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CARDIOVASCULAR EFFECTS OF CONSUMING SMOKELESS TOBACCO AMONG CONSTRUCTION WORKERS AND AGRICULTURAL LABOURS IN WEST BENGAL

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ABSTRACT■ The use of tobacco without burning is referred to as smokeless tobacco(SLT). SLT use has been increased rapidly through out the world as it is considered as a safe alternative of smoking. SLT use is now proved to be associated with adverse effects on various physiological system including cardiovascular system. This study was undertaken in order to assess the cardiovascular efects of consuming 'khaini', a widely used SLT in India. The cardiovasculareffect of 'khaini' use was examined using data from a representative survey of adult males carried out in different villages of Hooghly district, West Bengal. The study was performed on two different occupational categories :construction workers and agricultural labours. In each category there was one control(nonusers of 'khaini') and one experimental group('khaini' users). In both categories blood pressure (BP) and resting heart rate (HR) were significantly higher in 'khaini' users than that of nonusers. The Percentage of subjects with high normal systolic blood pressure(SBP) and diastolic blood pressure (DBP) was comparatively greater in experimental groups than control groups. A high percentage of 'khaini' users of both categories were under hypertensive SBP and DBP. The percentage of subjects with high normal HR was also greater in 'khaini' users than that of their nonusers counterpart. Adverse Cardiovascular efects of 'khaini' were more prevalent in construction workers than agricultural labours. Results of this study suggested that the use of 'khaini' affected BP and HR in rural workers and such effect might be due to sympathico-adrenal stimulatory activity of nicotine and high sodium content in 'khaini'.

Key words: Smokeless tobacco, 'khaini', hypertension, heart rate

Introduction :

Tobacco consumption is a major source of mortality and morbidity in India. Currently over 20% of worldwide tobacco related mortality occurs in India (WHO, 1999; Gupta and Ball, 1990). Tobacco use is a public health concern worldwide as well as in India. However, the patterns of tobacco use in India are quite different from those observed in other countries. In India, tobacco consumption is mainly done in two forms: smoked tobacco and smokeless tobacco. The tobacco use without burning is referred to as smokeless tobacco (SLT) use. SLT use has been increased rapidly through out the world especially among adolescent boys and young men (Christen et. al., 1989). SLT is used

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by some smokers as a method to quit smoking (Fagerstrom and Ramstrom, 1998) and by other as substitute for cigarette in location where smoking is not allowed. Thus SLT is now considered as safe alternative of cigarette smoking (Christen n et. al., 1989). Because of vigorous efforts toward increasing awareness of the adverse effects of the tobacco, smoking has declined paradoxically the use of SLT has greatly increased (Gupta et. al., 2004). In India tobacco is used in a smokeless manner in wide variety of ways with various products including 'khaini', 'gutkha', 'mowa' and many others (Gupta, 2001). The 'Khaini' is taken by oral mode. Prevalence of SLT in India is 20% (Pandey et. al., 2009). It is significantly higher in males than females and in rural people in compared to urban population (Rani et. al., 2003). Association of SLT consumption with occurance of adverse cardiovascular effects suggested a mixed picture with some showing increase incident of adverse events (Bolinder et. al, 1994; Hergens et. al., 2008) while other showing no such association (Huhtasaari et. al., 1992; Johansson et. al, 2005). In India limited numbers of studies have shown that tobacco chewing is associated with increased prevalence of cardiovascular risk factors like dyslipidemia, hypertension and abnormalities in ECG (Gupta et. al., 2007; Khurana et. al. 2000: Hazarika et. al., 2002). Oral snuff tobacco significantly increased heart rate and blood pressure (Squires et. al., 1984; Wolk et. al., 2005).

The most common form of smokeless tobacco used in rural West Bengal is 'khaini', which is made up of tobacco with slaked lime. The present study was conducted on rural people to assess the Cardiovascular effect of this SLT.

Maerial and Methods :

The data presented in the report were obtained from a community based cross sectional study. The sites of study were chosen by random selection. The study was carried out on two different occupational categories, construction workers and agricultural labours at different villages in Hooghly district of West Bengal state. Construction workers were selected for this study as they used to take SLT in high frequency and amount. Besides this SLT related many studies have been done on construction worker (Bolinder et. al.1994). Agricultural labours also use SLT at low frequency and also selected for this study. Male subjects of each occupational categories having age limit 20 to 40 were included after taking an informed consent. Exclusion criteria for the subjects included presence of any self reported acute illness, history of heavy alcohol or recreational drug use. Subjects of each site were divided into two groups: one experimental and one control group.

Survey included two components : 1. interview of the subjects and 2. measurements. Interview was done with a structured questionnaire to obtain information on age, occupation, education, food habit and tobacco related behaviors including type of tobacco use, frequency and duration of tobacco intake. Data were sorted after interview at each site. Subjects those were not taken SLT at least for last threr years were placed into control group. Subjects those taken SLT at least for last three years were placed in to experimental group.

The body weight of the subjects was measured using a portable human weighing with an accuracy of 0.5 kg. The machine was kept on a flat surface and adjusted with "0" mark. Now the subject was requested to step on it in bare feet. The subjects were in light clothing during the measurement.

The height of the subject was measured using an anthropometric rod. It was recorded without footwear and expressed to the nearest 0.1 cm.

BMI was calculated from the height and weight as follows: BMI = weight (kg) / height^2 (m). Subjects having normal range of BMI (18.5-25.0 kg/m^2) were selected for the measurement of BP and HR.

We measured Blood pressure (BP) using digital blood pressure monitor (Citizen, CH-432B) in the right arm in standing position following the method of Pandey et. al., 2009. The heart rate (HR) was measured by finger pulse oximeter (Nidek). BP and HR were recorded two times at 10 min intervals. The average of the two values was calculated. Participants who had eaten or taken SLT were made to rest for one hour before recording. The subjects were divided into different categories according to their blood pressure values. Hypertension was defined as systolic blood pressure (SBP)> = 140 mm Hg and /or diastolic blood pressure (DBP) >= 90 mm Hg (JNC VI, 1997). The resting HR ranged from 60 to 80 beats per min was taken as normal (Cook et. al., 2006). Decrease in HR below 60 beats per min was taken as bradycardia and rise of HR above 100 beats per min was taken as tachycardia. On this basis HR was classified in our result.

Statistical analysis: Results were expressed as mean ±SD. Statistical significance regarding the difference between two group means was determined by student's t test.

Results

The general characteristics of subjects of construction workers and agricultural workers have been represented in Table 1 and Table 2 respectively. The same for the control groups were also included in those tables.

The blood pressure (SBP, DBP, and MP) of construction workers , those who consumed 'khaini', was significantly higher ($p<0.001$) than their nonuser counterpart (Table 3). The percentage of occurrence of high normal SBP and stage 1 systolic hypertension were comparatively greater in 'khaini' users than that of nonusers. Similar trends of results were found in case of DBP (Table 4).

Table 1 : Comparison of general features between control and experimental group of construction workers.

Parameters	Control group (n = 56)	Experimental group (n = 68)
Occupation	Construction	Construction
Sex	Male	Male
Age (year)	31.9 ± 4.22 *	31.7 ± 5.36*
BMI (kg / m)	21.6 ± 1.31	19.8 ± 0.84
Smoking last three years	No	No
SLT use :	No	Yes
Type	---	'khaini'
Frequency	-------	10-12 times / day
Amount	----	10-12 gm / day

* Value represent mean ± SD

Table 2: Comparison of general features between control and experimental group of agricultural labours

Parameters	Control group (n = 59)	Experimental group (n = 55)
Occupation	Agricultural labour	Agricultural labour
Sex	Male	Male
Age (year)	30.2 ± 5.63 *	30.5 ± 5.02 *
BMI (kg / m)	21.6 ± 1.26 *	19.6 ± 1.04 *
Smoking	Nil to rare	Nil to rare
SLT use :	No	Yes
Type	-	'khaini'
Frequency	---	4-6 times / day
Amount		4-6 gm / day

* Value represent mean ± SD

Table 3: Comparison of blood pressure (mean ± SD) between control and experimental groups of construction workers.

Blood pressure (mm Hg)	Control group (n = 56)	Experimental group (n = 68)	P value
SBP	118.8 ± 4.83	132.3 ± 7.03	P< 0.001
DBP	75.1 ± 3.65	82.6 ± 4.49	P< 0.001
MBP	96.9 ± 4.09	107.4 ± 5.42	P< 0.001

The mean value of HR of experimental group of construction workers was significantly higher ($p<0.001$) than that of control group. The percentage of subject with high normal HR and above normal HR values was greater in 'khaini' user than that of nonusers (Table-5)

The agricultural labours were involved in different types of agricultural activities. In this group of workers the SBP, DBP, and MP were significantly higher ($p<0.001$) among the SLT users than that of the control group (Table 6). It was also noted that the percentage of subjects with high normal BP (both SBP and DBP) and hypertensive BP values were greater in 'khaini' users in comparison to the nonusers (Table 7).

Table 4 : Percentage contribution of 'khaini' users and nonusers in different categories of Systolic and diastolic blood pressure among the construction workers

Blood pressure (mm Hg)	Control group (n = 56)	Experimental group (n = 68)
Systolic blood pressure		
Normotensive : *i) optimal (<120)*	65.2	2.9
ii) normal (120-129)	32.6	22.1
Iii) high normal (130-139)	2.2	47.1
Hypertensive : *I) stage 1 (140-159)*	0	27.9
Ii) stage 2 (160 -179)	0	0
Ii) stage 3 (≥ 180)	0	0
Diastolic blood pressure		
Normotensive : *I) optimal (< 80)*	89.1	14.7
Ii) Normal (80-84)	8.7	63.2
Iii) high normal (85-89)	2.2	16.2
Hypertensive : *I) Stage 1 (90-99)*	0	5.9
Ii) stage 2 (100-109)	0	0
Iii) stage 3 (≥110)	0	0

Table 5: Comparison of different categories heart rate between control and experimental group among the construction workers

Heart rate (beats / min)	Control group (n = 56)	Experimental group (n = 68)
Average	71.3 ± 2.8 *	81.0 ± 6.34 *
Bradycardia (< 60)	0	0
Normal (60 – 80)	87 %	48.5 %
Higher normal (81-100)	13.0 %	51.5 %
Tachycardia (≥ 101)	0	0

*Values represent mean ± SD , $p < 0.001$

The effect of 'khaini' intake on HR among the agricultural workers have been presented in Table 8. The average HR of the experimental group was significantly higher ($p<0.001$) than that of the control group. The percentage of subject with high normal values of was greater in 'khaini' users than that of the nonusers .

Table 6: Comparison of blood pressure (mean ± SD) between control and experimental groups of agricultural labours.

Blood pressure (mm Hg)	Control (n = 59)	Experimental (n = 55)	P value
SBP	117.9 ± 6.17	129.1 ± 6.74	P< 0.001
DBP	73.5 ± 4.61	81.5 ± 4.43	P< 0.001
MBP	95.7 ± 5.15	105.3 ± 5.29	P< 0.001

Table 7: Percentage contribution of 'khaini' users and nonusers in different categories of Systolic and diastolic blood pressure among the agricultural labours.

Blood pressure (mm Hg)	Control group (n = 59)	Experimental group (n = 55)
Systolic blood pressure		
Normotensive : *i) optimal (< 120)*	50.8	7.3
ii) normal (120-129)	45.8	36.5
Iii) high normal (130-139)	3.4	45.5
Hypertensive : *I) stage 1 (140-159)*	0	10.7
Ii) stage 2 (160 -179)	0	0
Ii) stage 3 (≥ 180)	0	0
Diastolic blood pressure		
Normotensive : *I) optimal (< 80)*	91.5	27.3
Ii) Normal (80-84)	8.5	52.7
Iii) high normal (85-89)	0	10.9
Hypertensive : *I) Stage 1 (90-99)*	0	9.1
Ii) stage 2 (100-109)	0	0
Iii) stage 3 (≥ 110)	0	0

Table 8: Comparison of different categories heart rate between control and experimental group among the agricultural labours.

Heart rate (beats / min)	Control group (n = 59)	Experimental group (n = 55)
Average	72.4 ± 5.24 *	80.8 ± 7.19 *
Bradycardia (< 60)	0	0
Normal (60 – 80)	93.2%	58.2%
Higher normal (81-100)	6.8%	41.8%
Tachycardia (≥ 101)	0	0

* Values represent mean ± SD , $p < 0.001$

Table 9: Comparison of cardiovascular and other parameters (Mean ± SD) between the experimental groups of construction workers and agricultural labours.

Parameters	Construction workers (n=68)	Agricultural labours (n=55)
Age (year)	31.7 ± 5.36	30.5± 5.02
BMI (kg/m2)	19.8 ± 0.84	19.6+1.04
Frequency of SLT use per day	10 - 12	4 - 6
SBP (mm Hg)	132 ±7.03	129.1 ± 6.74
DBP (mm Hg)	82.6 ± 4.49	81.5 ± 4.43
HR (beats per min)	81.1 ± 6.34	80.8 ± 7.19

The comparison of cardiovascular parameters between the experimental groups of construction workers and agricultural labours showed no significant difference in BP and HR (Table 9), although the former group consumed SLT more frequently than the latter group.

Discussion :

Smokeless tobacco, 'khaini', consumption is associated with increased prevalence of high blood pressure in the adult male rural population. This finding is supported by some previous studies done in India (Gupta et . al. , 2007; Hazarika et . al ., 2002) as well as western population (Bolinder et. al . 1992 : Accortt et . al . , 2002 : Hergens et . al . , 2008). Both SBP and DBP are significantly higher in the 'khaini' users than the nonusers. A few percentage (2-3 %) of subjects , who are nonusers of SLT, have high normal SBP where as a large percentage of the 'khaini' users possess high normal SBP. Further, comparatively more percentage of 'khaini' users are under the category of stage 1 systolic hypertension than their nonuser counterpart. Similarly, a high percentage of the 'khaini' users are under high normal DBP and Stage 1 DBP.

High HR is a cardiovascular risk factor (Cook et . al . 2006). The SLT ('khaini') consumption is associated with increased prevalence of high HR in rural males workers. This finding is similar to some previous studies (Squires et . al . , 1984). A large percentage of SLT users among the workers showed high normal HR (81-100 beats / min).

There is no significant difference of BP and HR among SLT user construction workers and agricultural labours in spite of mark difference frequency of SLT intake. This finding indicates that frequency and amount of SLT intake may not be related to cardiovascular effect. Similar finding was obtained by Henley et. al. (2005).

Studies have shown that smokeless tobacco acutely increases blood pressure and HR similar to tobacco smoking (Bolinder and de Faire, 1998; Wolk et . al ., 2005). Acute nicotine exposure from cigarette smoking is responsible for adverse cardiovascular effect (Asplund, 2003). Evidence suggests that chewing tobacco leads to blood nicotine level similar to that seen in smoking. Moreover, due to prolonged absorption, high levels of nicotine are achieved for longer duration (Benowitz , 1988a).

Oral tobacco contains large amount of sodium (Hampson, 1985). Smokeless tobacco causes sodium absorption far more than cigarette smoking (Benowitz, 1988a). Moreover, nicotin is a potent sympatho-adrenal

stimulator (Benowitz, 1988b; Wolk et. al., 2005). Thus nicotine induced increased sympatho – adrenal activity and high sodium content of SLT preparation could be the main contributing factors for higher blood pressure and HR in 'khaini' users. High sodium content could be more contributory to DBP than SBP. The consumption of 'Khaini', which contain nicotine, might cause an increase in Nicotine - induced sympatho-adrenal activity and this in turn increased the blood pressure and heart rate of the workers.

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...ON THE DIVERSITY, ADAPTATION, AND IMPORTANCE OF MANGROVES

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Abstract ■ The vegetation of intertidal coastal estuary in the tropical region of the world are usually considered 'Mangroves'. Total 48 number of true mangroves species are spread over both the Old world and the New world tropics. Assessed as rich habitat, Indian coastal estuary and Islands harbour 40 true mangroves out of 48, besides numbers of mangrove associates and back mangal species. The effect with regard to adaptation of mangroves in coastal saline region is as much distinct as visual even casual spectators can spot them easily. Modified in such a way to acclimatize salinity, organs of leaves, stem and roots are visible as adaptive: succulence, shininess, lenticels, gall, vivipary, cryptovivipary, pneumatophore, pneumatothode, stilt root, prop root, root buttresses are few instances. This vegetation is of immense role in protection of coastal littoral ecosystem, biodiversity in general and thus its ecosystem services render economic benefit for livelihood in particular.

Key words: Diversity, distribution, adaptation, mangroves, importance

Introduction :

The term 'Mangrove' usually defines the vegetation that occurs in the intertidal zones of coastal estuary in the tropical region of the world (McNae, 1968; Chapman, 1976, Tomlinson, 1986; Mandal & Naskar, 2008). The intertidal zone means the areas lying between the highest and the lowest tidal limits. Tidal limits vary in different areas of coastal regions. The oxford dictionary mentioned the word, 'mangrove' since 1613, referring to the tropical trees and shrubs growing in coastal swamps with tangled roots which grow above ground. Experts opine that individual plant of tidal forest refers to 'mangrove' whereas tidal plant communities along with the entire ecosystem are known as 'mangal' (Mepham & Mepham, 1984). Mangroves are salt-tolerant plant species growing at the land sea interface, which connects interdependent links between inland terrestrial landscape and near shore marine environment. They constitute different plant communities found in tropical coastal estuary, cover about 240×10^3 km^2 and spread over river deltas, lagoons and estuarine complexes (Twilley et al.1987: Lugo et al.1990, Mooney et

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al. 1995).

Disribution :

There are broadly two mangrove ecosystem regions in the world The Old World tropics and The New World tropics (Tomlinson, 1986). The Old World tropics include 28 countries. Of which major (based on total areas) are; Indonesia (42510 km^2), Australia (11,500 km^2), India (6,749 km^2), Bangladesh (5,800 km^2), Burma (5,200 km^2), Papua New Guinea (4,116 km^2), Thailand (2,873 km^2), Philippines (2,321 km^2), Madagascar Republic (3,207 km^2), Sabah (3,503 km^2), Vietnam (2,800 km^2), and Pakistan (2,495 km^2). They spread over the coast line of the Indo-West Pacific region lying between the longitudes 30.0°E – 170.0°E and latitudes 38.45°S – 36.0°N. In the New World tropics, major mangroves (based on total areas) are as; Brazil (25, 000km^2), Nigeria (9, 730 km^2), Venezuela (6, 730 km^2), Mexico (6, 600 km^2), Senegal (5, 000 km^2), Panama (4, 860 km^2), Columbia (4, 400 km^2), USA (2, 050), Gabon (2, 500 km^2), Ecuador (2, 154 km^2), and Cameroon (2, 000 km^2). They all cover the West Coast of Tropical Africa (Eastern Atlantic) and both the East and West coast of Tropical America (Western Atlantic and Eastern Pacific) within the longitudes 15.0°E – 120.0°W and latitudes 25.0°S – 38.0°N (Naskar & Mandal, 1999). There are also distinct as well as respective mangrove plant species in the two world regions; out of 48 true mangroves considered worldwide, 40 species represent from the Old World tropics, only 8 species from the New World tropics (Tomlinson, 1986). In perspective of the Old World tropics (area wise), India stands 3rd position, while being 5th in both the Old and the New World tropics together.

Diversity :

Literally, diversity means variety in all aspects. In biological context, diversity comprises both variety of organisms and also variety of their habitats where they are a part. Importantly, a wide range of diversity containing both organisms and their habitats are prevalent in Indian mangroves regions.

In habitat diversity there are three distinct regions such as i] East Coast habitats, ii] West Coast habitats, and iii] Andaman and Nicobar, and Lakshadweep Islands habitats, which belong to a] Deltaic mangrove habitats, b] Coastal mangrove habitats, and c] Island mangrove habitats respectively, following Thom's classification of coastal habitats (Thom, 1982). Five major mangrove zones such as Sundarbans mangrove forest, Bhitarkanica mangrove forest, Krishna and Godavari delta mangrove forest, Cauveri delta mangrove forest (Pichavaram), and Andaman & Nicobar Islands are situated along the East Coast of India and in Bay of Bengal. Six minor mangrove zones are found each in Cochin estuary, in Coondapur & Malpe estuary, in Zuary estuary, in Bombay coast, in Bhabnagar estuary, and in Lakshadweep Atoll, situated along the West Coast of India and in Arabian sea (Table 1).

In species diversity there are about 82 plant species recorded. All these species are distributed in 52 genera and 36 families, which constitute coastal estuarine vegetation occurring in and around inter tidal regions (Mandal & Naskar, 2008). Comparatively, species diversity of East Coast mangrove habitats, including Andaman & Nicobar Islands is more diverse than that of West Coast mangrove habitats, including Lakshadweep Atoll (Table 2).

Adaption :

Adaptation defines the modification of organs or of whole organism occurring to adjust the existing environmental conditions. If it is so, then a wide range of adaptations covering leaves, stems, and aerial roots occur in mangrove species; which are distinctly visual and invite

Table 1. Indian major mangrove zones and their habitat diversity

Sl.no.	Name of zones	Provinces	Location	Category	Area (km^2)	No. of species*	Relative diversity (%)*
1	Sundarbans forest	West Bengal	East Coast	DMH	4200	69	90
2	Bhitarkanica forest	Orissa	East Coast	DMH	150	57	72.3
3	Krishna & Godavari delta	Andhra Pradesh	East Coast	DMH	200	36	48.8
4	Cauveri delta	Tamilnadu	East Coast	DMH	150	35	47.6
5	Cochin estuary	Kerala	West Coast	CMH	negligible	32	44.1
6	Coondapur & Malpe estuary	Karnataka	West Coast	CMH	60	33	29.4
7	Zuary estuary	Goa	West Coast	CMH	200	22	45.3
8	Bombay coast	Maharashtra	West Coast	CMH	330	29	38.8
9	Bhabnagar esruary	Gujrat	West Coast	CMH	260	26	35.3
10	Andaman & Nicobar Islands	A & N territory	Bay of Bengal	IMH	1190	61	76.5
11	Lakshadweep Atoll	Lakshadweep atoll	Arabian sea	IMH	negligible	08	9.4

DMH=Deltaic Mangrove Habitat, CMH=Coastal Mangrove Habitat, IMH=Island Mangrove Habitat; * Source: Tropical Ecology 49 (2), 2008, R.N.Mandal & K.R.Naskar; * No. of species includes major mangroves, mangrove associates and Back mangals.

attention too (Table 3). These visual adaptations due to morphological modification of organs are so distinct keeping aside anatomical modifications (which are not discussed here), even casual visitors can spot them at dense vegetation. Mangroves species need all these modifications essentialpertaining to adaptation so as to sustain in the coastal inter tidal estuarine habitats. The habitats mangroves grow in are considered the most fragile and dynamic ecosystem where occur very often some common phenomena such as sea surges, sea waves, high tidal flow, soil erosion. In addition, natural calamities like cyclones, hurricanes, cider, tsunami, etc. happen very frequently (Naskar & Guha Bakshi, 1987; Untawale 1987; Blasco & Aizpuru, 1997; Jagtap et al. 1993).

To withstand such habitats along with high salinity in coastal areas, survival strategy of vegetation is referred to '*Halophytic adaptation*'.

Leaf: For leaves, there are necessary modifications by means of thick cuticle, gregarious hair, and succulence so as to help preserve water which otherwise get lost due to transpiration. Hence, water available in tissue need to be stored; because, salt in form of solute remains as much as in sap where amount of water as solvent is less in quantity, and so is essential for physiological function.

Stem: For stem, there are some modifications: Standing upright is necessary for defending natural calamities. Canopy is of pyramid shape in order to avoid strong wind in general and cyclones in particular. Lenticels develop frequently to facilitate breath of tissue - a characteristic feature of halophytic adaptation.

Root: For root, a diverse range of adaptation occurs in provision of both mechanical and physiological functions (Saenger, 1982; Mandal, 1996). Development of pneumatophores (above ground root) is related to estuarine soil. Usually, muddy substrata are of anaerobic property of water logged soil that influence oxidation-reduction potential from aerobic (+700mV) to extreme anaerobic (-300mV) prevailing in soil chemistry (Clough et al. 1983). As a result oxygen is first reduced to water; then at the lowest level, carbon dioxide is reduced to methane (Tomlinson, 1986). Hence mangrove soil do not contain sufficient amount of O_2 (oxygen) essential for physiological functionof under ground organs; therefore, soil of mangrove habitats is known as '*Physiologically dry*'. In such condition, roots are compelled to come out above the ground so as to breathe inhaling O_2 from air. Even in few species, pneumatophores perform a few additional functions such as photosynthesis, and excretion apart from breathing. For other above ground roots, provision of mechanical support get priority as major function to keep plant erect from adversities caused by frequently natural disturbances which sometimes effect devastation to the whole vegetation. Besides, most of the above ground roots perform breathing as secondary function. In newly silted up loose soil bed,*Porteresia coarctata* develop a long stout tap root to anchor the whole plant, though being a grass species it usually develop fibrous roots (Saenger, 1982; Mandal, 1996).

Reproduction: For reproductive organ, high salinity in habitats is responsible for vivipary germination. To avoid high salinity hypocotyle comes out while fruit remains attached with mother plant. In case of cryptovivipary and epigeal germination, hypocotyles are rather more tolerant to salinity; they come out from cotyledons but remain in distance from substrata until they develop salt tolerable mechanism. Usually, development of all these hypocotyles is distinctly visibleat the onset of rainy season, for they remain fully matured to produce seedlings afterwards while substrata having lower amount of salinity. Salinity gets down during rainy season due to heavy rainfall and

Table 2. Mangrove species diversity in India (only major mangroves distribution)

Sl.no.	Scientific name	Family	Status	1	2	3	4	5	6	7	8	9	10	11
1	*Rhizophora apiculata*	Rhizophoraceae	T	+	+	+	+	+	+	+	+	+	+	-
2	*R. mucronata*	Rhizophoraceae	T	+	+	+	+	+	+	+	+	+	+	+
3	*R. stylosa*	Rhizophoraceae	T	-	+	-	-	-	-	-	-	-	+	-
4	*R. lamarckii*	Rhizophoraceae	T	-	-	-	-	-	-	-	-	-	+	-
	R. annamalayana	Rhizophoraceae	T	-	-	-	+	-	-	-	-	-	-	-
4	*Bruguiera gymnorhiza*	Rhizophoraceae	T	+	+	+	+	+	+	+	+	+	+	+
5	*B. cylindrical*	Rhizophoraceae	T	+	+	+	+	+	+	+	+	+	+	+
6	*B.sexangula*	Rhizophoraceae	T	+	+	-	-	-	-	-	-	-	+	-
7	*B. parviflora*	Rhizophoraceae	T	+	+	+	-	+	+	+	+	+	+	+
8	*Ceriops tagal*	Rhizophoraceae	T	+	+	+	+	+	-	+	+	+	+	+
9	*C. decandra*	Rhizophoraceae	S	+	+	+	+	+	+	+	+	+	+	+
10	*Kandelia candel*	Rhizophoraceae	T	+	+	+	+	+	+	+	+	-	+	-
11	*Avicenna marina*	Avicenniaceae	T	+	+	+	+	+	+	+	+	+	+	+
12	*A. alba*	Avicenniaceae	T	+	+	+	+	+	+	+	+	-	+	-
13	*A. officinalis*	Avicenniaceae	T	+	+	+	+	+	+	+	+	+	+	-
14	*Sonneratia caseolaris*	Sonneratiaceae	T	+	+	-	-	+	+	+	+	+	+	-
15	*S. apetala*	Sonneratiaceae	T	+	+	+	+	+	+	+	+	+	+	-
16	*S. alba*	Sonneratiaceae	T	-	+	-	-	+	+	+	+	+	+	-
17	*S. griffithii*	Sonneratiaceae	T	+	+	-	-	-	-	-	-	-	+	-
18	*Xylocarpus granatum*	Meliaceae	T	+	+	-	+	+	-	-	+	+	+	-
19	*X. mecongensis*	Meliaceae	T	+	+	+	-	-	-	-	-	-	+	-
20	*Heritiera fomes*	Sterculiaceae	T	+	+	-	-	-	-	-	-	-	+	-
21	*H. littoralis*	Sterculiaceae	T	-	+	-	-	-	-	-	-	-	+	-
22	*Phoenix paludosa*	Araceae	T	+	+	-	-	-	-	-	-	-	+	-
23	*Nypa fruticans*	Araceae	S	+	-	-	-	-	-	-	-	-	+	-
24	*Aegiceros corniculatum*	Myrsinaceae	T	+	+	+	+	+	+	+	+	+	+	-
25	*Aegialitis rotundifolia*	Agialitidaceae	S	+	+	-	-	-	-	-	-	-	+	-
26	*Lumnitzera racemosa*	Combretaceae	T	+	+	+	+	+	-	+	+	-	+	+
27	*Scyphiphora hydrophyllacea*	Rubiaceae	T	+	+	+	-	-	-	-	-	-	+	-
28	*Acanthus ilicifolius*	Acanthaceae	S	+	+	+	+	+	+	+	+	+	+	-
29	*Excoecaria agallocha*	Euphorbiaceae	T	+	+	+	+	+	+	+	+	+	+	-
30	*Porteresia coarctata*	Poaceae	H	+	+	+	+	-	+	+	+	+	+	-

+ = present, - absent; 1= Sundarbans mangrove forest, 2 = Bhitarkanika mangrove forest, 3 = Godavari & Krishna delta mangrove forest, 4 = Cauvery delta mangrove forest, 5 = Cochin estuary, 6 = Coondapur & malpe estuary, 7 = Zuary estuary, 8 = Bombay mangroves, 9 = Bhabnagar estuary, 10, Andaman & Nicobar Islands mangrove forest, and 11 = Lakshadweep atoll mangroves; Source: Tropical ecology 49(2):131-146, Mandal and Naskar)

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Table 3 Modifications of different organs in mangrove species and their respective function

Organs	Modifications	Visual appearance	Function		Species
			Mechanical	Physiological	
Leaves	Thick cuticle	Glossy appearance	-	To reflect sunlight so as to reduce the rate of transpiration	*Rhizophora apiculata, R. mucronata, Bruguiera gymnorrhiza, B. sexangula, B. cylindrical, B parviflora, Ceriops tagal, C. decandra, Kandelia candel, Xylocarpus granatum, X. mekongensis Aegialitis rotundifolia, Excoecaria agallocha, Acanthus ilicifolius*
	Gregarious hair	Velvet appearance		To protect stomata and thus to reduce transpiration	*Avicennia marina, A. alba, A. officinalis, Heritiera fomes, H. littoralis*
	Succulent texture	Fleshy appearance		To accumulate and store extra salt	*Sonneratia apetala, S. griffithii, S. alba, S. caseolaris, Aegiceros corniculatum, Lumnitzera racemosa, Scyphiphora hydrophyllacea*
Stems	Galls	Extra growth outside		To breathe and excrete extra salt	*Excoecaria agallocha*
	Lenticels	Large number of small spots		To breathe and excrete extra salt	*Excoecaria agallocha, Avicennia marina, A. alba, A. officinalis, Sonneratia apetala, S. griffithii, S. caseolaris, S. alba*
Roots (above ground)	Pneumatophores	Pencil appearance,		To breathe and excrete extra salt, along with photosynthesis	*Avicennia marina, A. alba, A. officinalis*
		Rod appearance with blunt tip,		To breathe and excrete extra salt, along with photosynthesis, and bark removal as function of excretion	*Sonneratia apetala, S. griffithii, S. caseolaris, S alba*
		Buffalo horn,		To breathe and excrete extra salt	*Xylocarpus granatum, X. mekongensis,*
		Flat conical,		To breathe and excrete extra salt	*Heritiera fomes, H. littoralis*
	Pneumatothods	Pencil appearance with round white ring at intervals		To breathe and excrete extra salt	*Phoenix paludosa*
	Stilt roots	Bow appearance	To support trunk base standing erect	To breathe	*Rhizophora apiculata, R. mucronata.*

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	Prop roots	Straight downward	To support bending branch remaining upward	To breathe	*Rhizophora apiculata, R. mucronata.*
	Root buttresses	Flat extended at trunk base	To support trunk base standing erect		*Xylocarpus granatum, X. mekongensis, Heritiera fomes, H. littoralis*
	Knee roots	Knee appearance along cable root	To support trunk base standing erect	To breathe	*Bruguiera gymnorrhiza, B. sexangula, B. cylindrica, B. parviflora*
	Broom roots	Broom appearance at trunk base	To support trunk base standing erect	To breathe	*Bruguiera gymnorrhiza, B. sexangula, Ceriops tagal, C. decandra, Kandelia candel,*
	Cable roots	Long horizontal	To support the entire plant standing erect		*Avicennia marina, A. alba, A. officinalis; Sonneratia apetala, S. griffithii, S. caseolaris, Lumnitzera racemosa, Scyphiphora hydrophyllacea, Xylocarpus granatum, X. mekongensis, Heritiera fomes, H. littoralis*
	Anchor roots	Downward like nail attached with cable root	To support cable root remaining attached with earth		*Avicennia marina, A. alba, A. officinalis; Sonneratia apetala, S. griffithii, S. caseolaris, Lumnitzera racemosa, Scyphiphora hydrophyllacea Xylocarpus granatum, X. mekongensis, Heritiera fomes*
	Nutritional root	Fibrous appearance originating from base of pneumatophore		To accumulate nutrients from soil surface	*Avicennia marina, A. alba, A. officinalis; Sonneratia apetala, S. griffithii, S. caseolaris, Lumnitzera racemosa, Scyphiphora hydrophyllacea Xylocarpus granatum, X. mekongensis, Heritiera fomes, H. littoralis*
	Plank root	Pyramid appearance at the base of trunk	To support the entire plant standing erect	To breathe	*Aglaia rotundifolia*
	Hanging root	Bow appearance but diagonal		To breathe	*Avicennia marina, A. alba, A. officinalis*
Root (under ground, but visual)		Long downward	To support the entire plant remain attached with earth		*Porteresia coarctata*
Reproductive organs	Vivipary	Hanging hypocotyle		To have secure germination by avoiding high salinity in substrata	*Rhizophora apiculata, R. stylosa, R. mucronata, Bruguiera gymnorrhiza, B. sexangula, B. cylindrica, B. parviflora, Ceriops tagal, C. decandra, Kandelia candel,*
	Crypto vivipary	Hypocotyle come out but remain hidden within fruit coat		To have secure germination by avoiding high salinity in substrata	*Avicennia marina, A. alba, A. officinalis; Aegiceras corniculatum, Aglaia rotundifolia, Nypa fruticans*
	Epigeal	Cotyledons remain above ground		To keep plumule above ground so as to avoid salinity in substrata	*Excoecaria agallocha*

addition of freshwater from upstream river.
Not that every plant community has similar way of adaptation but that diverse range of modifications are prevalent in mangroves communities; this signifies that adaptations vary as per need of individual community and so occurs modification of organs accordingly – which are visually distinct.

Importance :

Mangroves occur in the areas linking land-sea interface; ecosystem of which act as dwelling for a wide range of organisms including plants, animals and microorganisms. In world wide these coastal ecosystem are considered the most resourceful one and thus benefit the welfare of human livelihood. The importance of mangrove regions may be summarized as;

i] Contribution of a huge amount of nutrients added into the ecosystem as nitrogen (N) 46.6kg, potassium (K) 25.6kg, calcium (Ca) 99.3kg, magnesium (Mg) 34.1kg, sodium (Na) 31.8kg/ha/yr released by a full grown tree after mineralization of decomposed litters (Gong et al. 1984), besides addition of uncountable nutrients resources released from other living sources including both plants and animals.

ii] Provision of availability of a variety of resources such as fodder, fuel wood, timber for building material, alcohol, honey, wax, paper, charcoal, medicine, etc. which are of potential economic importance (Upadhyay et al. 2002; Mandal & Naskar, 2008).

iii] Dwelling places for diverse organisms comprising both terrestrial and aquatic flora and fauna: algae 150, lichens 32, wetlands herbs 80, intertidal plant communities including mangroves 69, total number of aquatic invertebrates 886, total number of fishes 154, amphibians 8, reptiles 58, birds 163, and mammals 40 in respect of undivided Sundarbans (Chaudhuri & Chaudhury, 1994; Junk et al. 2006).

iv] Provision of breeding, spawning, rearing and growing out ground of the most highly priced prawn species in the world.

v] Acting as much as buffer zone through dense mangrove vegetation known as 'Tree wall' to mitigate natural calamities like sea surges, strong tidal flow, soil erosion, high sea waves, cyclones, cider, hurricanes, tsunami, etc.

Conclusion :

Soil and water fertility by addition of a huge amount of nutrient released through litter decomposition – a unique ecosystem services that mangrove forest ensures the coastal ecosystem. The regeneration of mangrove forests warrants maintaining food chain of both terrestrial and aquatic systems, apart from other economic benefits necessary for livelihood. Let's protect and preserve the valuable mangroves vegetation and their ecosystem for our future generation.

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EVALUATION OF THE HEPATOTOXIC POTENTIAL OF CYPERMETHRIN IN MATURE MALE WISTAR RAT BY INTRA-PERITONEAL ROUTE

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Abstract ■ Cypermethrin is a synthetic insecticide originally extracted from *Chrysanthemum cineriaefolium*. Chemically it is (+/-) alpha-cyano-(3-phenoxyphenyl) methyl (+)-cis, trans-3-(2, 2-dichloroethenyl)-2, 2-dimethylcyclopropanecarboxylate. Cypermethrin is highly toxic to bees, fishes and water insects but shows very low toxicity to birds. It has moderate carcinogenic, mutagenic, immunosuppressive effects and reproductive toxicity. It produces brain and locomotor disorders and polyneuropathy. The present study investigates the hepatotoxic effects of cypermethrin after intraperitoneal treatment at the dose level of 64mg, 80mg and 160 mg/kg body weight. The liver activity indices were reduced markedly in a dose-dependent manner in the intraperitonealy cypermethrin-treated rats. Blood glucose level and serum cholesterol level were elevated in the cypermethrin treated rats. The serum transaminase activities and billirubin level were increased in a dose- dependent manner in the treated groups compared to that in the control rats. The serum alkaline phosphatase activity was significantly enhanced whereas tissue alkaline phosphatase activities and liver glycogen level were reduced in a dose-dependent manner. The results of this experiment indicate that cypermethrin exerts an adverse effect on hepatic tissues and produces hepatotoxicity in male albino rats.

Keywords: Cypermethrin; Liver indices; Blood glucose level; Serum Cholesterol level; Serum transaminase activities and billirubin level; Serum and liver alkaline phosphatase

Introduction

Pesticides, the agricultural chemicals are the largest group of poisonous substances being disseminated throughout our environment (Ecobichon, 1994). Synthetic pyrethroid insecticides have been used in agriculture and indoor insect management for more than 30 years and account for approximately one-forth of worldwide insecticide market (Casida et al, 1998). Cypermethrin, an active synthetic pyrethroid insecticide is commonly used to control various pests in agriculture, public health and in veterinary practice against ectoparasites (WHO, 1989; Bhunya et al, 1988). The chemical structure of cypermethrin is based on pyrethrum, a complex of chemicals extracted

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from the *Chrysanthemum cineriaefolium*. It is chemically (+/-) alpha-cyano-(3-phenoxyphenyl) methyl (+)-cis, trans-3-(2, 2-dichloroethenyl)-2, 2-dimethylcyclopropanecarboxylate(Bhunya et al, 1988). It is highly toxic to bees, fishes and water insects but has lower toxicity to birds. It has moderate carcinogenic, mutagenic and immunosuppressive effects. It produces reproductive toxicity to female rabbits (Ullah et al, 2006).

It has been shown that α-cypermethrin inhalation induced a significant decrease in the carbohydrate inclusions, total proteins and RNA content in the liver cells of treated animals, which were exposed to α-cypermethrin spray for 5 mins daily for 15 days (Sakr et. al, 2002). The activity of liver transaminases (liver GOT, GPT) was reported to be altered by treatment with cypermethrin in male rabbits (El-Demerdash, 2003). The different liver parameters were also significantly changed in male rats with the treatment of α-cypermethrin dissolved in DMSO (Manna et al, 2004; Yavasoglu et al, 2006). According to Manna et al (2004), the subacute toxic effect of α-cypermethrin in orally fed rats was shown by increased activities of serum amino transaminases (ALT, AST), alkaline phosphatase, lactate dehydrogenase enzymes and blood glucose level significantly

Cypermethrin when ingestedthrough oral route or inhalation, can produce different biochemical, histopathological and hematological changes in liver. But the investigation was not done in the intraperitoneal route which has a great importance in toxicological studies because intraperitoneal treatment causes direct toxicological effects to the different viscera. The present study investigates the hepatotoxic effects of cypermethrin in male mature rats by intraperitoneal route.

Materials and methods

The study was conducted on 40 mature Wistar male albino rats weighing 130-150 gm. They were housed in colony cages, at an ambient temperature of 25°±2°C with 12 hrs light-dark cycle. Standard laboratory food and water was given ad *libitum*. Intraperitoneal treatments of cypermethrin were done for each animal. Forty albino mature male rats were divided into four groups, each consisting of ten rats. Control animals were treated with 0.01 ml of NaCl (0.9 gm %) per 10 gm of body weight. Intraperitoneal treatment at the dose level of 64mg, 80mg and 160 mg of cypermethrin /kg body weight were done on every alternate day for 14 days (total 7 doses). Body weights of rats in each group were taken before the treatment period. All the rats were sacrificed 24 hrs after the last dose. On the 15th day of experiment, the entire animals were sacrificed under light ether anesthesia followed by recording of bodyweight. Blood samples were taken from the animals and serum was separated and kept at -20°C for biochemical studies. The livers were dissected out and weights were recorded and stored properly for the biochemical estimation.

For the estimation of blood sugar level 0.1 ml heparinized blood was taken in a centrifuged tube. The blood was deproteinzed by adding 0.95 ml of barium hydroxide solution (90 gm $BaOH_2$ in 2000 ml distilled water) and mixed by rotation. Then 0.95 ml of zinc sulphate solution (100 g ZnSO4 in 200 ml distilled water) was added to the centrifuge tube and mixed thoroughly. After centrifugation 0.5 ml supernatant was collected and used for the determination of glucose by Nelson and Somogyi method (Nelson, 1944, Somogyi, 1945). Total serum cholesterol was measured by the method of Zlatkis et al (1953).Briefly, 0.1 ml of serum and 9.9 ml of ferric chloride solution was taken in a glass stoppered centrifuged tube. It was shaken for 1 minute and was allowed to rotate between the hands at an interval of 5

minutes for three times. It was then centrifuged at 2000 rpm for 5 minutes and 3 ml of ice-cool concentrated H_2SO_4 was given to the supernatant. Then reading was taken at 560nm.

Protein assay was done by the method of Lowry et al (1951). Briefly, 50µl of serum or liver homogenate and 200µl of 0.1(N) NaOH were mixed with Folin's reagent and the readings were taken at 660 nm.

The total serum billirubin level was measured by the method of Malloy and Evelyn (1937).Here 0.4ml of serum sample was mixed with 0.8 ml of diazo reagent and 4.0 ml of methyl alcohol and the mixture was allowed to stand for 30 minutes. Spectophotometric reading was taken against total billirubin control at 530nm.

The measurement of serum glutamate oxaloacetate transaminase (SGOT) and glutamate pyruvate transaminase (SGPT) were done according to the Method of Reitman and Frankel (1957).

Serum and liver alkaline phosphatase (ALP) activity were estimated at 405 nm by the formation of para-nitrophenol from para-nitrophenylphosphate as a substrate (Vanha-Perttula & Nikkanen, 1973).

The hepatic glycogen was measured by the method of Seifter et al. (1950). In this method, 1 ml of sample was incubated with 4.0 ml of anthrone (200 mg in 100 ml of 95% sulfuric acid) and the tubes were heated for 8 min in a boiling water bath and then cooled. The optical density was read at 620 nm.

The experimental results were expressed as the mean ± standard error of mean (SEM). Analysis of variance (ANOVA) followed by Student's t-test were done for statistical analyses of the collected data. Difference was considered significant when $p<0.05$.

Results:

Table 1 shows the effect of intraperitoneal administration of cypermethrin on the change of body weight of mature male Wistar albino rats. Body weight was decreased in the cypermethrin-treated groups in a dose-dependent manner. At a high dose of

Table-1: Effect of cypermethrin on body weight and liver index in male albino rat.

Group	Initial body weight(gm) (Mean±SEM)	Final body weight(gm) (Mean±SEM)	Change in body weight(gm) (Mean±SEM)	Liver Index (Mean±SEM)
Control	139.6±5.64	151.8±7.7	12.2±2.06	4.98±0.24
1/9 th LD50 dose	135±6.92	125±7.48	-10±0.56**	4.52±0.26
1/7 th LD50 dose	138.7±6.74	112±4.06	-16.7±2.68***	3.40±0.18*
1/5 th LD50 dose	140.4±4.64	118±4.63	-22.4±0.01***	3.04±0.22*

- indicates $p<0.05$, ** indicates $p<0.01$, *** indicates<0.001; values are taken in respect of control.

cypermethrin (1/5th LD_{50}), the body weight of rats was decreased more than that of the rats treated with other doses.

The hepatic indices were reduced significantly in cypermethrin- treated groups compared to that in saline treated control group and the reduction of these indices was more prominent in the rats treated with high dose of cypermethrin.

The fasting blood glucose level was elevated markedly (Fig 1) in cypermethrin treated rats compared to that in saline control group. The

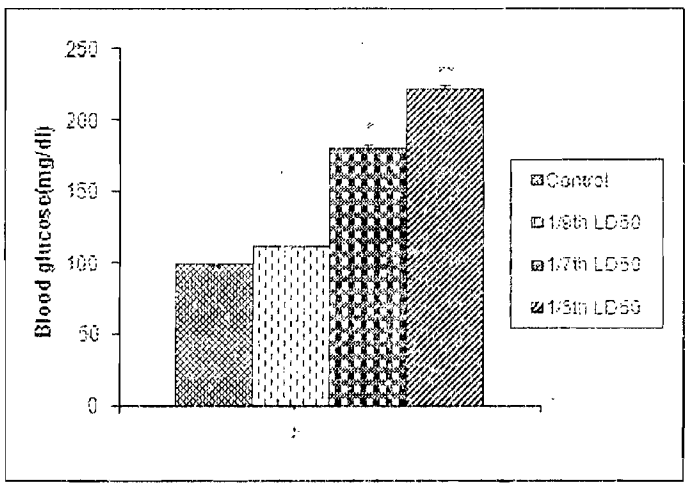

FIG 1: The bar diagram shows the effect of Cypermethrin on Blood glucose (mg/dl) in male albino rat. Results are expressed as MEAN±SEM.Probability values are given in asterisks.* indicates $p<0.05$, ** indicates $p<0.01$; values are taken in respect of control.

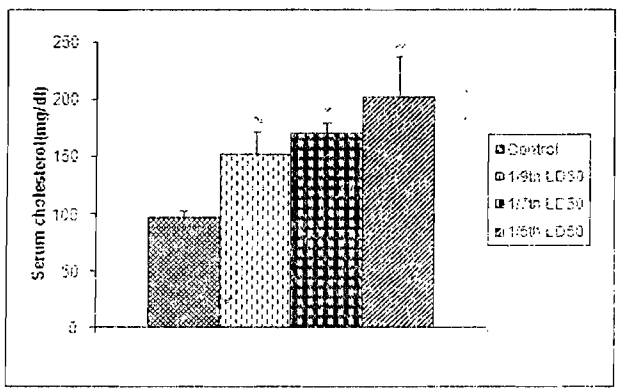

FIG 2: The bar diagram shows the effect of Cypermethrin on Serum cholesterol (mg /dl) in male albino rat. Results are expressed as MEAN±SEM. Probability values are given in asterisks.* indicates $p<0.05$, ** indicates $p<0.01$; values are taken in respect of control.

serum cholesterol level was increased in a dose-dependent manner in cypermethrin-treated rats (Fig 2).

The serum protein level was increased and liver protein level was slightly decreased (Fig 3, 4) in cypermethrin treated rats. The serum

billurubin level was increased significantly in a dose-dependent manner (Fig 5).

The activities of serum transaminases, i.e., SGOT and SGPT were increased significantly in cypermethrin-treated rats compared to the control group (Fig 6 & Fig 7).

The serum ALP level was increased significantly whereas tissue ALP level reduced in a dose-dependent manner (Fig 8, 9). Both of these changes were highest in the rats treated with a

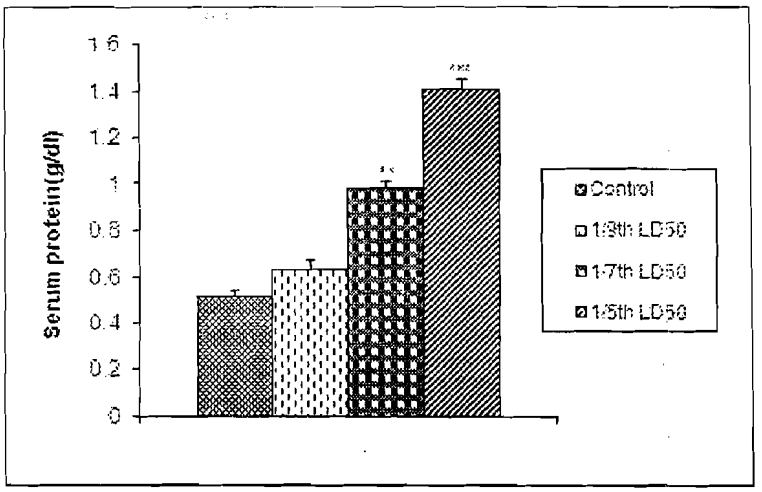

FIG 3: The bar diagram shows the effect of Cypermethrin on Serum protein (g /dl) in male albino rat. Results are expressed as MEAN±SEM.Probability values are given in asterisks ** indicates $p<0.01$, *** indicates<0.001; values are taken in respect of control.

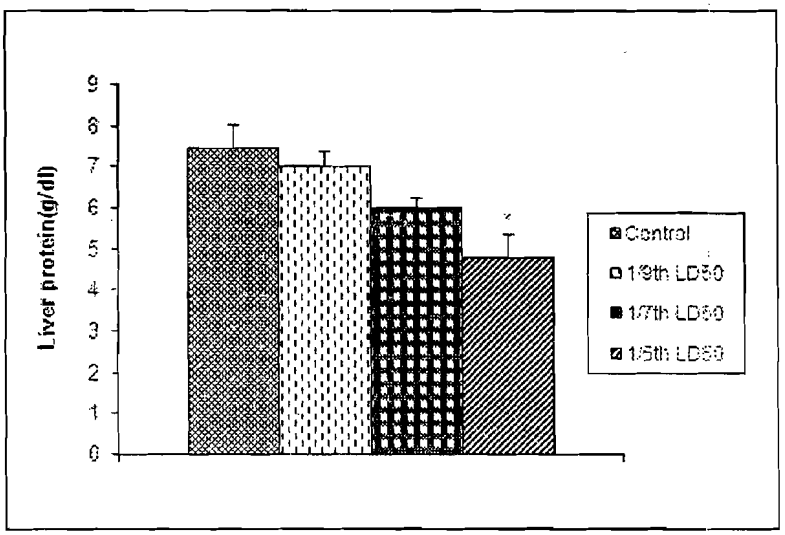

FIG 4: The bar diagram shows the effect of Cypermethrin on Liver protein in male albino rat. Results are expressed as MEAN±SEM.Probability values are given in asterisks.* indicates $p<0.05$; values are taken in respect of control.

dose of 1/5th LD50.

The liver glycogen level was decreased in cypermethrin-treated groups compared to that in the control group (Fig 10).

Discussion :

In case of male matured albino rats, cypermethrin decreased the body weight as well as hepatic index in a dose-dependent manner. The above alteration may occur due

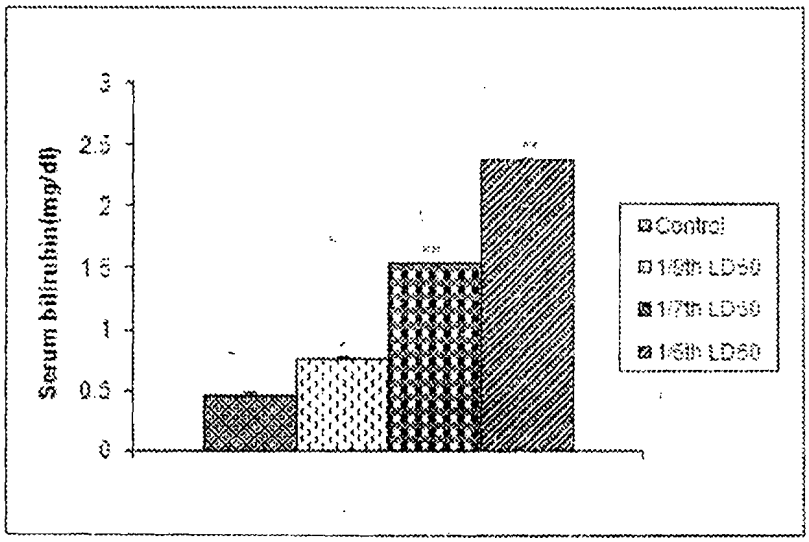

FIG 5: The bar diagram shows the effect of Cypermethrin on Serum bilirubin (mg /dl) in male albino rat. Results are expressed as MEAN±SEM. Probability values are given in asterisks.* indicates $p<0.05$, ** indicates $p<0.01$; values are taken in respect of control.

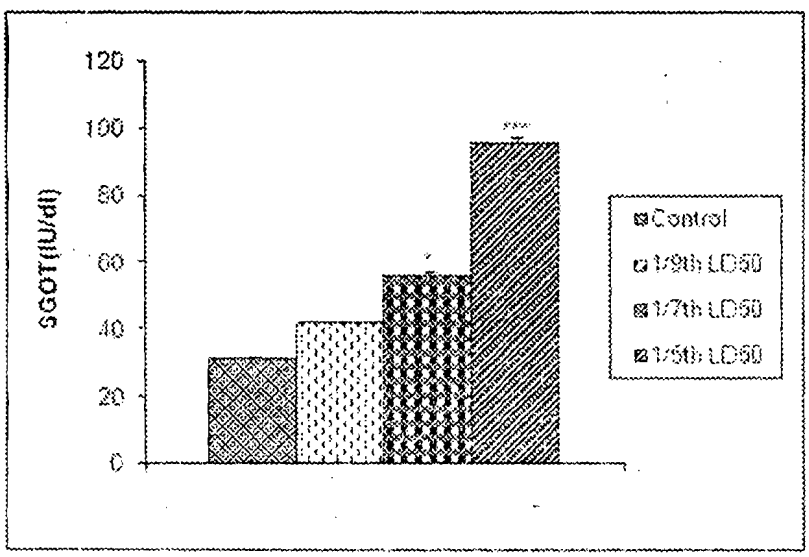

FIG 6: The bar diagram shows the effect of Cypermethrin on SGOT (IU/dl) in male albino rat. Results are expressed as MEAN±SEM. Probability values are given in asterisks.* indicates $p<0.05$, ** indicates $p<0.01$; values are taken in respect of control.

to the toxic effect of cypermethrin. The reduction of body weight and liver weight may be due to the decrease in growth rate, hepatic activities or may be due to another toxic effect of cypermethrin on other organs and systems of the animals.

The present study showed the increased fasting blood glucose level in cypermethrin-treated rats compared to the control group. The elevation of blood glucose may be due to the interference of carbohydrate metabolism which may be caused from the alteration of the catecholamine

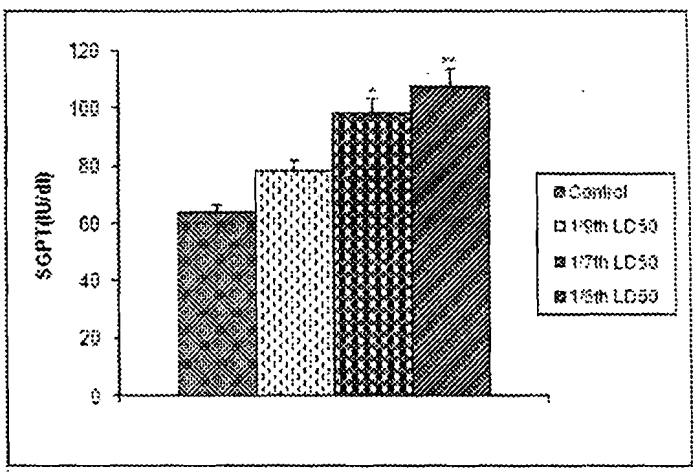

FIG 7: The bar diagram shows the effect of Cypermethrin on SGPT (IU/dl) in male albino rat. Results are expressed as MEAN±SEM.Probability values are given in asterisks.* indicates $p<0.05$, ** indicates $p<0.01$; values are taken in respect of control.

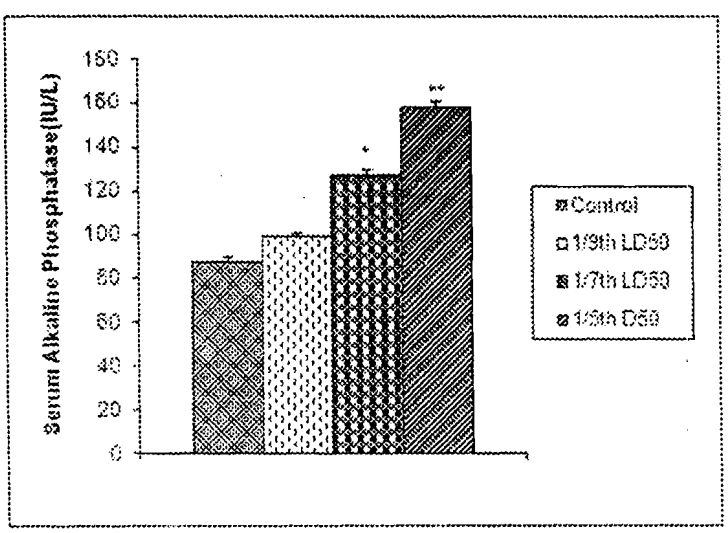

FIG 8: The bar diagram shows the effect of Cypermethrin on Serum Alkaline Phosphatase (IU /L) in male albino rat. Results are expressed as MEAN±SEM.Probabilityvalues are given in asterisks.* indicates $p<0.05$, ** indicates $p<0.01$; values are taken in respect of control.

levels (Goodman & Gilman, 1975) or phosphorylase activities or due to low peripheral utilization of glucose.

Hypercholesterolemia was observed in cypermethrin-treated animals in comparison to the control group. Elevated serum cholesterol level may be due to decrease in cholesterol catabolism or due to high blood glucose level or for an inhibition of lipoprotein lipase activity. The serum protein level increased and the liver protein level slightly decreased in a dose-dependent manner due to the damaging action of cypermethrin on liver.

The serum billurubin level significantly enhanced in treated groups which indicate the toxic action of cypermethrin in the hepatic tissues in which the metabolism of bile pigments has been impaired. Rana et al. (1996) reported that the increase in plasma bilirubin (hyper-bilirubenimia) may be resulted from decreased liver uptake,

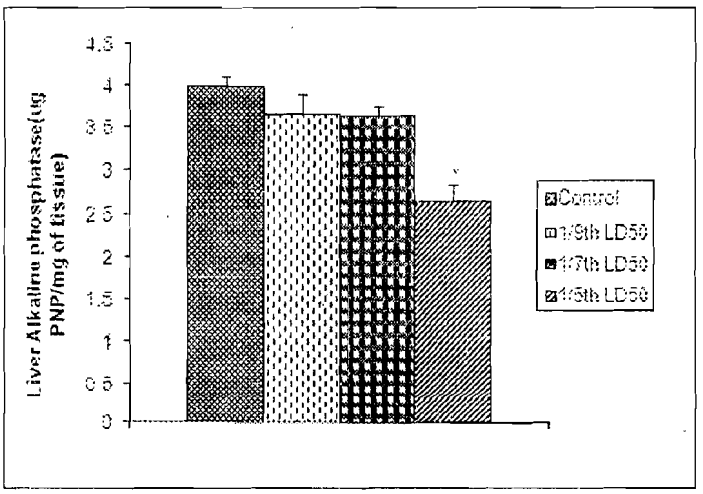

FIG 9: The bar diagram shows the effect of Cypermethrin on Liver Alkaline Phosphatase (µg PNP/mg of tissue) in male albino rat. Results are expressed as MEAN±SEM.Probability values are given in asterisks.* indicates $p<0.05$; values are taken in respect of control.

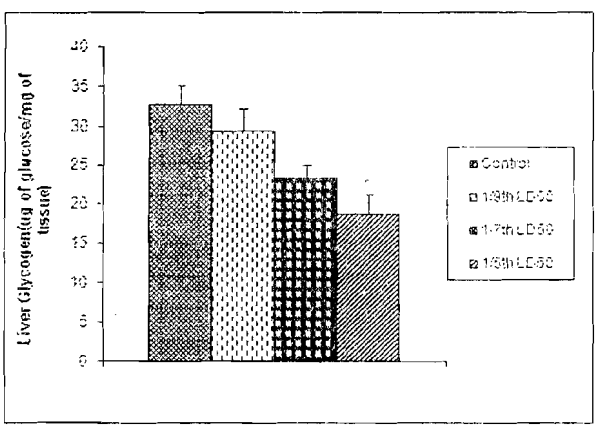

FIG 10: The bar diagram shows the effect of Cypermethrin on Liver Glycogen (µg glucose/mg of tissue) in male albino rat. Results are expressed as MEAN±SEM.Probability values are given in asterisks.* indicates $p<0.05$; values are taken in respect of control.

conjugation or increased bilirubin production from hemolysis.

Hepatic transaminase activities increased significantly in a dose-dependent manner. Liver necrosis is generally associated with increasing activities of both SGPT and SGOT.

The activity of alkaline phosphatase(ALP) significantly increased in serum and decreased in liver. These results are in agreement with the reports of Moreno et al (1996), Labana et al (1997) and Yousef et al (1999) in rat and Habiba et al (1992) in rabbit. Alkaline phosphatase enzyme is a sensitive biomarker (Lakshmi, 1991) of liver toxicity. Serum alkaline phosphatase increases with obstructive jaundice and liver cell damage (Cheesbrough et al, 1985). The increase in the activity of ALP may be due to the alteration in the membrane transport system, and an inhibitory effect on cell growth and proliferation (Lakshmi et al, 1991). Any cellular damage may release phosphatases into the systemic circulation (Rajinder et al, 1990). According to Yousef et al. (1998), alkaline phosphatase activity was increased in deltamethrin-treated rat's plasma. Therefore, the decrease in ALP activity in liver may be due to the leakage of this enzyme to the blood stream.

Liver glycogen level decreased in cypermethrin-treated groups compared to the control group. This may occur due to the interference in carbohydrate metabolism. In the current study, we observed a significant depression in liver glycogen content following cypermethrin intoxication. This process of glycogen breakdown is efficiently pursued by glycogen phosphorylase which catalyses the nucleophilic attack of phosphate on the C-1 position of the glucose residue.

On the basis of above experimental data it is evident that cypermethrin has a potent hepatotoxic effect in a dose-dependent manner by intraperitoneal route.

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A Longitudinal study of weight gain among Santal and Non-Santal infants of Kankabati Gram Panchayat, West Bengal, India

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Abstract ■ A community based longitudinal study among Santal tribal and non-Santal infants and young children of Kankabati Gram Panchayat, West Bengal, India was undertaken. The objective was to compare the growth in weight of the studied communities. The weights of 48 boys and 51 girls were taken at one month interval over periods of up to 24 months. Among boys, there existed significant ethnic differences in mean weight at all ages except birth. Similarly, in girls, there existed significant ethnic differences in mean weights at all ages except at birth, 17 months and the duration 19-24 months. Significant sex differences ($p < 0.05$) at ages 8 and 13 months were observed among non-Santals.

Key Words: Longitudinal Study; India; Santal; Infants; Tribals;

Introduction :

India probably has the largest number of tribal communities in the world. About half of the world's autochthonous people, comprising 635 tribal communities including 75 primitive tribal communities live in India (ICMR Bulletin, 2003). According to the 2001 census conducted by the Government of India, India has a tribal population of more than 84 million, constituting 8.2% of India's population. They are found in all states except Punjab, Haryana and Jammu & Kashmir. (Government of India, 1998). Santals (also spelled Santhal; formerly also Sonthal), the third largest tribe in India, live in many states including West Bengal, Bihar, Jharkhand, Orissa, Tripura etc. The native language of Santals is Santali, an Austro-Asiatic language. Santals are primarily engaged in agriculture. Their social system is patriarchal. Their total number in all India is nearly two

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million. In West Bengal, Santals represent 54.27% of total tribal population and they are spread over in vast areas of Purba and Paschim Medinipur, Bankura and Purulia (Bagchi, 1994). In general, the tribal populations are among the most underprivileged and undernourished people in India (Topal and Samal, 2001). This tribe lives in remote places and is characterized by poverty, illiteracy, and nutritional problems. The health status of this community remains unreported excepting few studies (Bagchi, 1981; Ghosh *et al.*, 2006). The prevalence of undernutrition in children is an indicator of community health status. Child growth is the universal means to assess adequate nutrition, health and development of individual children, and to estimate overall nutritional status and health of populations. Compared to other health assessment tools, measuring child growth is a relatively inexpensive, easy to perform and non-invasive process. Moreover, growth patterns of Santal children, with respect to weight, have not been investigated from Paschim Medinipur District. The objective of the present study was to compare the weight of Santal (tribal) infants and young children with the Non-Santal children of Kankabati Grampanchayet, Paschim Midnapore.

Materials and Methods :

This longitudinal community based study was conducted in the villages of Kankabati Grampanchayet, Paschim Medinipur district which is 23 meters above sea-level and about 127 km from Kolkata city, the provincial capital of West Bengal. This study was conducted at monthly intervals over periods of up to 24 months from 2008 and 2010. A total of 99 (Santal boys =17, Santal girls = 28; non- Santal boys = 31, non- Santal girls = 28) young children aged 0-24 months were measured. Parents were informed about the objectives of the study and their consent was obtained. The study protocol was approved by the institutional ethical committee. Information on age, gender and weight was collected on a pre-tested questionnaire by house to house visit following interview and measurement.

Weights were measured by a trained investigator (AS) according to standard procedures (Tanner, 1969). Weights were measured in the nude to the nearest 10g on infant beam balance. The balance was calibrated before the start of each day's measurements. Statistical analyses were done using SPSS 16 software. Student's t-test were undertaken to test for sex and ethnic difference.

Results :

Table 1 shows the mean, standards deviation and t-test values of the Santal (tribal) and non-Santal infants of Kankabati Grampanchayet, West Bengal. It was observed that non-Santal boys and girls had greater means in all 24 months than Santals despite of their close place of residence.

Among boys, there existed significant ethnic difference in mean weight at all ages except birth. Similarly, in girls, there existed significant ethnic difference in mean weights at all ages except at birth, 17 months and the duration 19-24 months. Significant sex difference ($p < 0.05$) at ages 8 and 13 months were observed among non-Santals. There was no significant sex difference observed among the studied Santal infants and young children.

Maximum weight gain among non-Santal boys was observed at age 0 – 1 months (+0.93 kg) and among non-Santal girls at age 0 – 1 months (+0.92 kg). Similarly, minimum weight gains among non-Santal boys were observed at age 13 – 14 months (+0.10 kg) and among girls at ages 18 – 19 and 19 – 20 months (+0.10 kg). We observed maximum weight gains among Santal boys at age 3 – 4 months (+0.74 kg) and among girls at age 1 – 2 months (+0.68 kg).

Table 1: Mean (sd) of weight among Non-Santal and Santal infants and young children

Age (months)	Boys			Girls		
	Non-Santal N=31	Santal N=17	t	Non-Santal N=28	Santal N=23	t
0	2.75 (0.28)	2.66 (0.28)	1.012	2.83 (0.43)	2.69 (0.42)	1.120
1	3.68 (0.48)	3.29 (0.38)	2.919**	3.75 (0.62)	3.20 (0.50)	3.395**
2	4.40 (0.66)	3.77 (0.56)	3.349**	4.47 (0.69)	3.88 (0.41)	3.610***
3	5.32 (0.74)	4.32 (0.53)	4.871***	5.21 (0.74)	4.38 (0.57)	4.412***
4	5.95 (0.79)	5.06 (0.57)	4.086***	5.82 (0.65)	4.80 (0.60)	5.762***
5	6.44 (0.78)	5.50 (0.53)	4.430***	6.28 (0.65)	5.29 (0.65)	5.384***
6	6.93 (0.83)	5.91 (0.50)	4.593***	6.69 (0.60)	5.81 (0.60)	5.156***
7	7.27 (0.89)	6.21 (0.50)	4.553***	7.01 (0.62)	6.17 (0.61)	4.860***
8	7.72 (0.88)	6.61 (0.67)	4.507***	7.25 (0.59)	6.51 (0.68)	4.165***
9	7.94 (0.97)	7.05 (0.74)	3.299**	7.53 (0.62)	6.87 (0.71)	3.539***
10	8.23 (1.01)	7.21 (0.77)	3.634***	7.82 (0.62)	7.06 (0.77)	3.923***
11	8.47 (0.96)	7.45 (0.73)	3.846***	8.08 (0.67)	7.28 (0.72)	4.115***
12	8.71 (0.96)	7.89 (0.71)	3.080**	8.28 (0.76)	7.43 (0.73)	4.033***
13	8.88 (1.00)	8.06 (0.79)	2.894**	8.40 (0.77)	7.60 (0.78)	3.697***
14	8.98 (0.95)	8.25 (0.74)	2.739**	8.57 (0.85)	7.86 (0.72)	3.200**
15	9.11 (0.96)	8.35 (0.80)	2.775**	8.78 (0.92)	8.12 (0.73)	2.788**
16	9.25 (1.01)	8.52 (0.86)	2.506*	8.92 (0.94)*	8.31 (0.75)	2.511*
17	9.40 (1.06)	8.66 (0.87)	2.455*	9.06 (0.98)	8.59 (0.81)	1.819
18	9.51 (1.00)	8.78 (0.88)	2.517*	9.23 (0.96)*	8.71 (0.84)	2.050*
19	9.63 (0.92)	8.96 (0.91)	2.384*	9.33 (0.98)	8.90 (0.76)	1.717
20	9.78 (0.90)	9.13 (1.02)	2.271*	9.43 (1.00)	9.04 (0.79)	1.501
21	9.91 (0.92)	9.31 (1.06)	2.059*	9.55 (1.05)	9.29 (0.81)	0.984
22	10.09 (0.91)	9.52 (0.97)	2.046*	9.72 (1.02)	9.49 (0.85)	0.864
23	10.28 (0.97)	9.62 (0.94)	2.302*	9.90 (1.16)	9.74 (0.88)	0.536
24	10.50 (0.96)	9.91 (0.93)	2.046*	10.05 (1.12)	9.90 (0.90)	0.509

Standard deviations are presented in parentheses. Asterix in the table refers to significant ethnic differences. * = $p < 0.05$; ** = $p < 0.01$; *** = $p < 0.001$.

Similarly, minimum weight gain was observed among Santal boys at ages 14 – 15 and 22 – 23 months (+0.10 kg) and among girls at age 17 – 18 months (+0.12 kg).

Discussion :

Figure 1 highlights the comparative ethnic and sex differences in mean weight among Santal and non-Santal children. It is clear that non-Santals were significantly heavier than Santals. A noteworthy observation among girls was that there existed no significant ethnic difference in mean weight during the duration 19-24 months. This implied that both these ethnic groups were experiencing similar nutritional stress during this later period. In other words, the nutritional deficit was not ethnic-specific. It is probable indicative of gender discrimination rather than ethnic disparity in nutritional intake. Interestingly, both the ethnic groups had similar

weights before 1 month of age. This is suggestive of the fact that the additional nutritional stress being faced by Santals, as compared to non-Santals during infancy and early childhood, was absent at birth.

Children are the most important assets of a country because they will be tomorrow's youth and provide the human potential required for its development. Nutrition in the early years of life plays a big role in physical, mental and emotional development. Possibly the primary cause of underweight among the Santals observed in the present study is maternal malnutrition and inadequate consumption of calorie and protein along with socioeconomic status, hygienic condition, sanitation, life style, education etc. Other important factors like infection, adverse cultural practices of child care, breast feeding and weaning may be responsible for this nutritional deficit. Unfortunately, one of the limitations of our study was the absence of data on these variables. Comprehensive child survival programmes and supplementary feeding practices are required to enhance the nutritional status of Santal infants. In the present study, we have covered only a limited sample of Santal and non-Santal children. We feel that further detailed research on larger sample sizes incorporating the study of related socio-economic and socio-demographic are required to obtain a clearer insight into the likely causes of this nutritional deficit among Santal infants. Moreover, similar studies should be undertaken on pre-school children and adolescents to determine whether this nutritional stress exits among them Lastly similar studies should be undertaken among other tribal infants and children from different parts of India. To the best of our knowledge,

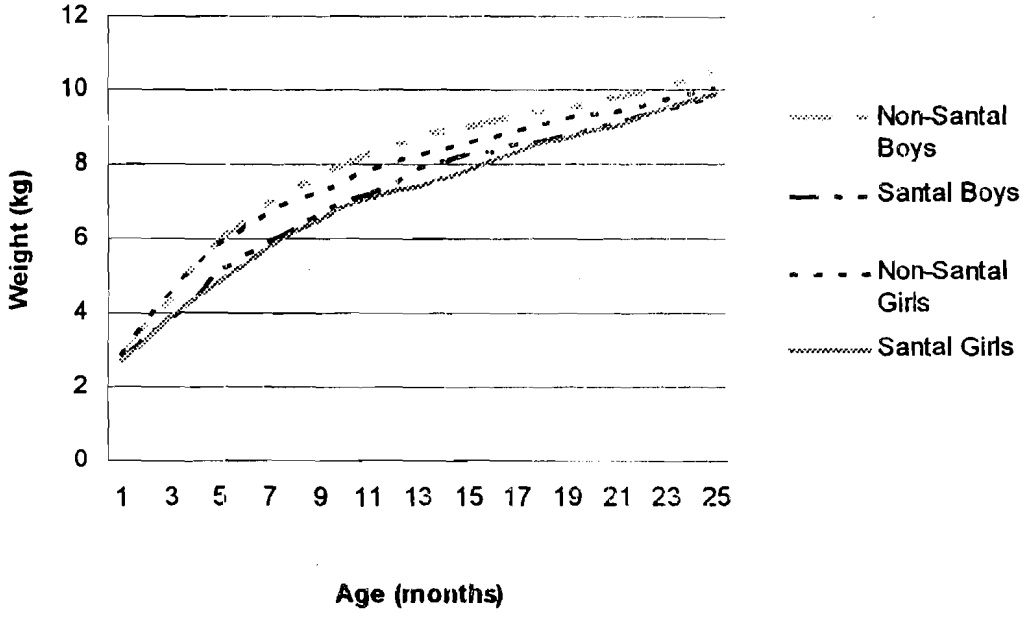

Figure 1. Mean weight *(kg) of the Santal and non-Santal infants and young children.*

longitudinal studies dealing with growth patterns of tribal children are hitherto non-existentfrom India.

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ANTHROPOMETRIC ASSESSMENT OF NUTRITIONAL STATUS AMONG ADULT FISHERFOLK IN DIGHA, WEST BENGAL.

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ABSTRACT ■ The present cross-sectional study attempts to understand the variations in anthropometric characteristics among male fishermen (aged > 18 years) of Sankarpur, Digha, West Bengal in order to reveal their nutritional status. This work is mainly based on the occupation of the present study population. Overall 5.92 % of the total sample was underweight and 15.8 % were overweight. However, the result of the present study may show good status for the population health of the fishermen, because 78.29 % of them belongs to the normal range (i.e. 18.50–24.99 kg/m^2) BMI of the overall. So, there is necessity of such studies that would be utilized for better understanding of human population variation.

Key Words: Fisherfolk, malnutrition, undernutrition, male, Digha.

Introduction :

The World Health Organization defines malnutrition as "the cellular imbalance between supply of nutrients and energy and the body's demand for them to ensure growth, maintenance, and specific functions"(WHO). World Health Organization (1995) has recommended that anthropometry could be used to assess the nutritional and health status of adults. Although adult nutritional status can be evaluated in many ways, the BMI is most widely used because its use is simple, inexpensive, safe and suitable for large scale surveys (Lohman et al., 1988; Ferro-Luzzi et al., 1992; James et al., 1994; Lee and Nieman, 2003). Thus, BMI is the most established anthropometric indicator used for assessment of adult nutrition status (Lee and Nieman, 2003). BMI is generally considered a good indicator of not only the nutritional status but also the socio-economic condition of a population, especially adult population of developing countries (Ferro-Luzzi et al., 1992; Shetty and James, 1994; Nube et al., 1998; Khongsdiar, 2002; Mosha, 2003). A BMI < 18.5 kg/m^2 is widely used as a practical measure of chronic energy or hunger deficiency. (CED), i.e., a 'steady' underweight in which an individual is in energy balance irrespective of a loss in body weight or body energy stores (Khongsdiar 2005). CED is caused by inadequate intake of energy accompanied by high level of physical

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activities and infections (Shetty and James, 1994; Shetty et al., 1994). Nutritional anthropometry has been defined as "measurements of the variations of the physical dimensions and the gross composition of the human body at different age levels and degrees of nutrition" (Jelliffe, 1966).

The fisherfolk form an integral part of Indian peasantry. Fishing is one of the most prehistoric occupations all over the world. Very few attempts have taken so far in India to throw light in the nutritional status of the present community. To speak of West Bengal there has hardly taken any step in this respect. So, the present study has attempted to investigate the nutritional status based on BMI among the male fisherfolk of Digha, Purba Medinipur, West Bengal, who are engaged in deep sea fishing with the help of mechanized vessels.

Materials and Methods :

The present study was community (occupation) based, cross-sectional study conducted among the deep sea fishermen who operates from Old-Digha fishing harbour located in Purba Medinipur District, that are situated about 187 km from Kolkata, the capital of West Bengal, India. This study was carried out during February, 2009. A total of 152 males above 18 years were measured. The Southern West Bengal is one of the most famous sea coasts on the eastern coast of India, which is known as Digha. The splendor of this place was discovered during the time of Warren Hastings. At that time, Digha was known as Beercool. Today, Digha is a small town, which is packed with hotels usually around one main road. Digha lies between 21° 41' 0" north latitude and between 87° 33' 0" east latitude. It has an average elevation of 6 m (22 feet). It lies in East Midnapore district and of the northern end of the Bay of Bengal.

Fisherfolk form an integral part of Indian peasantry. Fishing, as an occupation, can be traced back to prehistoric times almost all over the world. But a few anthropologists have so far shown scanty interest in a systematic study of this most ancient occupation & the people involved therein. It is unfortunate that so far very little systematic health and nutritional study has been done about the marine fisherfolk of India. It is only during the last two decades that the interest has gradually been shifted to the structural-functional study of the peasantry in various types of village communities. It has been noted earlier that the members of the fishing units are recruited for about four months, either on share or on salary basis, & after the fishing season, they all return to their respective villages in rural or semi-urban set up. Most of the fisherfolk are practically landless, except for about few kathas of land for their homestead. Under the situation, seasonal marine fishing alone is not sufficient for their subsistence for the whole year. So, in their village set up, they have found various types of 'non-caste' occupation like rickshaw-pulling, agricultural labor etc. The level of literacy among the unit members is extremely low. A large number of them are illiterate (60.5%) & whatever little education they have hardly exceeds the standard of class IV. (Raychaudhuri, 1980)

Data were collected after obtaining the necessary verbal approval from the respondents after informing them about the objectives of the study. Information on age, gender, weight and height were collected on a pre-tested questionnaire. Height and weight measurements were taken on each subject by (MP) following the standard techniques. (Lohman *et al.* 1988). Height and weight were taken to the nearest 0.1 cm and 0.5 kg, using standard Martin's anthropometer and weighing scale (Libra, New Delhi, India), respectively.

BMI was computed using the following

standard equation:

BMI = Weight (kg) / height (m^2) Nutritional status was evaluated using internationally accepted BMI guidelines (WHO, 1995). The following cut-off points were used:

CED BMI <18.5

Normal: BMI= 18.5-24.9

Overweight: BMI ≥ 25.0

World Health Organization's classification (1995) of the public health problem of low BMI, based on adult populations worldwide was followed. This classification categorizes prevalence according to percentage of a population with BMI< 18.5.

1) Low (5-9%): warning sign, monitoring required.
2) Medium (10-19%): poor situation.
3) High (20-39%): serious situation.
4) Very high (= 40%): critical situation.

All statistical analyses were undertaken using the SPSS Statistical Package. Statistical significance was set at $p < 0.05$.

Results :

The list of mean, standard deviation, minimum and maximum for age and other anthropometric measurements of 152 adults (=18years) fishermen of Digha, West Bengal have been presented in the table 1. It is clear from the table that the mean age and BMI of = 40 years' adult males have greater than their younger counterpart. On the other hand younger adults (18 – 39 years) are taller than their older male counterpart. There exist significant age difference (P<0.001) in two age groups is observed.

Table-1: Mean standard deviation (SD), minimum and maximum of anthropometric variables among 152 adult fishermen (= 18 years) in Digha, West Bengal.

Variables	Age group	N	Minimum	Maximum	Mean	Standard Deviation	Anova
Age (years)	18 - 39	105	18	39	29.61	5.68	305.7***
	? 40	47	40	67	47.87	6.53	
Weight (kg)	18 - 39	105	43.50	90	57.50	7.95	0.690
	? 40	47	47.0	74.0	58.61	6.99	
Height (cm)	18 - 39	105	146.50	176.60	161.14	5.88	0.126
	? 40	47	148.30	173.0	160.77	6.32	
BMI (kg/m^2)	18 - 39	105	16.42	36.75	22.17	3.11	0.966
	? 40	47	18.22	28.75	22.68	2.41	

*** P<0.001

Table 2 shows the percentage of nutritional status based on BMI (Kg/m^2) of the studied sample. It is clear from the table that 21.71 % of the total sample experiencing malnutrition (underweight (5.92 %) and overweight (15.79 %)). Percentage of underweight decreases with increasing age 4.26 % (among ≥ 40 years) and overweight gradually increases with increasing age (17.02 %) among ≥ 40 years old people. There is no significant age group difference in prevalence of CED.

is related to abdominal adiposity measures and the body energy store, and this relationship is influenced by age, sex and ethnicity (Norgan, 1990).

Figure 1 compares the prevalence of CED based on BMI among the different available data. It is clear from this figure that Slum dwellers (46.8 %) of Paschim Medinipur (Bose et. al. 2007) were experiencing highly critical nutritional stress and have the highest prevalence of CED followed by Telegas (28.5

Table-2: Percent distribution of nutritional status of the adult fishermen (≥18 years) in Digha, West Bengal, India.

Sl. No.	Age Group (Years)	N	Body mass index (kg/m^2)		
			Underweight (<18.5)	Normal (18.5-24.9)	Overweight (25.0-29.9)
1	18-39	105	6.67 %	78.10 %	15.24 %
2	≥ ? 40	47	4.26 %	78.72 %	17.02 %
Total		152	5.92 %	78.29 %	15.79 %

Chi-square = 1.385; df= 4; p= 0.847 (based on BMI)

DISCUSSION

Anthropometric measurements, being simple, reproducible, cheap and non-invasive, have been widely recommended for field investigations relating to public health (Despres, 2006). BMI

%) of Paschim Medinipur (Banik 2007) and Santals (26.2 %) of Bankura (Bose et. al. 2006) and Fisherfolks (5.92 %) using BMI.

it is clear from the Present study, that the fisherfolk of Sankarpur, West Bengal observed

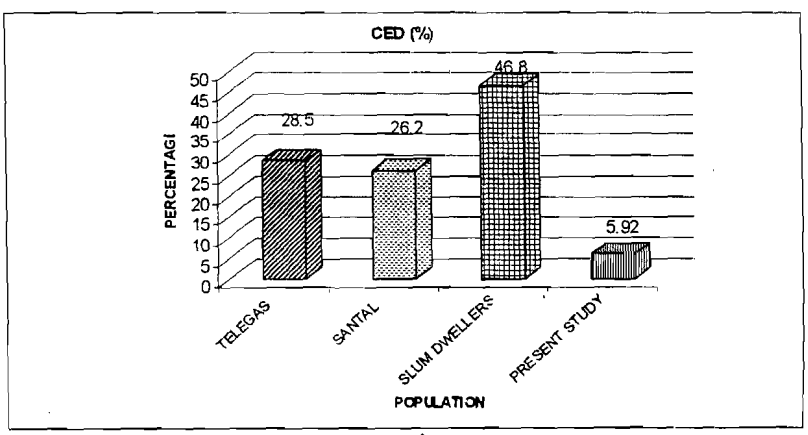

Figure 2: Comparison of CED (based on BMI) among different population.

low rate of undernutrition. It must be pointed out here that further studies are needed among different occupational group population in India to determine the prevalence of malnutrition among them and using such studies could be utilized for better understanding human population variation. One of the limitations of the present study was the small sample size.

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SEX-RATIO PATTERNS AMONG THE LODHAS OF PASCHIM MEDINIPUR DISTRICT, WEST BENGAL

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Abstract ■ In this study a preliminary attempt has been made to record and analyse some demographic information collected from selected Lodha settlements in Binpur II and Nayagram blocks in Pachim Medinipur district, West Bengal. The main thrust of the study is on the sex-ratio patterns among the Lodhas, which have not yet been studied by the anthropologists and the demographers. The findings have revealed a preponderance of females in almost all age groups of the study population. A comparison of the sex-ratio of the study population with all India and state-level figures show that among the Lodhas of Paschim Medinipur district the females far outnumber the males in contrast to both all India and state-level figures.

Introduction :

An attempt has been made in this article to record the patterns of sex-ratio among one of the most marginalised and economically deprived tribe of West Bengal, the Lodhas.[1] In the colonial period, the Lodhas were designated as a 'Criminal Tribe' who mainly depended on forest product collection and sporadic agriculture. After Independence, although the tribe was denotified by the government and was no more regarded as a 'Criminal Tribe', their socio-economic conditions did not improve appreciably. (Bhowmick 1994 & Danda 2002). Lodhas at present do not live exclusively in the jungle area, but have spread out into other deforested regions and work there as farm labourers. But their main economy is still based on collection of minor forest products, such as leaves, edible roots, tussore cocoons, etc. (Bhowmick 1994).

Recently, the government has been making an attempt to improve the living conditions of the Lodhas through various kinds of development inputs which are yet to take firm roots among the community.(Roy 2009 : 15) An impact assessment study done by a team of

[1] The Census of 1981 shows that the total population of the Lodhas including the Kharias and the Kherias of West Bengal is 53,718 The Lodhas are concentrated in Midnapore District and their total number according to the Census of 1981 was 16,534. Besides West Bengal, they are also found in the Mayurbhanj and Baleswar districts of Orissa, Originally, they inhabited hilly rugged terrains covered with jungle. Their mother tongue is Lodha, which is close to Savara, an Austro-Asiatic language. They are fluent in Bengali. Traditionally they were forest dwellers but now they have started cultivation either as owner or as agricultural labourer and are also engaged in hunting and fishing. More than 80% of them follow Hinduism with traditional belief in spirits and nature (Mondal, et.al. 2002:32).

anthropologists of Vidyasagar University sponsored by the district administration of Paschim Medinipur found that the Lodhas suffererd from landlessness and the development inputs given to them were not properly utilised among the majority of the beneficiary families under the Rastriya Sama Vikas Yoyona(RSVY) scheme of the Central Government(Panda & Guha 2009 : 69-75)

The anthropological studies on the Lodhas have mainly concentrated on their socio-cultural and religious life and problems around education and economic development (Duary and Haldar2006). The assessment of the nutritional levels of the Lodhas in West Bengal done by the anthropologists at Vidyasagar University revealed their extremely poor health conditions even during the later part of the present decade (Bisai. et.al. 2008; Bose,et.al. 2008). Studies on the health care practices of the tribe have also been conducted by the researchers (Kolay, .2005; Tiwari, et.al. 2001). There is virtually no study by the demographers and anthropologists on the age-sex composition and sex-ratio patterns of this small tribe (Agnihotri 2000)

Under this background, we have undertaken this study on some basic demographic features of the Lodhas in two blocks of Paschim Medinipur district of West Bengal. The demographic features, which we have taken into consideration are, (i) age-sex composition and (ii) sex-ratio.

Materials and Method :

We have selected the Lodha settlements for our survey from the District Planning and Development Cell which keeps the record of the development inputs given to the Lodha community under the RSVY scheme. Within the stipulated time period of the impact assessment project we have been able to visit 11 Lodha settlements of Binpur-II and Nayagram Blocks and conducted basic census and survey on occupational diversity of the Lodhas who received development inputs from the district administration. Along with the basic survey we have collected quantitative and qualitative data regarding the nature and type of development assistance as well as the utilisation of the inputs by the beneficiaries at the household level. The fieldwork for this impact assessment survey was carried out by a team consisting of the author of this paper and three other investigators during January 2006. Under the supervision of Dr. Abhijit Guha. At a later stage, the author of the paper extended the survey for his Ph.D work to include another large village named Singdhui in Nayagram block. The fieldwork for the extended survey was conducted during the months of April to August 2009. This paper is based on the demographic data collected in course of the impact assessment study and the Ph.D fieldwork of the author. The fieldwork for this study was carried out by following the anthropological method of participant observation along with surveys by using structured questionnaire and village census schedules.

The total number of households in our sample is 269 and the total population is 1024 with a clear predominance of females in the sample. The village-wise sex-ratios also show a preponderance of females over males; only in three villages out of twelve in our sample there are more males than females(Table 1 & Fig.1). In the present sample, the Lodha settlements are distributed equally in Binpur-II and Nayagram Blocks. The number of households is greater in Nayagram than in Binpur-II and the largest Lodha settlement (49) in our sample comes from Nayagram while the smallest (07) belongs to Binpur-II. The average number of households per settlemenyt in Nayagram is 30.33, while that of Binpur-II is 14.5.

TABLE 1: PROFILE OF THE SURVEYED LODHA SETTLEMENTS

Sl. No.	Name of village	Male	Female	Total Population	Number of households	Mean Household size	Village wise sex ratio
1	Amlasole(Binpur-II)	21	39	60	18	3.3	1857.14
2	Chakadoba(Binpur-II)	27	40	67	18	3.7	1481.48
3	Chirakuthi(Binpur-II)	20	20	40	08	5.0	1000.00
4	Dhobakacha(Binpur-II)	22	26	48	10	4.8	1181.81
5	Rimradanga(Binpur-II)	37	46	84	26	3.2	1243.24
6	Sankhabhanga(Binpur-II)	10	11	20	07	2.8	1100.00
7	Ambhisole(Nayagram)	55	69	124	32	3.8	1254.54
8	Bansiasole(Nayagram)	42	33	75	19	3.9	785.71
9	Banksole(Nayagram)	62	66	128	33	3.9	1064.52
10	Palasia(Nayagram)	59	46	105	25	4.2	779.66
11	Sitalpura(Nayagram)	42	46	88	24	3.7	1095.24
12	Singdhui (Nayagram)	105	80	185	49	3.8	761.90
Total	**12**	**502**	**522**	**1024**	**269**	**3.8**	**1039.84**

Note:

These Lodha settlements have been ide.ntified from the district planning and development office records in which the names of the beneficiaries' villages are listed. We started our field observation in Binpur-II and then we moved to Nayagram block. Repeated visits to some villages of Binpur-II were made by the author of the paper and the fieldwork was completed within three months during December 2005 to February 2006.This survey was later extended to include a large Lodha settlement in Nayagram.

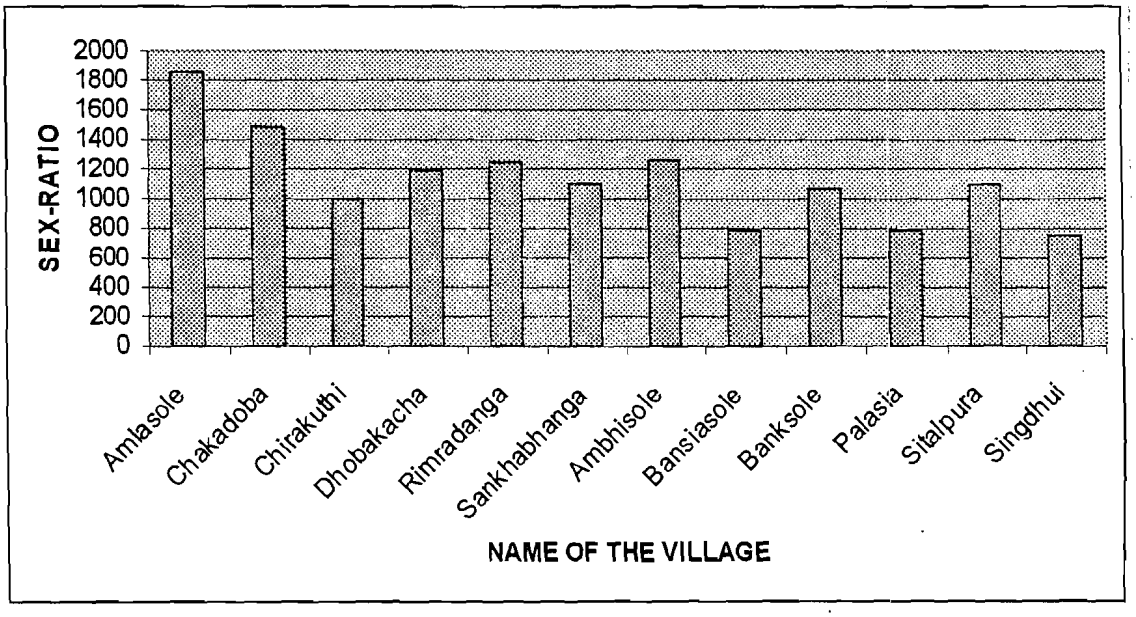

Fig. 1 : Bar graph showing the village wise sex ratio

Results and Discussion

Age-Sex Composition :

The age-sex composition of the sample population reveals higher number of younger persons including children belonging to 0-4, 5-9 and 10-14 age groups.Together,these three age groups constitute 37.60 per cent of the population. The population pyramid (Fig.1) also shows a broad base extending up to 15-19 years, after which the breadth of the pyramid begins to shrink although the number of females shows a sudden increase at the age group 25-29 which seems unusual. The female population in the higher age groups, particularly beyond the reproductive age, i.e. after 49 years, shows greater number than the males in general. No female above the age group 65-69 was found, but there were 4 males above 69 years in the population. The significant point about the demography of the Lodhas in this sample is the preponderance of females in almost all the age groups (the sex ratio being 1048.19). This fact is most revealing in all the younger age groups from 0-4 up to 25-29. (Table3 & Fig.3). It is only in the age groups, 30-34, 35-39, 40-44 and 45-49 that we find a predominance of males over females (Tables 2 and 3; Figures 2&3).

Table 2 : Age sex composition of the lodha population under the survey.

Age group	Male			Female			Total
0-4	[13.94]	70	(6.84)	[13.79]	72	(7.03)	142 (13.87%)
5-9	[12.75]	64	(6.25)	[14.56]	76	(7.42)	140 (13.67%)
10-14	[10.16]	51	(4.98)	[09.96]	52	(5.07)	103 (10.06%)
15-19	[8.17]	41	(4.00)	[8.62]	45	(4.39)	86 (8.40%)
20-24	[5.38]	27	(2.64)	[7.28]	38	(3.71)	65 (6.35%)
25-29	[8.56]	43	(4.20)	[12.84]	67	(6.54)	110 (10.74%)
30-34	[8.96]	45	(4.39)	[8.23]	43	(4.20)	88 (8.59%)
35-39	[7.97]	40	(3.91)	[6.90]	36	(3.52)	76 (7.42%)
40-44	[8.76]	44	(4.30)	[4.41]	23	(2.25)	67 (6.54%)
45-49	[5.98]	30	(2.93)	[2.87]	15	(1.46)	45 (4.39%)
50-54	[2.39]	12	(1.17)	[3.83]	20	(1.95)	32 (3.13%)
55-59	[1.99]	10	(0.98)	[3.25]	17	(1.66)	27 (2.64%)
60-64	[2.99]	15	(1.46)	[2.30]	12	(1.17)	27 (2.64%)
65-69	[1.20]	06	(0.59)	[1.15]	06	(0.59)	12 (1.17%)
70-74	[0.39]	02	(0.20)	[0.00]	00		02 (0.20%)
75-79	[0.00]	00	(0.00)	[0.00]	00		00 (0.00%)
80+	[0.39]	02	(0.20)	[0.00]	00		02 (0.20%)
Total	[99.98]	**502**	**(49.04)**	[99.99]	**522**	**(50.94)**	**1024 (100%)**

[ ] Represents percentage out of column total.

( ) Represent percentage out of grand total

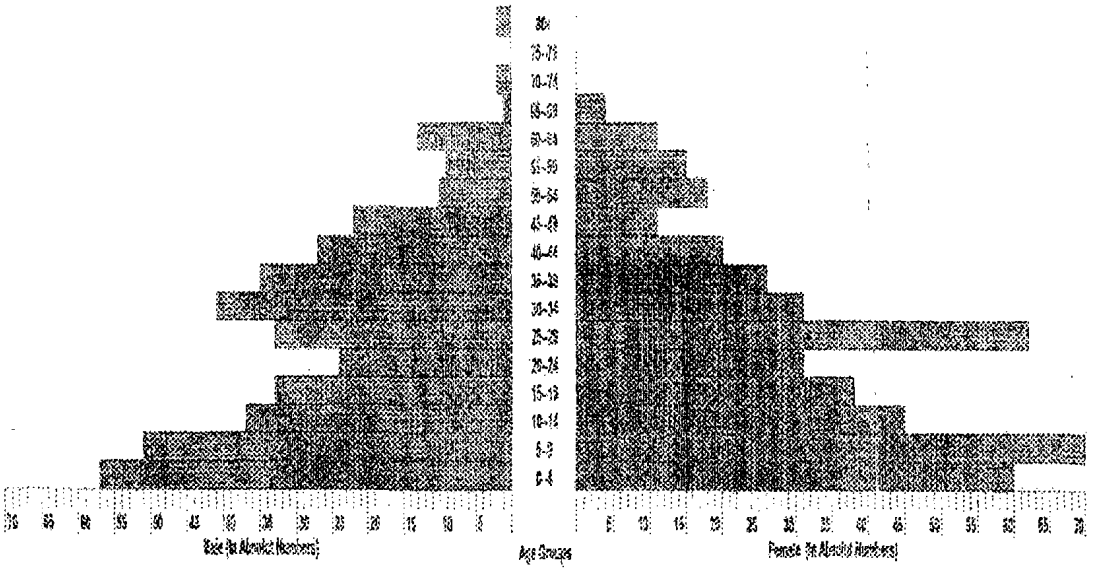

Fig: 2 Population Pyramid of the Lodhas in the Study Area

Table- 3 Age groupwise sex-ratio of the population

Age group	Male	Female	Sex ratio
0-4	70	72	1028.57
5-9	64	76	1187.50
10-14	51	52	1019.60
15-19	41	45	1097.56
20-24	27	38	1407.40
25-29	43	67	1585.14
30-34	45	43	955.55
35-39	40	36	900.00
40-44	44	23	522.72
45-49	30	15	500.00
50-54	12	20	1666.66
55-59	10	17	1700.00
60-64	15	12	800.00
65-69	06	06	1000.00
Total	**498**	**522**	**1048.19**

Sex ratio: 1048.19 [Female/Male] x 1000

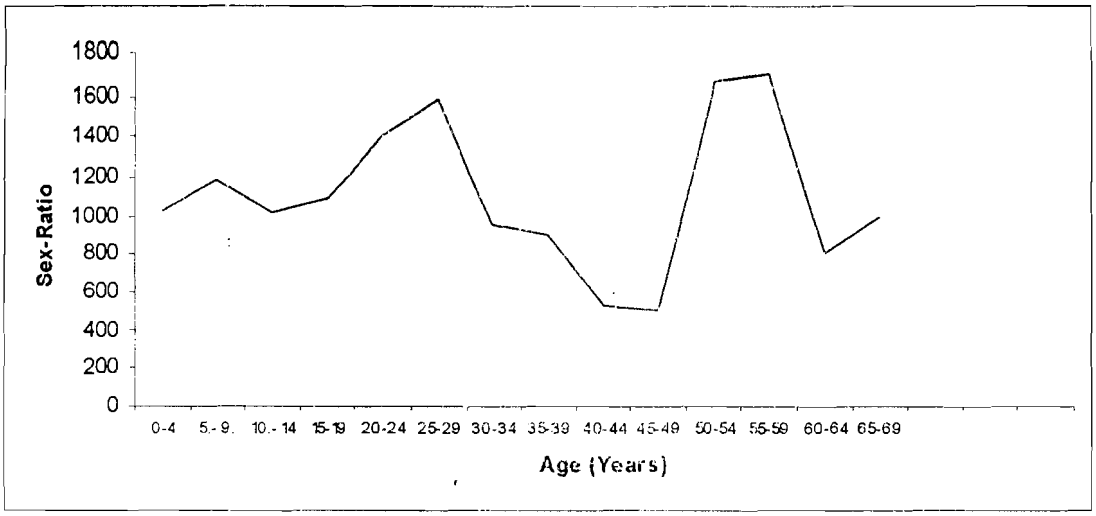

Fig. 3 : Line graphshowing the age groupwise sex ratioof the population

Concluding Remarks

Given the poor economic and health condition as well as low nutritional status, the preponderance of females over males among the Lodhas seems to be revealing. The longevity of the males, however, shows a higher span than the females, but the overall number of females in older age groups, i.e. 50-69 is much higher than the males. On the other hand, the higher number of females up to the age-group 25-29 clearly reveals that, unlike higher caste groups, Lodha females have a greater probability of survival. The lower number of females in the age range 30-49 indicates higher mortality of females, although the disparity in the sex-ratio reaches its peak in two age groups only viz.40-44 and 45-49. A comparison of the sex-ratio of the study population with all India and state-level figures show(Fig.4) that among the Lodhas of Paschim Medinipur district the females far outnumber the males in contrast to both all India and state-level figures(Agnihotri 2000 : 32and 41-43). On the whole, our data show that the sex-ratio among the Lodhas is more in favour of the females and the disparity in sex-ratio among this so called 'primitive tribal group'(PTG) is not at all pronounced compared to the 'scheduled caste and general categories of the Indian population of India.

Table 4 : A Comparison between all India & state level sex ratio figures with the study population

All India sex-ratio in 1991	All India scheduled tribe sex-ratio in 1991	West Bengal scheduled tribe sex-ratio in 1991	Sex-ratio of Lodhas under present study
927	972	964	1048.19

Source: The sex-ratio figures have been taken from *sex-ratio Patterns in the Indian Population: A Fresh Exploration* (2000) by Satish Agnihitri. P. Nos. 32 & 41-43

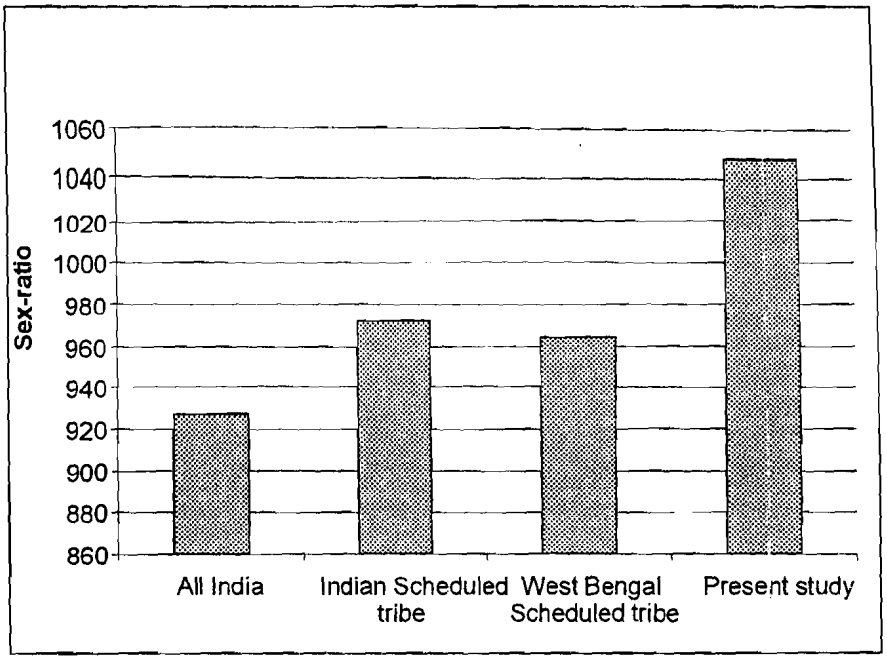

Fig. 4 : Bar graph showing comparative sex-ratios of the study population with all India and state level figures.

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DISTRIBUTION OF NUTRIENTS AND PRIMARY PRODUCTION IN TWO DIFFERENT SALINITY REGIME OF HOOGHLY RIVER, INDIA.

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ABSTRACT ■ The Hooghly estuarine system located in West Bengal is the important estuaries of the Indian coast under the Gangetic delta called the Sundarbans, which is considered as estuarine inlets carrying tidal brackish-water causing, considerable fluctuations in salinity and other physico chemical condition resulting in significant changes in the estuarine ecosystem. Water and soil characteristics of Hooghly estuary at freshwater and marine regions were studied during the period, July 2006 to June 2008. In water dissolved oxygen, pH, total alkalinity, phosphate, nitrate and silicate contents were higher in the freshwater zone compared to those at the marine zones indicating that the nutrients were allochthonous. Salinity was very low in freshwater zone, but high salinity was noted in marine zone. Nutrient rich diluted water from the Hooghly estuarine and run off from catchment areas, during monsoon, enter into this estuarine inlet. In soil the marine region had higher contents of available and total Nitrogen, available Phosphorus, Organic carbon and sp. conductivity. Gross and net primary productions were significantly higher at the marine zone which indicated that this zone is nutrient rich and more productive. The study indicated that the Hooghly main channel was, on the whole, conducive for aquatic animals during the period. Ample food supply from the Sundarban mangrove vegetation, absence of aquatic pollution, tidal effect etc., were important role for high availability of *P.monodon* seed and other fisheries resources, mainly prized prawns, mullets (Mugil sp), hilsa (Tenualosa sp.), milkfish (Chanos sp), bhetki (Lates sp) etc., because of regular active tidal interaction.

Key words : Estuary, Brackish-water, tidal effect, effluent, fish yield, Hooghly river.

Introduction :

The Hooghly estuary is (Latitude 21°-24° N and Longitude 88° -89°E; 300km from N-S and 150 km from E-W) one of the most productive estuaries of the world. The Hooghly-Matlah estuary can be divided into five zones on the basis of salinity gradient (Sinha *et. al.* 1996). However, my drotiology and Fishmy of Hooghly matlah estnary have been sequentially monitored and presontly have been subdisded into four zerox based on salinity regimes, zone I, II, III and IV has been B hens in Figure 1

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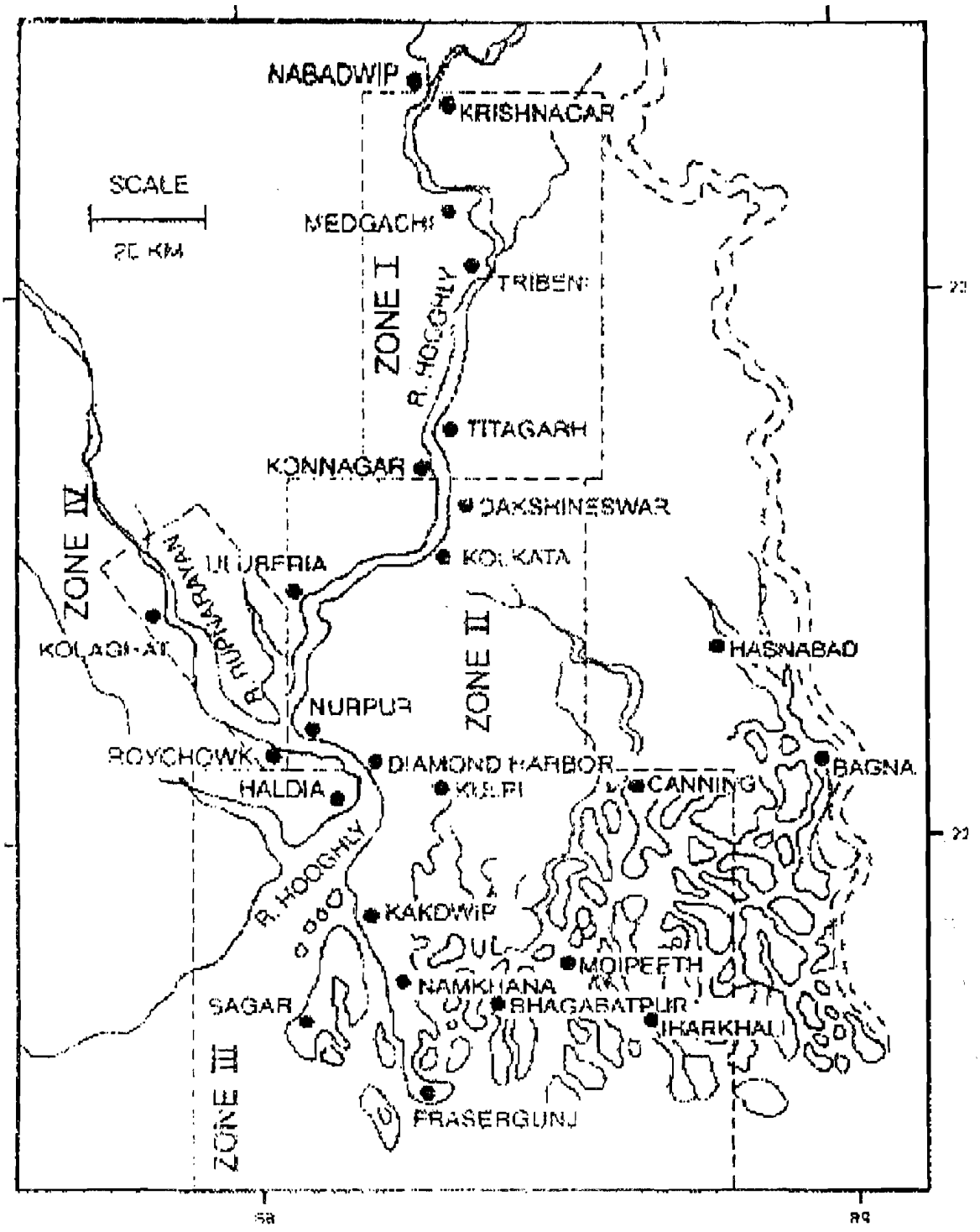

Figure-1 : Map showing the zonation of Hooghly Matlah Estuary. used to describe its ecology and fishery The centers were surveyed during 1995 to 1996.

(sinha 2004) But after construction of Farakka Barrage during 1975, the demarcation of the three zones changed considerably. Huge quantities of soluble and insoluble nutrients are carried into the Hooghly estuary from Ganga riverine system and from catchment areas which enhances its fertility of the system. But large number of industries and municipalities discharge their effluents, which may have ill effects on the aquatic habitat of the estuary. Significant water quality and primary production improvement was recorded after Ganga Action Plan 1987 (Jhingran, 1991; Sinha *et. al.*, 1998). Nowadays, freshwater zone of River Hooghly extends from Nabadwip to Daskhineswar, the gradient zone from Daskhineswar to Diamond-Harbour, the low saline zone from Diamond-Harbour to Kakdwip and the high saline zone from Kakdwip to Bakkhali. Detailed information on water characteristics of Hooghly River system is essential for proper utilization of the resource. The present study attempts to determine the distribution of nutrients in different salinity regimes and primary productivity in Hooghly river system during the period 2006-08.

Material and Methods :

Hooghly-Matlah is a coastal plain estuary where all the tidal phases' *viz.* bore, spring and neap tides are distinctly marked. Two sampling stations had been selected depending upon salinity during the study period 2006-08. One of was Nabadwip freshwater zone, near 290 km from sea face and other was Kakdwip low saline zone, near 40 km from sea face. Water samples were collected at a monthly interval and soil samples were collected at a quarterly interval for analysis. Samples were analyzed following standard methods (AOCA, 1980; APHA, 1980; Piper, 1966 etc.).

Results and Discussion :

The mean physico-chemical characteristics of two different regions of Hooghly river during the period 2006-08 are depicted in Table. 1-3.

Water analysis:

Temperature

The minimum water temperature 17.5 °C and 20.4 °C were recorded during winter, while maximum 33.4 °C and 33.6 °C during summer at Nabadwip and Kakdwip sample station respectively. Thermal stratification was not detectable may due to tidal interaction. Higher turbidity at the marine zone may cause of slight higher temperature. The water temperature of both the centres was conducive for fish health (Nath *et al.*, 1994).

Water reaction

The pH was higher in the Nabadwip (7.85 – 8.25) followed by those in Kakdwip (7.85 – 8.14) during the period under study. The water reaction of these zones were similar to Bose (1956) and Ray (1981), which indicated the alkaline character with good buffering capacity through out the periods, which was considered as congenial for aquatic habitats (Sinha *et al.*, 1998).

Dissolved oxygen

Dissolved oxygen content was ranged 5.68 to 7.42 mgl^{-1} at Nabadwip and 4.32 to 7.19 mgl^{-1} at Kakdwip during the study period. The range of dissolved oxygen was favourable for the aquatic productivity, since the content was above 5 ppm in all the regions (Nath *et. al.*, 1994). The dissolved oxygen value was maximum in freshwater zone than the marine region.

Total alkalinity

The total alkalinity content of freshwater zone i.e. Nabadwip (115 to 154 mgl^{-1}) was higher than the marine zone i.e. Kakdwip (98 to 136 mgl^{-1}). Maximum and minimum content were noted during winter and late summer in the

Table 1. Seasonal variation of water reaction (2006-08)

Season/ Year	Place	Water Temp^{r}.	pH	DO mg/l	Total Alk. mg/l	NO_3^{-1} mg/l	PO_4^{-3} mg/l	Total Hard. mg/l	Salinit y ppt
Monsoon 2006	Nabadwip	24.8 - 27.0	7.91 - 8.14	6.98 - 7.15	118 - 132	0.086- 0.101	0.044 - 0.058	290 – 330	0.082 – 0.096
	Kakdwip	26.1- 29.2	7.94- 8.14	6.78- 7.12	106- 118	0.182 - 0.198	0.062- 0.069	2685- 2732	4.20- 4.60
Winter 2006-07	Nabadwip	18.1 - 20.0	7.94 - 8.12	5.68 - 6.16	142 - 154	0.264- 0.274	0.072 - 0.084	278 – 302	0.200 – 0.230
	Kakdwip	21.2- 25.4	8.02- 8.14	4.32- 5.18	121- 130	0.178 - 0.188	0.078- 0.085	2191- 2301	5.74- 5.98
Summer 2007	Nabadwip	31.5 - 33.4	7.85 - 8.01	6.60 - 7.15	136 - 144	0.360- 0.369	0.094 - 0.106	245 – 265	0.318 – 0.350
	Kakdwip	30.8- 33.2	7.98- 8.11	5.70- 6.18	113- 128	0.202 - 0.216	0.084- 0.090	1842- 1869	6.02- 6.32
Monsoo n 2007	Nabadwip	24.5 - 27.3	8.04 - 8.25	7.02 - 7.25	128 - 140	0.088- 0.101	0.048 - 0.064	285 – 314	0.078 – 0.089
	Kakdwip	25.5- 29.0	7.92- 8.13	6.40- 7.19	102- 118	0.179 - 0.205	0.057- 0.069	2686- 2716	4.64- 4.72
Winter 2007-08	Nabadwip	17.5 - 20.6	7.96 - 8.16	6.90 - 7.42	115 - 124	0.257- 0.264	0.095 - 0.110	300 – 316	0.281 – 0.292
	Kakdwip	20.4- 23.5	7.98- 8.12	4.60- 5.40	112- 136	0.172 - 0.194	0.048- 0.063	2392- 2418	6.04- 6.84
Summer 2008	Nabadwip	30.5 - 33.0	7.95 - 8.08	6.92 - 7.24	124 - 134	0.295- 0.304	0.098 - 0.108	285 – 310	0.295 - 0.306
	Kakdwip	31.3- 33.6	7.85- 7.94	4.97- 5.27	98- 120	0.172 - 0.190	0.092- 0.104	1884- 1916	6.76- 6.93

All the water parameters showed significant difference ($P<0.05$) when compared with different season in two sampling stations

Table 2 : Seasonal variation of Soil reaction (2006-08)

Season/ Year	Place	Texture(%)			pH	Sp. cond (mmhos cm^{-1})	T.N (mg 100 gm^{-1})	Ave.P (mg 100 gm^{-1})	Org. C (%)	Free. $CaCO_3$ (%)
		Sand	Silt	Clay						
Monsoon 2006	Nabadwip	72	10	18	8.22	0.34	5.6	3.40	0.44	8.2
	Kakdwip	74	10	16	8.28	8.0	11.5	5.85	0.68	6.5
Winter 2006-07	Nabadwip	62	16	22	8.75	0.19	7.4	2.33	0.52	9.6
	Kakdwip	56	18	28	8.50	4.5	14.8	4.36	0.85	6.9
Summer 2007	Nabadwip	68	12	20	8.54	0.26	6.0	2.83	0.35	8.4
	Kakdwip	62	15	23	8.37	6.6	12.5	4.72	0.47	5.4
Monsoon 2007	Nabadwip	74	11	15	8.26	0.35	5.2	3.27	0.42	7.3
	Kakdwip	71	12	17	8.22	8.2	10.0	5.65	0.62	5.8
Winter 2007-08	Nabadwip	62	15	23	8.74	0.21	7.4	2.43	0.48	10.2
	Kakdwip	54	22	24	8.52	4.8	15.3	4.14	0.87	6.8
Summer 2008	Nabadwip	69	13	18	8.30	0.27	6.5	2.74	0.39	9.4
	Kakdwip	67	15	18	8.35	6.8	13.2	4.92	0.56	5.2

Table 3 : Seasonal variation of Primary Productivity (2006-08)

Season/ Year	Place	GPP			NPP			CR		
		g C $m^{-3}d^{-1}$	g O_2 $m^{-3}d^{-1}$	Kcal $m^{-3}d^{-1}$	g C $m^{-3}d^{-1}$	g O_2 $m^{-3}d^{-1}$	Kcal $m^{-3}d^{-1}$	g C $m^{-3}d^{-1}$	g O_2 $m^{-3}d^{-1}$	Kcal $m^{-3}d^{-1}$
Monsoon 2006	Nabadwip	0.624	1.6661	6.1276	0.411	1.0973	4.0360	0.246	0.6568	2.4157
	Kakdwip	0.678	1.8102	6.6579	0.378	1.0092	3.7119	0.201	0.5366	1.9738
Winter 2006-07	Nabadwip	0.762	2.0345	7.4828	0.516	1.3777	5.0671	0.306	0.8170	3.0049
	Kakdwip	0.855	2.2828	8.3961	0.648	1.7301	6.3633	0.270	0.7209	2.6514
Summer 2007	Nabadwip	0.672	1.7942	6.5990	0.456	1.2175	4.4779	0.228	0.6087	2.2389
	Kakdwip	0.759	2.0265	7.4533	0.555	1.4818	5.4501	0.231	0.6168	2.2684
Monsoon 2007	Nabadwip	0.618	1.6500	6.0687	0.399	1.0654	3.9181	0.192	0.5126	1.8854
	Kakdwip	0.672	1.7942	6.5990	0.432	1.1534	4.2422	0.150	0.4005	1.473
Winter 2007-08	Nabadwip	0.732	1.9544	7.1882	0.528	1.4097	5.1849	0.366	0.9772	3.5941
	Kakdwip	0.885	2.3629	8.6907	0.642	1.7141	6.3044	0.294	0.7849	2.8871
Summer 2008	Nabadwip	0.651	1.7381	6.3928	0.447	1.1934	4.3895	0.261	0.6968	2.5630
	Kakdwip	0.753	2.0105	7.3944	0.537	1.4337	5.2733	0.222	0.5927	2.1800

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studied zones. The range of total alkalinity, which was mostly contributed by bi-carbonate ions for both the sampling centers, indicated that the Hooghly estuary might be highly suitable for aquatic life and fish growth (Nath, 2001). The result also supported the inverse relation between alkalinity and the salinity (Ray 1981).

Salinity

The salinity varied widely in different zones of the estuary, where as in the freshwater zone i. e. at Nabadwip, the salinity was very low (0.078 - 0.350 ppt). Salinity was recorded higher in the marine zone, i.e. at Kakdwip (4.20 – 6.93 ppt). Salinity value decreases considerably due to increase of more freshwater discharge (Nath and Sinha, 1996). The moderate salinity of those regimes was congenial for reverine fishes and prawns (Nath and Sinha, 1996), which also supported the present study.

Phosphate

Phosphate, the other important nutrient was in the range between 0.044 mgl^{-1} to 0.110 mgl^{-1} at Nabadwip and 0.048 mgl^{-1} to 0.104 mgl^{-1} at Kakdwip, which also supported to enhance the aquatic productivity of this estuary. Phosphate content was generally higher in the freshwater compared to that in marine zone indicating that the nutrient was allochthonous .The phosphate value also indicated that the water body was free from industrial or, municipal effluents pollution. It is evident that phosphate concentration trends were inversely proportional to the salinity (Nath *et al.*, 2004).

Nitrate

Nitrate content was higher in the freshwater zone i.e at Nabadwip (0.086 to 0.369 mgl^{-1}), while lower content noted in the marine zone, i.e. Kakdwip (0.172 to 0.216 mgl^{-1}), which indicated that the estuary was free from industrial and domesticeffluent pollution (Nath and De, 1999) and similar trend of was observed by Staver *et. al.* (1996). Maximum value was recorded during summer probably due to receive of nutrient load from discharges from various industries.

Primary production

Both gross and net primary production was higher at Kakdwip (GPP- 6.5990 to 8.6907 Kcal $m^{-3}d^{-1}$ and NPP- 3.7119 to 6.3044 Kcal $m^{-3}d^{-1}$), while lower primary production was observed at Nabadwip (GPP- 6.0687 to 7.4828 Kcal $m^{-3}d^{-1}$ and NPP- 3.9181 to 5.1849 Kcal $m^{-3}d^{-1}$). Industrial effluents had adverse effect on primary production (Ghosh *et. al.*, 1980), which might bring down the primary production in the freshwater zone. Net primary production in Hooghly estuary during the period showed more or less an increasing trend which may presumably be due to effluent treatment under G.P.D.

Soil

Texture

Depending on the size and weight of the soil particles, velocity of river water, the Hooghly estuary received hugequantity of sand, silt and clay from Ganga and its tributaries deposited at the different zone of the estuary at different rate.

Sand

Sand content was noted quite lower in bottom soil at Kakdwip (54-74 %) than Nabadwip (62-74 %). The higher value might be due to the rapid silted up by huge deposition of sand, which is reducing the river flow.

Silt

The silt content in bottom soil was lower at Nabadwip (10-16 %), while highercontent was noted in soils of marine zone, i.e. Kakdwip (10-22 %).

Clay

In freshwater zone i.e. at Nabadwip, the clay deposition was comparatively low (15-23 %) than the marine zone i.e. Kakdwip (16-28 %). The clay deposition was comparatively low due to water current in the river, which carried the finer clay particles to the lower zone where the water current was comparatively low.

Soil pH

The soil reaction was alkaline at Nabadwip (pH 8.22 - 8.75) and at Kakdwip (pH 8.22 - 8.52), which considered as conducive for aquatic habitat. The soil reaction in different zones varied considerably during different years, as per the availability of allochthonous materials.

Specific conductivity

Specific conductivity of soil was minimum (0.19 - 0.35 millimhos cm^{-1}) at Nabadwip, while maximum value was noted in the marine zone (4.5 – 8.2 millimhos cm^{-1}), might be the presence of more soluble nutrients in the marine region.

Total nitrogen

The total nitrogen contents of soil Kakdwip (5.6-7.4 mg 100 gm^{-1}) was significantly higher than that of Nabawip (10.0-15.3 mg 100 gm^{-1}). Nutrient rich clay and silt particles were presumably deposited in the marine zone which made Kakdwip zone more productive (Nath *et. al.* 1994).

Available phosphorus

Available phosphorus is a very important nutrient for fish growth. Available phosphorus content in soil was maximum at Kakdwip (4.14-5.85 mg 100 gm^{-1}), while minimum value was recorded at Nabadwip (2.33-3.40 mg 100 gm^{-1}). So, Kakdwip might be said to be most productive (Nath *et. al.* 1994).

Organic carbon

Organic carbon content was generally higher in the marine zone i.e at Kakdwip (0.47-0.87 %), indicating higher productivity. At Nabadwip (0.35-0.52 %) had minimum content indicating lower productivity.

Free Calcium carbonate

Free Calcium carbonate content was significantly higher at Nabadwip (7.3-10.2 %), which indicated that the Hooghly estuary receives the nutrient from allochthonous sources. Minimum $CaCO_3$ was recorded at Kakdwip (5.2-6.9 %).

Conclusion :

Although the industrial effluents were highly toxic to aquatic organisms (Ray, 1981; Ghosh *et. al.*, 1980), their toxicity was presumably nullified in the main channel of the estuary due to huge dilution by river water. In spite of anthropogenic threat to Hooghly estuary, the water and soil qualities of Nabadwip and Kakdwip were more or less congenial for high aquatic productivity. In Hooghly estuary, the nutrients were allochthonous. Gross and net primary productions were higher in the marine zone which indicated that this zone was nutrient rich and more productive. Ample food supply from Sundarban mangrove vegetation, absence of aquatic pollution, tidal effect etc., were important role for high availability of *P.monodon* seed. This estuary might be constituted important fisheries resources, mainly prized prawns, mullets, hilsa, milkfish and lates etc., because of regular active tidal interaction.

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BASIC ISSUES IN THE STUDY OF MIGRATION: AN ANTHROPOLOGICAL PERSPECTIVE

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Prologue :

Anthropologists view human migration as a universal phenomenon since the origin of human beings 2-3 million years B.P (before present). Movement of human populations across geographical boundaries had played a crucial role in human biological and cultural evolution since prehistoric period. The lesson of human history is we cannot stop migration whether we like it or not. The reason that we are worried with migration is that often migration has had many adverse effects on human populations. So, we can at best design some form of management strategy to mitigate the deleterious effects of migration.[1]

Problems of Definition :

The lexical definition of migration is broad enough to incorporate all kinds of movements of human and animal groups and individuals. The demographic definition of migration however is quite rigorous. The International Encyclopedia of Population defines migration as '...geographic mobility that involves a change of usual residence between defined political or statistical areas, or between residence areas of different types. In general usage the term has been restricted to relatively permanent changes' (McNamara 1982:448). But the term 'permanent' in the definition is not very easy to pin down. William Petersen in his article 'Migration: Social Aspects' took up the issue in right earnest. To quote: 'More generally, when one speaks of migratory birds, or migrant laborers, or nomads, the connotation is not of a permanent move from one area to another, but rather of a permanently migratory way of life, which often means a cyclical movement within a more or less definite area.' (Petersen 1968:286-287) Petersen summed up his discussion on the problems of definition in the following manner: '...**whether short-term removals should be included in migration depends on the purpose of the statistics being collected. Thus, no particular specification of the duration of stay suits all**

[1] For demographers migration is one among the three demographic variables which affect population size and composition. The value of migration is zero in the demographic equation if we consider the earth as a single reservoir of human population. unless we migrate to other planets!

purposes, and each analyst has to adapt the available data to his needs as best as he can'*[my emphasis]* (Ibid). Moving from the International Encyclopedia of the Social Sciences to the Encyclopedia of Cultural Anthropology we come to know that the study of migration gained importance in Cultural Anthropology after the 1960s and '70s and within anthropology gender issues in the study of migration is much more recent. According to the author of the article 'Migration' in the Encyclopedia, **one of the interesting reasons that women have been ignored in migration studies is that "women predominated in short-distance population movements...'** [*My emphasis*] (Brettel 1996:796)[2].

Migration: Discrete Category or Continuum?

1. The immediate question which follows the discussion on the defintion of migration directs one to time and space. How many miles should one travel before we call her a 'migrant'? And, how many days should one stay at another place so that it becomes 'migration'? Let us take some examples. The women and men among many forest dwelling communities have to travel many miles for collecting minor forest produce and to sell those products in the markets, and they do it daily. Should we call it migration? Definitely even if we call the above phenomena as 'daily migration' it is different both in degree and kind from movements of large groups of people from one region a country to another or migration of people displaced by the construction of big dams and industrial projects or migration of refugees from one country to another. It seems it is better to visualize a continuum of migration, a kind of scale, on which one may situate daily movement of people at the one end while permanently displaced persons on the other. One can of course derive more than one continuum depending upon the criteria one may like to use.

Refugees

2. The next important question regarding migration is 'Who migrates?' Characterizing the migrants is primarily an empirical task. The age, sex, occupation, literacy level, socio-economic status, political affiliation, health condition, nutritional status, and even the ideology of the migrants should be unearthed to understand the nature of this ubiquitous phenomenon.

3. The third and the most vital question regarding migration relates to its cause or causes, that is, 'Why people migrate or have migrated in specific socio-historical contexts? Searching for causes of migration is both an empirical and theoretical task. One may, for example, collect a huge body of empirical data on the demographic and economic aspects of a group of nomadic pastoralists but in order to understand the pattern and causes of their movements over time, one should place the data within the framework of ecological or other theories. Frederik Barth's classic study on the ecology of three ethnic groups in the Swat region in Pakistan is a case in point. Elizabeth Colson's study of the displaced families in upper Volta Dam Project is another important study on the socio-psychological aspects of communities affected by internal displacement.

4. The fourth and the last question on migration should lead us to its 'consequences' or 'effects' that is 'What happens to the human

Daily Migrants..... Maid-servants commuting **Seasonal Migrants** to metropolis women agricultural labourers Crossing borders of countries

Fig. 1 Continuum of Migration

Spatiotemporal context of migration	Who migrates	Why do they migrate	What are the consequences
Delimiting the study	Collection of empirical Data(census, case studies etc.)	Search for causes	Collection of empirical data

Fig.2 : Spectrum of Migration Study

groups who migrate?' This again is largely an empirical question. Undoubtedly, the 'consequences' also have a strong relationship with the 'type of migration' on the continuum. Let us now try to develop a framework on the study of migration based on above four basic questions.

Concluding Remarks

A. Any study or project should fix up the four pillars of migration study shown in Fig 2 before embarking on it.

B. Secondly, the study on policy implications of migration can only be undertaken after covering the 'spectrum of migration study' with sufficient empirical data and field based case studies.

C. Thirdly, the policy measures to be adopted for ensuring safety and /or preventing migration having adverse consequences should also be specific according to the findings generated under the four columns of the spectrum of migration study.

D. Fourthly, we should not worry about the commonly discussed methodological dichotomies in the social sciences, viz. macro versus micro, qualitative versus quantitative data and survey and participatory methods of fieldwork etc. in migration studies. In migration studies, the types of data sources are more important than the standard methodological clichés prevalent in the social sciences and the data sources may range from fieldwork to parliamentary and assembly proceedings.

E. Fifthly, migration studies should also be multidisciplinary which would involve demography, economics, anthropology and medical sciences. John Caldwell's study of the spread of HIV/AIDS in North Africa caused by migration of women in long distance trade can be regarded as a classic multidisciplinary study on migration (Caldwell, et.al. 1989).

Acknowledgements :

I am greatly indebted to Dr. Indrani Mazumdar and Dr. Indu Agnihotri for inviting me to participate in the Regional Consultation on 'Gender and Migration' and also for giving me the opportunity to talk on the Anthropological Perspectives on Migration held during 17-18 January 2009 at Kolkata. I am also indebted to Lokenath Roy and Amit Kisku for quickly commenting on the first draft of this note before the presentation. I must also express my

[2] Brettel noted in her article in the Encyclopedia of Cultural Anthropology that despite the landmark study done by Ernest G. Ravenstein more than a century ago (Ravenstein 1889) which had shown that women predominated in short-distance population movements, women have generally been ignored in the study of migration until quite recently(Ibid).

gratitude to Prof. Malabika Chatterjee for raising an important issue regarding the fixing of time and space in migration study.

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POSITRON EMISSION TOMOGRAPHY, TECHNOLOGY FOR DIAGNOSIS OF CANCER- A CASE STUDY

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Cancer occurs when normal cells undergo a transformation that causes them to grow and multiply without control. These cells form a mass or tumor that differs from the surrounding tissues from which it arises. Lung cancer is the leading cause of cancer deaths in women and men, both in the United States, and throughout the world. Lung cancer has surpassed breast cancer as the leading cause of cancer deaths in women. Some tumors in the lung are metastatic, and form carcinogenous development elsewhere in the body. The lungs are common site for metastasis. Lung cancers usually are divided into two main groups that account for about 95% of all such cases. Adenocarcinoma is the most common type of lung cancer, making up 30%-40% of all cases. A subtype of Adenocarcinoma is called Bronchoalveolar cell carcinoma, which show a pneumonia-like appearance on chest X-rays. Cigarette smoking is the most common cause of lung cancer. Passive smoking, or secondhand smoke, presents another risk for lung cancer (Hackshaw 1998). A person who had lung cancer is more likely to develop a second lung cancer in comparison to an average person and is prone to develop a first lung cancer at the onset. Now a day, a new edge technology has evolved called PET (Positron emission tomography) scan to identify lung adenocarcinoma.

PET scans are simple, painless, and fast, offering patients and their families' some life-saving information that help physicians to detect and diagnose diseases early and quickly. PET is actually a nuclear medicine imaging technique, which develops and produces a 3D image of a workable system in the human body. The system detects, pairs of gamma rays emitted indirectly by a positron-emitting radionuclide (tracer), which is introduced into the body on a biologically active molecule (Song *et al* 2009). Generally, biologically active molecules, like an analogue of glucose are chosen for PET is FDG. The molecule most commonly used for this purpose is Fluorodeoxyglucose (FDG), a sugar. During the scan, a record of tissue concentration is made as the tracer decays.

A Case study: Detection of lung cancer by whole body PET scan (from base of skull to the middle of the thigh) after injecting 10mCi of 18F FDG, intravenously.

Standerdized uptake value (SUV) is also calculated for body surface area (BSA) at cm^2/

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ml unit.

PET findings: Normal physiological distribution of tracer is detected in the organs.

Increased FDG uptake (SUV maximum 3.2) noted in large heterogeneously enhancing soft tissue mass involving right upper lobe, of the posterior segment (Fig 1 & 2) and muscle of back and adjacent bones (ribs and vertebra). Rest of the survey however doesnot reveal any other abnormal focal FDG uptake elsewhere including the radiologically described other lung nodules and lymphnodes.

Impression: Findings are very much suggestive of active disease involving posterior segment of right upper lobe and adjacent soft tissues and bony structures.

Result and discussion :

Lesion	SUV max (bw)	Comments
Soft tissue mass in the posterior segment of upper lobe of right lung	11.7	Very high metabolic activity
Necrotic soft tissue mass in the uncinate process of pancreas	Mild FDG uptake	No finding
Multiple inter-muscular masses in the back of the neck	-	No finding
Multiple Liver lesions	-	No finding
Adrenal gland	-	No finding
Tail of the pancreas	-	No finding
Stomach wall	-	No finding
Mesenteric nodules	-	No finding

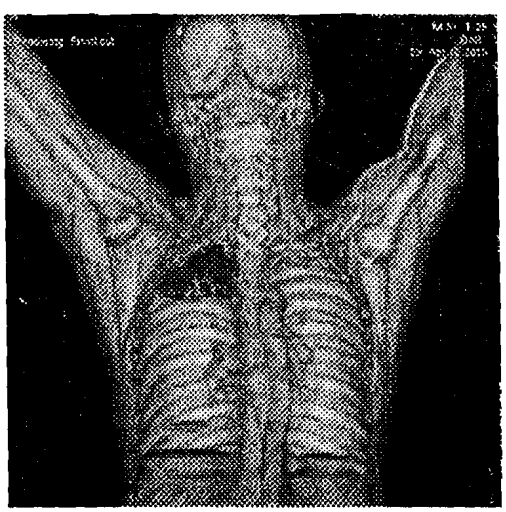

Fig: 1 Maximum SUV uptake in right upper lobe

Fig: 2 posterior segment of right upper lobe

Lung masses are usually first evaluated through a chest x-ray or a CT scan. These tests can provide informations regarding the size and location of a lung mass but most often they cannot tell whether the abnormality is benign or carcinogenous. Solitary pulmonary nodules and other lung masses can be screened with high accuracy using PET.

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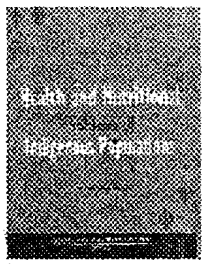
1. Hackshaw, AK. 1998. Lung cancer and passive smoking. Statistical Methods in Medical Research 7 (2): 119–136
2. Song, JW. Oh, YM. Shim, TS. Kim, WS. Ryu, J., Choi CM. 2009. Efficacy comparison between (18) F-FDG PET/CT and bone scintigraphy in detecting bony metastases of non-small-cell lung cancer. Lung Cancer.

Book Review *Indian Journal of Biological Sciences, 16 : 63-64, 2011*

BOSE, KAUSHIK (ED). 2008. *HEALTH AND NUTRITIONAL PROBLEMS OF INDIGENOUS POPULATIONS*. DELHI: KAMALA-RAJ ENTERPRISES (HARDCOVER). PP. 122Price: Rs. 750/-.



The book under review is a collection of 13 papers on health and nutritional problems of indigenous populations and tribal groups from selected areas. The selection of papers has been done probably not with any definite objective in mind, but to examine the different aspects of physical and nutritional health of indigenes and tribals in specific settings (barring one). They, as the author maintains, inhabit different ecological settings and are characterized by 'their unique food habits and social customs'. The implication is these have a bearing on indigenous and tribal health. It is common knowledge that indigenous peoples and tribes (not all tribes can claim the status of indigenes) are economically deprived and hence healthwise they are likely to suffer from deficiencies. The present volume endeavours to make a scientific analysis in that direction, which, though not fullproof, has enough substance in it.

The papers have been arranged in two Chapters – the First Chapter dealing with problems and prospects of health care in different contexts. These include non-communicable diseases among urban Black South Africans, a nationally representative child sample from New Zealand with regard to dental services and dental care, impact of urbanization in the form of chronic diseases on the tribal states of Northeast India, reproductive and child health in tribal areas of Andhra Pradesh, medicine murder in South Africa, ethnomedical plant conservation through sacred groves in India and age related changes in blood pressure and obesity among the Bhutias of Sikkim. Clearly, the problems for investigation are as diverse as the selected areas and people are. Still, credit must be given to the contributors for successfully identifying the health problems and contextual elements associated with health behaviours or behaviours and activities contributing to health risks. What emerges is the need for adopting a bio-cultural approach to carry out researches in the field of health and health- related problems. In this regard, it may be worthwhile to take a serious note of the observation made by R. Khongsdier.

"Central to the bio-cultural study is the interaction between biological and cultural characteristics of human populations in relation to the biotic and physical environment in time and space."

Almost all the contributions put emphasis on the cultural and social behaviour pattern or lifestyle activities to promote health. Thandi Puoane and Lungiswa Tsoekile have even suggested "incorporating cultural [culturally] appropriate

activities such as African dance to be a part of "special programmes aimed at helping those who have just moved fromrural areas to adjust to life in the city". Louise Vincent's study on muti murder in South Africa has laid emphasis on the evil effects of South Africa's Capitalist economy. Muti murders, according to her, can be understood "as an attempt to re-create a sense of orderliness and predictability in an unruly post-apartheid, late capitalist world of rapidly changing markers of identity, failed political expectations, massive economic deprivation amidst the sudden and conspicuous enrichment of the few, rampant criminality and the seemingly inexplicable risein the death rate of once healthy adults." These observations may hold true for many urban settlements distributed all over the world. R. K. Bhakat and U. K. Sen have treaded on a different area, which is very close to nature or, to be precise, a component of it. Their focus is on nature conservation in the form ethnomedical plant conservation through sacred groves with a view to preserve the biodiversity thereby 'protecting a good number of plant and animal species including some rare, threatened and endemic taxa'. The authors have made a passionate plea for not only protecting sacred groves for the sake of community's health, but also for reviving and reinventing such a form of traditional practice of nature conservation and environmental management. In a sense, their paper stands on a different footing and harps on preserving the balanced relationship between man and environment. Nature is after all the protector of organic life and human beings are no exception.

The Second Chapter deals with papers with established methodological orientation. The ecological dimension of health takes in its stride the growth pattern and estimation of nutritional status. Again, various social, economic and developmental constraints expose people to high rates of malnutrition or undernutrition and infectious disease making them susceptible and vulnerable. A national policy on health should develop suitable intervention strategies to negate the effects of such micro-level deficiencies and the resultant ill-health. That ethnic groupin the form tribe may be an ideal platform for examining the interplay of various social, cultural, economic and physical factors influencing poor nutritional and health status have been demonstrated time and again. The present exercise aided by studies on physical growth, body composition, and nutritional status on specific tribal and indigenous communities lends substance to it. What is common between the papers included in Chapter I and those of Chapter II are their bio-cultural orientation. When Geok Linkhor and Zalilah Mohd Sharift speak of health promotion among the Orang Asli, an indigenous community of Malaysia suffering from chronic energy deficiency and poor living standard, they need to be heard. "Health promotion, preventive and treatment measure aimed at the Orang Asli, should be appropriate taking into consideration biological, cultural sensitivities. Understanding their health and nutritional needs as well as cultural practices and preferences could facilitate the development of intervention efforts that will be accepted and adopted by the Orang Asli populations."

The book is replete with such stray, often disjointed observations and suggestions. In any case, Kudos to Kaushik Bose for compiling such a useful volume highlighting the problems of indigenous and tribal health with special emphasis on nutritional research.

Prof. Rajat Kanti Das, UGC Emeritus Fellow, Dept. of Anthropology, Vidyasagar University

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