil Nadu, Haryana and Kerala. Agility, players from Manipur had better motor fitness as compared to players from other states. No statistically significance difference was observed among the players of Tamil Nadu, Haryana and Kerala.

Table 6. Correlation between anthropometric and motor fitness parameters of the volleyball players.

	Jumping ability	Highest Spike Reach (cm)	Highest Block reach (cm)	Agility (10m) X 4 (Shuttle running Sec)
Age	0.148	-0.03	-0.011	-0.153
Height	0.001	.815**	.793**	.615**
Sitting height	0.071	.226	0.161	0.139
Body Weight	0.059	.644**	.542**	.389
BMI	0.071	-0.195	-.305**	-.260
Ponderal Index	0.047	-.536**	-.605**	-.481**
Arm Length	-0.058	.672**	.668**	.567**
Leg Length	0.157	.606**	.566**	.374**
Calf Girth	0.131	.249	0.066	-0.102
Chest Girth	0.116	-0.015	-0.107	-0.143
Upper Arm Girth	-0.026	0.185	0.122	0.132
Standing one hand reached	-0.089	.799**	.802**	.606**
Standing Two hand reached	-0.104	.782**	.786**	.612**

Table 6 and its corresponding figs. present the correlation analyses of selected anthropometric and motor fitness parameters among volleyball players. It is observed that anthropometric parameters such as age, height, body mass index, Ponderal Index, Arm Length, Leg Length, Calf Girth, Chest Girth, upper

Arm girth, and standing one and two hands reached of volleyball players did not demonstrate significant correlation with the jumping ability among the male volleyball players.

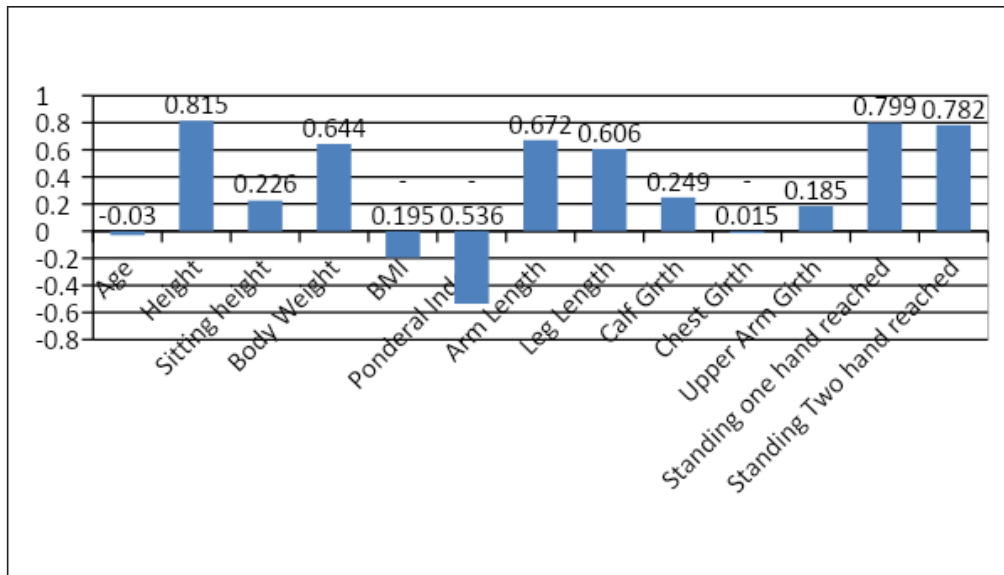


Fig 1: Correlation between Highest Spike Reach (cm) and Anthropometric Parameters

The above table 6 and its corresponding figure indicate that the performance of volleyball players in the highest spike reach was significantly correlated with anthropometric parameters viz. Height ($r=0.815$), body Weight ($r=0.644$), ponderal index ($r=-0.536$), Arm Length ($r=0.672$), Leg Length ($r=0.606$), standing one hand reached ($r=0.799$), and Standing Two hand reached ($r=0.782$).

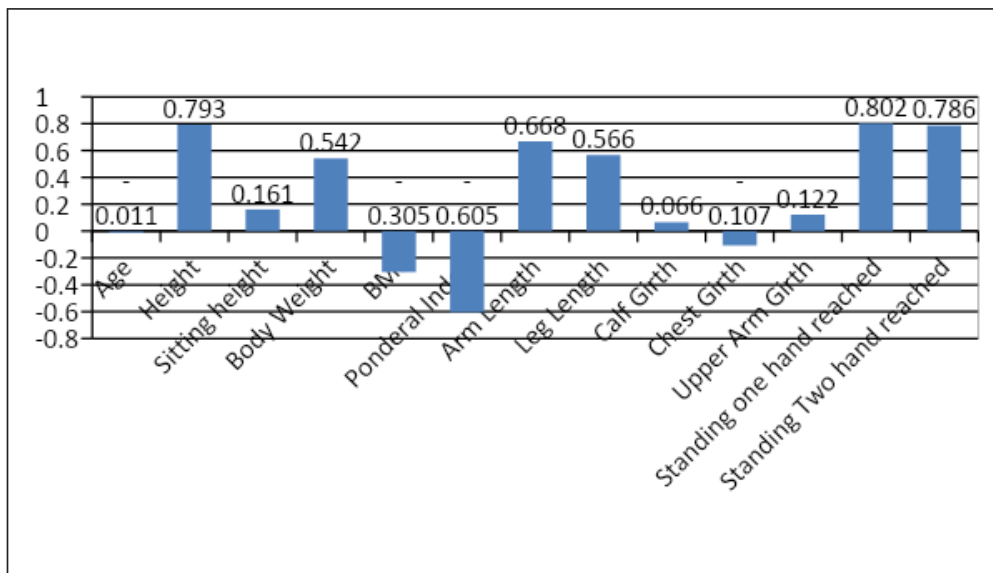


Fig 2: Correlation between Highest Block reach (cm) and Anthropometric Parameters

The above table 6 and its corresponding figure indicate that the performance of volleyball players in the highest block reach was significantly correlated with anthropometric parameters viz. Height ($r=0.793$), body Weight ($r=0.542$), ponderal index ($r=-0.605$), Arm Length ($r=0.668$), Leg Length ($r=0.566$), standing one hand reached ($r=0.802$), and Standing Two hand reached ($r=0.786$). and Anthropometric Parameters

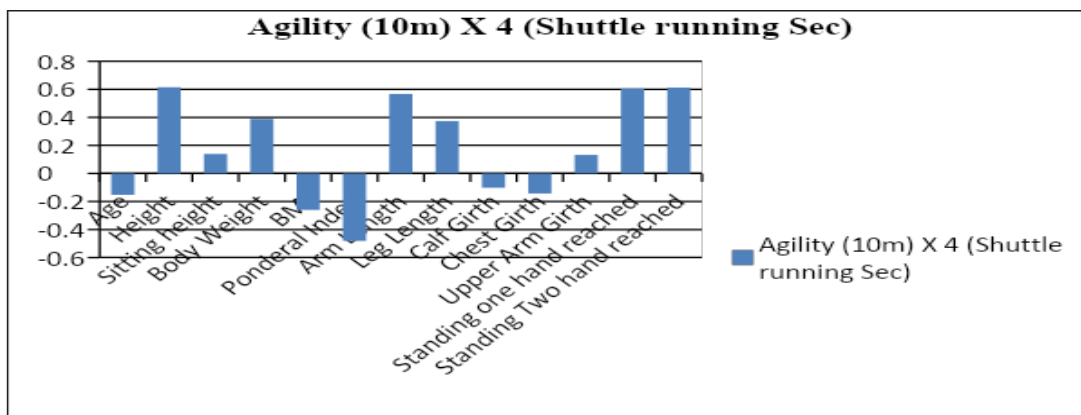


Fig 3: Correlation between Agility (10m) X 4 (Shuttle running Sec)

The above fig reveals that Agility was significantly correlated with anthropometric parameters viz. Height ($r=0.615$), Ponderal index ($r=-0.481$), Arm Length ($r=0.567$), Leg Length ($r=0.374$), standing one hand reached ($r=0.606$), and Standing Two hand reached ($r=0.612$).

Further, Regression analysis is used to identify the linear combination between independent variables used collectively to predict the dependent variables (MILES and SHEVLIN, 2001). Regression analysis helps us understand how the typical value of the dependent variable changes when any one of the independent variables is varied while, the other independent variables are held fixed.

First, we fit the model given in the following equation (1) based on the various physical parameters of the selected volleyball players. The dependent variable y_i , is to observe the motor fitness parameters of the players. Step-wise selection technique is used for the selection of significant variables in multiple regressions. For

testing the significance of individual variables selected in the model, the coefficients of variables are tested by t-statistic. The overall quality of the model fit has been tested by ANOVA specifically F and R2 tests.

The fitted model is given by

$$Y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \epsilon, \quad i=1 \text{ to } 7 \quad (1)$$

Where, y_1 = Highest Spike reach (cm)

Y_2 = Spinal Flexibility

Y_3 = Shoulder Strength Endurance

Y_4 = Agility (10m)X4

Y_5 = Grip Strength

Y_6 = Bank and strength

x_1 = Age

x_2 =High

x_3 = Sitting Length

x_4 = Body Weight

x_5 = Arm Length

x_6 = Leg Length

x_7 = Standing one hand length

x_8 = Standing Two hand length

Table 7: Regression coefficients of highest spike reach (Cm) with the selected variables of observed physical parameter

Variables	Estimated coefficient	t-Statistic	Significance level
INTERCEPT	85.836	4.288	0.000
Height	1.32	12.423	0.000

$R^2 = 0.664$, Adj. $R^2 = 0.66$, F - ratio = 154.34, F - probability = 0.000

Model 1: Dependent (highest spike reach) = $85.806 + 1.32(\text{Height})$

From the above table 7 and its corresponding model 1 reveal that a 1 unit (cm) increase in the

performance of spike reach (Cm) measurement corresponds to a 1.32 unit (cm) increase in the height of the player. Thus it could be concluded that height had a significant contribution to the spike reach. The value of R² indicates the percentage of contribution of predictors to the Volleyball playing ability (Dependent variables) i.e. R² = 0.66 indicates that 66 of the variation in

the volleyball playing ability (highest spike reach) was explained by the regression model with one predictor body Height and the other 34% remained unexplained. The adjusted R² for the model was 0.66, which indicates only a slight overestimation with the model. The above regression model was well fitted to the data since F ratio = 154.34, P = 0.000 was highly statistically significant.

Table 8: Regression coefficients of highest block reach (Cm) with the selected variables of observed anthropometric parameter

Variables	Estimated coefficient	t-Statistic	Significance level
INTERCEPT	27.571	1.137	0.259
Height	1.173	11.872	<0.001

R² = 0.644, Adj. R² = 0.639, F - ratio = 140.948, F - probability = <0.001

Model 2: Dependent (highest block reach) = 27.571 + 1.173(Height)

From the above Table 8 and its corresponding model 2, it could be concluded that height had a significant contribution to the spike reach indicating that a 1 unit (cm) increase in motor fitness of block reach (Cm) measurement corresponds to 1.173 unit (cm) increased on the height of the player. Also, R² = 0.639 indicates that approximately 64% of the variation in the volleyball playing ability (highest block reach) was explained by the regression model with one predictor body Height.

Table 9: Regression coefficients of Agility (10m)X4 with the selected variables of observed anthropometric parameter

Variables	Estimated coefficient	t-Statistic	Significance level
INTERCEPT	2.270	1.283	0.203
Height	0.061	7.414	<0.001
Calf Girth	-0.078	-2.431	0.017

R² = 0.423, Adj. R² = 0.408, F - ratio = 28.175, F - probability = <0.001

Model 3: Dependent (Agility) = 2.270 + 0.061 (height) - 0.078 (Calf Girth)

The above table 9 and its corresponding model explained that height had significant positive regression weights, whereas Calf Girth had a significant negative weight, indicating that after accounting for Calf Girth measurement, those players with higher Calf Girth measurement were expected to have lower motor fitness in the Agility.

4. CONCLUSIONS

On the basis of obtained results through statistical analytical data, the following conclusions were drawn within the limitation of this study:

To conclude, it was evident that the

results of motor fitness of volleyball players in Jumping ability were insignificantly related to anthropometric parameters i.e. height, sitting height, body weight, arm length, leg length, calf girth, chest girth, upper arm girth, standing one hand reach and standing two hand reach. But jumping ability from the surface to the extended feet was seen as better motor fitness than in other states.

Further, it was evident that the heights of the players had significant positive regression with weight to the motor fitness of Spike reach and block reach i.e. after accounting for height

measurement, those players with higher height measurement were expected to have better Motor fitness in the Spike reach and block reach. This was one of the main reasons that Manipur players had significantly less Motor fitness in the spike and block reach as compared to the other state players since the height of the Manipur players was significantly lower than the other state players.

ACKNOWLEDGMENTS

The author would like to thank the anonymous reviewer of his paper to whom the same was submitted for their valuable comments and thoughtful suggestions which greatly enhance the quality of the paper. The author is thankful to Prof. Kh. Mohon Singh, Editor-in-Chief, Thambal Marik College Research Journal (TMCRJ) for his constructive suggestions in the preparation of the paper. He is also thankful to all who cooperated and encouraged him in the construction of this paper.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

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Changing Dynamics of Regional Parties in Indian Politics with Special Reference to Manipur

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ABSTRACT

A political party that primarily operates inside a specific region or state of a nation is known as a regional party, sometimes known as a state party or regional political party. These parties champion the interests and concerns of their specific region, encompassing cultural, linguistic, economic, or political issues unique to that area. Regional parties have always been vital in determining the political climate of India. Numerous regional parties have taken control of specific states or regions. They also form alliances or coalitions with national parties to advance their goals or secure representation on a national scale. Throughout the years, these political parties have experienced substantial changes, both in their ideologies and strategies. While several regional parties have consistently retained their support bases over time, others have had variations in their fortunes due to factors such as leadership, performance in government, and alliances. Numerous regional parties around the nation have seen a discernible downturn in their fortunes in recent years. This decline can be attributed to a multitude of factors spanning political, socio-economic, and demographic dimensions. This paper seeks to offer a thorough examination of the evolving dynamics of regional parties in India with special reference to Manipur. It investigates the causes behind the development of regional parties and their functions within the Indian electoral system. It also discusses the challenges they face in the present-day political landscape. Furthermore, it examines the implications of these changing dynamics on India's democratic framework and governance. Lastly, the paper suggests certain recommendations to make the regional parties successful in Manipur.

Keywords: Dynamics, Elections, Coalition Politics, Manipur, Regional Parties.

1. INTRODUCTION

A regional party is a political party that functions exclusively inside a particular geographic area or state, rather than on a broader national scale. It is mostly popular in one or two states and is closely associated with the interests of a specific locality, community, or linguistic, cultural, or religious group. Its main focus is on harnessing local dissatisfaction or safeguarding a range of fundamental aspirations of the people in a particular region. They arise in regions with diverse populations or federal systems, where separate areas have distinct political, cultural, or economic interests. They also emerge as a result of perceived disregard or exclusion by national

political parties. Regional parties exert substantial influence in their specific regions and occasionally possess decisive power in national coalitions or alliances (Dogra N.K. & Singh V. 2014).

Nonetheless, there are two considerations in determining whether a political party is national or regional: (a) the extent of public or electoral support it receives in one or more states, and (b) the percentage of votes it receives in elections for the Lok Sabha and state assemblies. The initial criterion relates to the geographical territory, while the second is concerned with the party's popularity graph. In addition, many academicians aim to

determine the regional affiliation of a political party based on its ethnic or religious-cultural characteristics. Political parties must be formally registered with the Election Commission of India (ECI) to be granted status as national or state parties, depending on how well they perform in elections. In a state legislative assembly election, a political party is deemed a state party or regional party if it receives at least 6% of the total votes and wins two seats, according to the guidelines established by the Election Commission of India (ECI). The increasing prominence and significance of regional parties is undoubtedly the most notable facet of political advancements in Indian electoral politics (Levi, 1951).

2. OBJECTIVES OF THE STUDY

- a. To examine the significance of regional parties in the realm of Indian electoral politics;
- b. To examine the rise of regional political parties and evaluate their performance in the state of Manipur;
- c. To examine the evolving dynamics of regional parties in Manipur;
- d. To propose strategies for enhancing the influence and effectiveness of regional political parties in Manipur.

2.1. Factors for the Rise of Regional Parties in India: One important development in India's political landscape is the rise of regional parties. These political parties have shaped national and regional politics over the years by influencing the establishment of governments, policies, and the larger socio-political dynamics (Avasthi, 1951, p.2). A variety of historical, socioeconomic, and political factors that have influenced the formation and growth of regional parties in India must be examined in order to understand the reasons behind their rise. Numerous factors deeply embedded in India's socio-political landscape can be attributed to the rise of regional parties in the nation. Among the crucial elements are:

India exhibits remarkable diversity in terms of languages, civilizations, and traditions.

Typically, each region possesses a unique language and cultural identity. This diversity has resulted in the formation of regional political parties that promote the interests of particular languages or cultural communities. India's federal system of government allocates authority between the national and state governments. The decentralization of power allows regional parties to exert influence on policy-making at the state level, addressing the specific needs and desires of local populations (Hazary, 1991, pp. 208–215). Regional parties arise as a result of particular local or regional concerns that national political parties may not fully tackle. The wide challenges include problems related to agriculture, water resources, infrastructure, economic development, cultural identity, and autonomy. Regional parties in numerous states have gained prominence by using the anti-incumbency attitude directed against national political parties or state governments. They position themselves as substitutes for the traditional political system, pledging improved administration and representation. Identity-based politics exerts a substantial influence on Indian elections (Kumar, 1991, pp.554–560). Regional parties frequently exploit caste, religion, race, or linguistic identity to garner support from particular communities. These parties advocate for the interests of their specific social groupings, strengthening their political support (Pal, 2008).

India's political landscape is characterized by coalition governments, especially at the central level. Regional parties often assume a pivotal role in such coalitions, forging partnerships with national parties to acquire power and exert influence in the formulation of policies. Due to internal conflicts or declining support in some areas, national parties like the Indian National Congress and the BJP have occasionally struggled to maintain dominance. This has created opportunities for regional parties to fill the political vacuum and establish themselves as formidable contenders. Regional parties possess robust grassroots networks and cadres firmly established within local communities. They employ comprehensive grassroots mobilization strategies, which involve activities such as door-

to-door campaigning, community outreach programs, and local-level activism. These efforts are crucial in consolidating support and achieving electoral victories. As such, they affect India's political landscape and influence state and federal governance by fostering the establishment and survival of regional parties (Singh & Singh, 1950).

2.2. Role of Regional Parties in the Indian Political System: A considerable number of regional parties were established in the years following Indian independence, even though some emerged earlier or soon after. The electoral performance of regional parties fluctuates depending on the state and the specific election. The prominent regional parties in the Indian political system include Shiromani Akali Dal (Punjab), DravidaMunnetraKazhagam (Tamil Nadu), All India Anna DravidaMunnetraKazhagam (Tamil Nadu), Shiv Sena (Maharashtra), AsomGana Parishad (Assam), Mizo National Front (Mizoram), Manipur People's Party (Manipur), Lok Jan Shakti (Bihar), National Conference (Jammu and Kashmir), and Samata Party (Bihar) (Bhambhri, 1968). Regional parties in Indian electoral politics exert a substantial influence in their respective states and are capable of forming the government. They are essential to the formation of governments, especially in cases where national parties are unable to secure a majority. In situations where neither party can gain the required votes, regional parties make alliances with either of the big national parties to help them achieve the majority threshold. They offer better governance and ensure a stable regional government (Brancati, 2008). At the national level, they have presented the most formidable challenge to India's system of one-party dominance. Indeed, they have put an end to the era in which the Congress party dominated the Indian party system. These regional actors, such as the DMK, AIADMK, Telegu Desam, and Shiromani Akali Dal, have significantly influenced the nature and direction of Centre-state relations in India. The demand for greater autonomy for the states has gained momentum primarily because of the presence and influence of these active and powerful regional actors. In response, the central

government began to be more responsive to the needs and demands of the regional actors as the state governments made an effort to express their opinions more strongly in their interactions with it. In addition, regional parties operating within the liberal-democratic framework increased political competition and expanded voter involvement in the political process at the local level. (Burki, 1990) Although national parties may attain the required number of seats to establish the government at the national level, they often forge alliances with regional parties to establish a presence in particular states. As a result, regional parties have gained significant influence at the national level (Saini, 1971).

2.3. Regional Parties in Manipur: The Nikhil Hindu Manipuri Mahashaba of 1934 became the Nikhil Manipuri Mahashaba in 1938 after dropping the word "Hindu" from its name. This marked the beginning of the rise of regional parties in Manipur. This transformation was accompanied by a call for several political changes. Additionally, many political groups were established in the shape of political parties, such as PrajaSamelini in 1940, Manipur Krishak Sabha in 1946, Praja Sangha in 1946, Manipur State Congress in 1946, and Kuki National Assembly in 1946. During the era following independence, numerous new regional political parties emerged. They were the All Manipur National Union, AchumbaPamba Congress, Naga National League, Manipur Zelianrong Union, Mao Maram Union, and Paomei Progressive Party. These parties did not function as active political parties because they were created for ad-hoc purposes (Dutta, 1986).

Regional parties began to appear in Manipur in the late 1960s, which marked a dramatic change in the state's political climate. The Manipur People's Party was established in 1968 (The Constitution of Manipur People's Party, 1968). Afterwards, in 1972, the Manipur National Organisation emerged, followed by the Manipur National Party and Meitei Marup, which were formed just before the 1972 election (Ibid, p.24). The United Naga Integration Council, consisting of five members, merged

with Congress I immediately after the election. In 1972, the Kanglei League was established, but it later merged with the MPP in 1976. The Manipur Hill Union was formed in 1974, and the EreipakLeisemba Party was established in 1980, just before the 1980 election. The Manipur Nationalist Democratic Party was established by 15 Members of the Legislative Assembly (MLAs) from various political parties following the 1980 assembly election. However, the party ceased to exist after two years.

During the period from 1984 to 2002, several new regional political parties emerged. These included the National People's Party in 1989, the Manipur Hill and People Conference in 1990, the Manipur People's Council in 1989 (MHPC and MPC were later removed from registration by ECI notification on January 23, 2001), Federal Party of Manipur in 1993, Progressive Janata Dal in 1995 (which split from Janata Dal for temporary purposes and later merged with INC non-registered), Manipur People's Party (Kangleipak) in 1995, Manipur State Congress Party in 1997 (formed by certain factions of the Indian National Congress), Manipur People's Party (Democratic) in 1997, Naga National Party in 1999, Democratic Revolutionary Peoples' Party in 1999 (which later proposed to be renamed as Democratic Peoples' Party by deleting 'Revolutionary', but the Election Commission did not allow it), and Manipur Regional Congress Party in 2000.

Among the regional parties in Manipur, The Manipur People's Party (MPP), established in 1968 by a group of politicians to advocate for the welfare of the people of Manipur, stands out as a well-known regional party in the state. Over time, it has actively supported different causes related to the state, such as safeguarding Manipur's cultural heritage, promoting infrastructure, and implementing improvements in governance. The party has exerted a substantial influence in Manipur's political arena, particularly in the initial decades following its establishment. Both the Lok Sabha (the lower house of India's parliament) and the Manipur Legislative Assembly elections are

contested by the MPP. The party has established government in the state throughout three distinct periods: 1972-73, 1974, and 1990-1992 (The Imphal Free Press, March 17, 2023). In the Manipur state elections held in February 2007, the party obtained five out of the total 60 seats. And it was unsuccessful in securing even a single seat in the 2017 and 2022 state assembly elections. Presently, it is a constituent of the North-East Regional Political Front, which comprises political parties from the north-eastern region that have endorsed the National Democratic Alliance (India).

It is noteworthy that the Kuki People's Alliance, a newly formed regional political party in January 2022, has emerged. The Kuki community's goals and interests serve as its primary foundation. In the election for the Manipur Legislative Assembly in 2022, the party won two seats. KPA joined the BJP as an ally in its administration and supported the BJP in Manipur. But in August 2023, the government of Biren Singh withdrew its support. The primary cause is the NDA government's inability to put an end to the violence in Manipur, which broke out on May 3, 2023. Generally speaking, the majority of Manipur's regional parties saw a decline in influence during the State Assembly and Lok Sabha elections. (The Hindu, August 6, 2023).

2.4. Changing Dynamics: The dynamics of regional parties in Manipur have experienced substantial transformations over time, influenced by several socio-political factors. Below are some prominent trends and changes in the regional party landscape:

Regional parties have been weakened over time as national parties like the BJP and the INC have increased their influence throughout the states. This trend has been towards the nationalization of Indian politics. Thus, regional parties have experienced a decline in both state and national elections compared to earlier elections. Despite their emphasis on tackling local issues and concerns, they were unable to get public support in elections. In Indian politics, coalition politics has become a norm. However, when regional

parties lose their importance in national and state politics, they are unable to effectively contribute to the formation of coalitions, leading to a lack of influence in national and state politics (Pai, 1990).

Moreover, the demise of local parties may also be linked to the lack of strong and compelling leadership. As a result, it has little effect on their supporters and the general public. The demise of regional political parties is also influenced by changes in their leadership. The process of economic development and urbanization has brought about alterations in demographics and socio-economic circumstances, which in turn have impacted voter choices. (Ibid, pp. 400-413).

As regions develop and diversify, the significance of traditional politics based on identity diminishes, which can affect regional parties. As Indian society has evolved, the ideological inclinations of voters have also transformed. Some regional parties find it challenging to adapt to these shifts or expand beyond their traditional ideological base, leading to a decline in support. Internal power struggles or ideological differences often lead to fragmentation among regional parties, which can undermine their electoral effectiveness. Internal disputes inside a political party can result in the formation of factions and a decline in unity, which weakens the party's capacity to rally support. Although identity-based politics has played a large role in India's history, there is a noticeable shift in voter preferences toward prioritizing topics such as governance, development, and economic prosperity over limited identity concerns (Ibid, pp. 411–415). This shift has the potential to diminish the attractiveness of certain regional parties that predominantly depend on narratives that centre on identity. National political parties also possess superior resources and enjoy more access to media channels, which allows them to effectively reach a broader audience and exert a stronger influence on public opinion. This diminishes the prominence and impact of regional parties, especially those with little financial means. Regional parties, particularly those with low organizational structure or financial resources, face difficulties adhering to

changing electoral rules, regulations, and political fundraising practices (Meena, 2006, pp.705–710). These causes, individually or together, contribute to the downfall of regional parties in Manipur.

2.5. Strengthening Regional Parties in Manipur: Strengthening the electoral performance of a regional political party in Manipur requires a comprehensive approach that addresses organizational, strategic, and communicative dimensions. Establishing a resilient organizational framework is of utmost importance. Regional parties require committed personnel at the local level who can rally support and establish connections with voters. This entails the establishment of party offices, the recruitment of dedicated workers, and the organization of frequent meetings and events. There is a need to provide a clear and precise definition of the party's agenda and ideology that strongly connects with the hopes and worries of the local population. It is necessary to clearly express ideas and programs that specifically deal with local problems and distinguish the party from its national counterparts. Supporting leaders who possess a thorough understanding of the local dynamics, culture, and attitudes in the area is crucial. These leaders ought to be conspicuous and approachable to the populace, forging a robust connection at the local level. Parties that have similar beliefs can form alliances to enhance their chances of winning elections and utilize their collective force. Strategic alliances have the potential to extend the party's influence beyond its normal support base and create prospects for expansion. An all-encompassing communication strategy should be formulated to efficiently distribute the party's message. Both conventional and contemporary communication channels, such as social media, rallies, public meetings, and local media outlets, can engage with voters and communicate the party's vision and goals. If the regional party is in control of state governments, it must prioritize effective and transparent governance. It is imperative to fulfil election promises, prioritize development initiatives, and attend to the requirements of the populace. Effective governance improves

trustworthiness and bolsters election chances. Furthermore, it is imperative to establish avenues through which feedback and contact with voters can take place. This promotes a feeling of participatory democracy and enhances the party's connection with its voters. A strategic plan can be formulated to ensure the party's long-term expansion and viability. Allocation of resources towards the development of young leaders, the adoption of technology, and the strengthening of institutions to guarantee long-term continuity and relevance is also necessary for Form(Brancati, 2008).

3. CONCLUDING REMARKS

In India, the emergence of regional parties is a multifaceted phenomenon shaped by various historical, socioeconomic, political, and cultural factors. Due to their ability to represent the interests and concerns of numerous local communities, these parties play a critical role in shaping the political landscape of the country. At the state and national levels of politics, they have been quite influential. Their performance is a reflection of the political landscape's complexity and variety in the nation. Their existence and influence are essential in forming the democratic process and governance at the regional and national levels, even though they may not always be the dominant force in national politics. Even though they were able to have a big impact on the state elections in Manipur, their power has been waning recently. A variety of factors, including changing socioeconomic environments, intra-party strife, and the growing influence of national parties, have contributed to the demise of regional parties in Manipur. The aforementioned factors indicate a possible downward trend in the roles of regional parties in Manipur. However, it is imperative to acknowledge that regional parties maintain their critical roles in numerous states, particularly in instances where they enjoy robust grassroots support and effectively address the distinct needs and desires of their constituents. Many tactics can be used to build regional parties so they can become more powerful in the Manipur political sphere and perform better in electoral

politics. Since regional parties continue to have a vast influence in many states, the regional parties of Manipur also have the potential to be powerful if they work to strengthen their position.

ACKNOWLEDGEMENTS

The author would like to express his deep sense of gratitude to Prof. S. Mangi Singh, Department of Political Science, Manipur University, Canchipur in preparing the paper. The author would also like to thank the anonymous reviewer of his paper to which the same was submitted for their valuable comments and thoughtful suggestions which greatly enhance the quality of the paper. He is also thankful to Prof. Kh. Mohon Singh, Editor-in-Chief, Thambal Marik College Research Journal (TMCRJ) for his constructive suggestions in the preparation of the paper.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

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Guidelines for Author

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Notes to Contributors:

While fuller guidelines to authors will be given in the forthcoming issue of the Journal the following suggestions, for the present, should suffice for those, who may wish to send contributions for the next issue.

Manuscripts (MS Word) should be written in English.

MS-Word should preferably be prepared on a word processor and printed in a least 12 font size in double space, leaving wide margin (not less than 2.5 cm) on each side and include an abstract between 200 to 300 words.

The title page should include the name(s) of the author(s), their affiliation, email numbers (if any), etc. In case of more than one author, please indicate whom the correspondence should be made.

Author should provide 4 to 5 keywords.

Reference in the text should have the surname of the author(s) followed by the year of publication. All reference cited in the paper should be given in the reference list and vice versa.

All reference should be written in alphabetical order. Examples:

Ansari, T.A., Sharma, K.M., Singh T.N., (2019) Empirical slope stability assessment along the road corridor NH-7, in the lesser Himalayan. *Geotech & Geol Eng.*, v.37(6), pp.5391–5407

Basahel, H. and Mitri, H., (2017) Application of rock mass classification system of rock slope stability assessment: A case study. *Journal of Rock Mechanics and Geotechnical Engineering*, v.9:pp.993-1009.

Bieniawski, Z.T., (1973) Engineering classification of jointed rock masses. Transactions of the South African Institution of Civil Engineers, v.15(12), pp.335–344.

Bieniawski, Z.T., (1979) The geomechanics classification in rocks engineering applications. In: 4th ISRM Congress, International Society for Rock Mechanics, Montreux, Switzerland.

Illustration & Photographs (Glossy paper) or excellent quality should be consecutively numbered & referred to in the text.

One set of page proofs will be sent to the corresponding author to be checked for typesetting/editing.

Important guidelines for the preparation of MS Word are as follows:-

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|---|---|
| » Language: English | » Font Name: Times New Roman |
| » Title: 18 point font (Caps-small and bold) | » Name of the author: 13 point font (Caps-small and body) |
| » Affiliations with e mail: 13 point font (caps-small) | » Main Heading: 11 point font, all cap and bold. |
| » Abstract: 11 point font | » 2nd Sub-heading: 11 point font, small and bold. |
| » 1st Sub-Heading: 11 point font, caps-small and bold. | » Acknowledgements: 12 point font. |
| » 3rd Sub-Heading: 11 point font. | » Figures/Photographs caption: 12 point font and bold |
| » Reference: 12 point font, surname first & Alphabetical Table: Caption at the top. | |

- » Paper Title: The title should be at least 5 words but no more than 20 words.
- » The title of the paper should be precise and representative. Text font Times New Roman, 18 cap small and bold.

FIRST AUTHORS NAME¹, SECOND AUTHORS NAME², THIRD AUTHORS NAME^{3*}

- » Text with font Times New Roman, size 12, bold, cap small
- » Authors affiliated from the same institution, same number will be used as superscripts to indicate this.
- » Faculty, Department, Name of Organization, Full address.
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- » Text with font Times New Roman, 12 Regular, keep affiliations as succinct as possible.
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