

Nutritional Status of Adult Mishings of flood affected areas of Lakhimpur district, Assam

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ABSTRACT

Assessment of nutritional status of a community is important for understanding their health condition. Nutritional status of a community is dependent on both biological and socio-cultural factors of the society. Moreover, the nutritional status within the community may vary by age and sex. This paper is an attempt to study the nutritional status of adult Mishings of flood affected areas of Lakhimpur district, Assam and its relationship with other social variables. The sample of the study consists of 957 adult Mishings, out of which 470 are males and 487 are females in the age range of 20 years and above. Anthropometric measurements of stature, body weight, waist circumference and hip circumference are used to assess nutritional status. Body mass index (BMI) and waist hip ratio (WHR) are calculated and classified according to World Health Organization, 2008 cut off for the Asian population. Data have been collected during the month of October 2015 to December 2016.

Results: - *The nutritional status shows that the prevalence of overweight is high in both males (44.59%) and females (35.59%). According to body mass index, 49.57% adult male Mishings and 55.65% females are nutritionally normal. Chronic energy deficiency (CED) is very low among adult Mishings (male 5.53% and female 9.03%). Abdominal obesity according to waist hip ratio is higher among females (80.49%) than males (60.43%). The prevalence of abdominal obesity is higher among middle age adults and elderly in comparison to the young adults.*

Keywords: *Body Mass Index (BMI), Waist Hip Ratio (WHR), Mishings, obesity,*

INTRODUCTION

In the current context of globalization, obesity or the ‘lifestyle disease’ is one of the causes of burden for a healthy life (Gokhale *et al.*, 2017). Study on obesity is an important tool to understand the health of a community. India suffers simultaneously from the double burden of both obesity and chronic energy deficiency (CED) (Goswami and Bhattacharyya 2015). Especially, people who are living in rural areas lack proper nutrient due to poverty, suffers from chronic energy deficiency malnutrition (Das and Bose, 2012). On the other hand, a sedentary lifestyle and inactivity results in overweight and obesity (Gharakhanlou *et al.*, 2011). Malnutrition is one of the major public concerns in most of the developing countries (Kamath *et al.* 2005). In developing countries like India, under-nutrition is generally the main issue of concern, though industrialization and changes in eating habits have increased the prevalence of over-nutrition. (World Food Programme, 2005).

The World Food Programme (2000) defines malnutrition as “a state in which the physical function of an individual is impaired to the point where he or she can no longer maintain adequate bodily performance processes such as growth, pregnancy, lactation, physical work and resisting and recovering from the disease. Malnutrition is the condition arising due to the intake of inadequate (over/less) nutrients in the diet. It includes both under nutrition (imbalanced diet and specific deficiencies) and over nutrition (Das and Bose, 2012). Assessment of nutritional status of the community assumes an important role in understanding the nature of the problem and its magnitude, geographical distribution and distribution among different ages, gender and physiological groups. Analysis of data and identification of at risk groups and causative factors is essential for prioritization, development and targeting of appropriate Action programmes for prevention and control of malnutrition (National Institute of Nutrition, 2008).

The nutritional assessment of adults is more problematic. Despite metabolic differences between chronic and acute under nutrition, the absence of linear growth removes the power of a height variable to discriminate between the two main patterns of under nutrition. In 1988, the International Dietary Energy Consultative Group define chronic adult under nutrition as ‘chronic energy deficiency’ (CED) as “a steady state at which a person is in an energy balance although at a cost either in terms of increased risk to health or as an impairment of functions and health”(Collins *et al.*, 2000). In India, each state is practically equivalent to a country with its

specific socio-economic level, different ethnic groups, food habits, health infrastructures and communication facilities. Thus, the nutritional status of the population shows significant variation between states since it results from a varying combination of factors (FAO 2010).

The scope of the study: The Lakhimpur district of Assam is one of the most flood affected districts of the state. Almost every year flood occur destroying crops as well as cultivable land through the process of sand casting making the land unsuitable for cultivation. The study area of the present research is also a flood affected area. Seven villages have been included in the study. They are Maderguri, Santipur, Dakhin Bogori, Mishing Baligoan, Akoria, Charanchuk and Mishing Jamuguri. The seven villages have been identified from the most flood affected area of Kherkata Gaon Panchayat. The villages opted for the present study is located near each other and experience same environmental conditions. Of them the villages of Dakhin Bogori, Akoria, Charanchuk and Mishing Jamuguri have not lost their land to river bank erosion but most of their cultivable land has been rendered unsuitable for cultivation due to sand casting. The remaining villages of Maderguri and Mishing Baligoan have lost a large part of their cultivable land due to river bank erosion. Till 1997 Maderguri was a big village. Due to severe flood, the village had to lose more than half of their land and houses. The people of Maderguri have now settled in the villages of Santipur and Mishing Bali Goan. After the flood, an embankment over the river Brahmaputra was constructed. In 2003, another heavy flood occurred; houses, agricultural lands along with embankment were washed away by the river. Again, in 2004, the government made an embankment towards north to save the people. People of Maderguri and Mishing Baligoan have now constructed their houses beyond this embankment. Due to lack of cultivable land, people of this area are in search of alternate source of livelihood. In many cases their mode of livelihood has changed from cultivation to wage earning, poultry farming and weaving. The changing trend of their occupational pattern has affected their physical activities. The amount of the cultivable land has been reduced as a result of which the agricultural produce is not sufficient to meet their needs for the whole year. Consequently, the life of the people has undergone change. Cultivation is no longer their predominant occupation and even those who are engaged in cultivation are doing at a much lower rate. The present study is therefore an attempt to understand the nutritional status of the adult Mishing population of the above mentioned villages, under the prevailing condition. There were two adjacent villages to Maderguri, namely Jaji and Rkep in the bank of river Brahmaputra. Due to loss of lands the resident of the two villages Jaji and Rkep, have migrated to

other nearby districts. Now, a portion of the embankment is being upgraded with geo-tube technology but is not yet completed. According to them, their original village was around 6 km away from the present-day settlement.

LITERATURE REVIEW

Adak *et.al*, (2006) studied Nutritional Status of 7 adult male tribal populations of Maharashtra, India through Body Mass Index. Anthropometric data were collected on 600 adult males aged 18-60 years. Majority of them were found to be thin and lean with medium to short stature. The high proportion of individuals with CED corroborates their low social and economic status. Das and Bose (2012) studied nutritional deprivation among Indian tribe and found populations are experiencing extreme nutritional stress, which may have severe health implications with respect to morbidity and mortality. Das and Sarmah (2016) studied the nutritional status of aging Tiwas of Morigaon district; Assam found the prevalence of CED malnutrition is to be high. Women are more vulnerable to malnutrition. Marital status and poor economic conditions have a positive correlation with malnutrition. Sultana *et al*, (2015) studied 650 Bangladeshi adults and suggested MUAC as a simpler alternative to BMI cut off <18.50 to detect adult under nutrition. Das *et al*, (2012) studied 88 middle adult and 44 healthy elderly and found that the elderly had compromised nutritional status with lower levels of hemoglobin, Fasting Blood Sugar (FBS), vitamin and micronutrient. Sarmah (2014) conducted a comparative nutritional study among Deuris, Mishings and Thengal Kacharis of Lakhimpur District, Assam and found that the nutritional status of the Mishings is very poor compared to Deori and Thengal Kachari. Mukherjee *et al*, (2015) studied the nutritional status of adult Tharus of Uttarakhand and observed that under-nutrition was moderately high. Among males prevalence of under-nutrition is higher than females.

Borah and Sarmah (2012) in their study “Nutritional Status and Blood Pressure among the adult Karbi Women of Kamrup District” have found the prevalence of undernourishment to be high (35.97%). Women showing pre-hypertensive stage and hypertension increases with increase in age. Das and Das (2011) in “Food, Nutritional Status and Disease of the aged Male Kaibartas of Barpeta Town, Assam” studied the disease prevalent among the aged male Kaibartas of Barpeta Town, Assam where the male Kaibartas suffer various types of disease. Devi and Bagga (2006) conducted a comparative study on Women-Ageing in North-East India based on anthropometric measurements found significant changes with age in most of the variables. Goswami and

Bhattacharyya (2015) studied 300 adult Karbi women of Chandrapur and Dimoria block of Kamrup district study nutritional status of adult Karbi Women of Kamrup District, Assam and found the prevalence of under nutrition among the age groups was very less. The percentage of under nutrition was very less in comparison to other tribal groups in India.

The objective of the study: - The main objectives of the present study are as follows.

1. Present a demographic characteristic of the adult Mishing of the study area.
2. Assess their nutritional status from body mass index and waist-hip ratio.
2. Relate the nutritional status with the prevailing demographic variables.

MATERIAL AND METHOD

The present study is conducted among the adult Mishings of Dhakuakhana block of Lakhimpur district, Assam. It is a cross-sectional study. Data have been collected from the seven villages as mentioned earlier, under Dhakuakhana block of Lakhimpur district. Adult males and females in the age range of 20 years and above are considered for this study. Demographic data on age, sex, educational level, income, occupation and marital status are collected with household demographic survey schedule from 469 households. Nutritional status has been assessed with the help of nutritional anthropometry. The Anthropometric measurements used for measuring nutritional status are height, weight, waist circumference and hip circumference. Anthropometric measurements recorded to the nearest 0.1 cm in terms of Height and circumferences and up to 0.5 kg for body weight using standard techniques (Weiner and Lourie, 1981). Body mass index (BMI) has been calculated as weight (kg)/height (met²) and waist-hip ratio (WHR) as WC/HC cm. Assessment of nutritional status from body mass index has been done by following WHO, (2008) classification of BMI for Asian population. BMI <18.5 is underweight (CED), 18.5-22.9 as normal, 23.0-24.9 overweight, 25.0- 29.9 as obese I and ≥ 30 as obese II. The waist hip ratio has been used to assess the prevalence of abdominal obesity following World Health Organization classification (2008). World Health Organization defines abdominal obesity for the Asian population as Waist Hip Ratio (WHR) above 0.90 cm for males and above 0.80 cm for females. Pregnant women and elderly people who cannot stand erect were excluded from taking nutritional anthropometry for this study. The adult population for the purpose of the study is further categorized as young adult,

middle age adults and elderly. Individuals belonging to the age of 20 to 39 is categorized as young adult, 40 to 59 as middle age adult and 60 years and above as elderly.

Selection of area and people are important tools for anthropological research. North East India, especially Assam presents diversified cultural resources for anthropological studies. Apart from modernization, ethnic communities of Assam have well maintained their tradition and culture since time immemorial. The Mishings is the second largest contributor of great Assamese community. The Mishings are an important ethnic community of Assam for anthropological studies and quality research on it is lacking. By their tradition, the Mishings are the inhabitant of riverine areas of Assam and affected by flood every year. Flood plays a vital role in their day to day life. Keeping in mind, for the present study, villages have been identified near the embankment to find the effect of flood and its effect on them.

The people: - The study area is located in Kharkata and Pub Dhakuakhana Goan Panchayat under Dhakuakhana block of Lakhimpur district of Assam. Kharkata Goan and Pub Dhakuakhana Panchayat are mostly inhabited by the ethnic communities of Mishing and caste population of Kaibarta. It shares the border with Dhemaji in east, Sibsagar in south and Majuli in west. Mishing is the second largest ethnic community living in riverine areas of upper Assam. They construct their houses in pile dwellings near the bank of the river. By tradition Mishings are agriculturist. As their agricultural land opens to river Brahmaputra, cultivation during monsoon is not possible. Apart from cultivation, Mishings are very fond of fishing. As they live in remote areas education among Mishings is very poor. Instead of going to school, they like to go for cultivation and fishing. Paddy is important for Mishing people for both consumption of rice and rice beer. For all their social and religious occasions, they use rice beer with pork. While making rice beer, they use hundreds of wild leafy vegetables which have medicinal values. The Mishings have expertise in making of ethno medicine and use them in various treatments. The Mishing prefer monogamy and like to stay in joint or extended families.

RESULTS AND DISCUSSION

1. **Demographic profile:** - The total adult population considered for the present study is 957. Out of which 470 are males and 487 are females. The median age of the total population is 29.0 years which is greater in females (30.0 yrs) than in the males (28.0 yrs). The distribution of adult Mishing population according to age and sex has been shown in table 1. 33.18% of the males of the sample belong to the young adult age category, 34.68% to the middle age adult and 32.13% to the elderly category. Among the females the distribution in the three broad age groups are 34.29% in young adult category, 33.05% are middle age adult and 32.64% are elderly.

To understand the socio-economic condition of the sample there, three variables have been considered. Examination of the educational status, show that majority (45.10%) of the males of have studied up to secondary level, followed by higher secondary level (21.28%) and graduate level (9.79%). 8.94% are illiterates, 5.53% and 9.36% have studied to the primary and middle school label. Comparison of educational status of the males in the three broad age category show that illiteracy is higher among the elderly and most of the respondents of the young adults and middle age adults have studied to the secondary level. Respondents who have studied beyond the secondary level are higher among the young adults in comparison to the other age groups.

The occupation is an important determinant of socio-economic condition of a community. The Mishings of the study area have lost their cultivable land due to erosion and sand casting during flood. The present day occupation of the study area is the changing trend from agriculture to other alternatives. In terms of occupation of Mishing males, the highest percentage of the young adult category are involved in petty trade (35.89%), followed by agriculture (26.92%) and wage earning (19.32%). Middle age adults are mostly involved in agriculture (33.74%), followed by petty trade (26.38%) and wage earning (25.77%). Most of the elderly (55.63%) contributed to be agriculture as they do not have any other alternative. (31.91%) are no longer able to contribute for a living.

Given their current circumstances, the income level is very low. However, a clarification of income level have been done following the modified BG Prasad Scale of Socio-Economic Classification (Pandey *et al.*, 2018). Most of the adult Mishing male population belongs to the lower income group (57.66%) followed by middle income group (36.81%) and there are few people in the upper income group (5.53%). As the study area is a flood affected area ravaged

annually by flood, most of the respondents belong to the low income group accordingly. This is true for all the broad age categories and more than fifty percent of the sample belong to the low income category. Only 5.32% of the sample belong to the upper income category.

In case of three broad age categories, most of the young adults belong to lower income group (51.92%) followed by middle income (42.31%) and upper income (5.77%).

Among middle age adults, lower income shows highest percentage (65.03%) followed by middle income (28.83%) and upper income groups (6.13%). Among elderly, lower income group constitutes the highest percentage (55.63%) followed by middle income (42.55%) and upper income groups (4.96%).

In terms of marital status, majority of the adult male Mishings are married (80.21%) followed by unmarried (14.25%) and widower (5.53%). Unmarried individuals are found mostly in the young adults (40.38%) category. Only 2.45% of the males from middle age category are unmarried and whereas there are no unmarried males in the elderly category.

The distribution of adult female Mishings according to their educational status, occupational status, income category and marital status is shown on table 3. In case of educational status, majority (36.55%) of the adult females of the study area have studied up to secondary level, followed by middle school (19.50%). Among them, 16.02% of adult females are illiterate, 13.34% have studied up to higher secondary level, 10.88% up to primary school and 3.70% up to graduate level. Among young adult, most of them have studied up to secondary level (49.70%) followed by higher secondary (28.74%) and middle schooling (12.57%). Among middle age adult, most (40.99%) of them have studied up to secondary level followed by middle schooling (29.81%) and primary level (10.56%). Among elderly, 42.77% are illiterate and 22.01% have studied up to primary level.

In case of occupation of adult female Mishings, the highest percentage of the young adult category are involved in agriculture (80.24%) followed by student (8.38%), services (5.99%), and petty trade (5.39%). Middle age adults are mostly involved in agriculture (83.23%), followed by services (9.32%) and petty trade (6.21%). Elderly are mostly (70.44%) involved in agriculture followed by those who are no longer working for a living (26.42%).

According to modified BG Prasad Scale of Socio-Economic Classification (Pandey *et al.*, 2018), most of the adult Mishing female population belongs to the lower income group (55.65%) followed by middle income group (33.68%) and upper income group (10.67%). In terms of three broad age categories, most of the young adults belong to lower income group (44.31%) followed by middle income (34.13%) and upper income (21.55%). Among middle age adults, lower income shows highest percentage (64.60%) followed by middle income (27.95%) and upper income groups (7.45%). Among elderly, lower income group constitutes the highest percentage (58.49%) followed by middle income (38.99%) and upper income groups (2.51%).

In terms of marital status, majority of the adult female Mishings are married (77.21%) followed by unmarried (11.70%) and widow (11.08%). Unmarried individuals are found mostly in the young adults (32.34%) category. Only 0.62% of the females from middle age category are unmarried and whereas there are no widow females in the young adult category.

2. Anthropometry: - Anthropometry is considered to be an important tool for assessing nutritional status of adults. Body mass index (BMI) is found to be inexpensive, non-invasive and suitable for large-scale surveys. Thus, BMI is the most established anthropometric indicator used not only for assessment of adult nutritional status but also the socio-economic condition of a population, especially adult populations in developing countries (Tungdim and Kapoor 2010).

The distribution of anthropometric variables of height, weight, waist circumference and hip circumference of adult male Mishing is shown in table 4. For each of age groups, the range of the data is however, very high. In case of height, the mean height of young adult (162.48 ± 0.75) is similar to middle age adults (162.39 ± 0.75) groups and it is lower among elderly (157.98 ± 1.53). Likewise, the median height of adult male Mishing is similar among the young (162.65) and middle age adult (162.90) groups but lower among the elderly (158.46). The mode height of adult male is slightly increase from young adult (154.0) to middle age adult (156.25) groups and it decrease from middle age adults to elderly (152.36).

According to the mean weight, the middle age adults are heavier (61.40 ± 0.82) than young adults (60.94 ± 0.84) and elderly (56.98 ± 1.39). The range of the data for weight is very high in each of the age categories. Therefore, to have a clear understanding the median and mode weight have been calculated. The median weight of the young adults (60.55) and middle age adults (60.25) are similar but it is lower (56.63%) among elderly.

The mode weight of adults male is highest among the young (59.0) to middle age adults (56.5) followed by middle age adults. Among the elderly the mode weight is 45.3.

In case of waist circumference, the mean waist circumference of adult male Mishings is increases from young adult (78.25 ± 1.13) to middle age adult (81.47 ± 0.97) groups and it slightly decrease from middle age adults to the elderly (81.28 ± 1.86). Likewise, the median waist circumference of adult male Mishings is increase from young adults (78.70) to middle age adult (80.85) groups and it slightly decrease from middle age adults to the elderly (80.33). The mode waist circumference of adult male Mishings is decreases from young adults (81.70) to middle age adults (77.35) groups but is found to be highest among the elderly (82.53).

In case of hip circumference, the mean hip circumference of adult male Mishing is slightly increasing from young adult (87.21 ± 1.00) to middle age adult (88.38 ± 0.70) groups but decreases from middle age adult (88.38 ± 0.70) to elderly (86.78 ± 1.19). The median hip circumference of adult male Mishings is decreasing from young adult (88.15) to middle age adults (87.35) and middle age adults to elderly (86.30). Similarly, mode hip circumference of male Mishing is decreasing from young adults (88.85) to middle age adult (82.00) groups and middle age adults to elderly (81.50).

The distribution of anthropometric variables of height, weight, waist circumference and hip circumference of adult female Mishing is shown in table 5. Among females, the mean height of young adults (151.51 ± 0.66) and middle age adults (151.68 ± 0.62) groups are similar and it decreases in elderly (146.73 ± 1.29) females. The median height of young adults (151.5) and middle age adults (151.6) group is similar and it decreases from middle age adults to the elderly (145.7). The mode for adult female Mishing is increasing from young adults (147.3) to middle age adult (151.6) groups but it decreases from middle age adults to elderly (141.2).

In case of weight, middle age adult (52.40 ± 1.00) are heavier than the young adult (51.23 ± 0.95) and elderly (46.92 ± 1.79) groups. The median weight of adult female Mishing is increases from young adult (50.10) to middle age adult (51.30) groups but it decreases from middle age adult to the elderly (47.27). The mode for female weight is decreasing from young adults (49.0) to middle age adult (47.30) groups but slightly increasing from middle age adults (47.30) to elderly (48.67).

In case of waist circumference, the mean waist circumference of adult female Mishing is increase with age increase (young adult 70.57 ± 0.78 , middle age adult 73.64 ± 0.99 and elderly 74.46 ± 1.42). The median waist circumference of adult female Mishing is increasing from young adult to middle age adult and it decreasing from middle age adult to elderly.

In case of hip circumference, the mean hip circumference of Mishing female increases from young adult to middle age adult and it decreases from middle age adult to elderly. In terms of proportion, males are taller (males 160.32 cm, females 149.51 cm) and heavier (males 59.77 kg, females 50.18 kg) than females. In terms of waist circumference, the mean waist circumference of adult males (80.44 cm) is higher than the females (73.18 cm). In case of hip circumference, the mean hip circumference of adult males is higher (87.36 cm) than females (84.98 cm).

3. Nutritional anthropometry: - Against the backdrop of global nutrition and epidemiologic transitions, measuring and tracking overweight and obesity in adulthood is gaining importance in low and middle-income countries (Murray, 2015, Poplin, 2012). Epidemiologists and clinicians commonly employ anthropometric indices as convenient and informative body composition metrics to gauge population and individual level risk for cardiovascular disease. Waist circumference and waist-height ratio were the most useful indices for identifying South Asian adults with prevalent diabetes and hypertension (Popkin, 2013). Collection of waist circumference data in South Asian health surveys will be informative for population-based cardiovascular disease surveillance efforts. (Patel *et al.* 2017). Obesity has been increasing in epidemic proportion in both adults and children. Recent evidence indicates that obesity is associated with more morbidity than smoking, alcoholism, and poverty (Bhatt, 2010).

Distribution of the subjects for nutritional status according to body mass index is shown in table 6. Among the male adults, 44.89% belong to over nutrition category, 49.57% are normal and 5.53% are under nourished. The prevalence of over nutrition is very high among adult male Mishing of the study area. Among adult male, overweight is highest (21.06%) followed by obesity grade I (20.00%), and obesity grade II (3.83%). The prevalence of overweight and obesity show a variation by age group. Among young adult male 49.36% are normal followed by overweight (21.15%) and obesity grade I (18.59%). Among middle age adult 49.69% are normal followed by overweight (24.54%) and obese grade I (18.40%). Among elderly male 49.67% are normal followed by obesity grade I (23.18%) and overweight (17.22%). Overweight and obesity is found

more among young and middle age adults. On the other hand, underweight is mostly found among the elderly. In terms of females, 35.31% belong to over nutrition category, 55.65% are normal and 9.03% are under weight. Among the overweight females, obesity grade I is higher (17.24%) followed by over weight (14.37%) and obesity grade II (3.70%). In terms of three broad age category, most of the young females are normal (61.08%) followed by over weight (16.77%) and obese grade I (14.37%). In the category of middle age adult female majority of them are normal (55.28%) followed by obese grade I (16.77%) and overweight (15.33%). Among elderly, 50.31% are normal followed by obesity grade I (20.75%), under nutrition (13.21%) and overweight (10.69%). From the discussion, it is clear that the nutritional status of adult Mishings is normal to overweight and tend to be obese despite their poor economic condition. The distribution of abdominal obesity according to the waist-hip ratio (WHR) is shown on Table 7. The prevalence of abdominal obesity is higher in female (80.49%) than males (60.43%). Abdominal obesity in both male and female are increase with age increase. The abdominal obesity is highly prevalent among middle age adult and elderly, where young adults are normal.

Obesity and overweight are currently considered major public health problems both in developed and developing countries. The risk increases with increasing adiposity and there is excess mortality at any age. The importance of fat distribution has been realized in recent years. It has now become obvious that metabolic complications of obesity are associated with upper body segment or abdominal obesity (Krotkiewski, 1983). Increased risk of cardiovascular disease (CVD) has been found in individuals presenting with the distribution of excess fat in the abdominal region. Obesity itself is a cardiovascular risk factor and there is also a relationship between obesity and hypertension (Larsson et al. 1984, Lapidus *et al.* 1984). Even in healthy young people who are obese, some degree of myocardial dysfunction has been demonstrated echocardiographically which tends to be reversible with weight loss. BMI is a relative height weight index that shows the highest correlation with independent measures of body fat (Hoffmans *et al.* 1989, Holbrook *et al.* 1990). There are numerous reports suggesting that BMI values greater than 26 for women are associated with an increased risk of fatal and non-fatal coronary heart disease. In the present study 84 males (17.82%) and 79 females (16.22%) show BMI value greater than 26.

4. Relation of nutritional anthropometry with other social variables:

The distribution of relationship of social variables with body mass index of males is shown on table 8. Prevalence of underweight is higher in terms of occupational pattern. Cultivators and wage labor show more are normal BMI whereas businessman and service holders are overweight. In the case of income category, the low-income category people are predominantly normal, middle and upper-income category is overweight and obesity. In the case of marital status, more unmarried males are underweight where more married and widower are overweight to normal. The relationship of female nutritional status with social variables is shown on table 9. In the case of occupational pattern, proportion of overweight females is higher among wage earner and service holders. Dependent and petty traders are underweight, where student and cultivators are normal. In terms of income category, low and middle income is underweight, middle and upper-income category is normal and low and middle-income category is overweight. In the case of marital status, married women are normal to overweight and proportion of underweight are highest among widows. The distribution of abdominal obesity of males according to waist-hip ratio with social variables is shown on Table 10. In the case of occupational pattern, dependent, student, wage earner and cultivators are obese where business and service is normal. In the case of income category, middle income is obese and upper income is normal. In terms of marital status, married and widower are obese and unmarried are normal. The distribution of female abdominal obesity with social variables is shown on Table 11. In the case of occupational patterns, wage earner, dependent, service and business are obese while the student is normal. In the case of income category, low and middle income is obese while upper income is normal. In the case of marital status, widow and married are obese and unmarried are normal.

The test of significance of body mass index with bio-social variables is shown on table 12. In terms of age group both males and females do not show statistically significant difference. Between the sexes, body mass index show statistically significant difference. In terms of occupational patterns, males show significant difference while, females do not show difference. In terms of income category, both males and females do not show statistically significant difference. In terms of marital status, females show statistically significant difference while, males do not show difference.

The prevalence of test of significance of waist-hip ratio with other bio-social variables is shown on table 13. In terms of age group, males show statistically significant difference, while females do not show difference. Between the sexes, waist hip ratio show statistically significant. In terms of occupational pattern, both males and females show statistically significant difference. In terms of income category, males show statistically significant difference, while females do not show significant difference. In terms of marital status, males show statistically significant different, while females do not show difference.

Conclusion: From the above discussion, it is clear that the nutritional status of the study area is over weight to obesity. Most of the adults are either overweight or obese. From the test of significance it is found that the body mass index of males with occupational pattern show statistically significant difference. In terms of waist hip ratio, occupational pattern of both males and females show statistically significant difference. In case of income category, females show statistically significant difference. Originally, Mishings is agriculturist. Due to regular occurrence of flood, the people of the study area lose their cultivable land. Due to reducing of cultivable land, Mishings of the study area do not undertake much physical activities in cultivation. The changing trend of physical activities may have shaped their nutritional status.

Table 1. Distribution of adult Mishings according to age and sex

Age Group		Male		Female		Total	
		No	%	No	%	No	%
Young Adult	20-29	72	15.31	87	17.86	159	16.61
	30-39	84	17.87	80	16.43	164	17.14
Middle Adult	40-49	103	21.91	112	22.99	215	22.47
	50-59	60	12.77	49	10.06	109	11.39
Elderly	60-69	101	21.49	120	24.64	221	23.09
	70-79	40	8.51	29	5.95	69	7.21
	80+	10	2.13	10	2.05	20	2.09
Total		470	100	487	100	957	100

Table 2: Distribution of adult male Mishings according to educational status, occupational pattern, income category and marital status.

Age Category	Educational status of adult Mishing male													
	Illiterate		Primary		Middle		Secondary		HS		Graduate & above		Total	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%
Young Adult	1	0.64	1	0.64	3	1.84	70	44.87	59	37.82	22	14.1	156	33.19
Middle Age Adult	2	1.23	3	1.84	19	11.66	91	55.83	29	17.79	19	11.66	163	34.68
Elderly	39	25.83	22	14.56	22	14.56	51	33.77	12	7.95	5	3.31	151	32.13
Total	42	8.94	26	5.53	44	9.36	212	45.1	100	21.28	46	9.79	470	100
Occupational status of adult Mishing male														
Age Category	Agriculture		Wage earner		Petty Trade		Service		Student		Dependent		Total	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%
Young Adult	42	26.92	30	19.32	56	35.89	14	8.97	14	8.97	0	0	156	33.19
Middle Age Adult	55	33.74	42	25.77	43	26.38	23	14.11	0	0	0	0	163	34.68
Elderly	84	55.63	4	2.65	12	7.95	6	3.97	0	0	45	29.80	151	32.13
Total	181	38.51	76	16.17	111	23.62	43	9.15	14	2.98	45	9.57	470	100
Income category of adult Mishing male														
Age Category	Lower Income		Middle income		Upper income		Total							
	No	%	No	%	No	%	No	%						
Young Adult	81	51.92	66	42.31	9	5.77	156	33.19						
Middle Age Adult	106	65.03	47	28.83	10	6.13	163	34.68						
Elderly	84	55.63	60	39.74	7	4.63	151	32.13						
Total	271	57.66	173	36.81	26	5.32	470	100						
Marital status of adult Mishing male														
Age Category	Married		Unmarried		Widower		Total							
	No	%	No	%	No	%	No	%						
Young Adult	93	59.62	63	40.38	0	0	156	33.19						
Middle Age Adult	152	93.25	4	2.45	7	4.29	163	34.68						
Elderly	132	87.42	0	0	19	12.58	151	32.13						
Total	377	80.21	67	14.26	26	5.53	470	100						

Table 3: Distribution of adult female Mishings according to educational status, occupational pattern, income category and marital status.

Age Category	Educational Status of Adult Mishings female													
	Illiterate		Primary		Middle		Secondary		HS		Graduate		Total	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%
Young Adult	1	0.6	1	0.6	21	12.57	83	49.7	48	28.74	13	7.78	167	34.29
Middle Age Adult	9	5.59	17	10.56	48	29.81	66	40.99	16	9.94	5	3.11	161	33.06
Elderly	68	42.77	35	22.01	26	16.35	29	18.24	1	0.63	0	0	159	32.65
Total	78	16.02	53	10.88	95	19.5	178	36.55	65	13.35	18	3.7	487	100
Occupational Status of Adult Mishings female														
Age Category	Agriculture		Wage Earner		Petty trade		Service		Student		Dependent		Total	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%
Young Adult	134	80.24	0	0	9	5.39	10	5.99	14	8.38	0	0	167	34.29
Middle Age Adult	134	83.23	2	1.24	10	6.21	15	9.32	0	0	0	0	161	33.06
Elderly	112	70.44	1	0.63	2	1.26	2	1.26	0	0	42	26.42	159	32.65
Total	380	78.03	3	0.62	21	4.31	27	5.54	14	2.87	42	8.62	487	100
Income Category of adult Mishings female														
Age Category	Lower Income		Middle income		Upper income		Total							
	No	%	No	%	No	%	No	%						
Young Adult	74	44.31	57	34.13	36	21.55	167	34.29						
Middle Age Adult	104	64.6	45	27.95	12	7.45	161	33.06						
Elderly	93	58.49	62	38.99	4	2.51	159	32.65						
Total	271	55.65	164	33.68	52	10.67	487	100						
Marital Status of adult Mishings female														
Age Category	Married		Unmarried		Widow		Total							
	No	%	No	%	No	%	No	%						
Young Adult	113	67.66	54	32.34	0	0.00	167	34.29						
Middle Age Adult	149	92.55	1	0.62	11	6.83	161	33.06						
Elderly	114	71.7	2	1.26	43	27.04	159	32.65						
Total	376	77.21	57	11.7	54	11.08	487	100						

Table 4: Distribution of adult male Mishings by anthropometric variables.

Height (cm)							
Age Group	N	Range	Mean \pm SE	SD \pm SE	CV \pm SE	Median	Mode
Young adult	156	141.1-176.1	162.48 \pm 0.75	6.57 \pm 0.53	4.10 \pm 0.33	162.65	154.00
Middle age adult	163	140.8-177.8	162.39 \pm 0.75	6.53 \pm 0.35	4.02 \pm 0.33	162.90	156.25
Elderly	151	132.7-177.5	157.98 \pm 1.53	7.15 \pm 1.08	4.54 \pm 0.69	158.46	152.36
Total	470	138.2-177.1	160.95 \pm 1.01	6.75 \pm 0.65	4.22 \pm 0.45	161.34	154.20
Weight (Kg)							
Age Group	N	Range	Mean \pm SE	SD \pm SE	CV \pm SE	Median	Mode
Young adult	156	38.0-99.0	60.94 \pm 0.84	10.53 \pm 0.84	17.22 \pm 1.37	60.55	59.00
Middle age adult	163	34.5-98.0	61.40 \pm 0.82	9.94 \pm 0.82	16.17 \pm 1.32	60.25	56.50
Elderly	151	38.0-89.2	56.98 \pm 1.39	10.22 \pm 1.39	17.95 \pm 1.38	56.63	45.30
Total	470	36.83-95.4	59.77 \pm 1.02	10.23 \pm 1.02	17.11 \pm 1.36	59.14	53.60
Waist circumference (cm)							
Age Group	N	Range	Mean \pm SE	SD \pm SE	CV \pm SE	Median	Mode
Young adult	156	25.5-109.2	78.25 \pm 1.13	10.37 \pm 0.86	9.93 \pm 0.79	78.70	81.70
Middle age adult	163	58.2-102.2	81.47 \pm 0.97	9.48 \pm 0.73	8.28 \pm 0.68	80.85	77.35
Elderly	151	39.5-105.2	81.28 \pm 1.86	6.81 \pm 0.47	9.15 \pm 1.24	80.33	82.53
Total	470	40.97-105.5	80.33 \pm 1.32	9.18 \pm 0.93	9.12 \pm 0.90	79.96	80.53
Hip Circumference (cm)							
Age	N	Range	Mean \pm SE	SD \pm SE	CV \pm SE	Median	Mode
Young adult	156	26.5-109.4	87.21 \pm 1.00	8.78 \pm 0.71	10.14 \pm 0.82	88.15	88.85
Middle aged adult	163	65.4-111.2	88.38 \pm 0.70	6.14 \pm 0.49	6.99 \pm 0.56	87.35	82.00
Elderly	151	46.5-103.8	86.78 \pm 1.19	6.72 \pm 0.85	7.74 \pm 0.97	86.30	81.50
Total	470	46.13-108.1	87.45 \pm 0.96	7.14 \pm 0.70	8.29 \pm 0.78	87.27	84.12

Table 5: Distribution of adult female Mishings by anthropometric variables.

Height (cm)							
Age Group	N	Range	Mean \pm SE	SD \pm SE	CV \pm SE	Median	Mode
Young adult	167	125.6-167.2	151.51 \pm 0.66	6.02 \pm 0.47	3.97 \pm 0.29	151.5	147.30
Middle age adult	161	140.2-168.2	151.68 \pm 0.62	4.00 \pm 0.35	2.64 \pm 0.23	151.6	151.60
Elderly	159	123.2-164.6	146.73 \pm 1.29	6.11 \pm 0.92	4.15 \pm 0.65	145.7	141.20
Total	487	129.67-166.6	149.97 \pm 0.85	5.37 \pm 0.58	3.58 \pm 0.39	149.6	146.70
Weight (Kg)							
Age Group	N	Range	Mean \pm SE	SD \pm SE	CV \pm SE	Median	Mode
Young adult	167	35.0-95.0	51.23 \pm 0.95	8.67 \pm 0.67	16.91 \pm 1.31	50.1	49.00
Middle age adult	161	34.5-80.8	52.40 \pm 1.00	8.42 \pm 0.71	16.01 \pm 1.34	51.3	47.30
Elderly	159	26.5-92.0	46.92 \pm 1.79	9.25 \pm 1.27	19.73 \pm 2.85	47.2	48.60
Total	487	32.0-89.3	50.18 \pm 1.25	8.78 \pm 0.88	17.55 \pm 1.83	49.5	48.20
Waist Circumference (cm)							
Age group	N	Range	Mean \pm SE	SD \pm SE	CV \pm SE	Median	Mode
Young adult	167	45-92.2	70.57 \pm 0.78	7.15 \pm 0.55	10.12 \pm 0.78	69.8	66.30
Middle age adult	161	57.2-96.2	73.64 \pm 0.99	8.38 \pm 0.70	11.35 \pm 0.96	72.8	79.70
Elderly	159	53.3-101.1	74.46 \pm 1.42	8.02 \pm 1.03	10.91 \pm 1.37	71.5	69.60
Total	487	51.8-96.5	72.89 \pm 1.06	7.85 \pm 0.76	10.79 \pm 1.04	71.3	71.87
Hip Circumference (cm)							
Age	N	Range	Mean \pm SE	SD \pm SE	CV \pm SE	Median	Mode
Young adult	167	39.0-100.4	84.31 \pm 0.76	6.91 \pm 0.54	8.18 \pm 0.63	85.6	85.45
Middle age adult	161	74.0-106.2	86.52 \pm 0.68	5.73 \pm 0.48	6.61 \pm 0.55	86.3	78.65
Elderly	159	48.0-107.2	84.13 \pm 1.17	6.32 \pm 0.83	7.49 \pm 0.99	84.0	80.03
Total	487	53.67-104.6	84.98 \pm 0.87	6.32 \pm 0.62	7.43 \pm 0.72	85.3	81.38

Table 6: Distribution of adult Mishing according to nutritional grading by Body Mass Index.

Male												
Age	CED		Normal		Over weight		Obese I		Obese II		Total	
	No	%	No	%	No	%	No	%	No	%	No.	%
Young adult	11	7.05	77	49.36	33	21.15	29	18.59	6	3.85	156	33.19
Middle age adult	6	3.68	81	49.69	40	24.54	30	18.40	6	3.68	163	34.68
Elderly	9	5.96	75	49.67	26	17.22	35	23.18	6	3.97	151	32.13
Total	26	5.53	233	49.57	99	21.06	94	20.00	18	3.83	470	100
Female												
Young adult	10	5.99	102	61.08	28	16.77	24	14.37	3	1.80	167	34.29
Middle age adult	13	8.07	89	55.28	25	15.53	27	16.77	7	4.35	161	33.06
Elderly	21	13.21	80	50.31	17	10.69	33	20.75	8	5.03	159	32.65
Total	44	9.03	271	55.65	70	14.37	84	17.24	18	3.70	487	100

Table 7: Distribution of adult Mishing according to abdominal obesity by Waist Hip Ratio.

Male						
Age group	Normal		Abdominal Obesity		Total	
	No	%	No	%	No	%
Young adult	84	53.85	72	46.15	156	33.19
Middle age adult	54	33.13	109	66.87	163	34.68
Elderly	48	31.79	103	68.21	151	32.13
Total	186	39.57	284	60.43	470	100
Female						
Age group	Normal		Abdominal Obesity		Total	
	No	%	No	%	No	%
Young adult	42	25.15	125	74.85	167	34.29
Middle age adult	28	17.39	133	82.61	161	33.06
Elderly	25	15.72	134	84.27	159	32.65
Total	95	19.51	392	80.49	487	100

Table 8: Distribution of male BMI according to social variables

Occupational Pattern	BMI							
	Under Weight		Normal		Over Weight		Total	
	No	%	No	%	No	%	No	%
Agriculture	6	3.31	102	56.35	73	40.33	181	38.51
Wage Labor	5	6.58	41	53.95	30	39.47	76	16.17
Business	4	3.60	46	41.44	61	54.95	111	23.62
Service	2	4.65	16	37.21	25	58.14	43	9.15
Student	4	28.57	4	28.57	6	42.86	14	2.98
Dependent	5	10.87	24	54.35	16	34.78	45	9.57
Total	26	5.53	233	49.57	211	44.89	470	100
Income category	BMI							
	Under Weight		Normal		Over Weight		Total	
	No	%	No	%	No	%	No	%
Low	15	5.68	134	50.76	115	43.56	264	56.17
Middle	9	5.00	87	48.33	84	46.67	180	38.29
Upper	2	7.69	12	46.15	12	46.15	26	5.53
Total	26	5.53	233	49.57	211	44.89	470	100
Marital Status	BMI							
	Under Weight		Normal		Over Weight		Total	
	No	%	No	%	No	%	No	%
Married	17	4.51	191	50.66	169	44.83	377	80.21
Un Married	8	11.94	31	46.27	28	41.79	67	14.26
Widower	1	3.84	11	42.31	14	53.85	26	5.53
Total	26	5.52	233	49.68	211	44.80	470	100

Table 9: Distribution of female BMI according to social variables

Occupational Pattern	BMI							
	Under Weight		Normal		Over Weight		Total	
Agriculture	31	8.16	213	56.05	136	35.79	380	78.03
Wage Earner	0	0.00	1	33.33	2	66.67	3	0.62
Business	5	23.81	12	57.14	4	19.05	21	4.31
Service	1	3.70	14	51.85	12	44.44	27	5.54
Student	0	0.00	10	71.43	4	28.57	14	2.87
Dependent	7	16.67	21	50.00	14	33.33	42	8.62
Total	44	9.03	271	55.65	172	35.32	487	100
Income Category	BMI							
	Under weight		Normal		Over Weight		Total	
Low	27	9.12	158	53.38	111	37.50	296	60.78
Middle	16	9.47	97	57.40	56	33.14	169	34.70
Upper	1	4.55	16	72.73	5	22.73	22	4.52
Total	44	9.03	271	55.65	172	35.32	487	100
Marital Status	BMI							
	Under Weight		Normal		Over Weight		Total	
Married	30	7.98	210	55.85	136	36.17	376	77.21
Un Married	2	3.51	35	61.40	20	35.09	57	11.70
Widow	12	22.64	26	47.17	16	30.19	54	11.09
Total	44	9.03	271	55.65	172	35.32	487	100

Table 10: Distribution of male waist hip ratio according to social variables.

Occupational Pattern	Waist Hip Ratio					
	Normal		Obese		Total	
	No	%	No	%	No	%
Agriculture	65	35.91	116	64.09	181	38.51
Wage Earner	25	32.89	51	67.11	76	16.17
Business	57	51.35	54	48.65	111	23.62
Service	20	46.51	23	53.49	43	9.15
Student	5	35.71	9	64.29	14	2.98
Dependent	15	33.33	30	66.67	45	9.24
Total	187	39.79	283	60.21	470	100
Income Category	Waist Hip Ratio					
	Normal		Obese		Total	
	No	%	No	%	No	%
Low	112	41.33	159	58.67	271	57.66
Middle	61	35.26	112	64.74	173	36.80
Upper	14	53.85	12	46.15	26	5.53
Total	187	39.70	283	60.21	470	100
Marital Status	Waist Hip Ratio					
	Normal		Obese		Total	
	No	%	No	%	No	%
Married	138	36.60	239	63.40	377	80.04
Un Married	39	58.21	28	41.79	67	14.23
Widower	10	38.46	16	61.54	26	5.53
Total	187	39.79	283	60.21	470	100

Table 11: Distribution of female waist hip ratio according to social variables

Occupational Patter	Waist Hip Ratio					
	Normal		Obese		Total	
Agriculture	76	20.00	304	80.00	380	78.03
Wage Earner	0	0.00	3	100	3	0.62
Business	4	19.05	17	80.95	21	4.31
Service	4	14.81	23	85.19	27	5.54
Student	7	50.00	7	50.00	14	2.87
Dependent	5	11.90	37	88.09	42	8.62
Total	96	19.71	391	80.29	487	100
Income Category	Waist Hip Ratio					
	Normal		Obese		Total	
Low	57	18.81	246	81.19	303	62.22
Middle	28	17.72	130	82.28	158	32.44
Upper	11	42.31	15	57.69	26	5.34
Total	96	19.71	391	80.29	487	100
Marital Status	Waist Hip Ratio					
	Normal		Obese		Total	
Married	68	18.09	308	81.91	376	77.21
Un Married	17	29.82	40	70.18	57	11.70
Widow	11	20.37	43	79.63	54	11.09
Total	96	19.71	391	80.29	487	100

Table 12: Distribution of test of significance of BMI with bio-social variables

Bio-Social Variables	Sex	Chi Square	Degree of Freedom	Probability	Results
Age Group	Male	11.9	12	0.453	Not Significant
	Female	14.9	12	0.242	Not Significant
Sex	Male+ Female	10.3	2	0.006	Significant
Occupational Pattern	Male	31.2	10	0.001	Significant
	Female	15.3	10	0.12	Not Significant
Income category	Male	0.8	4	0.94	Not Significant
	Female	3.75	4	0.44	Not Significant
Marital Status	Male	6.68	4	0.154	Not Significant
	Female	18.2	4	0.001	Significant

Table 13: Distribution of test of significance of waist hip ratio with bio-social variables

Bio-Social Variables	Sex	Chi Square	Degree of Freedom	Probability	Results
Age Group	Male	29.0	6	0.000	Significant
	Female	11.7	6	0.069	Not Significant
Sex	Male Female	44.0	1	0.000	Significant
Occupational Pattern	Male	11.0	5	0.052	Significant
	Female	11.9	5	0.036	Significant
Income Category	Male	3.85	2	0.140	Not Significant
	Female	9.09	2	0.010	Significant
Marital Status	Male	11.2	2	0.004	Significant
	Female	4.35	2	0.113	Not Significant

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