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Editorial

Creating Research and Innovative Ideas in Higher Educational Institutions and the role of Teachers

Research and innovations (R&I) are the two very important arteries feeding the vibrancy of higher education (HE) masses and it is through the HE societies and people are empowered. Despite this critical importance of R&I, the investment in this two sectors is only 0.69% of our GDP as compared to 2.80% in the USA 4.3% in Israel and 4.2% in South Korea. The fruit of such investments is very well understood when one compares the high standard of living of these countries and their economic and military might. Here the role of knowledge creation and research are critical in growing and sustaining a large and vibrant economy like that of ours and for uplifting the society and continuously inspiring the nation to achieve greater heights. It has always been the strong knowledge hubs of various developed countries like USA, Germany, Italy, South Korea and Japan that contribute towards newer knowledge in the realms of science as well as arts, language and culture that enhance and uplifts not only their own civilizations but others around the globe as well. Therefore building a robust ecosystem of research has become more important than ever due to the rapid changes in the spheres of climate change, population dynamics and management , biotechnology , an expanding digital marketplace and the rise of machine learning and artificial intelligence.

The emphasis on research and innovations also are to be rooted through deeper understanding of the various fields of social sciences and humanities and the various socio-cultural and environmental dimensions of the nation or for that matter of the region. For successful addressing of various challenges the need of the hour is the high quality interdisciplinary research across fields which is very well articulated in the new NEP 2020. Thus the creation of a knowledge society for building new knowledge is a must to meet the challenges of the future – the NEP 2020 is here to guide us for building such societal knowledge infrastructure – the most catalytic factor for this is the motivated teacher for creating a learning society. It is only through motivated, energized and capable faculty that the desired level of revamping of higher education can be achieved (NEP 2020).

In today's context of universal adoption of UGC curriculum and CBCS syllabus in most of Universities and Higher Educational Institutions(HEIs) the input of knowledge becomes more or less uniform across the country. To create uniform and equally capable output from HEIs the most important role and responsibility has to be taken by the teachers so that we can create a knowledge society and that will create all the avenues for new knowledge, new ideas , creative and critical aptitude for new thinking that ultimately will open for new areas of research and innovations.

In our state of Assam and in other north eastern states when the Govt. of India is emphasising on the Act East policy and for creation of market for Eastern Asia , it is high time that the HEIs should come forward and involve deeply in the areas of research and innovation for creating generations of youngsters in their graduation courses to motivate them for industry/market oriented projects based on local resources which is so rich and diverse. Such innovative ideas can be in areas of science , social sciences and in multidisciplinary fields, but to build this important infrastructure, the need of the hour is creation of 'knowledge incubation centres' for each HEIs which is yet to take its footings. Various Govt. Schemes are in fact already in place for the HEIs in the form of RUSA grants which requires proper allocation towards the R&I areas. A small beginning of creating and incubating ideas will transform the region and its population towards greater heights which ultimately will replace poverty of mindset for development with areas of attraction, work culture and growth. The skilling of youth as conceived in the NEP 2020 will also be possible through this approach which will focus on the growth of Human Development Product(HDP) which is rooted in education, health, livelihoods, societal norms, political climate , environmental conditions and more others. Thus it is the ideas and motivations for development where R&I can multiply its growth and bring happiness to the masses but the main source of energy must come from the motivated and committed teachers.

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Status of ornamental fish diversity and Anthropogenic hazards in Nitai *beel* of Kamrup district of Assam, India

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ABSTRACT

India is endowed with vast expanse of freshwater resources which can be broadly put under two categories depending on basic ecological consideration. They are ponds and lakes and streams and rivers. In Assam alone nearly one lakh hectare of water spread area is covered under beels. Assam is recognized as one of the hotspots of freshwater fish diversity. A survey was conducted on the Nitai beel of Kamrup district since April-2018 till March -2019. The present investigation reveals an ornamental fish diversity of 43 fish species belonging to 18 families has been recorded. Out of which 16 species belongs to cyprinidae family, 4 species from bagridae, 2 species from cobitidae, 2 species from ambassidae, 2 from nandidae, 2 species from osphronemidae, 2 species from Channidae, 3 species from mastacembelidae family. 38 species enlisted as least concern (LC), 2 species as near threatened (NT), 3 species as not evaluated (NE) and 2 species as data deficient (DD). Mystus vittatus, Nandus nandus, Anabas testidunieus, T. fasciatus, Botia derio, Notopterus notopterus, Monopterus cuchia etc.for having high overseas demand have potential value as food and ornamental. Moreover different anthropogenic stress have been recorded from the beel. So in this study an attempt has been made to know the actual status of ornamental resources of the Nitai beel and its anthropogenic stress.

INTRODUCTION

Fishes make up most of the abundant class of vertebrates, both in terms of number of species and of individuals. They exhibit enormous diversity of size, shape and biology, and in the habitats they occupy. Researchers have arrived at different estimates, most of which range between 17,000 and 30,000 for the numbers of currently recognized fish species. The eventual number of living fish species may be close to 28,000 in the world. Jayaram (1981) listed 742 freshwater species of fishes under 233 genera, 64 families and 16 orders from the Indian region. Talwar and Jhingran (1991) estimated 2,546 species of fish belonging to 969 genera, 254 families and 40 orders. The Indian fish population represents 11.72 per cent of species, 23.96 per cent of genera, 57 per cent of families and 80 per cent of the global fishes. Goswami (2007), Vishwanath at. al. (2007) studied Natural and Anthropogenic Hazards of fish fauna of Northeast India. Malakar *et al.* (2017) studied diversity and present status of three flood plain wetland of central Assam.

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Wetlands since time immemorial have been perceived as life sustaining units of the world. They are considered as future food and fodder resources for human population and its related allies. Ecologically, wetlands are of great significance as they support varied food chains and food webs, regulate hydrological cycle, recharge ground water and maintain its quality by acting as filters, provide refuge to a large number of endangered flora and fauna help in trapping of energy and carbon-dioxide and in nutrient cycling treatment of waste water and provide natural check to floods. Wetlands also have great recreational and aesthetic values. As a part of the non–traditional agriculture the wetlands also support agricultural economy. Around 6.4% of the earth's surface is covered with wetlands. They are continuum of rivers and are locally known as *beels* and are biologically sensitive ecosystems which play a vital role in the inland fish production of the eastern and northeastern part of the country. The *beels* are unique water bodies which need in depth scientific study before undertaking any management measure.

Ornamental fishes are attractive and colourful species of fishes with peaceful nature of various characteristics, which are kept as pets in confined space of an aquarium or a garden pool for fun and fancy. Ornamental fishes are also known as living jewels and are kept in house as pets. In the recent years the ornamental fishes has become one of the major income sources for the small scale farmers and unemployment people of the world. In India the North Eastern Region is one of the major hotspot for ornamental fish diversity in the world (Kottelat and Whitten, 1996). Including 82 ornamental fish species are available in the upper Assam districts like Tinsukia, Dibrugarh, Sibsagar and Jorhat (Pandey *et al.,* 1998). Total 87 potential ornamental fish species are available in the state of Assam (Bhattacharjya *et al.,* 2000). Out of 217 fish species recorded in Assam 150 fish species have good ornamental value (Bhattacharjya *et al.,* 2003). So far, in the North Eastern Region a total of 274 species has been recorded, of which 250 fish species have ornamental value, out of 250 species 187 recorded from the state of Assam (Mahapatra *et al.,* 2004).

Study Area

The present study was done in Nitai *beel,* located on the flood plain of Kolajal River, at a distance of 05 km from Sualkuchi and 35 km. from Guwahati with a total area of 50.68 hectare. It lies between 91^0 31′06′′E longitude & $26^0$11′52′′N latitude (Figure 1a & 1b). The climate of the studied area remains mild throughout the year. It falls under tropical monsoon climate. The annual average recorded temperature is 22.67°C, annual average rainfall is 159.7 cm, and annual average humidity is 81.01%. The Nitai *beel* is endowed with rich floral and faunal diversity.

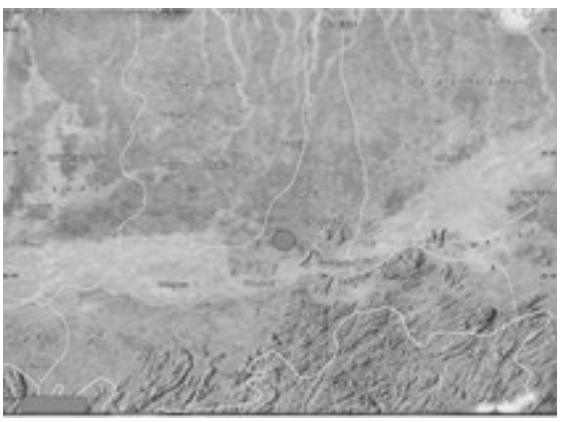

Figure 1. a. Map showing the study area

Figure 1. b. Nitai *Beel*

MATERIALS AND METHODS

Data collection was carried out in consistent manner from April-2018 till March -2019. Data analysis were done by visiting the *beel* itself on monthly basis and through questionnaire to the fishermen of the wetland having years of experience. Fishes were collected from the water body using locally available fishing gears from preselected sampling sites. Fishing gears and devices used during fishing operation were moving nets (*Dhekijal, Khewali jal etc* and *Drag nets* of various mesh sizes), Different traps namely *Jakoi, Polo, Sepa* and *Bamboo bana*. The moving nets were used throughout the year while, Gill net is extensively used during the monsoon period. Fishes were sorted out species wise using taxonomic keys (Talwar *et al.,* 1999), (Jayaram, 1999), (Nath *et al.,* 2000), (Vishwanath *et al.,* 2007). The latest scientific names of the fish species were used following Calacademy reports (2015). Fishes were photographed and preserved few individuals in 4% formalin for species representation. Further sorting of fish species were carried out into major group, intermediate group and minor group fishes. Fishes are categorized into threatened species based on IUCN Red List, CAMP (1998). Fishermen and native people were interviewed for information on species diversity. Fish catch statistics of commercially important species have been collected covering all the months of the year. Landing sites were visited once a week and data collected have been supplemented by direct enquiries from fishermen and fish traders.

RESULTS AND DISCUSSION

I. Ornamental fish fauna

In the present study a total of 43 fish species belonging to 18 families has been recorded. Out of which 16 species belongs to cyprinidae family, 4 species from bagridae, 2 species from cobitidae, 2 species from ambassidae, 2 from nandidae, 2 species from osphronemidae, 2 species from Channidae, 3 species from mastacembelidae family. Other families such as anabantidae ,synbranchidae, schilbeidae, belonidae, heteropneustidae, claridae, notopteridae, clupeidae, siluridae and tetradontidae each contains 1 species. All the species has been recorded are listed in (Table 1 and Figure 2). It has been observed that cyprinidae family having 37% abundance, 9% from bagridae, 7% from mastacembelidae family, 5% abundance from cobitidae, ambassidae, nandidae, osphronemidae and Channidae family. Again 2% abundance from anabantidae ,synbranchidae, schilbeidae, belonidae, heteropneustidae, claridae, notopteridae, clupeidae, siluridae and tetradontidae families (Figure 3). Out of 43 species recorded during the study period, 38 species enlisted as least concern (LC), 2 species as near threatened (NT), 3 species as not evaluated (NE) and 2 species as data deficient (DD).It has been observed that, almost all the fish species bear food value. However, *Badis badis* is considered here as weed fish and does not bear any demand as fish food. But this species is an excellent ornamental fish because of its small size and beautiful colour patterns. Notwithstanding, *Badis badis* has not received any attention in this region for ornamental fish culture and most of the time discarded improperly during sorting of commercially important species. *Amblypharyngodon mola, Labeo calbasu, Puntius chola, Puntius conchonius, Puntius sophore, Lepidocephalichthys guntea, Chanda nama, Anabas testudineus, Channa stewarti* and *Channa punctatus* are found abundant in the *beel*. Whereas *Chela cachius, Danio aequipinnatus, Danio devario, Botia Dario, Mystus cavasius, Mystus vittatus, Eutropiichthys vacha, Clarias batrachus etc.* are found to be moderate. Apart from this *Notopterus notopterus, Barilius bendelisis, Danio rerio, Esomus danricus, Rasbora daniconius, Rita rita, Xenentodon cancilla, Monopterus cuchia, and Leiodon cutcutia* are found low occur-

rence in the *beel*. *Ompak pabo* and *Barilius barna* species are found to be Near threatened species.

Fishes like *Trichogaster lalius, T.fasciatus, Badis badis, etc* were the larvicidal fish found. Air breathing fishes such as *Clarias magur, Hetero-pneustes fossilis, Channa spp.* and *Mastcembelus armatus* fetch having high market value as live fish. Moreover the rate of fish catch is increasing over years due to presence of many commercially important species like *Mystus vittatus, Nandus nandus, Anabas testidunieus, T. fasciatus, Botia derio, Notopterus notopterus, Monopterus cuchia* etc.for having high overseas demand have potential value as food and ornamental. It has been found that different anthropogenic stress going on in the *beel* such as total fishing, festival fishing, use of mosquito net for catching fish, use of pesticides in the agricultural land near the beel, fish disease etc.

Table 1. Ornamental fish diversity of Nitai *Beel*.

Family	Species name	Occurrence	IUCN Status
Notopteridae	*Notopterus notopterus* (Pallas,1769)	Low	LC
Clupeidae	*Gudusia chapra* (Ham. 1822)	Low	LC
Cyprinidae	*Amblypharyngodon mola* (Ham-Buch, 1822)	Abundant	LC
	Barilius barna (Ham-Buch, 1822)	Low	NT
	Barilius bendelisis (Ham-Buch, 1807)	Low	NE
	Chela cachius (Ham-Buch,1822)	Moderate	LC
	Danio aequipinnatus (McClelland,1839)	Moderate	LC
	Danio devario (Ham-Buch,1822)	Moderate	LC
	Danio rerio (Ham-Buch,1822)	Low	DD
	Esomus danricus (Ham-Buch,1822)	Low	LC
	Labeo calbasu (Ham-Buch,1822)	Abundant	LC
	Osteobrama cotio (Ham-Buch,1822)	Moderate	LC
	Puntius conchonius (Ham-Buch,1822)	Abundant	LC
	Puntius chola (Ham-Buch,1822)	Abundant	LC
	Puntius sophore (Ham-Buch,1822)	Abundant	LC
	Pethia ticto (Ham-Buch,1822)	Moderate	LC
	Rasbora daniconius (Ham-Buch,1822)	Low	NE
	Salmostoma bacaila (Ham-Buch,1822)	Moderate	LC
Cobitidae	*Botia dario* (Ham-Buch, 1822)	Moderate	LC
	Lepidocephalichthys guntea (Ham-Buch,1822)	Abundant	NE
Bagridae	*Mystus cavasius* (Ham-Buch,1822)	Moderate	LC
	Mystus tengara (Ham. 1822)	Moderate	LC
	Mystus vittatus (Bl. 1794)	Moderate	LC
	Rita rita (Ham. 1822)	Low	LC
Siluridae	*Ompak pabo* (Ham. 1822)	Low	NT
Schilbeidae	*Eutropiichthys vacha* (Ham. 1822)	Moderate	LC
Claridae	*Clarias batrachus* (Linn. 1758)	Moderate	LC
Heteropneustidae	*Heteropneustes fossilis* (Bl. 1794)	Moderate	LC
Belonidae	*Xenentodon cancilla* (Ham. 1822)	Low	LC
Mastacembelidae	*Macrognathus aral* (Bl.&Schn. 1801)	Low	LC
	Macrognathus pancalus (Ham. 1822)	Moderate	LC
	Mastacembelus armatus (Lecepede,1800)	Moderate	LC
Synbranchidae	*Monopterus cuchia* (Ham-Buch,1822)	Low	LC

Ambassidae	*Chanda nama* (Ham-Buch,1822)	Abundant	LC
	Parambassis ranga (Ham-Buch,1822)	Moderate	LC
Nandidae	*Badis badis* (Ham-Buch,1822)	Moderate	LC
	Nandus nandus (Ham-Buch,1822)	Moderate	LC
Anabantidae	*Anabas testudineus* (Bloch,1792)	Abundant	DD
Osphronemidae	*Trichogaster fasciatus* (Bl.-Schn,1801)	Abundant	LC
	Trichogaster lalius (Ham. 1822)	Moderate	LC
Channidae	*Channa punctatus* (Bl. 1793)	Abundant	LC
	Channa stewarti (Playfair,1867)	Abundant	LC
Tetradontidae	*Leiodon cutcutia* (Ham-Buch,1822)	Low	LC

LC – Least Concern, DD – Data Deficient, NE – Not Evaluated, NT – Near Threatened

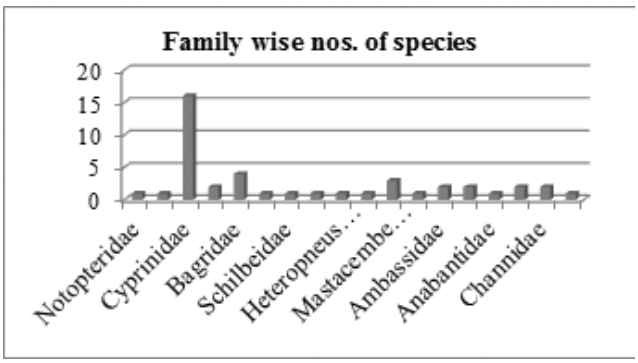

Figure 2. Graphical representation of number of fish species in families

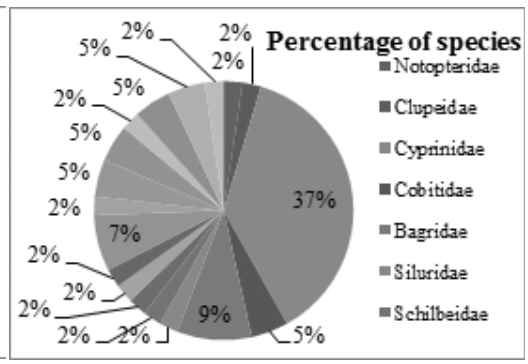

Figure 3. Graphical representation of fish population in percentage

II. Anthropogenic stress in Nitai *beel*

Different anthropogenic stress has been observed in the *beel*. Some of the observations discussed below.

- **Lack of the sprit for implementation of fishery acts**

  Different fish and fisheries acts or legislatios are not being implemented in the true spirit, regarding matters such as the use of gears, regulation of mesh size of nets and fishing of fries, fingerlings and gravid fishes. An awareness on the implementation of all such acts would definitely depict drastic changes on the conservation and propagation of fishery resources in the *beel.*

- **Total fishing**
- This is practice where water from wetlands are pumped out or physically removed totally and the fishes are also fished out. In this process not only the fish, but other associated non-piscian or amphibians species are also totally filtered. This is termed as total filtration. It is a detrimental process where a all categories fishes will be totally destroyed.
- **Festival fishing :** In some special time of the year specially in festival time, people used to catch fish fauna as a whole. This practice de-

stroy the fish abundance as well as fish habitat.

- **Pollution :** Agricultural sewage creates pollution to the wetland. Use of pesticides amd fertilizers effect the fish populations. Acts should deal with environmental clearance issues for any such establishments.
- **Fish disease :** There are several diseases of protozoan, fungal, viral, and helminthic origin that have been occurring in all species of fish.
- **Turbidity :** Due to soil erosion the water of the *beel* in a turbid condition for several months, and more so during the monsoon and post monsoon periods. The turbidity of the water hinders the condition conductive for laying eggs by which fish fail to reproduce. This is a most disadvantageous environmental condition during the breeding season for most of the fishes dwelling in such environment.

CONCLUSION

Wetlands are socio-culturally associated with the native people. Wetlands are the sources of water for agriculture, food in the form of fish, edible aquatic flora and molluscans. It harbours a wide variety of indigenous ornamental fishes. But, now a day, the production of the fish species is declined according to the fishermen communities living in and around *beel* due to over exploitation and human interference or economic benefit. The Nitai *beel* supports other biological resources such as invertebrates and aquatic flora. The ornamental fish diversity of Nitai *beel* is dominated by indigenous small sized fishes. *Amblypharyngodon mola* and *Puntius sophore* are the most abundant fish species during winter and post monsoon fishing respectively. Fish diversity comprises of both lentic and lotic water species due to seasonal river connection.

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Review Article

Probiotic microorganisms in fermented food of North Eastern States of India

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ABSTRACT

Probiotics are live microorganisms that provide health benefits when consumed in specific quantities, by improving or restoring gut flora. Probiotics balances gut microflora of host and are linked to a wide range of health benefits. Northeast region of India region has a diverse population. Ethnic people of this region use their own methods of fermenting food for the purpose of preservation. They have been practicing these methods from long time. All the fermented products are region specific and have their own unique preparation methods. Some of the most common microbes isolated from fermented foods of this region are *Lactobacillus bulgaricus, Streptococcus thermophilus, Lactobacillus helveticus, Salivarius ss, Thermophillus, Saccharomyces cerevisiae, Lactobacilli*, *Leuconostoc mesenteroids, Lactobacillus brevis, Pediococcus pentosaceus, Staphylococcus sp., Lactobacillus delbrueckii , Lactobacillus acidophilus etc.* This review work aims at summarizing available information on microorganism found in fermented food of North eastern states.

Key words: Probiotics, Fermented food, Ethnic tribes of NE states, Lactic acid bacteria,

INTRODUCTION

It is a well-known fact that fermented foods are enhanced with beneficial probiotic microbes. Probiotics are defined as "a living microbial food supplement which benefits the host by balancing the intestinal microbes'' (Metchnikoff, 1907). He reported that ingested bacteria in the form of fermented food could beneficially affect the normal gut flora .One of the ancient methods of food processing and preservation is fermentation. Ethnic fermented foods are produced by the ethnic people from locally available raw materials of plant or animal sources either naturally or by adding starter culture containing functional microorganisms which modify the substrates. Ethnic people all over the world have their own methods of fermenting food materials and they have been carrying this from time immemorial. North eastern part of India is characterized by a diverse population of people with different ethnic backgrounds. Most of the people of this region have their own methods of fermenting food materials and they have been carrying this from time immemorial. Fermentation of food is the most economical method for the development of aromas, textures and flavors as well as for preservation and biological enrichment by manipulation of different microbial populations. Wild

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fruits and vegetables have more nutritional value than that of the cultivated ones and hence, contribute to the sustainable food production and security. Fermented foods with live cultures of beneficial microbes are considered as foods with probiotic benefits. These microorganisms in fermented foods are known to balance the friendly bacteria in the digestive system. Probiotics can confer different health benefits. Common microorganisms associated with some fermented foods are listed in Table 1.

In some parts of the world fermented foods make a significant contribution to the diet of millions of individuals. This ancient food preservation process increases the shelf life of ingredients and decreases the need for refrigeration or other forms of food preservation technology. It enhances digestibility by breaking down biomolecules and enables the production of organic acids, nutritional enrichment and reduction of toxins (Sekar and Kandavel). Each fermented food in association with its distinct micro flora increases the level of proteins, vitamins, amino acid, fatty acid and other nutrient component (Das *et al*). Microorganisms can transform the raw materials into biochemically useful products and destroy or detoxify the harmful products like phytales, tannins, and polyphenols.

Commercially, cultured dairy product manufacturers have long promoted the presence of live cultures. For many years, cultured dairy products were the only fermented foods that included label declarations regarding the presence of live microorganisms. Probiotic microorganisms from dairy products mostly belong to Lactic Acid bacteria (LAB) group. In some countries the number of live microbes presents in yogurt and other cultured dairy products must satisfy regulatory requirements. According to the CODEX standards for fermented milk products, the minimum number of starter culture bacteria in yogurt is 10^7 cfu per g (CODEX STAN 243-2003).If presence any other organisms is indicated, it must be present at 10^6 cfu per g. Recently, intake of fermented foods contain-

Table1. Some common microbes present in fermented foods.

Food	**Organisms**
Yogurt	*St. thermophilus, L. delbrueckii ssp. Blgaricuss.*
Chesse, sour cream	*Lc. lactis, Lu. mesenteroids*
Sausage	*L. sake, L.planatarum, S.carnosus, S.xylosus, P.acidlactici*
Wine	*Sa.cerevisae, O oeni*
Beer	*Sa.cerevisae, (L.brevis)*
Bread	*Sa.cerevisae,*
Sourdough bread	*L. sanfranciscensis, C. humilis*
Saurkraut or Kimchi	*Lu. Mesenteroids, L.planatarum, L.brevis*
Olives	*L.planatarum,*
Soy sauce, miso	*A. soyae, Z.rouxii,T.halophilus*
Tempeh	*R.oligosporus*
Natto	*B.subtilis var. natto*

(Data adopted from work of Marco *et al*).

ing live microorganisms has emerged as an important dietary strategy for improving human health (Marco *et al.*, 2017). In general, lactic acid bacteria (LAB) are predominant in fermented foods, but other bacteria as well as yeast and fungi also contribute to food fermentations. Commercially-produced fermented foods also frequently serve as carriers for probiotic bacteria. Common fermented dairy products are accepted by consumers as good sources of live bacteria. Fermented food products may also serve as a source of income to many rural people, who prepare them at home and market them locally. Detailed studies on nutritive and medicinal value of these products can provide valuable information and would prove beneficial in guiding the use of these products on a wider scale. Conservation of indigenous knowledge and proper documentation of wild edible bio-resources are suggested for sustaining the livelihood of ethnic communities. Steinkraus and Tamang suggested that globally fermented foods can be categorized into nine major groups on the basis of various substrates viz cereals, vegetables, bamboo shoots, legumes, roots/tubers, milk products, meat products, fish products, fermented products, and alcoholic beverages.

Selection of potential probiotic candidate from fermented food

A microbial strain has to undergo all the standard biochemical tests for probiotic selection. It should also be able to withstand the food processing procedure and stay alive to confer the health benefit. Only a viable microbe inside the host gut will be able to interact with gut micro flora, survive in the hostile environment and adhere to the lining of stomach and intestine. The microbial strains from fermented foods are subjected to various biochemical tests for its characterization as per ICMR-DBT Guidelines, before it can be termed as probiotic. Probiotics must meet important qualifications, including being non-pathogenic acid and bile -tolerant strains that possess the ability to act against pathogens in the gastrointestinal tract. The final stages of selection involve the accurate identification of the probiotic species. Many genera/ species of microorganisms have been reported in relation to various fermented foods and beverages across the world. Basic microbiological identification procedures are used for identification of strains from all the samples after their purification by standard microbiological methods. Initial

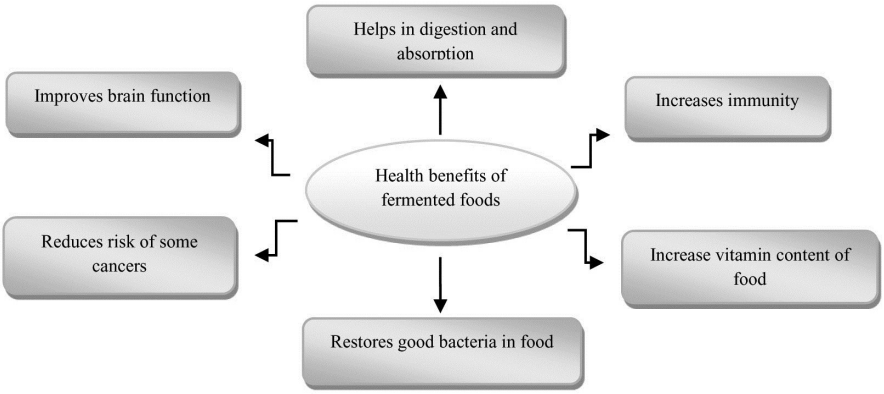

Figure 1. Health benefits of fermented food

screening of microbial strains for in vitro phenotypic tests will be performed by established protocol. Purified strains are checked for their properties to be a probiotic viz production of antimicrobial compounds, resistance to low pH and acids, hemolytic activity, bile salt hydrolysis (BSH activity), auto aggregation, bacterial surface hydrophobicity, high cell viability and survival in a simulated human digestion process. Its ability to survive through the entire GIT will be evaluated as the beneficial effects of probiotic are mainly centralized in the GI tract.

Probiotic Strains of Microorganisms in Different Fermented Food

There are many different types of fermented foods that are consumed by the people around the globe. They are Kefir, Sauerkraut, Tempeh, Natto, Cheese, Kombucha, Miso, Kimchi, Salami, Yogurt, Sourdough bread, beer, wine, olives, etc. Some common microbes found in them are listed below *Lactobacillus bulgaricus, Streptococcus thermophilus, Lactobacillus helveticus, Salivarius ss, Thermophillus, Saccharomyces cerevisiae, Lactobacilli*, *Micrococacease, Leuconostoc mesenteroids, Lactobacillus brevis, Pediococcus pentosaceus, Staphylococcus, Clostridium, Lactobacillus delbrueckii , lactobacillus acidophilus etc.* Several studies have shown the existence of several fungi such as *Saccharomyces sp.,* in different Indian fermented dairy and dairy-related products like curd, cheese, idli, dosa, jalebi, warries, pappad, Kanji, fruit juices, bakery products and brewery products (Mahasneh A.M, Abdas M.M. 2010). *Saccharomyces cerevisiae* has a QPS (Qualified Presumption of Safety) status according to EFSA (European Food Safety Authority). *Saccharomyces cerevisiae* is the only commercialized yeast which is practically used as probiotic in human medicine (Czerucka D at al., 2007). Aerobic bacterial count in Miso, were reported to be 10^{2} to 10^{7} cfu/g while LAB counts for other fish based fermented food were between 10^{3} to 10^{7} cfu/g (Rezac *et al*, 2018).Some major groups of fermented food prepared by different communities of North eastern India and prevalent microbes in them are discussed in this review paper.

Vegetable based fermented food

Bamboo shoots have been used as a traditional fermented foods in the parts of Asian counties such as China, Japan, US, India, Thailand, Nepal, Bhutan, Korea, Malaysia and Indonesia. Bamboo shoots have been used as a part of tribal diet since ages. Bamboo shoots are rich in mineral content, low in fat and high in dietary fibres. Thakur *et al* (2015) reported that these species of *Lactobacillus plantarum, L. brevis, L. Corniformis, L. fermentum, Leuconostoc fallax, Lactococcus lactis, L. mesenteroides, Enterococcus durans, Streptococcus lactis, L. Casei* and *Tetragenococcus halophilus* were primarily present in bamboo shoots based fermented foods. LAB species present in fermented bamboo shoots possess functional probiotic properties (Jeyaram *et al.*, 2010; Thakur *et al.*, 2015).

GUNDRUK is a fermented food from Arunachal Pradesh, prepared with leaves of mustard/radish/cauliflower. The microorganisms involved are *Pediococcus pentasaceous, Lactobacillus cellubiosus* and *Lactobacillus plantarum*. (Tamang *et al*, 2005). SINKI is another one, prepared from radish root (*Raphanus sativus L.*) and the fermentation takes 30–40 days. The microorganisms involved in the production are *Lactobacillus fermentum* which initiates the fermentation in sinki production, followed by *Lactobacillus brevis* and *Lactobacillus plantarum.* (Tamang and sarkar, 1993). Khalpi is another fermented cucumber food product .*Lactobacillus plantarum, Lactobacillus brevis, Leuconostoc fallax*are involved. Nepali tribe prepare a sticky fermented soybean food from soybean seeds known as Kinema and *Bacillus subtilis*is is a functional microorganism in Kinema fer-

mentation. *Bacillus subtilis, Bacillus cereus, Bacillus lichenforms,* are mostly involved in fermentation of Hawaijar, which is a sticky fermented soybean food from Assam.

Young shoots of *Dendrocalamus hamiltonii, Dendrocalamus giganteus, Bambusa tulda, Bambusa balcooa* and *Bambusa pallida* are used to make SOIBUM. The microorganisms involved in this fermentation process is *Lactobacillus plantarum, L. brevi, L. corniformis, L. delbrueckii, Leuconostocfallax, L. lactis, L. mesenteroides, Enterococcus durans, Streptococcus lactis, Bacillus subtilis, B.licheniformis, B.coagulans* and *yeast Candida, Saccharomyces* and *Torulopsisn*. Giri and Janmejay (2000) found that longer incubation time results in a better quality of the fermented bamboo shoot products . SOIDON is a vegetable based fermented food from Manipur. The microorganisms involved are *Lactobacillus brevis, Leuconostoc fallax, L. lactis* .HIRING is a vegetable based sour fermented food, prepared from bamboo shoots. It is sour and has acidic taste. The microorganisms involved in this fermented food is *Lactobacillus plantarum* and *Lactococcus lactis* (Sonar and Halami, 2014; Das and Deka, 2012; Tamang *et al.*, 2008).

Fruit based fermented food

M. Battcock *et al* in the year 2001 with his investigation in this area reported that the consumption of lactic acid fermented fruits and vegetables supports to refine the human gut system in several ways such as the fulfillment of a balanced nutrition, receiving of vitamins, minerals, and carbohydrates, and put a stop to several diseases such as diarrhea and cirrhosis of liver because of probiotic properties. Research and development of fermented fruit has broad prospects in enriching the beverage market and increasing the vegetable value due to good flavor and nutritional health value. Ethnic tribes usually prepare different types of fruit beverages from fruits. Some of them are fruits like Naga apple *(Docynia indica)*, passion fruit *(Passiflora edulis)*, plum *(Prunus sp.)* and gooseberry *(Phyllanthus emblica)*. The fruits/ pulps are boiled after removing the seeds. The boiled fruits or pulp is then soaked in sugar syrup for fermentation process for 1 to 2 weeks. The fermented product is usually taken as beverage. Some other fruit based fermented products are prepared from preservation of local fruit with salt or sugar and dried. Probiotic bacteria, predominantly found in fermented fruits are *Lactobacillus plantarum*, *Lactobacillus acidophilus, Streptococcus faecalis, Pediococcus pentosaceus, Lactobacillus casei, Lactobacillus brevis, Lactobacillus fermentum etc.*

Cereal based Fermented Food

Cereals provide a natural growth media for probiotics and also protect the organisms in the hostile condition of the intestine. For this reason, the cereal based fermented foods are now more popular than the other conventional dairy-based food products, particularly in Japan and Europe (Mousumi Ray et.al, 2016).Ethnic people of North East India produce different cereal based fermented foods viz *Selroti*, *Jalebi*, *Sour Rice*, *Hakua* etc. Selroti is a rice-based fermented product .Selroti is a cholesterol free and trans-fat free food item. J.P. Tamang et. al (2012) found selroti has beneficial impact on health and can be recommended diet for protecting dyslipidemia and cardio metabolic disorder. Selroti fermentation process are carried out by *L. mesenteroides, E. faecium, P.pentosaceu, S. cere visiae, S.kuyveri,D kluyveri*, *Z. rouxii., D. hansenii, P.burtonii.* Sour rice is famous fermented food in Assam and West Bengal which is popularly known as *poita bhat* and *panta bhat* . The main raw ingredients are rice and water. The cooked rice is cooled down to room temperature and adequate water is added to it. This watery rice is allowed to ferment overnight at room temperature. Mousumi Ray et. al, (2016)studied microbial species associated with poita bhat are LAB like

Lactobacillus bulgaricus *Lactobacillus casei*, *Streptococcus thermophilus, Saccharomyces* sp, *Pediococcus acidilactici*, *S. faecalis*, *Microbacterium flavum.*

Meat Based fermented food

Fermented meat products are prepared and can be preserved for years in normal room temperature. Excess meat is processed and preserved by drying or by drying cum smoking or by salting and drying with local herbs or by fermentation. In the traditional fermentation process, acid is generated which is responsible for the enhancement of the taste and other nutritional value of the meat products. The acid generators are primarily Gram-positive acidogenic lactic acid bacteria such as *lactobacillus, Streptococcus, Pediococcus, Leuconostoc , Lactococcus and Enterococcus.* These can metabolize several saccharides into lactic acid, alcohol, lipids and some amino acid. Different bacteria have a different level of efficiency for metabolizing saccharides present in the meat.

Fish based fermented food

Fermented fish is a traditional method of preserving fish. Popular fermented fish products of north eastern region include Shidal, Utongkupso, Hentak and Ngari were studied to record the preparation process and biochemical and microbiological charateristics of the products.

Thapa *et al.* (2004 and 2016) studied and isolated the bacterial communities *Lactococcus lactis subsp. cremoris, L. plantarum, L.fructosus, L.amylophilus, L.coryniformis, L.plantarum,*

Enterococcus faecium, Bacillus subtilis and B.pumilus, B.cereus, Staphylococcus aureus and Enterobacteriaceae population in Ngari, Hentak and Tungtap.

CONCLUSION

The various fermented food products are not only rich in nutritional supplements but also rich in medicinal value. The bamboo shoots are found to be associated with health benefits like anti-aging, anticancer, prevent cardiovascular diseases, weight loss, improves digestion, decrease blood pressure, and anti-microbial activity. Fermentation methods show a strong connection of ethnic people with nature and their assessment techniques of microbial benefits without much scientific background. Beneficial food products may be formulated in future by selecting productive microbial strains, genetic improvement, study of probiotic activity which will lead to the commercialization of fermented food products. These fermented food products contain high content of probiotic strains which preserve the food for a long period of time. Multiinstitutional research will lead to the standardization of the fermented food products and extend their shelf life. As, we are now entering in the post genomic age of microbiology where many microorganisms have already been sequenced for food production, this offers a new knowledge-based method which has been used to the exploitation of bacteria for food production. As development of probiotic cultures of well documented microorganisms is need of the hour, basic information about the physiology and genetics of probiotic strains from traditional fermented food of this community relevant to their intestinal roles, functional activities, and interactions with other gut micro flora. It will also help to popularize these foods among non-consumers. It is also essential to conserve traditional knowledge of ethnic people and empower them to establish small scale food businesses. Integrated research will help in formulation of new probiotic products and help millions of people facing malnutrition, maternal and infant morbidity and mortality. These foods have long been a part of the human diet, and certainly worthy of recommendation of regular consumption. It would be detrimental to human health if fermented food uses are declined. Current challenge for food scientists will be how to manage large scale production of fermented foods without

losing the unique flavours, textures, and other traits associated with the traditional products from which they are derived. Future scientific research involving microorganisms from all types of fermented food from different communities will help to integrates micro flora of traditionally fermented food of North eastern states of India and nutritional benefits to maintain health.

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Potential of wild plants as food in West Jaintia Hills district of Meghalaya

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ABSTRACT

India is a country with a large ethnic society and has immense wealth due to which it is rich in biodiversity. Wild edible plants are giving more nourishment and nutrition. Wild plants from forest have medicinal value specially in treating the aliments like cuts, wounds, cough, pain, stomach problems, *etc.* It provides food and other life support commodities and it is very important for the survival of human beings and other organisms besides maintaining nature and protection to our environment. The study of indigenous knowledge and selection of natural commodities has an immense importance in fulfilling the nutrition and medicine subsistence. Therefore a study was initiated in West Jaintia Hills of Meghalaya to understand the resource utilization pattern. The study found that 147 species of plants belonging to 62 families were utilized by the local tribal people as commodities for food and medicinal subsistence. The plants belonging to the family Rosaceae were selected in the highest number as the commodity with 11 species. The majority of the species were wild and collected from the forest. Some of the species were consumed mostly as they contain high nutrition and medicinal property. This indigenous knowledge about the high nutritional and medicinal value further indicates for initiating scientific study as well as community-based biodiversity conservation.

Keywords: Wild edible plants, Jaintia Hills, medicinal plants; nutrition, indigenous knowledge, biodiversity conservation

INTRODUCTION

Human existence and culture have straightforwardly otherwise by implication been impacted by their immediate environment (Radhakrishnan et al., 1996; Ignacimuthu et al., 1998). The importance of ethnobotany stems from the varied economic uses of plants among the primitive human societies, which may be equally beneficial to modern man. The known and unknown worth of plants had already been conveyed to the world (Jain, 1981). Uses of wild edible plants have played an important role in human life, since time immemorial. Millions of people do not have enough food to meet their daily requirements and are deficient in one or more nutrients (Ogle and Grivetti, 2000; FAO, 2004) and a similar situation is noticed in India with a 70% rural population with a rain-fed agriculture-dependent population. In India, most rural inhabitants rely on wild edible plants to satisfy their further food needs as they provide staple and supplement foods to rural communities.

Traditional food systems depend on and reflect biological diversity as they typically incorporate locally available foods of plant and animal origin, are high in species variety, and have rich nutrient sources (Kuhnlein and Receveur, 1996; Tontisirin *et al.*, 2002). In India, the leaves of a large number of wild and cultivated plants are used

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as vegetables. They have a very high protective food value and are very easy to grow (Chauhan *et al.*, 2014).

There are about 3000 eatable plant species known to man, with just 30 developed yields adding to over 90% of the world's calorie consumption, and just 120 harvests are monetarily significant on a public scale. It is estimated that in India about 800 species are consumed as wild edible plants over the country (Singh and Arora, 1978). Wild edible plants not only provide food quantity but also make a significant contribution to the population nutrition throughout the year (Grivetti and Ogle, 2000; Ogle, 2001; Ogle *et al.*, 2001; Ogle *et al.*, 2003). The nutritional value of wild plants is higher than several known common vegetables (Ogle and Grivetti, 2000; Sundriyal and Sundriyal, 2001).

India got second position on the planet close to China in vegetable creation. However, usually this is often abundant however the suggested demand of 300g/capita/day of vegetables for a diet. Although 175 major and minor vegetable crops are grown in India including 82 leafy vegetables, there is a challenge to achieve the target of 160 million tons of vegetables to fulfill the recommended requirement by 2020 (Rai *et al.*, 2004). The World Health Organization (WHO) recommends a daily intake of more than 400g of vegetables per person to protect against diet-related chronic diseases (WHO, 2003). Besides, wild edible plants are a rich resource of carbohydrates, oils, proteins, minerals, ascorbic acid, and the antioxidant phenols (Aberoumand and Deokule, 2009).

Green Leafy Vegetables (GLVs) occupy an important place among the food crops as these provide adequate amounts of vitamins and minerals for humans. Green leafy vegetables, particularly in wild and weedy species, are key elements of traditional diets, as they are accessible, locally gathered or cultivated, and have diversified sources of nutrients and phytochemicals (Ogle *et al.*, 2001; Tontisirin *et al.*, 2002; Tarwadi and Agte, 2003). Studies by Chauhan *et al.* (2014) conducted in Chhattisgarh revealed that the life and economy of the tribal and local people are intimately connected with the natural vegetation. Leafy vegetables play a major role in the nutritional requirement of the tribal and local population in remote parts of the Chhattisgarh. Leafy vegetables not only provide food quantity but also make a significant contribution to the population's nutrition throughout the year.

The tribal normally collect seeds of local forest products and sell them to earn their livelihood. Also, the diversity of leafy vegetable species offer variety in family diet and contribute to household food security as well as increase dietary diversity. Further, it provides rural households with supplemental income opportunities through their sale in the markets (Chauhan *et al.,* 2014). Traditional Knowledge of wild food is largely transmitted through the participation of individual's helps future generations to obtain inexpensive food resources (Misra *et al.*, 2008). Wild edible plants not only provide food quantity but also make a significant contribution to the population's nutrition throughout the year (Ogle *et al.*, 2003). The nutritional value of wild plants is higher than several known common vegetables (Ogle and Grivetti, 2000; Sundriyal and Sundriyal, 2001).

Most of the tribal community depends on agriculture for their livelihood, especially in hilly areas. Scientists have recently realized the importance of such plants in the rural economy. In the areas having high plant diversity income from non-timber forest products (NTFP) can be the main sources of household income of rural communities.

Wild edible plants are giving more nourishment nutrition besides, the hybrid one. Hybrids are pest resistant and of large size but nutrients are less. So the wild edible plants that are available should be given importance as they can be meet the requirements of nutrients and hunger. Studies are available on medicinal plants used by tribal communities but less emphasis is given on wild edible plants. So, the present investigation is undertaken to study the potential of wild plants as food in Jowai, Meghalaya.

MATERIALS AND METHODS

Meghalaya 'the abode of clouds' is a treasure of nature with its richly varied and dense endemic, ex-

otic, and cultivated flora. This is due to the diverse topography, varied and abundant rainfall, and differential climate edaphic conditions within the diferent regions. The climate of Meghalaya is moderate but humid.

West Jaintia Hills District where this study was conducted is one of the 11 districts of Meghalaya with a total geographical area of 1693 km² (654 sq m) (Figure 1). It has its physiographical features almost similar to that of Khasi Hills. The only difference is that it has a comparably more flat topography with a mild gradient. The entire Jaintia Hills is richly endowed with natural resources and in the bygone days was endowed richly with natural resources and rich flora and fauna. With Jowai as its headquarters, the district is gradually fading away in terms of ecology and environment due to the large-scale denudation of forests for lumbering business purposes and human encroachment towards the habitat.

A questionnaire method was followed to conduct a survey targeting the local market, Anganwadi center/school, and household during 2018 -19. For this, more than 40 years age group was selected as the respondents. Close-ended questions were designed in such a way that details information on the edible plants' selection and their part use, the purpose of use, harvesting time were ascertained. For identification of the wild edible plants, the Plant tissue Culture Laboratory, Silviculture Division of the Meghalaya Forest and Environment department assisted.

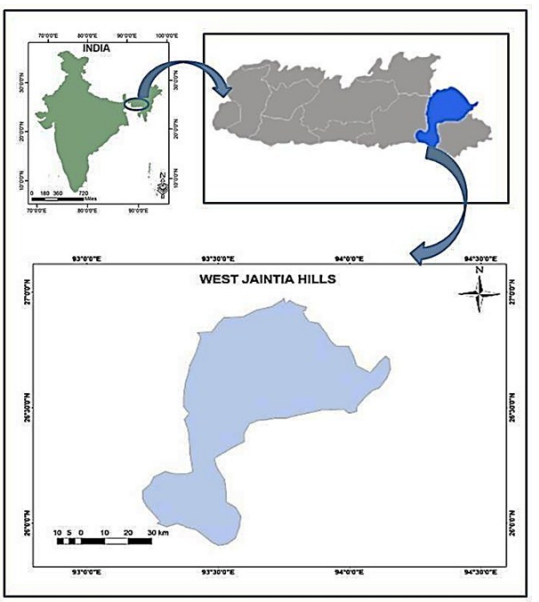

Figure 1. Map of Meghalaya showing the location of West Jaintia Hills district

RESULTS

Selection of edible plants

A total of 147 species belonging to 62 families were recorded during the survey. The plants belonging to the family Rosaceae were selected in highest number as the commodity (11 species) followed by Moraceae and Rutaceae each with 10 numbers, Myrtaceae with 9 numbers, Euphorbiaceae with 8 numbers, Anacardiaceae with 7 numbers, Clusiaceae, Myrsinaceae, and Rubiaceae each with 6 numbers, Sterculiaceae and Tiliaceae each with 5 numbers, Sapindaceae and Piperaceae each with 4 numbers, Caesalpiniaceae with 3 numbers and Apiaceae, Arecaceae, Dilleniaceae, Elaeocarpaceae and Saurauiaceae while remaining 43 number of families represented by single number of species (Figure 2).

About 49.7% of the respondent stated that people preferred mostly the leaves of the wild plants.27.7 % of the respondent stated that fruits are preferred while 12.7% stated that tubers are their choice, 8.7% of them stated that endocarp is used and 1.2% stated that flowers are used (Figure 3).

Source and preference of edible plants

The wild plants are mostly collected from the forest as stated by 45.5% of the respondent.31.6% of the respondent stated that they grow it in their gardens while 22.9% of the respondent favored both the choices (Figure 4).

Forty-five percent of the respondent stated that they used to purchase the wild edible plant while 4% stated that they use to collect it. However, 50.7% of the respondent stated that they purchase as well as they collect those wild plants (Figure 5).

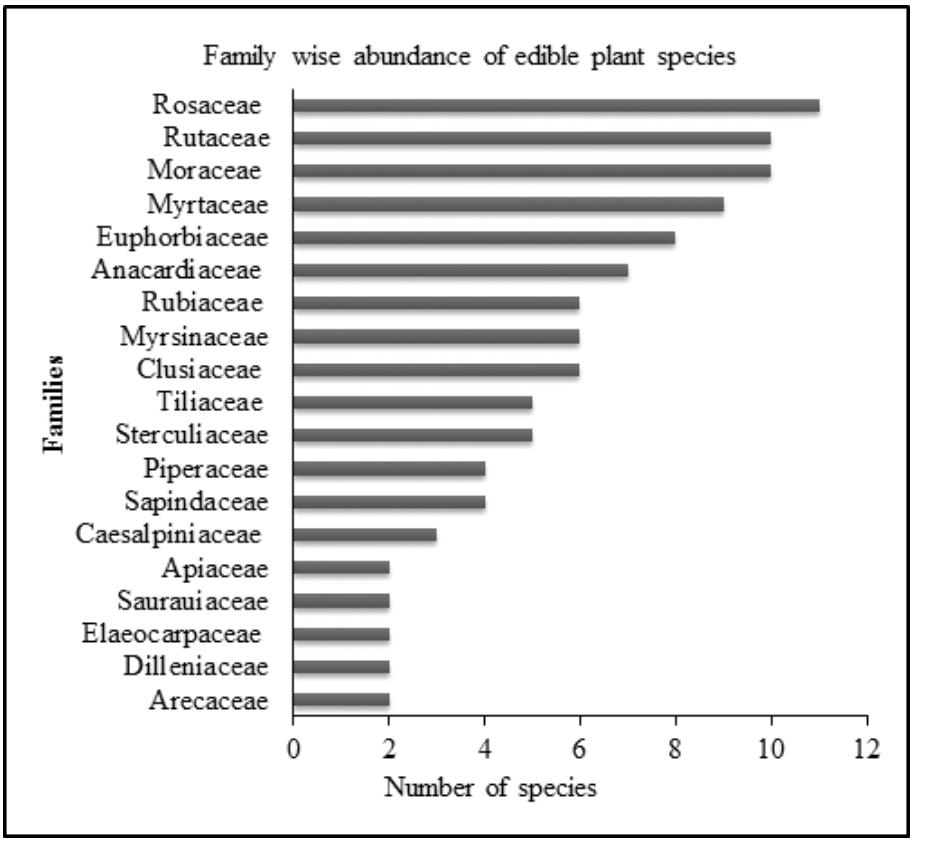

Figure 2. Families with some plant species selected as the food commodities

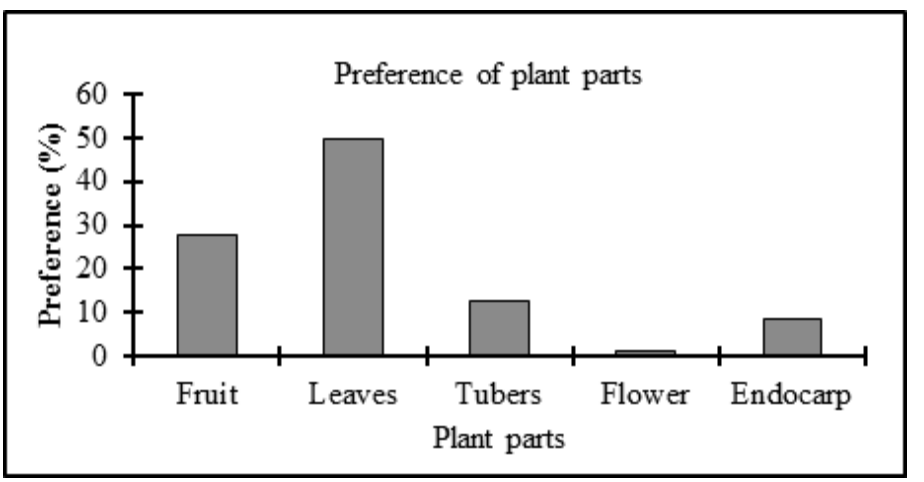

Figure 3. Preference of the wild edible plant parts in the study area

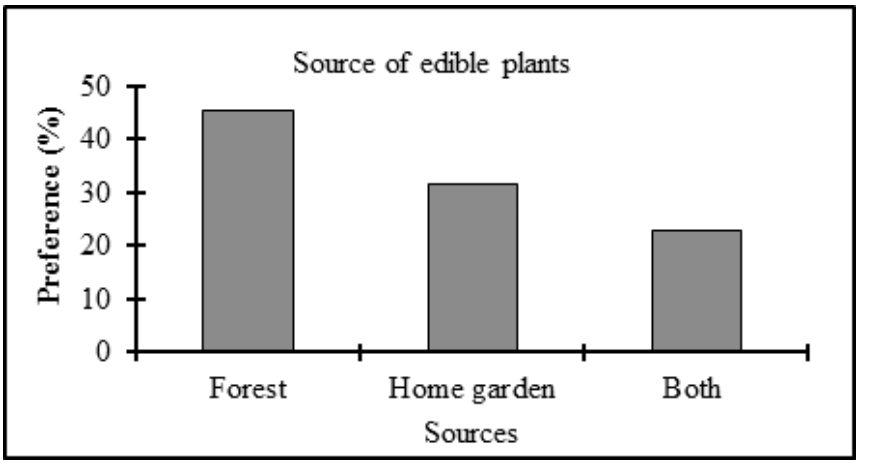

Figure 4. Collection of the wild edible plants

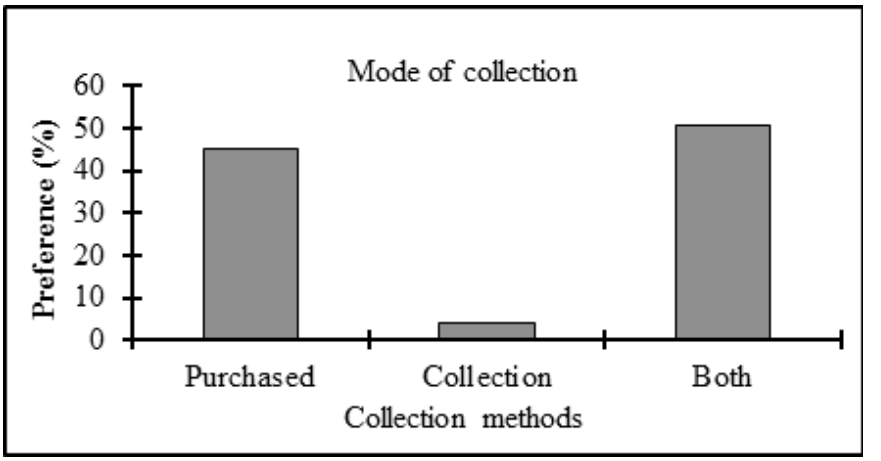

Figure 5. Mode of collection of wild edible plants

Seventy-four percent of the respondent stated that mostly wild variety of the plants are preferred, 21.5% of the respondent stated that cultivated variety are chosen while 4.7% of the respondent stated both of them are selected (Figure 6).

Cultivation of wild edible plant is done mostly in the study area (94.7%) whereas some preferred hybrid variety (1%) and some choose both (4.3%) (Figure 7).

Most of the wild edible plants in the study area are seasonally available (82%) while some are monthly available also (18%) (Figure 8).

Values of edible plants

Wild edible plants in the study area are mostly used for nutritional purposes (42.6%) followed by medicinal purposes (7.1%). 50.3% of the respondent stated that these plants are used for both the purpose (Figure 9, Appendix-1).

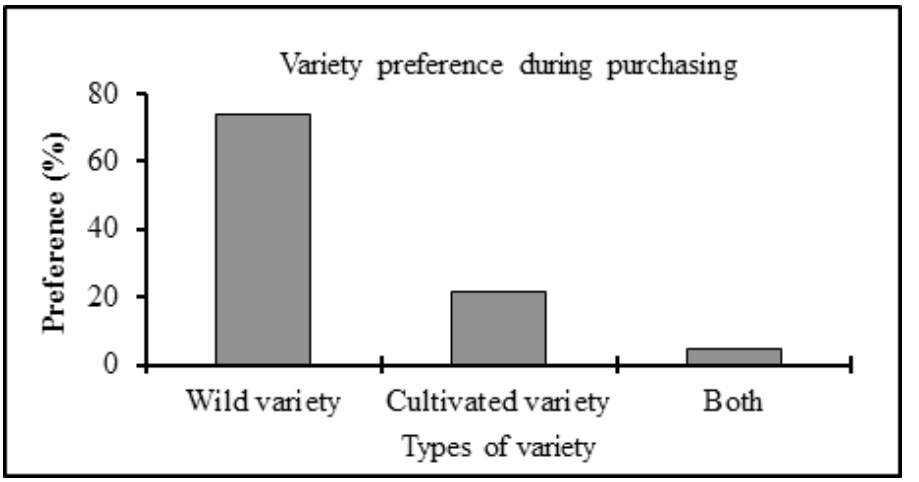

Figure 6. Peoples preference in variety selection during purchasing of wild edible plants

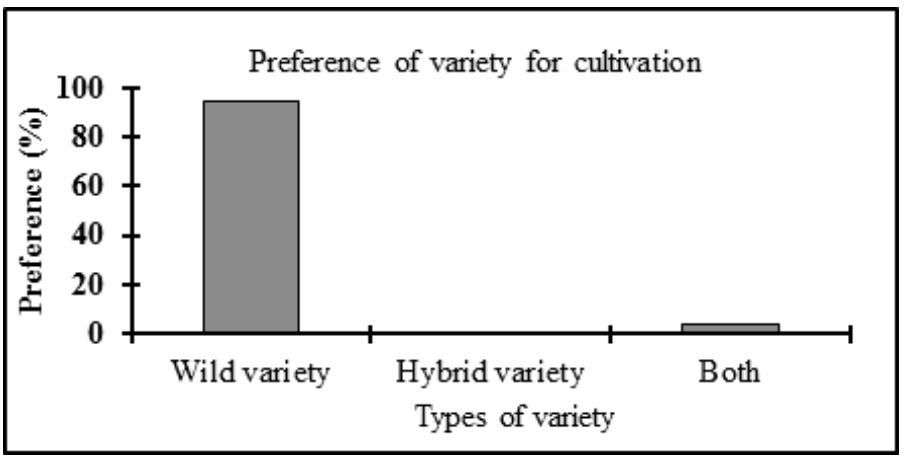

Figure 7. Variety selection of edible plants for cultivation

Conservation status

Among the identified wild edible plants, *Passiflora edulis* and *Citrus latipes* fall into the endangered category while *Cucurma aromatic*, *Ficus ariculata*, *Potentilla fulgens,* and *Acorus calamus* in the vulnerable category. Interestingly, two species namely *Begonia palmate* and *Docynia indica* categorized as endemic species. So there is an urgent need for the conservation of these wild edible plants in this area (Table 1).

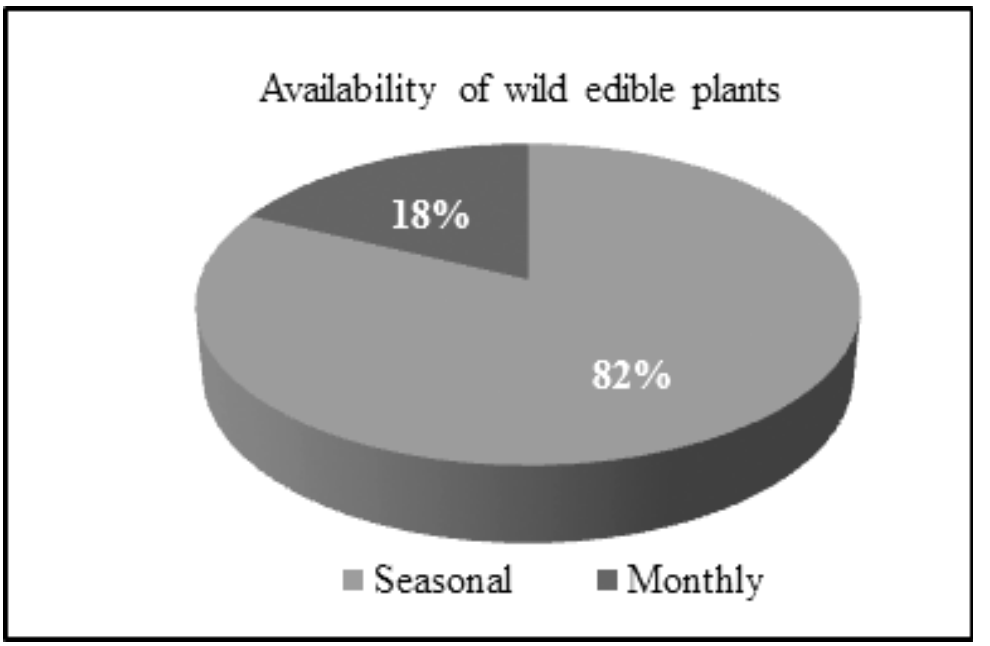

Figure 8. Availability of wild edible plants in the study area

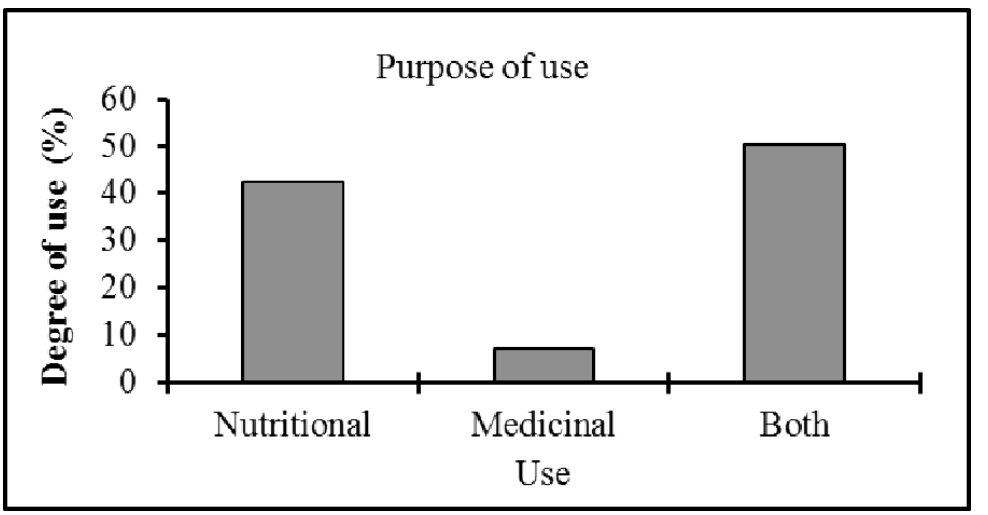

Figure 9. Uses of wild edible plants

Table 1. List of edible plants with their conservation status

Sl. No	Local name	Scientific name	Family	Conservation status
1	Sohbrab	*Passiflora edulis*	Passifloraceae	Endangered
2	Tyngkhieh	*Centella asiatica*	Apiaceae	Least concerned
3	Jamyrdoh	*Houttuynia cordata*	Saururaceae	Least concerned
4	Iajaw	*Begonia palmate*	Begoniaceae	Endemic
5	Dhania khloe	*Eryngium foetidum*	Apiaceae	Least concerned
6	Lachein	*Cucurma aromatica*	Zingiberaceae	Vulnerable
7	Soh-jaw	*Citrus latipes Tanaka*	Rutaceae	Endangered
8	Selishiat	*Ficus ariculata*	Moraceae	Vulnerable
9	Wathang	*Potentilla fulgens HK*	Rosaceae	Vulnerable
10	Iyew	*Acorus calamus*	Acoraceae	Vulnerable
11	Lapaiur	*Docynia indica*	Rosaceae	Endemic

DISCUSSION

Tropical forests are the major reservoir of plant diversity as they harbor about 50% of the total plant species identified so far, with 12% area of the earth. These forests inhabit a large number of trees, shrubs, herbs, climbers, epiphytes, faunal wealth, and a wealth of non-timber forest products (NTPF) including Medicinal and Aromatic plants (MAP) and wild edible plants. The wild edible plants with high diversity are widely distributed in mountain forests and are a valuable source of food and medicines for domestic and commercial purposes. Previous studies reported on the importance and contribution of some plants and NTFPs in local, forest-reliant livelihoods in some tropical developing countries (Malhotra *et al.*, 1991; Ganesan, 1993; Gunatilake *et al.*, 1993; Townson, 1995; Cavendish, 2000; Malik, 2000; Ambrose-Oji, 2003; Malla, 2003; Mahapatra *et al.*, 2005). In our study, the finding of 147 numbers of species further indicates the importance of the bioresource of this region in the livelihood option of the local tribal people. The present study also recorded that *Houttuynia cordata* and *Centella asiatica* were the most preferred wild edible plants in this area. It is also found that the leaves of the wild edible plants are mostly used by them. The people used to purchase as well as collect the wild edible plants from both the forest and from their home garden. However, sustainable harvesting might help in both conservation and economic development of the rural people (FAO, 2001; Mahapatra *et al.*, 2005; Negi *et al.*, 2011; Heubes *et al.*, 2012; Shackleton *et al.*, 2011; Anglesen *et al.*, 2014).

People of this area use the wild edible plants both as food as well as for medicine. In the present study, *Passiflora edulis* and *Citrus latipes* are categorized as endangered species. On the other hand, *Begonia palmate* and *Docynia indica* are categorized as endemic species. So conservation of these plants needs more attention.

Selecting the preference of a few species is the cause of biodiversity loss. Besides, several

anthropogenic threats are there namely habitat loss and fragmentation for human settlement, developmental activities, and conversion of forest land into agricultural land (Talukdar *et al.*, 2019). However, an intermediate management system (Silva and Caballero, 2006) or agro-forestry combining both forest resources and semi-cultivated species must be implemented in the private land to check further loss of the forest. This may help maintain the biodiversity and complexity of the ecosystem (Michon *et al.*, 2007) and also relieve the poverty of this region.

The study concluded that wild plants have good potential of serving human beings as food material or as a substitute for crops. Therefore, there is a need to transfer the indigenous knowledge of wild plants to the subsequent generations for their sustainability. Similarly, the study also found that some of the plants need conservation measures due to excessive utilization failing which may lead to extinction of the species.

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Appendix-1: Plants used as medicine by the localities Body aches and colic

Species	**Family**	**Habit**	**Parts used**
Begonia palmata	Begoniaceae	Herb	Leaves
Citrus latipes	Rutaceae	Shrub	Fruit
Docynia indica	Rosaceae	Tree	Fruit
Dysoxylum gobara	Meliaceae	Tree	Leaves

Dermatological problems

Species	**Family**	**Habit**	**Parts used**
Hedychium spp.	Zingiberaceae	Herb	Rhizomes
Vangueria spinosa	Rubiaceae	Tree	Fruit
Plantago erosa	Plantaginaceae	Herb	Leaves
Fagopyrum dibotrys	Polygonaceae	Herb	Leaves

Gastro-intestinal disorder

Species	Family	Habit	Parts used
Begonia palmata	Begoniaceae	Herb	Leaves
Centella asiatica	Apiaceae	Herb	Leaves
Drosera indica	Droseraceae	Tree	Fruit
Eriosema spp.	Fabaceae	Herb	Leaves and fruits

Eye diseases

Species	Family	Habit	Parts used
Begonia palmata	Begoniaceae	Herb	Leaves
Oxalis corniculata	Oxalidaceae	Herb	Leaves

Blood related problems

Species	Family	Habit	Parts used
Centella asiatica	Apiaceae	Herb	Leaves
Dysoxylum gobara	Meliaceae	Tree	Leaves
Houttuynia cordata	Saururaceae	Herb	Leaves

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A practical design of a primitive low wattage inverter with its duty cycle and efficiency calculation

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ABSTRACT

A primitive low wattage electronic inverter has been designed using very few low cost and easily available electronic components such as resistors, capacitors, transistors, MOSFETS, transformer and battery only and its duty cycle is theoretically calculated and also experimentally measured at a few representative and practically viable values of resistors and capacitors. Measurements are done by using a Digital Oscilloscope – 'Scientech ST201C' and a sophisticated Source Meter – 'Keithley 2401' with high accuracy in our laboratory. The measured values of the duty cycles well match with the theoretically calculated ones. This designed circuit, though primitive in nature, is well acceptable from the practical point of view.

INTRODUCTION

An inverter is an electronic device that coverts a direct current (d.c.) in to alternating current (a.c.) which is used to run a.c. loads, such as bulbs, fans, motors, etc. (Kelley, A. W. and Yadusky, W. F., 1992.).

The inverter that has been designed in our laboratory consists of very few elements such as transistors, MOSFETS, resistors, capacitors, transformer and battery only. The portability and simplicity of the circuit gives a boost towards the practical utility of the mini inverter.

THEORY

The basic principle of an inverter circuit is to produce oscillating signal (current / voltage) using a battery (or a given DC source). These signals are amplified and then fed across the secondary of the transformer. This voltage is then stepped up to a higher voltage depending upon the number of turns in primary and secondary coils of the transformer (Figure 1).

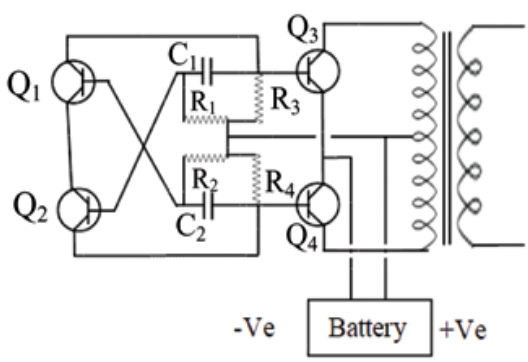

Figure 1. Mini inverter circuit diagram

There are two sections or the two halves of the circuit (upper and lower halves in our case) which operate in a regenerative manner. No matter how much they are matched, these two sections of

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the circuit always have a slight imbalance in the values of the parameters surrounding them. Due to this imbalance both the sections can't conduct together at one instant. The circuit actually works with a push pull kind of operation where the transistors $Q1$ and $Q2$ form a simple astable multivibartor thereby creating an approximate frequency of 50 Hz (Sze and Lee, 2010).

Let it be assumed that the upper half transistor Q_1 conducts first. Obviously it gets the biasing voltage through the lower half of the winding of the transformer via the biasing resistor R_2. The moment it conducts fully and saturates, the entire battery voltage is pulled through its collector to the ground. This sucks-out dry any voltage through R_2 to the base of the upper half transistor Q_1 and it immediately stops conducting. The lower transistor Q_2 now gets an opportunity to conduct with the biasing voltage through the upper half of the winding of the transformer via the biasing resistor R_1. The cycle keeps on repeating automatically. The whole circuit thus starts to oscillate. Thus the current through the transformer coil keeps alternating at the same frequency. This in turn induces ac voltage across the secondary coil of the transformer where the load remains connected.

The base emitter resistors R_3 and R_4 (along with the capacitors C_1 and C_2) are used to maintain a particular threshold for their conduction, i.e., they help to fix a base biasing reference voltage level. Reduction in the values of the resistors R_1 and R_2 result in increase in the output power of the transformer or vice-versa. The power of the inverter can mainly be increased by increasing the number of MOSFETs in the form of cascades.

Electrical Waveforms, Technically speaking, are basically graphical representations of the variation of a voltage or current over time (Fig.2).

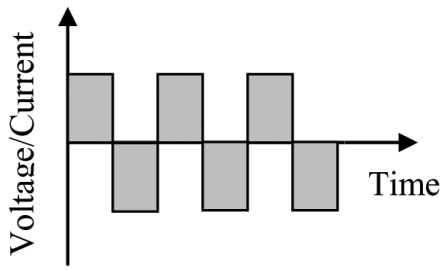

Figure 2. Square waveform in ideal form

Square electrical waveforms are, in general or ideally, symmetrical in shape, i.e., both the halves of the cycle are identical. The time interval of the positive pulse is equal to that of the negative halve. The time interval of the positive pulse is known as the 'Duty Cycle' (Rashid, M. H., 2001).

The time interval corresponding to the positive pulse of the square waveform is 'ON' time and that corresponding to the negative pulse is called 'OFF' time. In digital electronics, the positive pulse is used to represent 'logic level 1' or 'high' and the negative pulse is used to represent 'logic level 0' or 'low' (https://www.popsci.com). The positive and negative pulse widths of a square wave are sometimes called as 'Mark' and 'Space' respectively. The ratio of the Mark time to the Space time is called 'Mark-to-Space' ratio. For a symmetric square wave, 'Mark-to-Space' ratio is one (http://www.circuitstoday.com and http://visionics.a.se/html).

In a symmetric square waveform, 50% duty cycle means the time interval of the positive pulse is half of its time period. If the duty cycle of the waveform is any other value than 50%, the resulting waveform would then be called a **rectangular waveform. If the** 'ON' time is really small it is simply called a pulse (Babarinde, Adeleke, Adeyeye, Ogundeji, and Ganiyu, 2014).

Thus the time period of a square wave may be expressed as –

$$T = ON\ time + OFF\ time$$

In terms of pulse time intervals –

$$T = T_{(positive\ pulse)} + T_{(negative\ pulse)}$$

In terms of Mark and Spaces –

$$T = T_{(Mark\ time)} + T_{(Space\ time)}$$

The formula for the frequency of square wave generated by the transistor astable multivibrator (Ommitola, Olatinwo, and Oyedare, 2014.) is given by

$$f = \frac{1}{1.38 \times R_2 \times C_1}$$

The values of R_2 and C_1 decide the frequency.

The time period is given by

$$T = \frac{1}{f} = 1.38 \times R_2 \times C_1$$

Duty cycle can be calculated from this T.

MATERIALS AND METHODS

This inverter has been designed using low cost and easily available simple electronic components such as MOSFETs, transistors, resistors, capacitors, transformer and battery only. Its duty cycle is theoretically calculated and also measured by using a Digital Oscilloscope – 'Aplab D36100C' and a sophisticated Source Meter – 'Keithley 2401' with high accuracy in our laboratory. Efficiencies are also measured at a few representative values of R_1 or R_2.

Construction of the circuit :

To begin with, the two power transistors (both are IRFZ44) are facilitated with proper heat-sinks (they are fixed to the heat-sinks and tightened enough with the help of nuts and bolts). The resistors are connected in a cross-coupled manner to the leads of the normal transistors Q_1 and Q_2. Capacitors are inserted in the requisite positions of the circuit. This assembly of components is now connected to the secondary winding of the transformer. A 12V 7Ah battery is hooked up in the proper position as per the circuit diagram (fig.1) and a 60 watt lamp, in the form of a small load, is attached to the output of the inverter.

RESULTS AND DISCUSSION

The experimentally measured and the theoretically calculated duty cycles enlisted in table-1 are found well-matched. The values of the duty cycles are found to be well close to 50% which indicates that this designed mini inverter also produces a very good symmetric square waveform in the output. The slight gradual increase in the values of duty cycle with increase in the values of resistor R_2 (C_1 is kept same for a comparative study of the results), is in accordance with the theoretical expectation.

Table 1. Experimentally measured duty cycles and their comparison with theoretically calculated ones at some representative sets of values of R_2 and C_1 .

Choices of R_2 and C_1	**Theoretically calculated Duty cycle**	**Experimentally measured Duty cycle**
$R_2 = 100\ \Omega$ $C_1 = 0.47\ \mu F \quad (100V)$	48.4 %	47.7 %
$R_2 = 220\ \Omega$ $C_1 = 0.47\ \mu F \quad (100V)$	49.0 %	48.3 %
$R_2 = 330\ \Omega$ $C_1 = 0.47\ \mu F \quad (100V)$	49.2 %	48.5 %
$R_2 = 1000\ \Omega$ $C_1 = 0.47\ \mu F \quad (100V)$	49.6 %	49.0 %

Table 2. Experimentally measured efficiency of the inverter at a few representative values of resistors R_1 and R_2.

Values of Resistors R_1 and R_2	Experimentally measured efficiency
$R_2 = R_2 = 100\ \Omega$	80.3 %
$R_2 = R_2 = 220\ \Omega$	78.1 %
$R_2 = R_2 = 330\ \Omega$	75.8 %
$R_2 = R_2 = 1000\ \Omega$	71.5 %

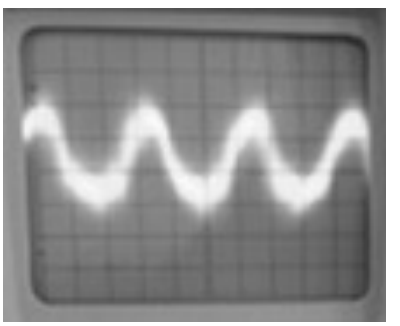

Figure 3. Image of the screen of the oscilloscope.

Duty cycle plays the most crucial role in maintaining the symmetry of the output waveform of an inverter. Its value in an inverter is expected to be very close to 50% so that both the positive and negative halves of the output wave have equal pulse widths thereby maintaining an excellent symmetry. The symmetric waveforms produce less noise in the loads when run.

The experimentally measured efficiencies at the same representative values of resistances R_1 and R_2 (i.e. at 100 Ω , 220 Ω , 330 Ω and 1000 Ω) and their comparison with theoretical values are enlisted in table-2. The measured values of the efficiencies of the inverter are found increasing with decrease in the values of resistances (as the resistances decrease, the transistors conduct more which results in increase in efficiency). A representative image of the screen of the oscilloscope is shown in fig.3.

The working of this type of mini inverter circuit is unique and different from the normal inverter which involves discrete oscillator stage for powering the power transistors. Normal inverter circuits are often very complicated and involve huge repairing cost.

CONCLUSION

This inverter circuit, though appears simple in design, can produce output voltage of excellent duty cycle and a reasonably high efficiency of around 75%. It can be used to light up LED and CFL lamps, to run drill machines, hair dryer, mobile chargers, etc. through a low ampere-hour battery, but not good or recommended for modern complex and costly electronic devices. Lastly, the simplicity of structure and low cost production become an added feature to be considered in such mini inverters.

The output voltage is observed to contain some spikes or fluctuations which could be minimized by inserting some filters (such as L- and Pi-section filters) across the primary coil of the transformer. These filters smoothen out the output voltage of the inverter making it more suitably usable for modern complex and costlier electronic devices. Such studies have also been performed. The results may be published in near future communications.

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A new PBE2 distribution and life expectancy prediction for India

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ABSTRACT

The Binomial Exponential 2 (BE2) Distribution was proposed by Bakoch et al. as a distribution of a random sum of independent exponential random variables, when sample size has zero truncated binomial distribution. In this article we analyze power binomial exponential 2(PBE2) Distribution, Proposed by Habibi and Asgharzadeh (2017) which is a generalization of BE2 Distribution which offers more flexible model for studying life time data with monotone as well as non-monotone failure rates than the BE2 distribution. From the analysis we have observed that the present PBE2 distribution is not suitable for fitting the life expectancy of Indian data. Therefore, a new transformation is necessary to fit life expectancy of Indian data. Here we have developed a New Power Binomial Exponential 2 (NPBE2) distribution which is suitable for fitting the life expectancy of Indian data.

Key words: Binomial Exponential 2 distribution; Power Binomial Exponential 2 distribution; Survival function; Life expectancy

INTRODUCTION

To model life time data and phenomena related to life time many probability distributions have been used. Of them Gamma and Weibull distributions have been extensively used in the literature for monotone failure rates. The limitation of the Gamma distribution is that its distribution function or the survival function cannot be expressed in a closed form. The Weibull distribution is comparatively popular than Gamma distribution because it has closed form survival and hazard rate functions (Habibi and Asgharzadeh, 2017). However, reliability and survival studies commonly encounter non-monotone failure rates such as the bathtub shaped and unimodal failure rates. Unfortunately, Weibull and Gamma distributions do not provide a reasonable parametric fit for such rates. Further, there are situations where mortality reaches a peak after some finite period and then slowly declines (Gupta and Gupta, 1998).

Several generalizations of Gamma and Weibull distributions have been introduced in the literature for modeling non-monotone failure rate data (Stacy, 1962; Mudholkar and Srivastava, 1993).

Bakouch et al. (2014) introduced the Binomial-Exponential 2 (BE2) distribution as an alternative to the Weibull and Gamma distributions. The probability density function (pdf) of BE2 distribution is given by-

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$$f(t) = \left\{1 + \frac{(\lambda t-1)\theta}{2-\theta}\right\}\lambda e^{-\lambda t} \quad ; t > 0;\ \lambda > 0;\ 0 \le \theta \le 1 \qquad (1)$$

Where θ is the shape parameter and λ is the scale parameter.
The cumulative distribution function (cdf) is given by

$$F(t) = 1 - \left\{1 + \frac{\lambda\theta t}{2-\theta}\right\}e^{-\lambda t} \qquad ; t > 0$$

Now, Survival function of t is given by

$$S(t) = \left\{1 + \frac{\lambda\theta t}{2-\theta}\right\}e^{-\lambda t} \qquad ; t > 0$$

The pdf (1) can be written as

$$f(t) = p\lambda e^{-\lambda t} + (1-p)\lambda^2 t e^{-\lambda t} \qquad ; t > 0$$

where, $p = \frac{2(1-\theta)}{2-\theta}$.

So, the BE2 distribution is a mixture of Exponential distribution (with scale parameter λ), and a Gamma distribution (with shape parameter 2 and scale parameter λ), with mixing proportion p.
Note that the exponential distribution arises when $\theta = 0$, and for $\theta = 1$ the BE2 distribution reduces to the Gamma distribution with shape parameter 2 and scale parameter λ.
The BE2 distribution allows for increasing rates only. So, this distribution is not suitable for modeling non-monotone failure rate data. Non-monotone failure rates are very important in practice, particularly modeling life expectancies at different ages in life tables of developing countries. In most of the developing countries high rates of infant and childhood mortality result in lower values of life expectancy at birth than at other ages (Romo and Becker, 2011). In India, the Sample Registration System (SRS) life tables show that the highest life expectancy occurred at age 5 till 1980 and then crossed over to age 1 during 1981-85 and remained at that age till date. In all the major states of India, except Kerala, the situation is same. In Kerala, whose demographic features are like the developed countries, the highest life expectancy occurred at birth right from the time since when SRS provides life tables, i.e., 1970-75 (Sarma and Choudhury, 2014).

Habibi and Asgharzadeh (2017) proposed a more flexible distribution for studying non monotone failures. They proposed a new three-parameter generalization of the BE2 distribution. Due to the great flexibility of the failure rate function of the new model, it is suitable for modeling many sets of lifetime data with monotonic as well as non-monotonic failure rates. Further, it has closed form expressions for survival and hazard rate functions. This new extension of BE2 distribution is obtained by considering the power transformation $X = T^{\frac{1}{\alpha}}$, where T be a BE2 random variable with p.d.f. (1). The p.d.f. of X is then,

$$f(x) = \alpha\lambda x^{\alpha-1}\left[1 + \frac{(\lambda x^{\alpha}-1)\theta}{2-\theta}\right]e^{-\lambda x^{\alpha}} \qquad ; x, \alpha, \lambda > 0 \text{ and } 0 \le \theta \le 1$$

And the survival function of X is

$$S(x) = P(X > x) = \left(1 + \frac{\lambda\theta x^{\alpha}}{2-\theta}\right) e^{-\lambda x^{\alpha}} \quad ; x, \alpha, \lambda > 0 \; and \; 0 \leq \theta \leq 1$$

They named this distribution as Power-Binomial-Exponential 2 (PBE2) distribution.

Habibi and Asgharzadeh (2017) also gave the pdf for Residual (or remaining) life random variable under PBE2 distribution.

Given survival to time t ≥ 0, the residual life is the period from time t until the time of failure. More specifically, if X is the life of a component, then the conditional random variable $X_{(t)} = X - t | X > t$ is called the residual life of the random variable.

The survival function of the residual life $X_{(t)}$, t ≥0 for the new distribution is

$$S_{X_{(t)}}(x) = \frac{S(x+t)}{S(t)} \quad ; x > 0$$

And the corresponding pdf is

$$F_{X_{(t)}}(x) = \frac{f(x+t)}{S(t)}$$

$$= \frac{\alpha\lambda(x+t)^{\alpha-1}[2-2\theta+\lambda\theta(x+t)^{\alpha}]}{[2-\theta+\lambda\theta(x+t)^{\alpha}]}$$

The mean residual life (popularly known as life expectancy in Demography) is given by

$$K(t) = E[X_{(t)}] = \frac{1}{S(t)} \int_{t}^{\infty} x f(x) dx - t$$

$$= \frac{(2-\theta)e^{\lambda t^{\alpha}}}{2-\theta+\lambda\theta t^{\alpha}} L(1,t) - t \quad ; t \geq 0$$

Where,

$$L(1,t) = \lambda^{-\frac{1}{\alpha}} \left[\left(1 - \frac{\theta}{2-\theta}\right) \Gamma\left(\frac{1}{\alpha} + 1, \lambda x^{\alpha}\right) + \left(\frac{\theta}{2-\theta}\right) \Gamma\left(\frac{1}{\alpha} + 2, \lambda x^{\alpha}\right) \right]$$

We have tried different combinations of the parameters to fit the life expectancy curve of India from SRS based life tables. We have found no single value of the parameters that satisfy the life expectancy curve. Finally, for $\lambda = 1 \; and \; \theta = \frac{1}{2}$ and varying values of α, life expectancy at different ages can be obtained. That is, $\alpha = \alpha(t)$. However, we have observed that for the present PBE2 distribution, the values of α becomes nearly zero at old ages. Therefore, a new transformation is necessary to fit the life expectancy of Indian data.

Objectives:

The following are the objectives of the present study:

1. To develop a new three-parameter generalization of the BE2 distribution suitable for studying monotone as well as non-monotone failure rates.
2. To determine the parameters $\alpha = \alpha(t)$ for different ages (t) from life expectancies in six SRS life tables of India across age and across time periods.
3. To predict the life expectancies for a future time period by fixing two of the three parameters at constant levels and studying the trend of the third.

MATERIALS AND METHODS

We have taken six SRS life tables of India (Male, Total) from 2008-12 to 2013-17 as our data. A New three parameter distribution is obtained by the transformation $X = T^{\alpha}$ (instead of the transformation $X = T^{\frac{1}{\alpha}}$ as taken by Habibi and Asgharzadeh (2017) in the BE2 distribution.

The probability differential of BE2 distribution is given by

$$dF(t) = \left\{1 + \frac{(\lambda t-1)\theta}{2-\theta}\right\}\lambda e^{-\lambda t}dt \qquad ; t > 0$$

By considering the transformation $X = T^{\alpha}$, The probability differential of X is obtained as

$$dF(x) = \frac{\lambda}{\alpha}x^{\frac{1}{\alpha}-1}\left\{1 + \frac{\left(\lambda x^{\frac{1}{\alpha}}-1\right)\theta}{2-\theta}\right\}e^{-\lambda x^{\frac{1}{\alpha}}}dx$$

Therefore, the pdf of X is given by

$$f(x) = \frac{\lambda}{\alpha}x^{\frac{1}{\alpha}-1}\left\{1 + \frac{\left(\lambda x^{\frac{1}{\alpha}}-1\right)\theta}{2-\theta}\right\}e^{-\lambda x^{\frac{1}{\alpha}}} \qquad ; x > 0 \qquad (2)$$

If we put $\lambda=1$,$\theta = \frac{1}{2}$ in (1) we have pdf of X as

$$f(x) = \frac{1}{\alpha}x^{\frac{1}{\alpha}-1}\left\{1 + \frac{\left(x^{\frac{1}{\alpha}}-1\right)}{3}\right\}e^{-x^{\frac{1}{\alpha}}} \qquad ; x > 0 \qquad (3)$$

and survival function of X is given by

$$S(x) = P(X > x) = \left\{1 + \frac{x^{\frac{1}{\alpha}}}{3}\right\} e^{-x^{\frac{1}{\alpha}}} \qquad ; x > 0, \lambda > 0 \qquad (4)$$

The survival function of the residual life $X_{(t)} = X - t | X > t$, for $t \geq 0$ for the new distribution is

$$S_{X_{(t)}}(x) = \frac{S(x+t)}{S(t)} \qquad ; x > 0$$

And the corresponding pdf is

$$f_{X_{(t)}}(x) = \frac{f(x+t)}{S(t)}$$

$$= \frac{\frac{1}{\alpha}(x+t)^{\frac{1}{\alpha}-1}\left\{1+\frac{(x+t)^{\frac{1}{\alpha}}-1}{3}\right\}e^{-(x+t)^{\frac{1}{\alpha}}}}{S(t)}$$

Where S(.) is the survival function given by (3) , consequently the hazared rate function of $X_{(t)}$ is

$$h_{X_{(t)}}(x) = \frac{f_{X_{(t)}}(x)}{S_{X_{(t)}}(x)}$$

$$= \frac{f(x+t)}{S(x+t)}$$

$$= \frac{\frac{1}{\alpha}(x+t)^{\frac{1}{\alpha}-1}\{2+(x+t)^{\frac{1}{\alpha}}\}}{\{3+(x+t)^{\frac{1}{\alpha}}\}}$$

Further, the mean residual life (life expectancy) is obtain as follows

$$K(t) = E(X_{(t)})$$

$$= \frac{1}{S(t)} \int_t^{\infty} x f(x) dx - t$$

$$= \frac{1}{S(t)} \int_t^{\infty} x \frac{1}{\alpha} x^{\frac{1}{\alpha}-1} \left\{1 + \frac{x^{\frac{1}{\alpha}}-1}{3}\right\} e^{-x^{\frac{1}{\alpha}}} dx - t$$

$$= \frac{1}{S(t)} \left\{\frac{2}{3}\Gamma(\alpha+1, t) + \frac{1}{3}\Gamma(\alpha+2, t)\right\} - t$$

$$= \frac{3}{(3+t^{\frac{1}{\alpha}})e^{-t^{\frac{1}{\alpha}}}} \left\{\frac{2}{3}\Gamma(\alpha+1, t) + \frac{1}{3}\Gamma(\alpha+2, t)\right\} - t$$

Or $$K(t) = \frac{e^{t^{\frac{1}{\alpha}}}}{3+t^{\frac{1}{\alpha}}}\{2\Gamma(\alpha+1,t) + \Gamma(\alpha+2,t)\} - t \quad (5)$$

Note that in this case α varies with t, i.e., $\alpha = \alpha(t)$.

RESULTS AND DISCUSSION

We have estimated different values of α to obtain the life expectancies at different ages from the SRS life tables (Table 1). From the variations of α over age and over time period we have found that α varies linearly over time period and over age. We have fitted a set of regression lines (Table 2) to fit α for different ages (t) over years, where years are the mid-year of the time period of SRS life tables (for example year =2010 for the SRS life table of 2008-12). Tables 3.1 to 3.6 give the estimated α's for different ages and the observed and estimated life expectancies for the SRS life tables we considered. Putting Year = 2016 we can predict the α's for different ages for the 2014-18 period. Then we can use these values to estimate K(t) for different t by (5). That is, we can estimate the life expectancies for different ages for the period 2014-18 (which have not been published yet) and consequently, the whole life table for that period by indirect methods. Table 4 presents the predicted life expectancies for the period 2014-18.Similarly we can estimate the life expectancies for different ages for the periods 2015-19;2016-20;2017-21;2018-22….etc. Table 5,6,7 and 8 presents the predicted life expectancies for the period 2015-19;2016-20;2017-21 and 2018-22 respectively.

Table 1. Estimated values of α across time period and across age

YEARS	α					
	2008-12	**2009-13**	**2010-14**	**2011-15**	**2012-16**	**20013-17**
0	4.094	4.098	4.103	4.108	4.112	4.116
1	3.687	3.690	3.693	3.697	3.701	3.704
5	3.8319	3.8343	3.8371	3.8396	3.8416	3.8441
10	4.7786	4.7805	4.7818	4.7841	4.7861	4.7876
15	5.8424	5.8442	5.8452	5.8472	5.8489	5.8498
20	6.9018	6.9033	6.9043	6.9055	6.9069	6.9084
25	7.9395	7.9404	7.9416	7.9426	7.9438	7.9448
30	8.9539	8.9547	8.9555	8.9563	8.9576	8.9584
35	9.9466	9.9474	9.9481	9.9489	9.9499	9.9507
40	10.9209	10.9215	10.9223	10.9231	10.9237	10.9242
45	11.8783	11.8791	11.8794	11.8801	11.8807	11.8811
50	12.8213	12.8216	12.8223	12.8226	12.8233	12.8236
55	13.7508	13.7514	13.7518	13.7521	13.7527	13.7531
60	14.6692	14.6698	14.6701	14.6704	14.6711	14.6714

65	15.5771	15.5774	15.5777	15.5780	15.5786	15.5786
70	16.4763	16.4763	16.4763	16.4763	16.4769	16.4769
75	17.3672	17.3668	17.3662	17.3660	17.3660	17.3660
80	18.2517	18.2496	18.2480	18.2475	18.2472	18.2470
85	19.1248	19.1244	19.1228	19.1221	19.1218	19.1213

Table 2. The parameters of fitted regression lines for α at age t over different years [α (t, year) = a(t)+b(t)*year]:

Age (t)	a(t) (Intercept)	b(t) (Slope)	R^2
0	-4.92233	0.004486	0.999
1	-3.31967	0.003486	0.997
5	-1.0724	0.00244	0.999
10	1.097367	0.001831	0.998
15	2.793033	0.001517	0.995
20	4.317533	0.001286	0.996
25	5.774367	0.001077	0.999
30	7.116067	0.000917	0.993
35	8.2926	0.000823	0.997
40	9.548367	0.000683	0.994
45	10.75853	0.000557	0.990
50	11.8507	0.000483	0.987
55	12.84923	0.000449	0.992
60	13.79633	0.000434	0.984
65	14.9224	0.000326	0.967
70	16.2005	0.000137	0.686
75	17.86087	-0.00025	0.804
80	20.0425	-0.00089	0.836
85	20.61787	-0.00074	0.940

Table 3.1: Estimated α, Γ(α+1, *t*), Γ(α+2, *t*), estimated and SRS life expectancies for different ages, India (male, Total, 2008-12):

2008-12					
Age (t)	**α**	$\Gamma(\alpha+1,t)$	$\Gamma(\alpha+2,t)$	**Est. L.E**	**SRS L.E**
0	4.094	27.67695	140.9864	65.45	65.4
1	3.687	15.05138	70.91368	67.65	67.6
5	3.8319	7.66363	53.0949	64.32	64.3
10	4.7786	4.685209	54.34207	59.63	59.6
15	5.8424	3.534462	58.29325	54.81	54.8
20	6.9018	2.904654	62.2698	50.14	50.1
25	7.9395	2.496832	65.92406	45.63	45.6
30	8.9539	2.204815	69.18356	41.17	41.1
35	9.9466	1.981212	72.03625	36.67	36.6
40	10.9209	1.809324	74.80627	32.38	32.3
45	11.8783	1.670556	77.40146	28.15	28.1
50	12.8213	1.560284	80.07784	24.16	24.1
55	13.7508	1.468378	82.68999	20.25	20.2
60	14.6692	1.397078	85.64945	16.75	16.7
65	15.5771	1.340283	88.84839	13.54	13.5
70	16.4763	1.297951	92.75328	11.00	10.9
75	17.3672	1.2726	97.0876	8.87	8.8
80	18.2517	1.2634	102.694	7.84	7.1
85	19.1248	1.2404	107.025	5.73	5.7

Table 3.2. Estimated α, Γ(α+1, *t*), Γ(α+2, *t*), estimated and SRS life expectancies for different ages, India (male, Total, 2009-13):

2009-13					
Age (t)	**α**	**Γ(α+1, *t*)**	**Γ(α+2, *t*)**	**Est. L.E**	**SRS L.E**
0	4.098	27.84654	141.9616	65.88	65.8
1	3.69	15.11678	71.26556	67.98	67.9
5	3.8343	7.698836	53.34566	64.62	64.6
10	4.7805	4.707009	54.59654	59.94	59.9
15	5.8442	3.552317	58.58849	55.15	55.1
20	6.9033	2.918031	62.55695	50.45	50.4
25	7.9404	2.504196	66.11865	45.83	45.8
30	8.9547	2.2109	69.37461	41.36	41.3
35	9.9474	1.986915	72.24368	36.87	36.8
40	10.9215	1.813368	74.97353	32.54	32.5
45	11.8791	1.67569	77.63937	28.37	28.3
50	12.8216	1.562128	80.17251	24.25	24.2
55	13.7514	1.471933	82.89027	20.43	20.4
60	14.6698	1.400538	85.86187	16.94	16.9
65	15.5774	1.342115	88.95959	13.64	13.6
70	16.4763	1.297951	92.75328	11.00	10.9
75	17.3668	1.2518	96.9184	8.69	8.7
80	18.2496	1.2634	101.75	7.05	7.0
85	19.1244	1.2382	106.834	5.57	5.5

Table 3.3. Estimated α, Γ(α+1, *t*), Γ(α+2, *t*), estimated and SRS life expectancies for different ages, India (male, Total, 2010-14):

2010-14					
Age (t)	**α**	**Γ(α+1, *t*)**	**Γ(α+2, *t*)**	**Est. L.E**	**SRS L.E**
0	4.103	28.06011	143.1908	66.44	66.4
1	3.693	15.18249	71.61931	68.31	68.3
5	3.8371	7.740116	53.63973	64.98	64.9
10	4.7818	4.721984	54.77135	60.16	60.1
15	5.8452	3.562275	58.75315	55.34	55.3
20	6.9043	2.926983	62.74912	50.66	50.6
25	7.9416	2.514048	66.37899	46.10	46.1

30	8.9555	2.217002	69.56618	41.55	41.5
35	9.9481	1.991918	72.42566	37.05	37.0
40	10.9223	1.818775	75.19713	32.76	32.7
45	11.8794	1.677619	77.72878	28.46	28.4
50	12.8223	1.56644	80.39384	24.45	24.4
55	13.7518	1.474307	83.02406	20.55	20.5
60	14.6701	1.402271	85.96779	17.04	17.0
65	15.5777	1.343234	89.07091	13.74	13.7
70	16.4763	1.297951	92.75328	11.00	10.9
75	17.3662	1.266	96.583	8.43	8.5
80	18.248	1.2403	100.815	6.23	6.4
85	19.1228	1.2256	105.745	4.64	4.9

Table 3.4. Estimated α, Γ(α+1, *t*), Γ(α+2, *t*), estimated and SRS life expectancies for different ages, India (male, Total, 2011-15):

		2011-15			
Age (t)	**α**	**Γ(α+1, *t*)**	**Γ(α+2, *t*)**	**Est. L.E**	**SRS L.E**
0	4.108	28.27548	144.4312	66.99	66.9
1	3.697	15.2706	72.0939	68.75	68.7
5	3.8396	7.777163	53.90369	65.30	65.2
10	4.7841	4.748595	55.08199	60.53	60.5
15	5.8472	3.582276	59.08387	55.72	55.7
20	6.9055	2.937762	62.98051	50.92	50.9
25	7.9426	2.522288	66.59672	46.33	46.3
30	8.9563	2.223121	69.75829	41.75	41.7
35	9.9489	1.997652	72.63421	37.26	37.2
40	10.9231	1.824198	75.4214	32.97	32.9
45	11.8801	1.682129	77.93779	28.65	28.6
50	12.8226	1.568292	80.48889	24.54	24.5
55	13.7521	1.476093	83.12447	20.65	20.6
60	14.6704	1.404006	86.07383	17.13	17.1
65	15.578	1.345069	89.18236	13.84	13.8
70	16.4763	1.297951	92.75328	11.00	10.9
75	17.366	1.266	96.583	8.43	8.4
80	18.2475	1.2403	100.815	6.23	6.2
85	19.1221	1.2256	105.745	4.64	4.6

Table 3.5. Estimated α, Γ(α+1, *t*), Γ(α+2, *t*), estimated and SRS life expectancies for different ages, India (male, Total, 2012-16):

		2012-16			
Age (t)	**α**	**Γ(α+1, *t*)**	**Γ(α+2, *t*)**	**Est. L.E**	**SRS L.E**
0	4.112	28.44908	145.4317	67.44	67.4
1	3.701	15.35928	72.57186	69.19	69.1
5	3.8416	7.806929	54.1158	65.56	65.5
10	4.7861	4.771857	55.35355	60.86	60.8
15	5.8489	3.599365	59.36645	56.05	56.0
20	6.9069	2.950388	63.25154	51.22	51.2
25	7.9438	2.532212	66.85895	46.61	46.6
30	8.9576	2.233101	70.07158	42.07	42.0
35	9.9499	2.004842	72.89574	37.51	37.5
40	10.9237	1.828275	75.59004	33.13	33.1
45	11.8807	1.686005	78.11739	28.82	28.8
50	12.8233	1.572621	80.71109	24.75	24.7
55	13.7527	1.479665	83.32578	20.83	20.8
60	14.6711	1.408041	86.32233	17.35	17.3
65	15.5786	1.348746	89.41751	14.05	14.0
70	16.4769	1.300158	92.91421	11.14	11.0
75	17.366	1.266	96.583	8.43	8.4
80	18.2472	1.2386	100.682	6.12	6.1
85	19.1218	1.224	105.603	4.52	4.5

Table 3.6. Estimated α, Γ(α+1, *t*), Γ(α+2, *t*), estimated and SRS life expectancies for different ages, India (male, Total, 2013-17):

		2013-17			
Age (t)	**α**	**Γ(α+1, *t*)**	**Γ(α+2, *t*)**	**Est. L.E**	**SRS L.E**
0	4.116	28.62384	146.4396	67.90	67.8
1	3.704	15.42616	72.93254	69.53	69.5
5	3.8441	7.8443	54.38213	65.88	65.8
10	4.7876	4.789378	55.55811	61.11	61.1
15	5.8498	3.608445	59.5166	56.22	56.2
20	6.9084	2.963975	63.54322	51.54	51.5
25	7.9448	2.540511	67.07826	46.84	46.8
30	8.9584	2.239264	70.26508	42.26	42.2

35	9.9507	2.010613	73.10564	37.72	37.7
40	10.9242	1.831681	75.73086	33.27	33.2
45	11.8811	1.688593	78.23735	28.93	28.9
50	12.8236	1.574479	80.80651	24.83	24.8
55	13.7531	1.48205	83.46027	20.95	20.9
60	14.6714	1.409783	86.42877	17.45	17.4
65	15.5786	1.348746	89.41751	14.05	14.0
70	16.4769	1.300158	92.91421	11.14	11.0
75	17.366	1.266	96.583	8.43	8.4
80	18.247	1.2375	100.593	6.05	6.0
85	19.1213	1.2212	105.368	4.33	4.3

Table 4. Estimated α, Γ(α+1, *t*), Γ(α+2, *t*), estimated life expectancies for different ages, India (male, Total, 2014-18):

		2014-18		
Age (t)	**α**	**Γ(α+1, *t*)**	**Γ(α+2, *t*)**	**Est. L.E**
0	4.121446	28.86367	147.8237	68.52
1	3.708106	15.51822	73.42931	69.99
5	3.84664	7.882455	54.65409	66.21
10	4.788663	4.801834	55.70352	61.29
15	5.851305	3.62368	59.76853	56.51
20	6.910109	2.979532	63.87719	51.90
25	7.945599	2.547162	67.254	47.02
30	8.964739	2.288706	71.81733	43.84
35	9.951768	2.018342	73.38679	38.00
40	10.9253	1.83916	76.04018	33.56
45	11.88144	1.69081	78.34007	29.03
50	12.82443	1.579621	81.07046	25.08
55	13.75441	1.489924	83.90353	21.35
60	14.67127	1.409063	86.38362	17.41
65	15.57962	1.354714	89.79487	14.38
70	16.47669	1.299393	92.85839	11.09
75	17.35687	1.2171	92.847	5.22
80	18.24826	1.24465	101.17	6.54
85	19.12603	1.2471	107.599	6.21

Table 5. Estimated α, Γ(α+1, *t*), Γ(α+2, *t*), estimated life expectancies for different ages, India (male, Total, 2015-19):

2015-19				
Age (t)	**α**	$\Gamma(\alpha+1,t)$	$\Gamma(\alpha+2,t)$	**Est. L.E**
0	4.125932	29.06286339	148.97426151	69.03
1	3.711592	15.59685832	73.8539123	70.75
5	3.84908	7.91928391	54.91663979	66.52
10	4.790494	4.82336553	55.95489891	61.59
15	5.852822	3.63910191	60.02354942	56.80
20	6.911395	2.99129263	64.12964720	52.18
25	7.946676	2.55615455	67.49162554	47.27
30	8.965656	2.29594816	72.04470069	44.06
35	9.952591	2.02431932	73.60419136	38.21
40	10.925978	1.84384045	76.23375403	33.75
45	11.881999	1.69442558	78.50764371	29.18
50	12.824911	1.58262873	81.22482064	25.21
55	13.754863	1.49262127	84.05553181	21.48
60	14.671708	1.411570429	86.53838829	17.54
65	15.579942	1.35620905	89.91646066	14.48
70	16.476829	1.30295315	92.89266696	11.12
75	17.35662	1.21558002	92.73473915	5.12
80	18.24737	1.23956984	100.7570837	6.18
85	19.12529	1.24315685	107.2591475	5.92

Table 6. Estimated α, $\Gamma(\alpha+1,t)$, $\Gamma(\alpha+2,t)$, estimated life expectancies for different ages, India (male, Total, 2016-20)

2016-20				
Age (t)	**α**	**$\Gamma(\alpha+1,t)$**	**$\Gamma(\alpha+2,t)$**	**Est. L.E**
0	4.130418	29.26356202	150.13430537	69.55
1	3.715078	15.67593488	74.281135153	70.78
5	3.85152	7.956287723	55.180471540	66.84
10	4.792325	4.844993584	56.207411900	61.89
15	5.854339	3.654589396	60.279657762	57.10
20	6.912681	3.003099397	64.383107223	52.45
25	7.947753	2.565178780	67.730087805	47.52
30	8.966573	2.303213210	72.272790754	44.29
35	9.953414	2.030313864	73.822233040	38.42
40	10.926661	1.848533002	76.427820538	33.93
45	11.882556	1.698049338	78.675577612	29.34
50	12.825394	1.585641708	81.379479580	25.36
55	13.755312	1.495325035	84.207811167	21.62
60	14.672142	1.414094028	86.693117798	17.68
65	15.580268	1.358064590	90.039493505	14.59
70	16.476966	1.303714992	92.946985589	11.17
75	17.35637	1.214263536	92.634300161	5.03
80	18.24648	1.234727567	100.36346291	5.84
85	19.12455	1.239063009	106.90591476	5.62

Table 7. Estimated α, $\Gamma(\alpha+1,t)$, $\Gamma(\alpha+2,t)$, estimated life expectancies for different ages, India (male, Total, 2017-21)

2017-21				
Age (t)	**α**	$\Gamma(\alpha+1,t)$	$\Gamma(\alpha+2,t)$	Est. **L.E**
0	4.134904	29.46577418	151.30392174	70.07
1	3.718564	15.75545450	74.710999855	71.18
5	3.85396	7.993466767	55.445590125	67.16
10	4.794156	4.866718847	56.461067624	62.20
15	5.855856	3.670142850	60.536859930	57.39
20	6.913967	3.014952784	64.637569453	52.73
25	7.94883	2.574234875	67.969392816	47.77
30	8.96749	2.310501246	72.501603053	44.53
35	9.954237	2.036326158	74.040920700	38.64
40	10.927344	1.853237495	76.622381105	34.12
45	11.883113	1.701680845	78.843870747	29.50
50	12.825877	1.588660413	81.534433008	25.50
55	13.755761	1.498033690	84.360366406	21.76
60	14.672576	1.416622139	86.848123961	17.82
65	15.580594	1.361897517	90.293638666	14.81
70	16.477103	1.304477277	93.001335981	11.22
75	17.35612	1.212948478	92.533969948	4.94
80	18.24559	1.229904208	99.971379834	5.51
85	19.12381	1.234982643	106.55384530	5.32

Table 8. Estimated α, $\Gamma(\alpha+1,t)$, $\Gamma(\alpha+2,t)$, estimated life expectancies for different ages, India (male, Total, 2018-22):

2018-22				
Age (t)	**α**	**$\Gamma(\alpha+1,t)$**	**$\Gamma(\alpha+2,t)$**	**Est. L.E**
0	4.13939	29.66951196	152.48319312	70.60
1	3.72205	15.83541982	75.143523615	71.58
5	3.8564	8.030821885	55.712001929	67.48
10	4.795987	4.888541765	56.715871276	62.51
15	5.857373	3.685762554	60.795160601	57.69
20	6.915253	3.026852976	64.893037858	53.01
25	7.949907	2.583322949	68.209543560	48.02
30	8.968407	2.317812346	72.731139875	44.76
35	9.95506	2.042356258	74.260256259	38.85
40	10.928027	1.857953961	76.817436998	34.30
45	11.88367	1.705320119	79.012523895	29.66
50	12.82636	1.591684866	81.689681492	25.64
55	13.75621	1.500747252	84.513198032	21.90
60	14.67301	1.419154770	87.003407280	17.96
65	15.58092	1.361783285	90.286064475	14.80
70	16.47724	1.305240008	93.055718154	11.26
75	17.35587	1.211634844	92.433748403	4.86
80	18.2447	1.225099692	99.580828494	5.18
85	19.12307	1.230915715	106.20293532	5.03

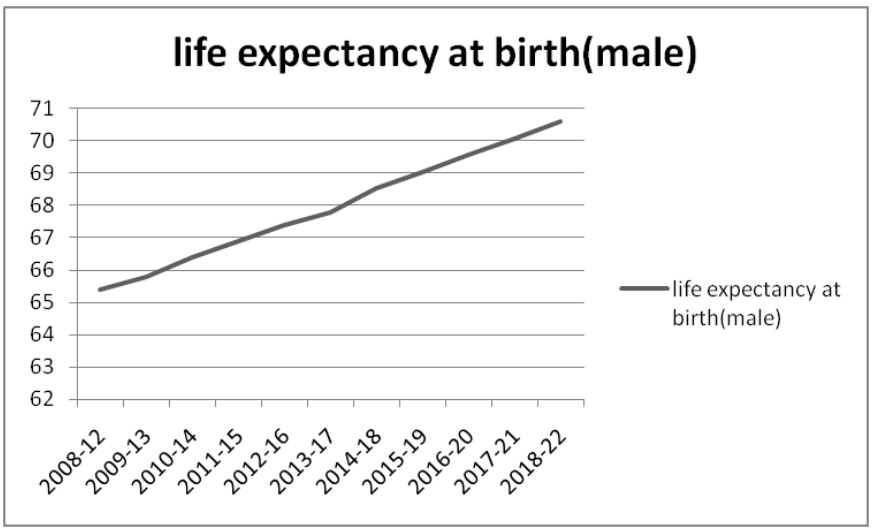

Figure 1. Life expectancy at birth (male), 2008-2022

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Re-reading William Wordsworth and Thomas Hardy in Eco-Critical Perspective

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ABSTRACT

Reading literature in ecocritical perspective is a late 20th century trend and it centers round the idea of discovering or rediscovering how literature and environment are interrelated. William Wordsworth and Thomas Hardy are two prominent literary personalities whose poems explicitly emphasize on this interrelationship and how literature is a stakeholder in the whole discourse on environmental issues. Ecocritical reading demonstrates that just as Wordsworth cannot be dismissed simply as a romantic poet or a worshipper of nature, in the same way, Hardy's dealing with the objects of nature and natural scenes also cannot be relegated simply to his fondness for such objects. What is important about them is why did they unequivocally dealt with nature with such an acuteness, though they are unalike in their approach to nature. Hardy started his career as a poet nearly a hundred years after Wordsworth established himself as a poet. During these hundred years radical changes loomed in English life. These changes have a far-reaching effect on the making of Hardy as a poet of nature and more so why in his poetry protection of the environment has been presented as a concern. Hence, while studying their poetry in the vein of ecocritical reading, it becomes pertinent to consider the factors behind the changes in Victorian England to understand greater nuances involved in the concern for global deterioration of environment in the contemporary age.

INTRODUCTION

The discourse on the environmental issues is not very old and it stems from the realization that the environment has increasingly been hazardous for the survival of mankind. In the global concern for the deterioration of the ecosystem, not only the environmentalists, but people from other disciplines also, including literature written in various languages around the world, especially, English literature, have contributed a lot. That English literature, be it poetry, fiction and non-fiction, has played an active role in deciphering various issues concerning the environment can be understood from the poetry of William Wordsworth (1770 - 1850) and Thomas Hardy (1840 - 1928) when these are read in an ecocritical perspective. Both these two poets belong to two different literary periods. Wordsworth started his career as a poet in 1793 with the publication of *An Evening Walk*, a collection of poems. However, his *Lyrical Ballads* which he published in collaboration with S.T. Coleridge in 1798 gave him distinctiveness as a poet. It was such a work which marked the advent of a new kind of poetry, commonly known as Romantic poetry. After that he published *Poems in Two Vol-*

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umes in 1807 and *The Excursion* in 1814. During the period between 1820-35, he devoted himself to writing sonnets. Hardy, who is basically known as a novelist, has published six volumes of poetry. His first volume of poetry, *Wessex Poems and other Verses* (1898), was published a hundred years after the publication of *Lyrical Ballads* of Wordsworth and Coleridge and this is a very long period if considered the rapidity with which English life underwent changes in the Victorian England. This transition also had a far-reaching impact on man's attitude to the environment and Hardy's poetry is significant in understanding how man's changing attitude is at the core of environmental degradation.

Theoretical Framework

The theoretical framework of this paper is ecocriticism, a literary theory which originates in the phrase 'literary ecology' coined by Joseph Meeker (Meeker, 1972) and was propounded as a theory by William Ruekart (Ruekart, 1996). A comprehensible definition of the theory was given by Cherryll Glotfelty. That literature also has a voice for the protection of the ecosystem remained unexplored or ignored until recently when from 1970 the relationship between literature and environment became a topic for serious and widespread discussion, and the relationship between literature and environment was formalized in 1990 when the University of Nevada, Reno took the first initiative of creating the first academic position in Literature and the Environment. As defined by Glotfelty, ecocriticism objectifies the study of how literature and the physical environment are correlated with an 'earth-centered approach' (Cheryll Glotfelty, 1996). Eco critics consider that when a man reclines amidst a pastoral environment, he simply is moved by the idea of nature as stable and as having its own power to endure as well as to counter any disruptive energy emanated from the actions of human beings. Similarly, when a poet refers to 'wilderness', it signifies nature as pure or free from contamination inflicted by civilization (Garrard, 2013).

OBJECTIVES AND METHODS

This paper centers round the following objectives.

a) Environment as presented in the selected poems of William Wordsworth and Thomas Hardy.
b) The dichotomy between Wordsworth and Hardy in their concern for the environment.
c) Relevance of reading poetry of Wordsworth and Hardy in understanding and addressing environmental issues.

To arrive at the objectives the author has adopted descriptive and analytical method for presenting and analyzing data collected from the primary and secondary sources supported by observation as key technique. Primary sources are the poems of Wordsworth and Hardy selected for the purpose of analysis. All other books or journals used for the purpose of analysis and corroboration are the secondary sources.

Ecocritical Reading of Selected Poems of Wordsworth

Wordsworth has been associated with 'Romantic ecology', a phrase popularized by Jonathan Bate in his book, and acknowledged as a pioneer of running an 'environmental tradition' (Coupe, 2000). The uniqueness of Wordsworth lies in the fact that he has presented in his poetry an account of how man is related to nature. He had a 'great romantic vision of cosmic unity' (Gerard, 1991) and considered all created things as part of a unified whole. His "Lines Written a Few Miles Above Tintern Abbey, on Revisiting the Banks of the Wye during a Tour, 13 July 1798", commonly known as "Tintern Abbey" and which was included in *Lyrical Ballads*, expresses the indispensability of nature in human life. Here the poet gives an account of how he was moved by the landscape of Tintern Abbey which was tinged with beauteous forms of nature such as the river Wye making a soft murmuring sound as it rolls from mountain springs, mountain cliffs, the sky above, trees, orchard tufts, hedge-rows and cottage

-ground. He had been absent from this beautiful landscape for long five years and during that period the memories of the beauteous scenes had been a source of pleasure which refreshed his troubled and wearied mind. So, he writes,

'But oft, in lonely rooms, and 'mid the din
Of towns and cities, I have owed to them
In hours of weariness, sensations sweet…' (line 25 -27)

The poet has not forgot to emphasize on the moral influence of nature. When he considers nature as teacher, mother and guardian and nurse of man, he actually emphasizes the communion between man and nature. It is nature which leads man 'from joy to joy' (line 125) and breeds lofty thoughts and ideals in the mind of human beings. In other words, nature is the true friend, philosopher and guide. So, he advises his sister, Dorothy, to allow the mountain bridge blow on her when she undertakes a 'solitary walk' (line 135). However, the poet is very much disturbed because of the selfishness of people of his time which made them blind even to the beauty of nature. So, in the poem "To Milton", he invites Milton to take a rebirth and give them 'manners, virtue, freedom, power' (line 8).

Wordsworth thinks that it is not the primary experience of a beauteous sight that only gives pleasure, the remembrance of it at any moment in life also has meaning in man's life. Hence in "The Daffodils" the poet mentions how the sight of ten thousand daffodils 'tossing their heads in sprightly dance' (line 12.) was a source of pleasure for him even when he was away from them.

'For oft, when on my couch I lie
In vacant or in pensive mood,
They flash upon that inward eye
Which is the bliss of solitude;
And then my heart with pleasure fills' (lines 19-23)

The earth is a composite whole of various living and non-living things. Grass, trees, hills, mountains, springs, rivers and birds are some of its constituents which the poet frequently mentions in his poetry. In "To the Cuckoo" he praises the cuckoo as a 'blessed bird' (line 29) and 'darling of the spring' (line 13) for its unmatched voice which the poet hears while 'lying on the grass' (line 5) passing from 'hill to hill' (line 7). Similarly, in "To the Skylark" the poet praises the skylark for the music she pours into the earth from the sky and hence calls her 'Ethereal minstrel' and 'pilgrim of the sky'. Like the songs of the birds, the murmuring sound of a spring is also significant. In "The Fountain, A Conversation" the poet mentions how the 'pleasant tune' (line 10) of a fountain invigorates man.

'And here, on this delightful day,
I cannot choose but think
How oft, a vigorous man, I lay
Beside this fountain's brink' (lines 55-58).

In the sonnet "The World is Too Much with Us" the poet says that people are too much busy with the materialistic thoughts which have put them into oblivion about the role nature plays in man's life. The poet laments that the beauteous sight of the sea in moonlight, the 'howling' of wind throughout the day and its becoming very gentle like 'sleeping flowers' at night also fail to move these people (lines 5-7). So, he says that even though the people of his time failed to receive the gift of nature, he will not miss it and will stand by the pleasant sea to have a glimpse of old pagan gods Proteus 'rising from the sea' (line 13) or hear the Triton 'blow his wreathed horn' (line 14).

In "The Ode to the Intimations of Immortality" which was published in 1807, the poet focuses on the dichotomy between a child and a grown-up in their approach to nature. Referring to his childhood memories the poet says that he considered the objects, like meadows, forest, stream, rainbows, rose, the moon, the starry sky and sunshine as a divine gift of nature; but as he is grown-up, he does not feel the rapturous joy in them. So, he writes,

'Now, while the birds thus sing a joyous song
And while the young lambs bound
As to the tabor's sound,

To me alone there came a thought of grief' (lines 19-22)

"Lines Written in Early Spring" is another poem which describes the beauties of nature in early spring. Here the poet says that the flowers, leaves and birds – all are creatures created according to a divine plan. All these creatures are happy to be a part of this holy plan of nature; but man has become a stranger to this bliss. So, he laments with the question 'what man has made of man?' (line 24). The poet feels that the earth entices man by offering earthly pleasures and comforts which ultimately make him detached from nature. The child, on the other hand, follows the footsteps of the elders and because of that it takes the path treaded on by the elders. This makes the child gradually lose the heavenly ideals or love for nature as he grows up. The poet feels that his loss of childhood vision has been compensated by another vision which is more vital and more mature. Instead of that rapturous vision, now he has learnt how to look at the commonplace objects of nature with sobriety and perceive the presence of something nobler and wiser in all such objects.

Wordsworth's concept of nature also rests on his belief in animism. The word 'animism', according to *The Cambridge Advanced Learners Dictionary* (2003), is the belief that all the natural things, such as plants, inanimate objects and natural phenomena contain a spirit. It was Sir Edward Burnett Tylor who brought forth the concept of animism into academic discourse and pioneered the study on animism. The doctrine of animism, according to him, is man's recognition of 'the operation of personal life and will' (Tylor, 1871). In the poem "It is a Beauteous Evening Calm and Free" while giving a beautiful picture of the calm sunset the poet says that the whole scene is a manifestation of a 'mighty Being' (line 6) whose presence can be felt in the thunderous sound of the sea. In "The World is Too Much with Us" the poet sees god rising from the sea implying the existence of spirit in the waves of the sea. His conviction finds explicit expression in "Tintern Abbey' where he mentions his perception that in every object of nature there is a 'motion and a spirit' (line 102).

Ecocritical Reading of Selected Poems of Hardy

Thomas Hardy, is 'much more widely famous for his novels than for any other part of his work' and is 'by nature poet rather than story teller or playwright' (King, 1979). However, be it poetry, novel or short story, he scarcely writes anything without a reference to nature. In his writings, nature co-exists with man. He perceives nature mainly from two perspectives: sometimes as a benevolent force and very often as indifferent to the existence of mankind and its sufferings. His earlier poems are chiefly nature poems where nature is portrayed as a companion of human beings; but in his later poems nature's indifference to the existence of mankind is depicted. He believes that man is an object of nature and suffers for his own actions. In his poem "Domicilium" he followed Wordsworth and gives a description of his father's cottage lying in the midst of nature. His preoccupation with the flora and fauna finds expression in the poem. The poet shows how nature seems to engulf the entire cottage, as if, it is wishing to consume it in the long run. The cottage is covered by 'a veil of boughs' (line 2) and 'wild honeysucks' (lines 3-4). Here he depicts how nature can exercise a conscious perversity against the tiresome construction works of man. He then talks of the wild growth of the red roses, lilacs, herbs, esculents, fields, distant hills and the oak grown from the droppings of some birds. He thus shows the affinity of nature with the man-made cottage and its inhabitants. This is further strengthened with the mention of the snakes, newts and bats in the last stanza. Human and nature co-exist in the countryside as the village people are primarily dependent upon nature for everything. Nature is their constant companion and hence they love and respect her. Hardy in this nature poem also shows the distance between man and his immediate neighbours who are the furze cutters.

In his later poems Hardy focuses on ani-

mals, birds and trees and man's exploitation and cruelty towards them. He is sympathetic to animals and he expresses his inability that he could do little for dumb animals. Throughout his life he campaigned against cruelty to animals and birds. His compassion for the animal kingdom is touchingly humane. This is reflected in poems like "Afterwards" where he shows his concern for hedgehogs and expresses that even an 'innocent creature' like hedgehog 'should come to no harm' (line 11) because it has a right to live besides having a value and worth of its own. Again, in "The Blinded Bird" he puts forward his compassionate feeling to a blind bird. According to him, the bird has suffered long, but is tolerant to all its sufferings; it is pure in its heart and is happy.

In poems like "Neutral Tones", nature is portrayed as a being neutral or indifferent to the sufferings or conditions of human beings. Nature in this poem is just an on looker and do not console the heart broken lover. It is cold and lacks colour and thereby perfectly match the emotions of the two lovers involved, unlike in "Domicilium" where nature is vibrant. He uses ordinary images and symbols, such as ponds, winter day, leaves, winter sun to create an atmosphere of doom and somehow feel sinister. The barren winter soil on which 'a few leaves lay' reinforces the impression of something that is alive otherwise everything in nature lacks strength. In "Friends Beyond", he picturizes how nature is indifferent to the chances and changes of human life.

In "Voices from Things Growing in a Churchyard" the poet gives a picture of the remoteness or aloofness of nature from human beings. In this poem flowers whisper among themselves in the voice of the humans whose death has given them birth in a graveyard.

'These flowers are I, poor Fanny Hurd,
Sir or Madam
A Little girl here sepultures.
Once I flitted like a bird
Above the grass, as now I wave
In daisy shapes above my grave,
All day cherrily
All night eerily!' (lines 1-8)

ANALYSIS

Though nature is the prime concern in the poetry of both Wordsworth and Hardy, they hold a dichotomous view in their approach of dealing with nature; while Wordsworth considers nature as a guiding force, anchor and nurse, Hardy establishes the indifference of nature to human beings. Wordsworth depicted nature as a living force which has a capacity to heal human being. Hardy, on the other hand, never depicted nature as a nurse and guardian. What he shows is that man and nature do not co-exist always in friendly manner. This difference in their treatment of nature can be attributed to the changed attitude of man towards nature mainly because of fast-rising materialism in the Victorian era owing to various mechanical inventions and advent of new machineries which paved the way for Industrial revolution. As said by William J Long the nineteenth century is remarkable for invention of various machines (Long, 1993). These inventions on one hand stimulated setting up of various industries, on the other hand, industrialization facilitated urbanization and material prosperity. It also created radical changes by creating a class of industrialists or owners of factories and merchants who dominated the society and the working classes who had to strive for minimum needs. All these aspects became a guiding force of literature of the nineteenth century. Again, Darwin's theory of human evolution had a far-reaching effect on people's withdrawal of faith in God as the creator of the universe. The pantheistic beliefs which pervaded in the poetry of Wordsworth and overswayed the minds of people of that time started to wane because of Darwinism which compelled man to look at the old ideals and beliefs with a questioning look. Matthew Arnold in his poem "Dover Beach" lamented how the bond between man and nature fell apart due to the 'clash, struggle and flight' (36-37). While such withdrawal of beliefs from traditional outlook effected the

poetry of late Victorians including Hardy, it also has a lot to say about the materialistic tendencies that started to grow in the human mind in general and it catapulted disrespect to the serenity of the environment making man unmindful to the destruction caused to the ecosystem and it is a trend that can be witnessed globally. Thus, both Wordsworth and Hardy presented two worlds dichotomous in nature and the study of the factors involved in this dichotomy is very much relevant for understanding and addressing the nuances embedded in the environmental issues which have appeared to be threatening to life in this green planet. Further, the poetry of both the poets is earth-centered and is suitable for understanding the interrelationship between literature and the physical environment.

CONCLUSION

It is a wrong notion to consider literature standing for its own sake. Behind every text there is a man who is born out of a society. The basic purpose of literature is to raise societal issues with the ultimate aim of reforming the society. Hence, literature and change are correlated. This is true of Wordsworth and Hardy. Both wrote poetry in their own ways to bring about a social consciousness for saving the pure and serene atmosphere of nature. The difference in their approach is basically because of the changes that scientific revolution and industrialization brought about in the society making man more and more materialistic. Their poetry lets us contemplate on how man's ungratefulness, depravity and wantonness have transformed himself to an onlooker of the destroyers as well as the destruction caused to the environment.

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Saurabh Kumar Chaliha : Science Tools and the Reality Paradox

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ABSTRACT

Surendranath Medhi, better known by his pen name Saurabh Kumar Chaliha was an important short story writer from Assam. Educated as a physicist, Chaliha's stories explore the multidimensional nature of reality and the possibility of using technology to uncover the gaps in human comprehension. But, his observations are hardly sweeping or general assumptions because while he views machines as important human tools, he is also aware of the homogenizations which such tools may introduce. Such a point of ambivalence makes him an acute observer of men and their conditions, who nonetheless sees much that is beneficial in machines. So, unlike Eliot or Yeats he is not a modernist who is unhappy with the loss of tradition. He is also not a postmodern who revives old values, while continuing with what is around him. So his deconstructive logic is not alone a matter of philosophy but also of science. Infact, Chaliha blames instrumental reason for events such as the Holocaust and the pitfalls of *nationalism*, while drawing his comfort in human relationships, which tragically enough cannot go on forever.

Keywords: Chaliha, stories, reality, unconscious, risks, instrumental reason, love, tragedy.

INTRODUCTION

Suren Medhi, better known as Saurav Kumar Chaliha, is a recognized short story writer and litterateur of Assam. Educated as a physicist in the University of London, he migrated to Germany looking for livelihood. This demographic movement from a little developed place like Mangoldoi in Tezpur Assam to the great commercial and political centre of the world, mirror what Lionel Trilling remarks as "the story of the Young Man from the provinces." This movement made Medhi a stranger in an alien land. But, his perceptions of the human condition mark him close to Baudelaire and more closer to Kafka. In all these writers, images suggest a cityscape that is bewildering, scary and defies summation. This idea was later adopted by T.S. Eliot. In *The Waste Land*, Eliot describes heaps of broken images to explain an uncertain, post Einstenian world. This is a world of despair, where meanings do not connect and no fertility is possible. Industrialization makes men humanoids but so much for the worse. Eliot sets this against a better alternative of tradition, which nonetheless remains difficult to interpret, for at least those in the West. But Chaliha's viewpoint is more consistent. It emerges from his engagement with the idea of an industrial culture and of the role of the nomadic intellectual, who questions the modus operandi in subject formation. Much of this concern

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was a result of Medhi's association with the RCPI movement and his subsequent imprisonment by the representatives of the state. It is a well known fact that Chaliha sat for his plus two examinations from the prison and only later on migrated to the West because his hometown was too dangerous for him to continue to stay any longer.

METHODOLOGY

This work studies the short stories of Saurabh Kumar Chaliha in the context of postmodernism-fractured selves and histories, especially after new theories of science forced a break away from simplistic relations between cause and effect to a more volatile domain of uncertainty, relativism and quantum mechanics. While this means that science apprehended or explained physical and the material world as probabilistic, multidimensional and disturbing, literature saw the new reality, as challenging both for its form and contextual references. The work of art in an age of technological responsibility, as Walter Benjamin described it, adopted this new scientific realism without eschewing the human responsibility for error and the consequent human potential for change. But literature had also to account for the emerging modes of production that substantially entangled the human agent in a precarious schizophrenic illusion. This new economic order accentuated by technology had alienated the human agent from his labor, and literature, like the other social sciences expressed this dilemma of production through a radical incursus-clawing back to the sources of history, intellectual, moral and ethical using the trope of allegory, irony and deconstruction to question the primacy of knowledge. Chaliha, trained as a physicist in India and Germany was well aware of the new sciences of relativity and uncertainty and of their implications for human society. While he could draw suggestions from Kafka and his images of city and also Baudelaire for his ironic reticent poetry, Chaliha drew from the sciences, viewing interconnections between disciplines, as like membranes that allow for passages.

Concerned with the physical sciences as well as literature, the present study investigates language's power to constitute reality, and reality's power to constrain and direct language. It speculates about the broader cultural conditions that authorize the new visions of chaos, and inquires into how these conditions shape and are shaped by modern narratives. One idea in this regard is the idea of "chaos" which is generally referred to the mathematical and physical sciences, as non-linear dynamics. Chaos in my paper refers to the possibility of order within disorder. I do not equate chaos with quantum randomness. So my paper involves a study of how the idea of chaos, invested culturally with a rich tradition of literary signification, is taken up by the sciences and given a more specialized meaning. In particular, in the context of a networked work, as espoused by the sciences, where human behavior can be predicted, chaos denotes

The paper would also attempt to study the idea of chaos in relation to certain ideas in economics, especially in the context of global complexities, mediated by information technology and attention to small fluctuations. I adopt the definitions of Marx in his discussion of credit society, in particular to his idea that credit revolutionizes the relation of capital to labor from within, such that "the opposition between capital and labor is abolished [*aufgehoben*] (Bajorek *Counterfeit Capital* 3). I study the implications of this credit in regards to a networked society where policy/strategy/ business decision taken at a particular node has the chance of infecting the entire system. Here the idea of system is of a wired society-a complex network of man and machines. At the same time, my project accepts that most of these networks are immersive-i.e. it assumes that participants or human agents interacting within this vast network form a homogenous component and that their behavior can be predicted, my paper defines the human agent as intuitive-one who understands the difference between hallucination and veridical perception. I use the terms "veridical perception" and "hallucination" as suggested by Susanna Siegel (*Does Perception Have Content* 180) in her study

of the aforementioned terms as indicative of a mental state where the subject understands how one experience is different from another. Technology is a generic word in this case and generally applied to the availability to improved gadgets for communications and imaging. It is absent of technical rigor. Nonetheless, my project seeks to examine the use of such gadgets like the camera and how it can produce unexpected results that not only adds to a society's perception but exposes what is impossible to the naked eye. I adopt this idea of a revolutionary possibility in photography from the idea of Baudelaire and connect this with Saurabh Kumar Chaliha.

Limits of Instrumental Reason

His first literary contribution in the form of a short story entitled *Restless Electron* is a study in contrasts and examines the lack of relation between expected social outcomes and probable modeling. It examines a series of ideas beginning with Marxism, Capitalism, physical environments and economic decision making. The plays use formal experimentations to enter into a dark world of absurdist Chaplinesque humor, where romantic ideas of a cultural revolution counter brutal police hawkishness and confinement. Despite this, most characters in the story understand that "something should have been done" and yet this is not possible. Theoretical models are found incomplete in the face of undecided human behavior. Images of an old man picking up the morning newspaper, groping for spectacles; asylums and paralysis, insects biting; people holding books, and newspapers, trying to feel the world between the pages of the paper; bodies getting rust; smoking pipes, damaged and transformed; bottles of DDT lying around; broken window panes; Montu, Ranjan's small child suffering from fever; paper kites flying etc., build up on disintegration and helplessness. Even casual smiles are deceptive and hypocritical, as when Nikhil, the old man's son find Niru the advocate's daughter down the street coquettish and vulgar. In this world, where people come and go doing nothing, meanings are not easily detectable. Ranjan, the neighbor, who has learnt much but prefers ignorance or Jyotibabu, the other neighbor, supporting Communism but finding socialism ludicrous; present un-answerable: "what's that supposed to mean,"(Chaliha *Collected Works* 51) the old man asks.

The Past as unsettled

This is a place for wooden horses, where boys slap each other and cry endlessly. Nikhil, the old man's son finds nothing to interest him here nor does Ranjan who attempts to answer some of the problems using differential equations and laws of physics but fails. His failure is however a consequence of science's simplistic assumptions - Euclidean geometry and Newtonian law's of motion that would refer to a past history of demonstrable simple cause and effect, long outdated by Einstein's idea of warped spaces, as also the daring contributions of Neils Bohr. Nonetheless, quantum theory or Hisenberg's uncertainty theorems leave space for statistical models. Each of two models or two meanings negate the other, while at the same time referring to the other as its own historical condition, such that there is a generalized referential disorder. This means that what is the past or what constitutes the past remains unsettled.

Added to this is the proliferation of money, not just as a medium of exchange but as an asset in itself, prized beyond its use for the community and here by the likes of Kamini Sarma, the old man who labors for personal value and gloss. This would take us to Marx and Baudelaire, whose texts register the idea of capital as change in the nature and mechanisms of transmission of experience and the result of this change for our conception of history. The story of the old man, or of his sons or his neighbors could be then seen as microcosm of the material conditions for production, where poetic language itself becomes a material underworld that throws up meaning and references for circulation. So, while Nikhil and Ranjan argue endlessly about the political actors in story (these are the extensions of capital according to Walter Benjamin's study of Baudelaire and agrees with Marx's idea of

the inscriptions of capital) like Jawaharlal, with his endless schemes and socialists with their pamphlets, there is as Jennifer Bajoreck argues, space in the story "to produce effects in a strange relation to instrumental reason and calculative thinking"(Bajoreck *Counterfeit Capital* 9).

Chaos and Impossibility of Understanding

This study of effects that are in a strange relation to instrumental reason is possible when the literary tendencies in the text produce a counter text to the homogenizations of capital- here exemplified in the random and therefore disruptive selections of earlier works-a matter of intertextuality. This is evident when the narrator recollects Shakeaspeare's *Othello* or R. K. Narayanan's *Two Leaves and a Bud*, Chinua Achebe's *Things Fall Apart* or for that matter the *Bible*. The event renders his personal history incomplete and necessarily reorganizes his entrance into the events of his life afresh. This disruptive recollection of images and conversations is what Walter Benjamin calls "discovery" (*Walter Benjamin and Art* 4) and Paul de Man quoting from Freidrich Schlegel's *On the Impossibility of Understanding*, "non-understanding": Is not this entire infinite world built out of non-understanding, out of chaos, by means of understanding? (*Aesthetic Ideology* 183) So, beyond Ranjan's simplistic attempt at predictability, lies the deeper chaos of greed, lust, cowardice, and opportunistic tendencies where people like Mr. and Mrs. Dutta gain weight feeding on bribes, while Sandi Kalita cannot afford to buy a new frock for her little daughter, forcing the child to expose her chest. There can be "a new valve" as mechanical proof of the relation between matter at the microscopic level and at the larger macroscopic level to increase amplification and fidelity. But, as Ranjan admits, these are clever and pedantic manipulations and do not suggest how one can jump from Freud's "sensible mind" to the Communist's "sensible society." So, the failures of axioms requires a sharing of "guilt" and see narrative time as more than a linear chain of events, mathematically suggested in Reiman's new geometry of multi-dimensions. In 1931, Kurt Godel proved that formal systems is not axiomatic sand so the clue that Poincare's work provided for the labyrinthine difficulties of complex dynamics was in danger of dropping out of sight. To turn to the question of cause and effect then would be difficult here because as Nikhil understands, there is no certain way of knowing if Trotsky was a traitor or if Stalin betrayed the Revolution. Yet, from the logic of capital, the possibilities of socialists adapting to Capitalism would be very much true for larger than life figures, as much for ordinary citizens like Jyotibabu because it satisfies their intrinsic desire for power and control.

The beauty and failures of love

In Chaliha's story *Semester Ends*, the contradictions between the gloomy and serious Germans and the laughing Itialians are very much apparent. Germany, already industrialized before the coming of Hitler showed how killing could be an industry. Yet again, concentration camps, where thousands of people were made to work in the most inhuman conditions, with only food thrown in from outside parallel the subhuman conditions of labor in their ghetto occupations. And yet this labor was not just manual labor but most importantly, intellectual and creative. Germans were as much a part of this hyped process of nation building as much as the Jews, except that the latter were made the scapegoat of inventions-the gas chamber for example, while the former could go free. For the speaker, the opportunity for a release from the cold numbness of dim corridors and tightly shut doors in the story is only half realized or not realized at all, as attempts to open windows for some oxygen proves counterproductive. There is an effort at mechanized contravention, in the use of a ring to operate coffee machines, which in this story, the absent Physicist Jen can work out. As he is only busy in a party outside, the narrator finds his necessary relief and escape from hunger and cold in the humanism of Anna, whom he again must leave sooner or later.

The Risks of Science and Its tools for discovery

So, the possibility of a future happiness is seriously compromised, when self-conception is defined through Capital. The idea of Italy, another industrialized nation of much warmth and sunshine, captured in photographs where Anna had been earlier, only presents a wishful future, a possible hypocrisy. Photography, one of the great inventions of modern science could then be seen as a mode of capital, one that generalizes a temporal event of manufactured consent, here seen in the surreal world of partying and resort visiting. The promise of good life in the high mountains, or even in the city with its neon lamps and other lights would however again constitutes an allegory, which the speaker would have forgotten had it not been for the photograph and the listener has long forgot constitutes for Marx a "fetish" and for de Man again, a sphere of "pure anteriority"(Qtd Bajoreck 23). As Bajoreck further suggests, the point of allegory would create "de-stabilizing effects" for "the narrative logic of a self or for the identity of the subject, who is now in a position of having to refer backward repeatedly to his own essence as pure anteriority" (qtd, Bajoreck 37). "Marx's own analysis of capital's prehistory mobilizes" says Bajoreck "a similarly textual conception of history, in the chapters on primitive accumulation, in an attempt to account for capital's originary violence"(Bajoreck 37).

Reality and Illusion

These links between the real and illusion is the subject of Chaliha's story *Photo*. The story begins with a description of a wedding ceremony, where a variety of characters are dressed up in their best costumes. The narrator who is also an invitee in the program is the one carrying the camera and also technically equipped to develop the images later on. The ceremony goes as planned with the assembled guests all looking happy and graceful until the appearance of Nilu, whom the family had ostracized sometimes earlier for marrying a young maid's daughter, Prava. Nilu had gone forward in his choice for which reason; he was banned from attending all family ceremonies. But, he was somehow invited here. The Bhuyan family members find the unusual entrant a strain on their nerves but somehow put up with the idea and even strike happy poses with Nilu. Later, when the narrator develops this family photograph, he discovers Nilu, like the others, happily smiling. But, the narrator goes on to enlarge the picture on his own and then discovers a speck of tear in the corner of Nilu's eyes. That photography not only does not but cannot lie, is a matter of belief, an article of faith, said Charles Rosen and Henri Zerner: "We tend to trust the camera more than our own eyes"(*Romanticism and Realism* 107-108). But, pictures are never self-explanatory and hence the human task of interpretation is often a bigger obstacle that the technical task of taking a picture. So, while picture promise to clarify, they often confuse. In fact, as a matter of truth, pictures can be faked or manipulated or synthetically integrated and yet, the change is virtually undetectable.

The photographer's perception

The observations of a speck of tear in Nilu's eye could be a matter of the photographer's perception or he could have been self-deceived in enlarging the photograph beyond a certain point. But, his act of fragmentation between what constitutes a good photograph and what is not, until enlarged, attests to the power of photography and to all visual and audio mediums as means of invention: to produce what there is/is not and therefore not to/to lie. But, as Arjun Apadurai remarks in *The Social Life of Things*, the exchange value of things is a matter of politics and not so much a matter of function. Also, an object gets valuable only when there is a distance between it and the person desiring it. Combining the two arguments would put the onus of value on agencies that have the power of manipulating desires so that subjects are continuously deferred from getting what they want. One can of course link this deferral to the bourgeois creation of value and what is important. The Bhuyans who deprive Nilu of his rightful place in the family because he goes against their

interests, create this value against which Nilu is powerless. At, the same time, the role of the photographer is a double-to illustrate and expose the false bourgeois values or to continue it for surface gloss. Benjamin recognized this privilege of photography to transmit "revolutionary content—a power to which it seems Baudelaire's poetry can only aspire" (*SW* 2: 774). While acknowledging this, it has to be argued that a camera need not only be a prosthetic aid to a body. It cannot displace that body, to supplement in the sense of supplant it but can work in tandem with the thinking man. In this case, "the intellectual potentialities of production" are not alienated and the photo developer is not just a consumer but a producer who disrupts or resists homogenizations. He defeats predictability.

Religious illusions

Unfortunately, the narrator in the short story ***Shrouded*** is not allowed such solutions, as the only woman he visits refuses to meet him. He re-enters the city, sees people, shops, and goes about vehicles, none of whom he understands or any fondness for. He stands before a sweet shop, when an attendant asks if he needs an omelet. His views here are obstructed by a glass pane. This is no Western metropolis but a nondescript place in Guwahati, Assam. Like other important commercial centers, this place too is connected by railways, a residue of the British attempt to seize necessary raw materials for its industry in Manchester and elsewhere. His subsequent journey is some confused attempt to capture meaning into places and incidents. In his strolling around the city/ town, he is unlike the traditional Baudelairean flâneur, that experiences the city like a dream, even a surrealistic spectacle. In traditional Marxism, the end of capitalism is possible only with the end of alienation of labor and through the transfer of social capital to the hands of the immediate produces. But dreamers are not required to fulfill productive obligations because they negate the normal relation between action and production.

Things become more complicated when the speaker begins to look for his favorite "Krishna Pen" in his pocket and finds none. So, his not writing or inability to write or do anything meaningful has a reason, which could be translated as his lack of enjoyment in using other pens howsoever costly they are. In most south East Asian countries, Krishna, is a cult God of love and playfulness and in the context of the poem, the speaker's loss of the pen is suggestive of his deferred potential to reach his true self or ego. So, like the transparent glass plane through which he discovers eatables but takes none that he wants and his loss of an instrument of writing, the speaker confronts the immediate relations between him and the distortions of capital, with religion working in tandem to alienate him from his productive work. Yet, the playfulness of the God would suggest that there is no reason whatsoever to privilege one idea over another. So, if the speaker's unreal or dreamlike state provokes him to suggest the primacy of one pen over another, we as readers need not take him for granted, i.e if we as conscious agents understand why and how he has been created. Yet, if we continue to admit his references and texts he does for himself, we too have come in the same trap of capital-its power to create hallucinations. Marx recognized this problem when he talked of the historical past and its debilitating effect in the *Eighteenth Century Brumaire*.

Microcosms and urban modernity

Pandu, like Benjamin's Paris is a miniature symbol of capitalist culture and turns alienated human subjects into commodities. But, the narrator does not look at his city with the flˆaneur's intoxication with fleeting urban images for their own aesthetic sake; instead, he roams the streets of his hometown with a decidedly utilitarian purpose in mind: to find out the girl's location and intentions. Yet, in some ways, the narrator's text emerges as an autobiographical confession of his own helplessness and his inability to do anything to change it. Like the territorially disoriented figures in Kafka's early fiction, the narrator here demonstrates the ways in which *flanerie* is perverted, even threatened with extinction, amid the traffic, the in-

comprehensible surface appearances, and manipulative power mechanisms that for Kafka are typical of early twentieth-century urban modernity.

The classical flâneur and the mirror

According to Baudelaire, the classical flâneur is like a mirror. To some extent, K.'s subjectivity and the city's reality, too, mirror each other mimetically. The petty-bourgeois conventionality of the lodging house he visits, the crowded proletarian streets in the suburb are all the objective correlatives or outward manifestations of the narrator's inner world, his narrow-mindedness and social pretensions, his emotional self-oppression and delusions. Whether he succeeds or not, he raises the very important issue- the unpredictability of human social behavior and attempts to inseminate meaning and order into chaos. The story insinuates at the same time an idea of irreplaceable loss, which modernism laments. Against this, capital argues that what is lost can be recovered again and so negates the divisions between labor and capital. This was one of the central arguments of Marx in his discussion of credit society: "credit gets rid of capital without actually getting rid of it: it revolutionizes the relation of capital to labor from within, such that "the opposition between capital and labor is abolished [*aufgehoben*]," untill workers become their own capitalist" (571). So, when the author/narrator/ speaker is induced into phantasmagoria, trying to feel happy, when his senses and the intellect are overwhelmed to a large degree by a sense of hopelessness and the inconsequentiality of his position, we have a question of value that is more than a product of his situation. Walter Benjamin's study of Baudelaire, as has been suggested earlier, suggests the impossibility of a future, despite many claims otherwise, especially the monetary claim of infinite extensions or linkages between capital growth and hope for the future.

Human Behavior and the pitfalls of probability

This attempt to bring order into chaos is the subject of another short story-***Geometry***, which seeks to understand human behavior through mathematical diagrams-triangles, quadrilaterals, trapeziums and other notations. The importance of this subject would be to predict how humans react to circumstances and if there is any way to determine the results. Centered on a few boys who fall in love with a young girl, it plays with names and the corollary of a male chauvinistic culture. While this means that boys are the aggressive partners, it is the girl who dictates the game and throws the boys off guard by marrying an unexpected suitor. The result of this paradox is that the boy 'C', who had all along tried to put up a brave front to such reversals commits suicide much against expectations when his academic excellence was considered too good to protect him from self-destructive acts.

Like the first story *Semester Ends,* this one too deconstructs the simplistic assumptions of basic Pythagorean patterns, Newtonian mechanics and also Einesteinian laws of curved spaces to argue that there is no last word in human social behavior, except one certainty-that time flows endlessly. While this suggests the possibility of deterministic fatality, Chaliha or the narrator is too secular to leave it at that. This would explain why the grandson of 'A' would still want to "set up new triangles with unknown hearts in some unknown place" (Chaliha *Complete Works*). This is Descartes' logic of the intractability between past and present and would indicate why people must react to new situations without drawing from the unconscious. Walter Benjamin denoted the term history for this unconscious, calling his Arcade Project, a Copernican Revolution. But as Morss would indicate in her book *The Dialectics of Seeing*, the important idea was to release the present from its continuity with history by discovering the constellation of historical origins which has the power to explode history's continuum.

Breaking the culture code

In his story ***Crocodile***, Chaliha plays with cultural assumptions and how societies remember or interpret images or photographs. Based on his

image as a burly something, it examines role playing and appearances in a modern industrial society that still connects people to animals in a boy like attempt to make meaning. Within this tangled web of make believe, the photograph of the scholar who may or may not look like a walrus, or a crocodile but is described as such requires further exploration. Hence the domain of the real, here a zoo that host various animals like walrus etc project the inadmissibility of their transmission in a mechanized culture. It may also indicate the presence of the subterraneous within rational thought like when the famous Denmark scientist Neils Bohr known for breaking the atom is seen walking on a open field with football boots or Gamov, a brilliant Russian mathematician known for his calculations tows over the Cam river alone to fulfill his hobby. The effect of this falsification or accentuation of the imaginary is as Deobard says in the *Society of the Spectacle* is to give the illusion a better prestige. The mature speaker is forced to view himself from the adolescent imaginings of the girl who viewed a Walrus as in Alice in Wonderland. Subsequently, the speaker talks about a lot of things-about the simplicities of the laws of nature, the structure of atoms and is self admissibly garrulous. The whole effort is to prove his likeness to the walrus in Alice's story who continuously babbles: Of shoes and ships and sealing wax / Of cabbages and kings."

The important point raised here is not just of plain, simple talk but of something more monstrous- standardization as a rule in most developed societies that has the effect of negating individuality. The importance of the small girl is thus to help the babbling scientist know how he as the thinking subject can or has transferred his concepts to the world outside, thereby creating an analogous order of sameness and constancy. One of the most insidious roles played in the organization of Capital is this production of everything from an original principle. i.e. (truth), by "relating everything to an ideal" (justice), (translators forward to *A Thousand Platues* xii) and by "unifying this principle and this ideal in a single idea" (the State) (*A Thousand Pleatues* xii). The end product would be "a fully legitimated subject of knowledge and society"—each mind an analogously organized mini-state morally unified in the super-mind of the State (*A Thousand Pleatues* xii). This is proved when the speaker reenters his workplace singing of the "Onward Christian soldiers, marching as to war" and find his coworkers busy with their work, leaving aside everything else. Against this idea of a cloistered virtue of uniformity and surveillance, is the nomadic intellectual who questions the patters of history, something that the Gamov and Neils Bohr only attempt intermittently. These are also the counter figures in the story and constantly break the scientist's attempt to forge a monologue or an anesthetized harmony between him and the objects he observes.

Capitalistic Schizophrenia

One can of course suggest that this failure at harmony is a function of non-linear dynamics or that literary texts are not bounded and their configurations depend on who is the subject and why. But, a more important issue at hand is that complex social systems acknowledge such failures for future models that would absorb disturbances. Hence: the need to go back to the source and see everything as if they are new. Such an issue has bearing on the general questions of the sciences and humanities alike- what is of epistemic importance-knowledge as fulfillment of curiosity or one that address the problem of relevant social welfare and who decides what and how much?

Much of the scientist's digressions are only therefore inalienable apparently. There are some that are schizophrenic, i.e. the product of a culture of images- morning loveliness and golf courses, boat rides in the tranquil cam river and fantastic fetishes, that cannot synthesize the disparate elements of a consumerist culture, but temporally seduces the political agent into believing the "arcane and complex links between capital's powers of transformation and the very mode in which the future would have to come" (*Counterfeit Capital* 10). Hence, the ability of this laboratory physicist to forge a revolution or work as a political agent remains a matter of

aporia and abiding melancholy, as in Baudelaire. Here, it is counterfeited in humor and in oblique references of the narrator to Gamov and Neils Bohr and to lovely mornings. The issue can also be tackled from the perspective of disjunctivism so that a subject has no way of knowing an object through perception alone. The ability to distinguish between various objects and images has only meaning with a subject who understands why they are different. That the subject cannot do this and he admits the adolescent property of the small girl is proof that for him there is no way to distinguish one experience from the other. His cognitive faculties are thereby impaired. Yet, he is a laboratory scientist, very good with machines and apparatus. But, his, intuitive qualities are lost. This is one area of a networked society where hallucinations are not distinct or indiscriminate from every kind of veridical perception. In fact, his hallucinations constitute his veridical perception.

CONCLUSION

Chaliha's argumentative oeuvre discovers a parallel universe and in fact many such simultaneously to suggest that truth is only relative. As a humanist, his special contribution is interventionist and combines the senses with instrumental reason. This is why his short stories are deconstructive without deconstructions' excess play with linguistic binaries: them/us; oral vs. the written word that can only tiptoe into un-redeeming contortions. Chaliha has a discomfort with culture and his admission of the bittersweet taste of life is not to play just with reality or pleasure principle but dive even deeper and begin a reconnaissance of experience itself- a pure Wonderland. Of course, this Wonderland is his defense against mundane, lived reality, with its pretentions and solipsism, as much as it is an unknown journey full of risks, a kind of game of chess. One of it is the schizophrenia of modernism and yet its answers are not in tradition but in a future world of increasing and extreme madness-the rabbit hole down which Alice must travel to know who she is, or why she is going where she is going. One way to get such answers is to try and break away from atomization or by getting away from social relations mediated by images.

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Journalistic use of social media: A case study of *the Assam Tribune*

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ABSTRACT

Social media has changed the broad spectrum of journalism. The very nature of newsgathering by the print journalists has changed owing to growing impact of social media. The lead for a story could be found now on social media sites and this has been experienced everywhere. While User Generated Contents have become useful for journalists, lack of gatekeeping and credibility, the emergence of fake news and the likes have become challenges for journalists. Using a case study research method this paper examines the impact of social media use on journalistic practices in Assam. An analysis of data collected through a sample survey conducted among the journalists associated with *The Assam Tribune*, the highest circulated English daily suggests that although extensive use of social media for news lead and information gathering has changed some of the traditional journalistic practices, the importance of traditional sources has not diminished as they are still used as cross-verification tools for ensuring reliability of social media news stories.

Keywords: Social Media ,Print Journalism, User Generated Contents, Fake News

INTRODUCTION

Harcup says:
Social media is a broad term covering a growing range of peer to peer and many to many forms of communication conducted via computers and, increasingly, mobile devices. Social media include Facebook, Twitter, Youtube and countless other forums, and in just a few years they have become as important a way for journalists to find stories and sources as they are for news organizations to promote their brands. Social media have allowed for more direct communication and interaction between journalists and audience, with information and comment flowing in both ways.(282).
The growing influence of social media has changed the broad spectrum of media. Particularly the interactive features of it have transformed journalism into a forum where exchange of views is primarily taken place. With the advent of social media the style of newsgathering has undergone a vast change everywhere. While social media as well as social networks offer great opportunities to journalists in case of news sources, they could use it for research as well. Social networks as well as social media also enable journalists to collaborate with fellow journalists and audiences. This is no surprise today that a lead for a news story may originate on Facebook or Twitter.

A survey done in 2015 on social media use by journalists, finds that most of the journalists

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read news and search for news sources on social media. They also use social media to disseminate news stories. Journalists have public profiles on social networking sites as part of their professional role. (Tamara L. Gillis).

Indian journalists also have been using social media in their professional work not only to build relationship with the audience but also to find information helpful for news reporting.

In a 2014 survey titled *How Indian journalists use social media,* it is found that 28 percent of them use Facebook, whereas 11 percent use the Twitter. Both Facebook and Twitter are used by 57 percent of journalists and 04 percent of them use none of the social media platforms. While 68 percent use Facebook as news source ,61 percent use Twitter for the same purpose.62 percent use Facebook to follow others, for which 43 percent use the Twitter. For sharing other links, 49 percent use Facebook as against 55 percent using Twitter. 48 percent of journalists each use Facebook and Twitter for disseminating personal work. (Choudhury).

With technical tools in hand, journalists are now able to produce more and faster. Emphasis has shifted from research and content to production and form. Audience empowerment has redefined authorship to an extent that, today journalists and audiences act as partners in news making. Although analysing User Generated Contents (UGC) as useful information and playing the role of Gatekeepers simultaneously is a challenge for journalists, social media tools also help journalists many ways while performing their job more effectively.

Exploring the question of how the integration of UGC into news work helps and hinders the role of a journalist, Johnston is of the opinion that the rise of user-generated content has made journalists harness a variety of new skills. Johnston concludes, "Being capable of processing user -generated content and being able to navigate social media platforms which audiences inhabit are becoming core skills which journalists need to possess and maintain". (Johnston).

OBJECTIVES

While discussing the impact of social media on mainstream journalism around the globe the very aspect of the journalistic practices by Assamese journalists has been left out totally which could reveal a lot about the impact on the professional shifts and about the ever changing journalistic practices in Assam as well. Against this backdrop, this paper explores the issue of social media use by Assamese journalists and the impact on various aspects of journalism. In particular, there are three specific objectives of the study. *First*, it makes an attempt to identify the social media platforms and tools used by Assamese journalists and the purposes of their usage. *Second*, it examines the impacts of social media on journalistic practices. *Finally*, it tries to identify the challenges and opportunities of social media in Assam. Using a case study method, this paper finds that Assamese journalists have been using social media for journalistic purposes. Further, they have faced certain challenges like Fake news , lack of credibility, lack of gatekeeping while using social media.

LITERATURE REVIEW

There is a substantial literature on social media. *India Connected: Mapping the Impact of New Media* by Sunetra Sen Narayan and Shalini Narayanan (2016) is an analysis of the growth of new media in India from a broad communications and interdisciplinary perspective. Providing answers to some of the most relevant questions, this book critically examines the growth of new media in India. It looks at the opportunities and challenges posed by digital media to governance, development, and businesses as well as in social marketing efforts. With the government and the corporate sector's growing emphasis on 'Digital India', *India Connected* goes into various aspects such as digitiza-

tion, convergence, interactivity and ubiquity, which are affecting the Indian media landscape. (Narayan and Narayanan). In *Journalism in the Age of Social Media* by Jennifer Alejandro(2010) the impact of social media on journalists of international news organizations are discussed. The challenges faced by the journalists in the fast developing world due to newer technologies and systems have been discussed in it in details. The behavioral changes due to the use of social media platforms, the changes due to news sources found on social media sites, the overall impact of this sort of media on the journalists have been discussed thoroughly in it. Further, studies like *News 2.0: The Future of News in an Age of Social Media* by Ira Basen (2009) has discussed about how social media has become a challenge before the news. According to the author in this 21st century the tools of production now belong to just about everyone and the tools of journalism are no longer the exclusive assets of journalists. The so called "mainstream media" has lost its control over the tools of its trade, and its importance as a centre of social and political influence. The business and philosophical model both appear to be broken, perhaps irrevocably as the writer has analysed it. Lauren Fisher(2011) in *Social media is everywhere, but is print still valuable?* says that growth of social media isn't in doubt. But according to the author digital publications have problems as well. While social media may be seen as a popular platform that one can't afford to ignore, it's losing out to print media when it comes to being trustworthy and authentic. The study has quoted a survey, in which 62% of key opinion formers said they would react to a negative story if it was printed in the paper, while only 21% would react to it if it happened in social media. How social media challenges have been faced is well discussed in a study titled *The rise of social media and its impact on mainstream journalism.* This study by Nic Newman(2009) shows how newspapers and broadcasters in the UK and US are responding to a wave of participatory social media. The study examines how journalists at leading news organizations in the UK and USA are increasingly involving audiences in the way they research and tell stories. It also has investigated how mainstream media coverage of breaking news events is changing. Likewise, a report titled *Print VS Digital Media: The Death of Print?* says print and digital media triumph in areas where the other is lacking. In general they would complement the failings and strengths of each medium. *Social Media Versus Print Advertising: Is Print Really Dead?* by Trish O'Loughlin(2018) also says about social media utilization for print media content and the different means of popularizing them through social media platforms are discussed in it. The advantages social media has brought to business also have been discussed in it. Despite of social media expansion print still holds a certain prestige and even in some instances print trumps digital media .The writer advocates for the harmonization of the these two media for a better result. In *The development of journalism in the face of social media,* by Cheney Thomas(2013) social media's impact on a journalist's role, method and relationship to the audience is discussed. Different aspects of the overall impact of social media on journalism have been analyzed in details. In the research paper *The Double Edged Sword: The Effects of Journalits' Social Media Activities on Audience Perceptions of Journalists and Their News Products***,** Jayeon Lee(2015) addresses how journalists' self disclosure and interaction affect audience perceptions, hypothesizing positive effects in personal dimension perceptions and negative effects in professional dimension perceptions. The results of the research work shows that journalists' social media activities significantly affect perceptions of young audiences. Comparing the two mediums in *Social media versus print media,* Rochelle Beighton(2016) says that for almost a decade, social media has been the catalyst of change in the way we communicate and spread news throughout the world. Social media's rise to

internet domination has seen a large chunk of news organizations incorporate online into its readership. As some have even made the full switch from print to online journalism.

Studies like *Social media revolution - The new digital frontiers of Journalism* by Kaveri Devi Mishra (2017) has analysed and explored the role, growth and challenges of digital and social media with a case study approach on Indian Media Industry. In a research paper *Reshaping newsrooms in the age of social media: A study on reliability, verification of user-generated content for journalistic use* by Safiya Naeem(2019) has analysed the impact of social media on the journalists of Karnataka. The researcher has analysed it in relation to utilisation of user-generated contents of social media, authenticity of the, ethical and legal issues related to it. In another research paper titled *Advancement of Social Media and Future of Newspaper Industry* by Koustav Mukherjee (2016) investigates the perspectives of the journalists on social media effects on their profession, and also performance. "Interactivity with the people, and the rise of blogs and bloggers, as well as the journalist's preferences for working with social media", are examined and implemented in the study. In *A study on Journalistic use of Social Media,* Dr. Pitabas Pradhan and Niky Kumari(2018) have found that keeping pace with the global trends, Indian journalists have embraced social media services in a big way both in personal and professional life. Twitter is mostly used for professional purposes followed by Facebook. YouTube use is more common among TV Journalists compared to Print and Web Journalists. Another finding of the study is that Web Journalists more frequently use the social media services professionally compared to journalists in print media. Journalists mostly use Facebook followed by WhatsApp for personal purposes. Regarding personal matters they use YouTube and Instagram more frequently compared to Twitter. Another important finding is that getting information and build relationship are the primary reasons behind the use of social media in personal life by Indian journalists. (Pradhan and Kumari).

Numerous studies have been conducted on the impacts of social media on traditional media. To the best of my knowledge, none of these studies focuses on Assamese journalists or newspapers of Assam. Therefore, there is a special need to study the phenomenon that has certainly impacted journalism in Assam which has a history of more than 170 years. With the advent of social media as well as social networking sites, journalists in Assam also have become interested in the sites that they sometimes use as sources or leads for reporting. Press in Assam has seen a vast change in every sphere of it over the years. From language to technology, the changes in the newspapers of Assam are quite visible. The rapid growth of social media has expanded its feet into newspapers of Assam as well and therefore the study on the impact of social media on the print journalism in Assam is very important.

MATERIALS AND METHODS

This is a Case Study on *The Assam Tribune*. Qualitative method of Case Study has been taken for this research work. A case could be an individual, a group, a community, an instance, an episode ,an event ,a subgroup of a population, a town or a city. To be called a case study it is important to treat the total study population as one entity (Kumar 155). According to Kumar(156) besides using a single method ,in depth interviewing ,multiple methods of of data collecting such as obtaining information from secondary records ,gathering data through observations and collecting information through focus group and group interviews can be used in a case study but at the time of analysis the case must be considered as a single entity. Tools like Questionnaires have been used for primary data collection for this research work.

Sample

For this study Purposive or Judgmental sampling method has been taken.

Purposive sampling which is also known as judgment, selective or subjective sampling is a sampling technique in which researcher relies on his or her own judgment for choosing samples from population for a study. The researcher has selected *The Assam Tribune*, the highest circulted as well as the oldest running English daily. All the journalists (engaged with both editing and reporting) of this newspaper here are the population and samples have been drawn from editing section and reporting section . There are around 34 journalists (as per the norms defined by the Working Journalists Act 1955) in *The Assam Tribune* head office and they are chosen as samples for this study. For this purpose a specific questionnaire was prepared using multiple options (having both close and open ended questions) which were given to them. But 30 of them returned the filled up questionnaires.

Rationale for Sample Selection

The Assam Tribune is presently the oldest running English daily published simultaneously from Guwahati and Dibrugarh, Assam. *The Assam Tribune* is the highest circulated (93,942 copies daily) regional English newspaper in Assam (INS Press Handbook 2016-2017, 2017) .The newspaper was founded way back in 1939 in Gauhati.First published on 4 August 1939 in Gauhati by Radha Govinda Baruah as a weekly newspaper under the editorship of Lakshminath Phookan, it is now published simultaneously from Guwahati and Dibrugarh as a daily. It has a huge readership in Assam and is the most popular newspaper in the North-East India. *The Assam Tribune* has a wide reach in terms of circulation figures as well as the reliability of the news matter. In 2014 it celebrated the Platinum Jubilee in the presence of India's Prime Minister Mr. Narendra Modi.

It has been playing important roles in moulding public opinion on different crucial occasions like Assam Agitation in 80s. In case of journalists' welfare and job security *Assam Tribune* group wrote history by being the first media organisation in India to implement Justice Majithia Wage Board Recommendations for Journalists and Non-Journalists in 2011. It has always played the role of a active sentinel on the frontiers in order to keep the true character of journalism while maintaing journalistic integrity and media ethics. Moreover, it has a pan Assam presence as well.

In contrast, three major social media platforms, namely Facebook, Twitter and WhatsApp have been chosen. Although there are several other social media platforms such as YouTube, Instagram, it would not be feasible to include all of them.

SURVEY ANALYSIS

An analysis of the data obtained from survey questionaires reveals that most of the journalists (54%) of *The Assam Tribune* frequently use social media for journalistic purposes. While some of them (27%) use them occasionally, only a few (7%) use it rarely. This is an interesting finding of the study that 12% of the journalists don't use social media for journalistic purposes and they are mostly related to editing job.

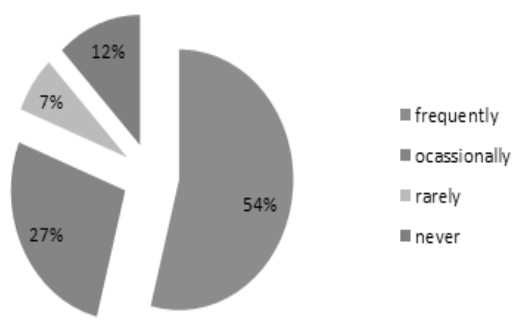

Figure 1. Use of social media for journalistic purposes
Source: Authors' creation on the basis of primary survey data

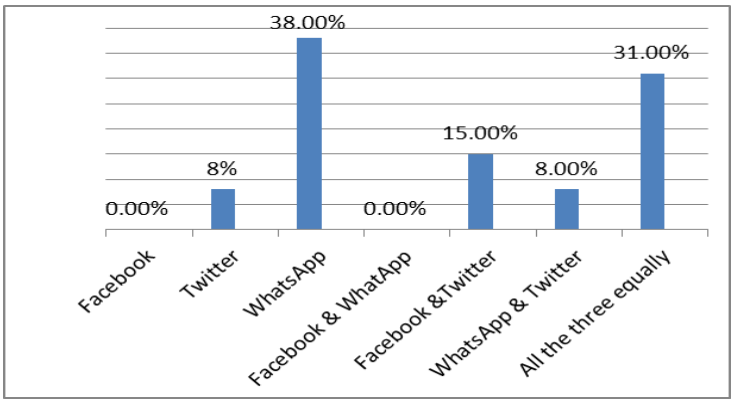

Figure 2. Use of different social media platforms for journalistic purposes
Source: Authors' creation on the basis of primary survey data

Among the social media user journalists about a third (38%) use only WhatsApp but 31 % use Facebook, Twitter and Whatsapp equally. While about a tenth (15%) use both Facebook and Twitter. Some of them (8%) use only Twitter and some of them(8%) use Whatsapp and Twitter together. But no one use only Facebook.

Being journalists of an English daily most journalists(88%) of *The Assam tribune* use English on social media for posting, tweeting and messaging. Only a handfull of (12%) use both Assamese and English. Regarding the use of social media as news sources, most journalists (70%) use social media sources as secondary news sources. The remaining 30% use them as both primary and secondary sources. About nine tenths (93%) of the survey participants (including both users and non users) think that social media sources are not as reliable as traditional sources. Among the users almost all of them cross-verify the social media sources before using them. About eight tenths (84%) of these journalists (who use social media) verify social media sources with the help of traditional sources (e.g. reporters on location), only 8% take the help of factchecker apps/websites, and the remaining 8% use both these tools. Thus, there are 7% of the journalists who are completely oblivious of whether social media sources are reliable or not.

While most journalists(69%) use social media occasionally for promotion of their personal work, 27% of them use it several times a week. Only a few (4%) never do so. While 58% of them use it ocassionally for sharing other important links,23% do it rarely and 4% never use it for this purpose. In contrast 15% do it frequently.

Most journalists use social media tools for various professional purposes. While they use Facebook as a source of various news stories, they often use WhatsApp for receiving government press releases and other information. They also share information with fellow journalists on WhatsApp. They use Twitter primarily for information communicated through tweets by important government officials, politicians, celebrities, activists and government Twitter handles. Some journalists use Facebook for increasing visibility of their news reports and other write ups. Some journalists also use Facebook to get knowledge about the mood of the audience/readers so that they can cope up with the growing challenges in their respective fields. These social media platforms are useful for sharing important information with fellow journalists in particular and general public at large.

According to all journalists, fake news on social media platforms is the primary challenge for using these tools for journalistic purposes. They are of the opinion that it is important to fight against fake news. While verification, cross check and authentication are some of the ways to fight against it ,some of the journalists want social media to be regulated to some extent because of the menace. Awareness creation is another way to fight against it. Some of them want to expose the fake news sources and defeat them in their own game. Among all participants (users and non users) 87% believe that fake news has not affected the credibilty either of their own work or of the newspaper. Among the users ,all are of the opinion that they have been benefitted by social media directly or indirectly.

Moreover, paid news, fabricated news, disinformation and misinformation pose serious challenges. A majority of the journalists are of the opinion that social media also pose challenges by rumor mongering that has the potential of creating mistrust among various groups and eventually leading to communal and ethnic clashes. Due to a lack of gatekeeping, anyone and everyone can create almost anything and such User Generated Contents may be challenging for the journalists in terms of authenticity and credibility of news. The violation of privacy rights in the name of information sharing on social media sites is another challenge. It is primarily because of the inadequacy of the existing legal framework to protect such rights on the merging media platforms. While click-baits have been a challenge before the journalists, satire/parody accounts on Facebook or Twitter sometimes create confusions in confirimg sources if the journalist is not well aware of such nuances of social media mechanism. Propaganda is another challenge as political leaders or parties often take it as a tool to gain political benefits.

While most journalists are aware of these challenges, almost all of them acknowledge the benefits they gain from the use of social media one way or the other. According to the survey

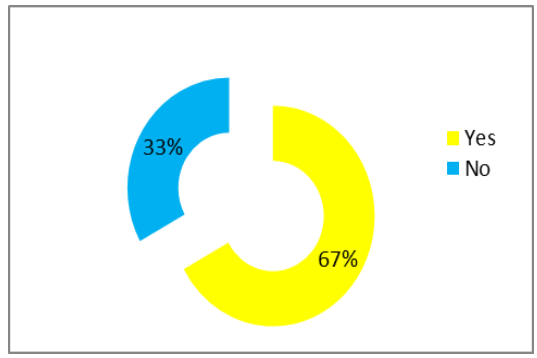

Figure 3. Threat to print media/newspapers
Source: Authors' creation on the basis of primary survey data

Among all the participants(users and non users) about two thirds (67%) are of the opinion that extensive use of social media poses a threat to newspapers /print media in the long run, while about one third (33%) do not perceive it to be a threat. Interestingly some of them opine that the process of affecting the circulation and readership has already begun. A few of them even say that overuse of social media may make it a Frankenstein some day. According to some journalists, the speed at which news get transmitted on social media is a challenge to the print media. Further, growing acceptability and popularity of social media are putting pressure on the overall production of print media. However, it is the lack of credibility and authenticity of social media that is preventing them from taking the place of print media. Unless some of the issues are addressed, social media could be a real threat in the long run. However, some of them are of the opinion that both the mediums can complement each other without ceating a division. Although there is not any written guidelines regarding social media in the newspaper, but the universal journlaistic principles compel them to adhere to the basics of authenticity, credibilty, ethics and truthfulness.

CONCLUSION

The findings of the research work have

shown light on various aspects of present day print journalism in Assam. The study has established the fact that most of the journalists use social media frequently for journalistic purposes. The use of social media sites among the journalists vary according to their convenience and needs. The outcomes of the study prove that social media has immense impact on day to day affairs of the journalists in print media. The growing impact has been seen in the basic news gathering practices of the journalists and in the overall production of the newspaper as well. While writing news reports for the newspaper they have to have a close eye on the happenings on social media so that they don't lose any lead or so called breaking news updates. They now have to compete with social media while performing their daily job. The menace of fake news in different forms are confronted while performing their duties as fake news in different forms sometimes even create confusions in reporting the facts and doing analysis. When some User Genrated Content becomes viral on social media the print journalists can not sit idle as other media outlets begin to follow them quickly. But being associated with a responsible media organisation like *The Assam Tribune* ,the journalists of it can not report them without proper verification of the facts. But this process of verification is painstaking and time consuming. So the journalists face the challenge of deadlines while verifying the facts of a social media source.

While growing popularity of social media for infotainment has threatened the very existence of the newspapers in general, some of the journalists of *The Assam Tribune* are of the opinion that there must be some mechanism in which these concerns could be addressed at the earliest.

Although the results of the study give us a crystal clear picture on the journalistic use of social media as well as the impact of social media on the print journalists in Assam , there is always a scope for further studies in this regard.

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Significance of Social Distancing during COVID-19 pandemic

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ABSTRACT

Social distancing is one of the key measures to prevent COVID-19 transmission. It is the initial policy used to minimize the spread of the virus that causes covid-19. We should maintain social distancing in various places such as educational institutes, workplaces, health care facilities and other public locations like market etc. Social distancing avoiding large gathering and close contact with others. To reduce the coronavirus, limitation of face to face contact with others is the best way. By the awareness programme necessary precautions to be adopted among people to prevent COVID-19pandemic. Everyone has a vital role to play in slowing the spread and protecting themselves, their family and their areas. This is a common practice which has been carried out over generations to minimize the spread of virus by limiting its reproduction rate among communities. To win this war it is necessary that all of us need to stay at homes, washing hands with soap and water, sanitization, mask-wearing, maintain social distancing and respect all our warriors. This coronavirus disease is attacking human lives and there is no effective vaccine or a specific drug against this virus still date. It is invisible enemy. So, social distancing is one of the major tool of coronavirus to protect all of us.

Keywords: *Social distancing, health sector, workplaces.*

INTRODUCTION

Social distancing is the initial policy used to minimize the spread of the virus that causes COVID-19. It is an essential way to slow this virus. It is one of the key measures to prevent COVID-19 spread. We should maintain Social distancing in various places such as workplace, healthcare facilities and other public locations like market etc. Limiting face to face contact is the another way to reduce the spread of corona virus disease 2019 (COVID-19). A recently recognized corona virus, SARS-Cov 2, is spreading across the whole world. Social distancing means avoid spending time in crowded places or in groups. It means not going out unless it is required. Necessary reasons to go to include buying food, getting medical care. If we have to go out then we are at least 6 feet (2meters) away from other people. Virus can grow when someone sneezes or coughs out tiny droplets. These droplets usually travel more than 6feet before falling to the ground. Social distancing is important for their, those who are at higher risk for severe illness from covid-19. In our day to day life preventive action to help prevent their spread of respiratory viruses should be followed, these include-frequently hand wash with soap and water for at least 20 seconds, use an alcohol-based hand sanitizer. We wear face mask, cover coughs and sneez-

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ers with a tissue, throw the tissue away and then wash our hands with soap and water. When a person is suffering from disease and can not wear a cloth face covering or face mask then caregivers should wear one while they are in the same room.

There is something within our control that each of us can do to contribute in the fight against COVID-19 that is social distancing. It is a non-pharmaceutical infection prevention and control intervention implemented to avoid contact between those who are infected with a disease causing pathogen and those who are not so as to stop or slow down the rate and extent of disease transmission in a community. In late December 2019 a new strain of corona virus originated in China (Wuhan) which was unknown to humans before. It came to be known as the novel corona virus disease or COVID -19. Chinas first phase of public health response to COVID-19 focused on short term measures to stop the virus spreading from Hubei to the rest of the country and within the general population. School closures, transport bans and working place shutdown helped to limit transmission of COVID-19.

COVID-19 pandemic is caused by tiny entity, which does not even have the capacity to survive outside a living cell, has brought the world almost to a standstill leading to major medical, social and economic problems. The lockdown and physical distancing have disrupted social fabric. The medical facilities including infrastructure trained manpower have been stretched to the limit and even frontline workers are falling prey to this scourge compounding the problem. Many industries and business establishments have closed down and millions of workers have lost their livelihoods. On top of that, there are fear, anger, hatred, suspicion and other negative psycho-social factors weakening the very edifice of a civilized society. But the pandemic of Spanish flue in 1918, which claimed about so million live, still evokes horror in our minds. While there were Asian flue in 1957 and HIV/AIDS in 1981, the new millennium witnessed many newer viral disease- SAARS (2003), Swine flue (2009), MERS (2012), Ebola (2014), Zikavirus (2018), Nipahvirus (2018) and now the novel coronavirus causing COVID-19. That is what we are doing now for COVID-19 with emphasis on lockdown, social distancing, personal hygiene, respiratory hygiene, quarantine and treatment etc. Globally, about 120,057,512 people are affected, closed cases 99,249,064 (series 2) out of 2,659,830 (3%) have died, recovered 96,589,234 (97%), currently active cases 20,808,448 (series 3) out of 20,719,136 (99.6%) in mild condition and 89,312 (0.4%) serious or critical and many more are living with fear of disease and death as on 14th March, 2021, shows in Figure 1 & 2 (source worldometers.info).

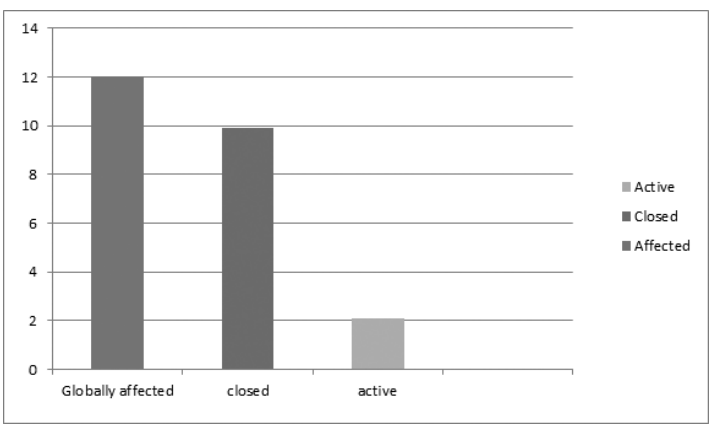

Figure 1. COVID 19 world data.

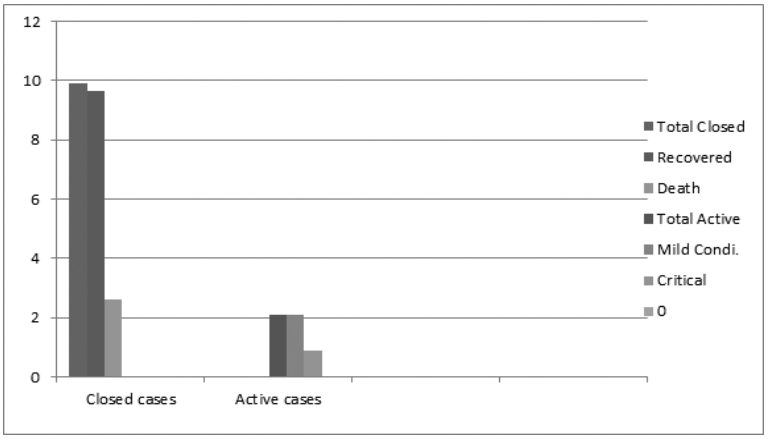

Figure 2. COVID-19 world data.

REVIEW OF LITERATURE

In the review of research work I find *Maharaj, S. and Kleczkowski, A. (2012)* attempted about "Controlling epidemic spread by social distancing". *Yu, D; Lin,Q; Chiu, A. P. and He, D (2017)* attempted to explain "Effective of reactive social distancing on 1918 influenza". Again *Fahin Aslam (2020)* attempted about "COVID-19 and social distancing". But nobody attempted the area of the "significance of social distancing during COVID-19 pandemic" So I attempt to fulfill the gap by this research study.

OBJECTIVES

To prevent transmission of novel corona virus among the people

To aware the societies about COVID-19for control

To fight againstCOVID-19 pandemic

MATERIALS AND METHODS

In case of collection of primary data I depend on information from observation, survey and experiments. On the other hand secondary data are collected from e-journal, Newspaper, reports, etc. I also adopt the descriptive analytic method in my research work.

RESULTS AND DISCUSSION

The pandemic of COVID-19 is one of the biggest challenges that societies and business have faced. Overcoming this challenge will be possible if we work together to stop the spread of the virus and provide a safe and healthy working environment for both home based teleworkers and those returning to their usual workplaces. The world of work is severely affected during the crisis, therefore all section of society including business, employers and social partners must play role in order to protect workers, their families and society at large.

By COVID-19 Over 221 countries and territories have been affected, which has infected millions of people and killed lacs. At the beginning the developed countries, apart from China (Wuhan) and Iran, had been the most afflicted. But now the clouds are darkening over the skies of Asia, Africa, Central and South America and there is death and disruption all over the world. Globally

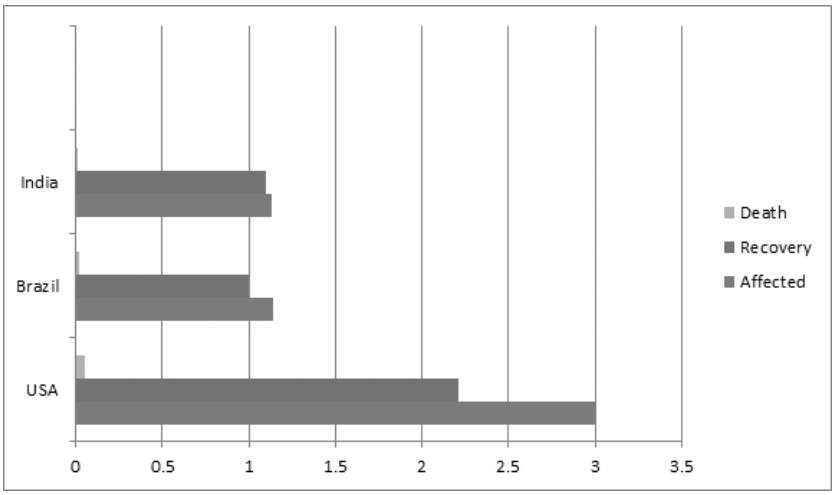

Figure 3. Total affected , death , recovery and active cases of India

three highest affected countries are USA, Brazil and India. In USA total affected people 30,046,128, death 546,661 recovery 22,108,944 and active cases 7,390,52. In Brazil affected people 11,439,250, death 277,216, recovery 10,036,947 and active cases 1,125,087; In India total affected people 11,382,610, death 158,750, recovery 11,003,784 and active cases 220,076; respectively as on 14th March, 2021, shows in Figure 3 (Source: world in data).

Need of social distancing in pandemic :

During pandemic so many communities cancelling events and gatherings of more than 10 people and closing shops, restaurants and bars, swimming pool, educational institute, gym etc. Social distancing is a method to minimize crowd interactions and prevent the spread of disease within groups of people. It is our responsibility, we should all take seriously. "Stop the spread" is a global campaign which aims to raise awareness about the risks of misinformation around COVID-19, and encourages them to double check information with trusted sources such as WHO and National Health Authorities.

Someone infected with COVID-19 can be contagious before symptoms ever even being. To make matters worse, some people remain completely asymptomatic, but are still contagious. This means that, even if we feel healthy, we could be unknowingly spreading the virus if we are not practicing social distancing. Social distancing can include large scale measures, like cancelling crowded group events and closing public spaces. But it also includes a conscious, individual effort from each one us to practice the measures that help prevent the spread of COVID-19. Though virus pandemicCOVID-19 is mild illness, it can make some people very ill. More rarely the disease can be fatal. Those who are already pre-existing medical conditions such as high blood pressure, heart problems, diabetes for their appear to be more vulnerable. There are two common practices followed using social distancing, one of them is social distancing and maintaining a distance of nearly 1 (one) meter within individuals and the other being staying indoors at home. This practice is important for a period of time to ensure the spread of the disease is minimized.

Social distancing is a public health safety intervention used to reduce the livelihood of transmitting communicable disease. It involves minimizing exposure to infected individuals by avoiding large public gathering in the **workplace.**

Many people have personal circumstances or situations that present challenges with practicing social distancing to prevent the spread COVID-19. It is a new disease and we are still learning how it spreads. If social distancing methods are ignored the effect could last on for the upcoming generations as the COVID-19 virus will be able to develop different strains where till date eight different strains of the virus has been discovered by scientists.

Health sector :

The novel coronavirus (COVID-19) has disrupted our lives in many ways, like healthcare system, education system, economic side etc. Due to the lockdown imposed by our country the spread and mortality has still been on the lower side of the graph. The present Government had introduced a scheme for some universal healthcare service in the country. This matter of an inclusive healthcare service for all in the country needs serious, urgent attention. The economic recovery challenge looms large, but the health and education services in the public sectors have to be revived simultaneously.

The outbreak of novel coronavirus (COVID-19) puts a spotlight on the resilience of health systems and countries emerging preparedness and response. The rapid expansion of COVID -19 emphasizes the urgent need for a strong health workforce as an integral part of every resilient health system. In the health system health workers are called the backbone. Without health workers we cannot imagine the health system. Due to the nature of their profession, millions of them risk their own health doing their daily work. We should respect them who are protecting health workers, who are so critical to the fight to stem the COVID-19 pandemic.

In COVID-19 pandemic, Globally 90,000 healthcare workers infected. Government has provided to health care workers good quality personal protective equipment (PPE), kits and N95 face masks. Health care workers are being infected both in the workplace and in the community, most often through infected family members. To protect frontline health care workers, the WHO stressed the correct use of PPE like masks, goggles, gloves and gowns. PPE have been widely used by healthcare workers and staff to ensure the disease spread is limited within the hospital. The use of PPE, such as mask and eye protection, for an entire shift may cause discomfort due to heat, skin irritation and breathing difficulties. Preliminary data from Wuhan, China during the COVID-19 outbreak suggest a high prevalence (up to 97%) of coetaneous irritation and skin damage in association with the use of PPE, which increased with the duration of PPE use.

For well managed of health sector Government is constantly motivating the doctor's, nurses, paramedical staff and health care workers. More hospitals with the latest facilities, more beds, more well-cared for doctors, nurses and paramedics along with a nationwide awareness on hygiene and health habits are what the nation expects from its Government.

Every infected health worker means a further gap in the fight against the pandemic. Ensuring the safety and health of health workers is therefore a matter of high priority. The health **workplace** is particularly vulnerable to the risk of exposure to COVID-19. According to current knowledge, the two main routes of transmission are direct interaction with patients and contact with respiratory droplets in the space closely surround-

ing an infected person. Today the survival time of the virus on surfaces remains unknown. The further extends the risk of contact transmission to support personnel, such as laundry staff, cleaners and workers dealing with clinical disposal. The protection of healthcare workers focuses on the prevention of contracting and spreading COVID-19.

The accredited social health activities, who are more popular among the people as ASHA workers, and who are at the forefront of the present battle against the dreaded COVID-19 pandemic. They are also actively working as part of the surveillance teams for alerting suspected covid -19 cases in their respective jurisdictions to the concerned health authorities. They said they are entrusted with the job of looking after the basic health needs of the people at the grassroots level, besides working tirelessly to oversee cases of institutional delivery, immunization, adolescent, nutrition, tuberculosis etc. and collecting blood samples of suspected malaria cases. They serve their duty through social distancing to reduce COVID-19 pandemic. Now, we are faced with a community challenge in the form of the COVID-19 pandemic. It challenges us to be creative in how we maintain our social connections and manage our mental and physical health. To control and prevention of corona virus the centers has recommended a policy of social distancing, which is a strategy to slow the infection rate to protect our most vulnerable community members. It preserves the ability of our health care system.

Health workers and employers should share the most recent information on clinical protocols, guidelines, measures and decisions to ensure effective implementation, as well as on workplace situation that expose health workers to risks. This highlights the need for a sustainable approach to safety and health at work as an integral part of the overall management of the health sector. In response to the COVID-19 outbreak, many health workers are facing heavy additional workloads, long working hours and a lack of rest periods. However, globally health workers are actively engaged in COVID-19 pandemic. The recently published state of the world's nursing report, 2020 highlights the need to create at least 6 million new nursing job's by 2030 to address the projected shortages of nurses primarily in low and middle income countries, and to work towards a more equal distribution of nurses around the world.

The study found that all around the globe, mankind is fighting with theCOVID-19 pandemic. The spread of the corona virus is on pace to overwhelm the whole world, but the public has a powerful tool to change this by social distancing. Social distancing measures like closing schools, cinema Hall, restaurant, gym, swimming pool etc. in the early stages of the outbreak experienced less disease transmission, as well as less death. Practicing social distancing is the most important thing we can all do right now to help fight the spread of COVID-19. The number of COVID-19 cases continue to rise in the whole world; so need for testing kits and PPE for healthcare workers should become the highest priority for every country to reduce and detect the disease early.

Policy suggestions:

There are various types of policies are found national and international to prevent covid-19 for the mankind in whole glob. Various types of policy suggested to prevent covid-19. These policies will be limited till vaccine or drugs outbreak. The main policies are described as follows :

1. To maintain social distancing i.e. (minimum 1 meter distance) in health sector, market place, educational institute, other public place etc. should be maintained by every individual to prevent the spread of virus.
2. To contain the spread of the novel virus and to

keep infections at a manageable level lock-down will significantly slow the spread of covid-19.

3. Regular practice of yoga and Ayurveda for prevention of corona and also encourage people to spread awareness about yoga and Ayurveda. To increase immunity power to fight with this virus turmeric, ginger, garlic, tulsi, etc. will be consumed.
4. Long term impacts can be achieved through a combination of policies that reduce the transmission of the virus including immediate quarantine or isolation of all individuals demonstrating symptoms of influenza like illness.
5. Physical distancing and universal face masking, restrictions on large gatherings and event are strictly maintained can prevent the covid-19.
6. Utilization of face masks, combine with social distancing and frequent hand washing and disposal of face masks are consider to be the basis assurances against covid-19.
7. Non-essential travel should be avoided. Small vehicles, buses, trains and aeroplanes to maximize social distancing which use in public transport besides ensuring regular and proper sanitization of surface.
8. Govt. and non-govt. employers to allow employees to work from home where feasible.
9. Closure of gyms, swimming pools, cultural programmes, cinema halls, educational institutions etc are for a specific period.
10. Education system should be promoted through online mode.
11. Containment zone and red zone should be declared by govt. to control virus.
12. Changes in government law relating to unlock
    a) Working should be Monday to Friday
    b) Working time should be reduced.
    c) Night curfew should be imposed at least 10-12 hours, later on it should be removed.
    d) Non-wearing of face mask should be imposed finable.
    e) Restriction of movement from one district to other, interstate and between the countries and left the restriction when situation improved.
13. Novel corona virus (COVID-19) testing facility and capacity should be enhanced.

CONCLUSION

There is no specific treatment for disease caused by a novel corona virus. Subsequently, COVID-19 is increased day by day. By the awareness programme necessary precautions to be adopted among people to prevent COVID-19. Everyone has a vital role to play in slowing the spread and protecting themselves, their family and their areas. To win this war it is necessary that all of us need to stay at homes, washing hands with soap and water, maintain social distancing and respect all our warriors. This corona virus disease is attacking human lives and there is no effective vaccine or a specific drug against this virus. It is invisible enemy. So social distancing is one of the major tool of novel corona virus to protect all until vaccine or specific medicine outcome.

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