An Evaluation on Household Dietary Diversity, Food Security & Nutritional Status among the Tribal Households at ModhupurUpazilla in Tangail District, Bangladesh

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1. ABSTRACT

A cross sectional study was carried out among the selected tribal households of ModhupurUpazilla in Tangail district to evaluate household dietary diversity, food security and hygienic condition. In this study we also assess the nutritional status of the respondents. Among 530 households we purposively selected 98 households for our study. Nutritional status was measured by BMI. In this study all of the 98 respondents were Garo and Koch. Among them 72 respondents were Garo who were Christian and 26 respondents were Koch who were Hindu. Among the respondents 27.6% were male and 72.4% were female. According to BMI nutritional status was normal for 85.7% respondents, underweight for 8.2% respondents and overweight for 6.1% respondents. Around 10.2% respondents were educated at primary level, 26.5% were educated at secondary level, 8.2% were educated at higher secondary level and 2% respondents were educated at Degree/Hon's level. Around 9.2% households had one earning person, 51% had two earing persons, 36.7% had three earning persons and 3.1% had four earning persons. More than half of the households (68.4%) had agricultural land and 31.6% households did not have any agricultural land. Among the agricultural land containing households 71.4% produced vegetables and 27.6% households did not produce any type of vegetables. 79.6% households produced fruits and 19.4% did not had. Only 22.4% households had pond and majority of the households (77.6%) did not have pond. Among the households who had pond 86.36% households cultivated fish and others (13.64%) did not cultivate in their ponds. Few adults (2%) in the households ate two meals and majority (98%) ate three meals per day. The same result occurred for the children, only 1% children in the households ate two meals and majority (99%) ate three meals per day. All the respondents (100%) ate rice 91% ate seasonal vegetables, 75% ate seasonal green leafy vegetables, 67% ate seasonal fruits, about 27.55%, 53%, 69%, 58%, 32%, 67%, and 82% households ate beef, mutton, poultry, egg, milk, pulses and fish respectively. They also ate pork, frog and crab. 97.96% households ate vitamin-A containing foods. Among 96.94% households ate vitamin-A containing foods from plant sources and 88.78% ate from animal sources. 91.84% households ate iron containing foods. Half of the households (50%) washed their hands and 11.2% households did not wash and in some households (38.8%) somebody washed their hands by soap or ash before eating or after coming from toilet. In this study educational level (P=0.000) was statistically significant with nutritional status at 1% level of significance. Washing hand before eating and after coming from toilet (P=0.014) were statistically significant with nutritional status at 5% level of significant. And occupation (P=0.082), using shoe or slipper at toilet or dirty places (P=0.050) were statistically significant at 10% level of significance. And for other variables there were no association.

Keywords:*Garo, households, BMI, nutritional, status, Diversity, Dietary*

2. Introduction

General Introduction

Bangladesh is a small country with a rich cultural heritage. It is not only the Bangalis (plains people) who have contributed to this culture, but also the several hundred tribal communities of the country who live mainly in the Hill areas of the Chittagong Hill Tracts, in the Districts of Dinajpur, Rajshahi, Sylhet and the plains forests in Dhaka, Tangail, Mymensingh and Jamalpur. Many tribes are live in Bangladesh, i.e. Chakma, Marma, Hajong, Garo, Khashia, Monipuri,Tonchongya etc. these different kinds of tribes have different life style, religion and culture. On the basis of their traditional knowledge. According to the 2001 (provisional) census report, the indigenous peoples of the plain regions were estimated to number about 1,036,060. However, plain indigenous peoples claim that their population is estimated 2 million. Among them, the santal are the most numerous,

constituting almost 30 per cent of the indigenous population of the plains, followed by the Garo, Hajong, Koch, Manipuri, Khasi, Rakhain etc.

The Garos form the largest tribal group of people of north-central Bangladesh residing mainly in Mymensingh, Netrakona, Gazipur, Sherpur and Tangail districts. Although a number of Garos have recently adopted Christianity, they basically follow their own religion with its associated customs and rituals.

More than 45 Indigenous ethnic communities with a population of nearly three million people have been living in the country for centuries. According to the 2001 (provisional) Census Report, the total number of indigenous (officially 'tribal') people in Bangladesh is about 1,772,788, which is 1.28 per cent of the total population of the country. However, indigenous peoples claim that the population ofthe indigenous peoples all over the country is about 3 million.

Indigenous peoples in other parts of'plains' Bangladesh are located mainly in the border regions in the northwest (Rajshahi-Dinajpur), central north (Mymensingh-Tangail), northeast (Greater Sylhet), south and southeast (Chittagong, Cox's Bazar and Greater Barisal). According to the 2001 (provisional) census report, the indigenous peoples of the plain regions were estimated to number about 1,036,060. However, plain indigenous peoples claim that their population is estimated 2 million. Among them, the Santal are the most numerous, constituting almost 30 per cent of the indigenous population of the plains, followed by the Garo, Hajong, Koch, Manipuri, Khasi, Rakhain etc.

There are different opinions and an acute shortage of reliable data and statistics regarding the population size of the different indigenous peoples. According to official statistics, there are about two million indigenous people in Bangladesh, out of which 1.6 million live in the plains. A total of 59 different groups are mentioned in various studies and censuses. There are 11 distinct indigenous peoples in the Chittagong Hill Tracts (CHT), while the indigenous peoples of the regions outside the CHT, referred to as the 'plains', are comprised of 21 *Adibashi/Adivasi*groups.

Figure 1: Location of the tribal area in Bangladesh map
Economic Status of indigenous peoples in Bangladesh

The disaggregated data on the actual socio-economic condition of the indigenous peoples in Bangladesh is not available. However it is generally accepted that the worst poverty situation in Bangladesh is among the indigenous peoples who live in the rural and hilly areas. Poverty among the indigenous peoples is pervasive and severe, particularly in northwest region of the country. Indigenous peoples are also represented disproportionately among both the poor and extreme poor. This trend has been worsening over the past decade due to the dispossession of land. Indigenous peoples also lack access to information and technology. This prevents them from participating in, and benefiting from, technological and other changes in the society, particularly economic reforms and developments. Many suffer from ethnic prejudice, ill-health, bad nutritional conditions and bad hygiene. These problems are slowly but steadily resulting in their marginalization and corroding their social fabric. Indigenous peoples live in remote areas and also far away from each other, and as a result of poor communications it is difficult to mobilize and organise them. Inadequate representation at various levels of government and the policy processes have hampered the ability of indigenous peoples and their leadership to influence policy decisions which affect their lives. (PRSP,2005).

The indigenous peoples are neither enjoying the benefits of development programmes nor are they getting back their lands (their main source of livelihood) from the occupants. Many indigenous youths are without any sustainable alternatives and are finding themselves in a difficult socio-economic situation, and in this way they are also losing their traditional livelihoods. For instance, a good number of Garo young girls have migrated to cities and are working in the beauty parlors.

These young girls often face discrimination and harassment at the workplace. They are lowly paid (most of them get Tk. 2,000-4,000 per month) and irregularly paid. They work for almost 10-12 hours per day and in many parlors, they do not even have weekly holidays. The Garo girls merely get permission to go out if they are to meet their relatives or to go out with friends. Sometimes the girls are battered by their employers for minimal mistakes.s

Cultural status

The indigenous people in Bangladesh are different from the rest of the people of the Bangladesh in all respects, including socially, economically, politically, and culturally. The indigenous people mainly practice Buddhism, Hinduism, Christianity and Animism as their religion. Each group has its own distinct language, culture, religion and customs. The mainstream population know little of the indigenous cultures of the country and because of this they are ignorant of the ceremonies and rituals that the indigenous people celebrate. With the help of different organizations, like Bangladesh Adivasi Forum, JatiyoAdivasiParishad, Bangladesh AdivasiOdhiakarAndolan, Society for Environment and Human Development (SEHD), the indigenous people are now organizing various cultural events in the capital city and district towns.

Indigenous peoples are susceptible to crises ofcultural and social identity. They are losing their own heritage, which threaten their sustainability. They are slowly and steadily losing their language, culture, customs and music. Indigenous peoples are rarely able to influence national decisions that affect them. (PRSP,2005).

Educational status

Indigenous peoples mainly live in isolated areas, outside the mainstream of national economies and development support. The areas they inhabit are even more likely to lack basic infrastructure such as roads, markets, schools and health facilities. Indigenous peoples also enjoy fewer opportunities in education and skills development compared to their mainstream counterparts. As a result, the illiteracy rate among them is very high. Furthermore, the existing regulations on the establishment of schools do not take into consideration the dispersed and remote nature of their settlements, particularly in the CHT.(PRSP,2005).

Socio economic condition

The overall socio-economic profile of the indigenous peoples in Bangladesh is a cause for serious concern. The national Poverty Reduction Strategy (2009-2011) contains the following observation regarding the poverty status and overall situation of the country's indigenous peoples: "Some of the 'hardcore' poor of Bangladesh are found among the indigenous communities. Indigenous communities face discrimination and are subject to extortion by land grabbers. The level of social awareness among them is very low. Many suffer from ethnic prejudice, ill-health, bad nutritional conditions and bad hygiene".(PRSP,2008)

The socio-economic status of most indigenous communities in the plains, particularly in the north-western Rajshahi administrative divisions, is known generally to be even worse than that of indigenous communities in the CHT. Drawing primarily upon her study of north-west Bangladesh, a researcher on *Adivasis*of Bangladesh makes the following observation on well-being and food security "... the colonial history of *Adivasis*is, in many respects, a disturbing one of exploitation, deprivation, deteriorating livelihoods and occasional experience of famine, as well as the regular, unavoidable autumn periods of food scarcity. On the other hand, their history is one of an extraordinary ability to cope with crises, shocks and stresses."

Dietary diversity has also been linked with food security, and particularly with household-level access to calories. In an analysis of data from ten poor and middle-income countries, increases in dietary diversity were associated with increased availability of calories both from staples and from non-staple foods, at the household level (Hoddinott and Yohannes, 2002).

Throughout this paper we use the term *dietary diversity*. This is a widely used term, and has been defined as either the number of foods or the number of food groups consumed over a given reference period (generally from one day to two weeks). Other authors have used the terms *dietary variety* or *food variety* to indicate the same thing. Two other related terms are *nutrient adequacy* and *dietary quality*. *Nutrient adequacy* refers to the extent to which the diet provides sufficient energy, protein, and essential micronutrients. We review below evidence for a relationship between dietary diversity and nutrient adequacy in the context of developing countries.

Dietary quality is a broader concept than either dietary diversity or nutrient adequacy. Historically, when the main nutrition concerns were related to nutrient adequacy, nutrient adequacy and dietary quality were often equated. Currently, in developed countries concepts of diet quality are multi-dimensional and include the avoidance of excess (for example, of simple carbohydrates, saturated fat and sodium) as well as achievement of nutrient adequacy. In middle- and low-income countries, concerns about avoidance of excess and imbalanced diets are increasingly relevant, as diet-related risk factors for chronic disease are rapidly becoming prevalent in many populations (WHO/FAO, 2003). However, in the poorest developing countries and the poorest areas of many other countries, nutrient adequacy remains the predominant diet quality concern, particularly when considering the needs of young children.

2.1. Measurement of dietary diversity

Dietary diversity is usually measured by summing the number of foods or food groups consumedover a reference period (Krebs-Smith et al., 1987; Löwik, Hulshof, and Brussaard, 1999). The reference period usually ranges from one to three days, but seven days is also often used and periods of up fifteen days have been reported (Drewnowski et al., 1997). A

variety of dietary assessment methods have been used, including in-home observation, food frequency questionnaires and simple food group recalls.

While most dietary diversity measures consist of a simple count of foods or food groups, some scales in developed countries have weighted elements and/or taken into consideration the number of servings of different food groups in conformity with dietary guidelines. Examples of this latter approach include the .dietary score. developed by Guthrie and Scheer (1981), which allocates equal weights to each of four food groups consumed in the previous 24 hours: milk products and meat/meat alternatives receive 2 points for each of 2 recommended servings, and fruits/vegetables and bread/cereals receive 1 point for each of 4 recommended servings.

A modification of this approach developed by Kant et al. (1991; 1993) evaluates the presence ofa desired number of servings from 5 food groups (2 servings each from the dairy, meat, fruit andvegetables groups and four servings from the grain group) over a period of 24 hours. This score,called the .Serving Score., allocates a maximum of four points to each food group, for a total score of 20. Finally, Krebs-Smith and colleagues (1987) used and compared four different types of dietary diversity measures (which they refer to as dietary variety): 1) an overall variety score (simple count of food items), 2) a variety score among major food groups (6 food groups), 3a) a variety score within major food groups, counting separate foods, and 3b) a variety score within major food groups, counting minor food groups. All dietary measures are based on a 3-day recall.

In developing countries, single food or food group counts have been the most popular measurement approaches for dietary diversity, probably because of their simplicity. The number of servings based on dietary guidelines was not considered in any of the developing country studies reviewed. In China (Taren and Chen, 1993), Ethiopia (Arimond and Ruel, 2002) and Niger (Tarini, Bakari, and Delisle, 1999) researchers used food group counts, while in Kenya (Onyango, Koski, and Tucker, 1998), and Ghana and Malawi (Ferguson et al., 1993) they used the number of individual foods consumed. Studies in Mali (Hatloy, Torheim, and Oshaug, 1998)and Vietnam (Ogle, Hung, and Tuyet, 2001) used both single food counts (called the Food Variety Score (FVS)) and a food group count (called the Dietary Diversity Score (DDS)). This brief overview highlights the fact that researchers have used a variety of dietary diversity measures based on different food and food group classification systems, different numbers of foods and food.

Dietary diversity is defined as the number of individual food items or food groups consumed over a given period of time (Ruel, 2003). It can be measured at the household or individual level through use of a questionnaire. Most often it is measured by counting the number of food groups rather than food items consumed. The type and number of food groups included in the questionnaire and subsequent analysis may

vary, depending on the intended purpose and level of measurement. At the household level, dietary diversity is usually considered as a measure of access to food, (e.g. of households' capacity to access costly food groups), while at individual level it reflects dietary quality, mainly micronutrient adequacy of the diet. The reference period can vary, but is most often the previous day or week (FAO, 2011; WFP, 2009).

The following chart is used for measuring household dietary diversity-

Group number	Food group
1	Cereals
2	White tubers and roots
3,4,5	Vegetables[1]
6,7	Fruits[2]
8,9	Meat[3]
10	Eggs
11	Fish and other seafood
12	Legumes, nuts and seeds
13	Milk and milk products
14	Oils and fats
15	Sweets
16	Spices, condiments and beverages

[1]The vegetable food group is a combination of vitamin A rich vegetables and tubers, dark green leafy vegetables and other vegetables.

[2]The fruit group is a combination of vitamin A rich fruits and other fruits.

[3]The meat group is a combination of organ meat and flesh meat.

2.1.1. FAO's dietary diversity guidelines

FAO has published operational guidelines for measuring dietary diversity in a standardized way, based on a tool originally developed by FANTA (FAO, 2011; Swindale and Bilinsky, 2006).

The FAO guidelines recommend the following ways of reporting information collected on dietary diversity.

- Dietary diversity scores are simple counts of the number of food groups consumed at individual or household level. The two dietary diversity scores recommended by FAO are the Household Dietary Diversity Score (HDDS) based on twelve food groups and the Women's Dietary Diversity Score (WDDS) based on nine food groups. Mean scores can be compared across population sub-groups and over time.

- Dietary profiles based on food groups consumed by a majority of individuals/households can be compared to provide insights on consumption patterns across population sub-groups
- The percentage of individuals or households consuming food groups or combinations of nutrient dense food groups (such as food groups rich in Vitamin A) can be analyzed.

Food security may require a stronger focus on nutrition outcomes. Over time, the concept of food security and related approaches to address food insecurity have been developed and modified in accordance with the common understanding of the nature of the food problem and the evolution of the global food system (Maxwell 1996; Maxwell and Slater 2003). The use of the term 'food security' at the national (and global) level has been often focused on issues on the supply side of the food equation and particularly a country's ability to provide enough food to meet the needs or demands of the population either through domestic production or food imports.

The reasons why people experience food insecurity include: a lack of resources (including financial resources and other resources such as transport); lack of access to nutritious food at affordable prices, lack of access to food due to geographical isolation; and lack of motivation or knowledge about a nutritious diet.

There are three key components of food insecurity: inadequate access to food, inadequate supply and the inappropriate use of food (e.g., inappropriate preperation of food). The prevalence of food insecurity amongst the Australian population is estimated at 5% (Burns, 2004).

Whereas food security is broadly defined as "access by all people at all times to enough food for an active, healthy life" (Radimer, 2002), food insecurity exists "whenever the availability of nutritionally adequate and safe foods or the ability to acquire acceptable food in socially acceptable ways is limited or uncertain" (Radimer, 2002). There are three key components of food security (World Health Organization, 2011):

1. Food access: the capacity to acquire and consume a nutritious diet, including:

- the ability to buy and transport food;
- home storage, preparation and cooking facilities;
- knowledge and skills to make appropriate choices;
- and time and mobility to shop for and prepare food.

2. Food availability: the supply of food within a community affecting food security of individuals, households or an entire population, specifically:

- location of food outlets;
- availability of food within stores; and
- price, quality and variety of available food (Nolan, Rickard-Bell, Mohsin, & Williams, 2006).

3. Food use: the appropriate use of food based on knowledge of basic nutrition and care.

- There are three different "levels" of food security (see Figure 1, based upon Burns, 2004):
  - secure;
  - insecure but without hunger - where there may be anxiety or uncertainty about access to food or inappropriate use of food (i.e., poor nutritional quality) but regular consumption of food occurs; and
  - insecure with extreme hunger - where meals are often missed or inadequate (Burns, 2004).

Figure 2: The Food Security Continuum

According to the United Nations World Food Summit in 1996, food security is a right for all people (United Nations Food & Agriculture Organization, 1996). Yet conservative estimates suggest that upwards of 5% of Australians experience food insecurity, 40% of those at a severe level (Burns, 2004).

Dietary diversity—the number of different foods or food groups consumed over a given reference period—is an attractive indicator for four reasons.

First, a more varied diet is a valid outcome in its own right. Second, a more varied diet, either directly or indirectly through improved acquisition of micronutrients, is associated with a number of improved outcomes in areas such as birthweight, child Anthropometric status (Hatloy et al. 2000; Onyango, Koski, and Tucker 1998; Taren and Chen 1993; Tarini, Bakari, and Delisle 1999), improved hemoglobin concentrations (Bhargava, Bouis, and Scrimshaw 2001), reduced incidence of hypertension, reduced risk of mortality from cardiovascular disease and cancer (Kant, Schatzkin, and Ziegler 1995). Third, such questions can be asked at the household or individual level, making it possible to examine food security and the household and intrahousehold levels. Fourth, obtaining these data is relatively straightforward. Training field staff to obtain information on dietary diversity is straightforward.

Food security is defined as a state in which "all people at all times have both physical and economic access to sufficient food to meet their dietary needs for a productive and healthy life" (USAID, 1992)

Household Food Insecurity Access Scale (HFIAS), which is an adaptation of the approach used to estimate the prevalence of food insecurity in the United States (U.S.) annually. The method is based on the idea that the experience of food insecurity (access) causes predictable reactions and responses that can be captured and quantified through a survey and summarized in a scale. Qualitative research with low-income households in the U.S. provided insight into the following ways that households experience food insecurity (access) (Radimer et al., 1992, Wehler et al.,1992, Hamilton, 1997):

2.1.2. Food insecurity

Household food insecurity exists whenever the availability of nutritionally adequate and safe foods or the ability to acquire acceptable foods in socially acceptable ways is limited or uncertain. The concept "household food security" refers to a household's ability to access. Understanding household food insecurity and knowing its consequences is an essential and important step in determining erective interventions. The measurements of household food insecurity is essential for planning, targeting, monitoring and evaluating interventions, but existing measures often are inadequate.

Food insecurity is a complex, multidimensional phenomenon which varies through a continuum of successive stages as the condition becomes more severe. Each stage consists of characteristic conditions and experiences of food insufficiency to fully meet the basic needs of household members, and of the behavioral responses of household members to these conditions. A variety of indicators is needed to capture the various combinations of food conditions, experiences, and behaviors that, as a group, characterize each such stage.

Household food security is an important dimension of the health of individuals within a household. Although it may not encapsulate all dimensions of poverty, the inability of households to obtain access to enough food for an active, healthy life is surely an important component of their poverty. In this context, devising an appropriate measure of food security outcomes is useful for several reasons:

- to identify the food- insecure
- access the severity of the food shortfall
- characterize the nature of their insecurity (for example, seasonal versus chronic)
- monitor changes in their circumstances and
- assess the impact of interventions

Food security refers to a household's physical and economic access or sufficient, safe, and nutritious food that fulfills the dietary needs and food preferences of that household for living an active and healthy life.

The World Health Organization defines food security as having three facets: food availability, food access, and food use. Food availability is having available sufficient quantities of food on a consistent basis. Food access is having sufficient resources, both economic and physical, to obtain appropriate foods for a nutritious diet. Food use is the appropriate use based on knowledge of basic nutrition and care, as well as adequate water and sanitation. The FAO adds a fourth facet: the stability of the first three dimensions of food security over time.

Two commonly used definitions of food security come from the UN's Food and Agriculture Organization (FAO) and the United States Department of Agriculture (USDA):

- Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life.
- Food security for a household means access by all members at all times to enough food for an active, healthy life. Food security includes at a minimum (1) the ready availability of nutritionally adequate and safe foods, and (2) an assured ability to acquire acceptable foods in socially acceptable ways (that is, without resorting to emergency food supplies, scavenging, stealing, or other coping strategies). (USDA)

Access to food depends on an adequate, stable, local food supply. This is influenced by many interacting factors, which play a role in determining the extent of food security. The most frequently cited factors include:

- Access to land,
- Livestock ownership,
- Food garden availability,
- Safe, accessible water supply,
- Stable climate conditions,
- Access to food shops,
- Access to alternative food supplies e.g. school feeding,
- Cash (income) to buy food (Steyn, Labadarios&Huskisson, 1999:31).

Access to food is closely related to poverty and economic growth: the poor usually do not have adequate means to gain access to food in the required quantities. Lack of access to food is a major contributor to malnutrition, which has an effect in a person's life. It is self evident that poverty and malnutrition are well linked, but the mechanisms through which this relationship is likely to operate, need to be considered.

Extensive research in the late 1980s focused on understanding household food security, food insecurity, and hunger. This work led to the development by an expert working group of the American Institute of Nutrition of the following conceptual definitions, which were published in 1990 by the

Life Sciences Research Office (LSRO) of the Federation of American Societies for Experimental Biology:

- *Food security* — "Access by all people at all times to enough food for an active, healthy life. Food security includes at a minimum: (1) the ready availability of nutritionally adequate and safe foods, and (2) an assured ability to acquire acceptable foods in socially acceptable ways (e.g., without resorting to emergency food supplies, scavenging, stealing, or other coping strategies)."
- *Food insecurity* — "Limited or uncertain availability of nutritionally adequate and safe foods or limited or uncertain ability to acquire acceptable foods in socially acceptable ways."
- *Hunger* — "The uneasy or painful sensation caused by a lack of food.The recurrent and involuntary lack of access to food. Hunger may produce malnutrition over time. Hunger is a potential, although not necessary, consequence of food insecurity."

Food insecurity and hunger, as the terms are used here, are conditions resulting from *financial resource constraint*. Hunger, for example, can occur in many situations, including dieting and being toobusy to eat. The measurement procedure described here, however, is concerned only with foodinsecurity and hunger that occur because the household does not have enough food or money to buy food. Hunger, in this perspective, may be seen as a severe stage or level of food insecurity, rather thanas a distinct or separate condition from the more general experience of food insecurity. Moreover,while this condition is usually associated with poverty, it is not the same thing as general incomeinadequacy.9 Rather, it is the condition of deprivation in this one area of basic need; its measurementcaptures the severity of deprivation due to resource constraint in this one specific area of need, as directly experienced and described by respondents.

2.1.3. Household dietary diversity

Household dietary diversity means the number of different food groups consumed in a family over a given reference period. The household dietary diversity score (HDDS) is meant to reflect, in a snapshot form, the economic ability of a household to consume a variety of foods. Studies have shown that an increase in dietary diversity is associated with socio-economic status and household food security (household energy availability) (Hoddinot&Yohannes, 2002; Hatloy et al., 2000).
Dietary diversity is closely related with food access and food supply. The figure shows the relationships between food access, food supply and dietary diversity

Figure3: Relationship between food access, food supply and dietary diversity.
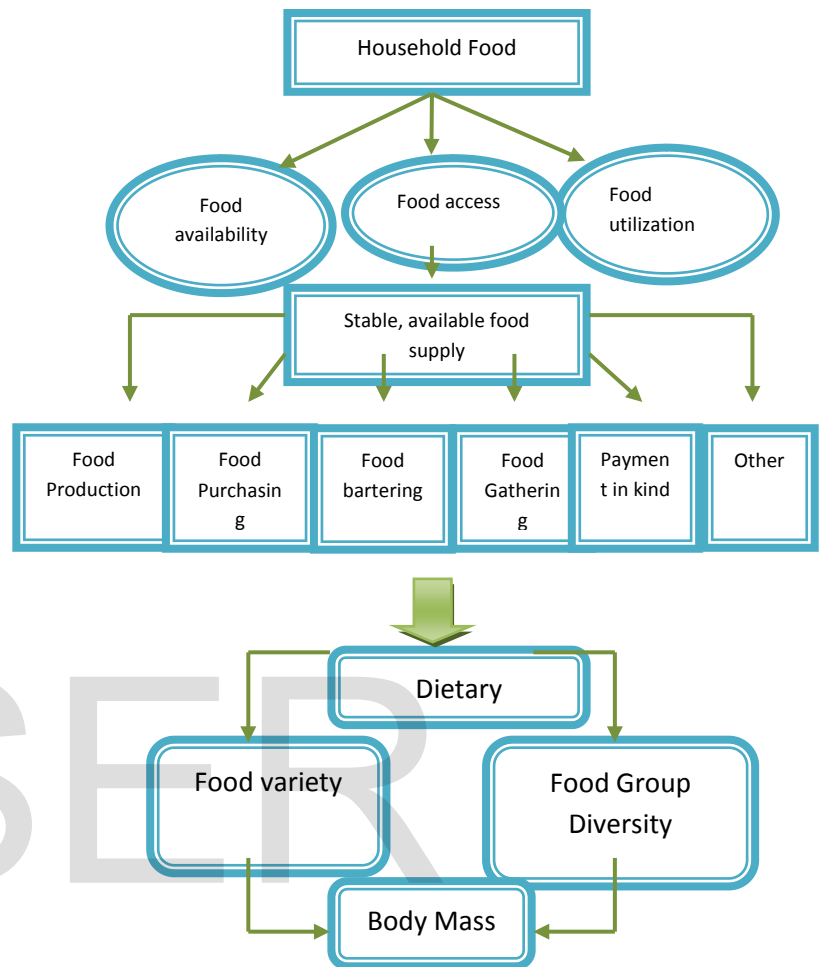
Dietary diversity scores are created by summing either the number of individual foods or food groups consumed over a reference period. The dietary diversity scores described in these guidelines consist of a simple count of food groups that a household or an individual has consumed over the past 24 hours. The guidelines describe the use of the dietary diversity questionnaire at both the household and individual level. The calculation of the score is slightly different if used at household or individual level, and household and individual scores have a different meaning.

The dietary diversity tool being proposed and used by FAO can aid in understanding if and how diets are diversified, and can also assess if households or individuals consume foods of special interest (for example: vitamin A-rich vegetables, tubers and fruit). The questionnaire is standardized and was developed with the intention of universal applicability. As such, it is not culture, population, or location specific. Therefore, prior to using it in the field, it is necessary to adapt it to the local context.

2.1.4. Nutritional status

Nutritional status is the current body status, of a person or a population group, related to their state of nourishment (the consumption and utilization of nutritions).

Intake of a diet sufficient to meet or exceed the needs of the individuals will keep the composition and function of the individual will keep the composition and function of the otherwise healthy individuals within the normal range. This equilibrium is disturbed by three processes: decreased intake, increased requirement, and altered utilization. When this disequilibrium occurs, then loss of body tissue ensurs. However, lack of nutrients produces a series of metabolism within hours or days of reducing nutrient intake, long before demonstrable anthropometric changes. As well these functional changes predict complications better than weight loss or arm muscle circumference. Thus malnutrition and its adverse changes and finally anthropometric effects.

Nutritional status is a measurement of how well the nutrients in your diet are meeting the physiologic needs of your body. Health care professionals like registered dietitians, nurses and physicians are trained to review and assess many different parameters to assess a person's nutritional status. They do this through the use of medical tests and other tools that provide dietary information.

The nutritional status is determined by a complex interaction between internal/constitutional factors and external environmental factors:
Internal or constitutional factors like: age, sex, nutrition, begavior, physical activity and diseases.
External environment factors like: food safety, cultural, social and economic circumstances.
An ideal nutritional status occurs when the supply of nutrients conforms to the nutritional requirement or needs.

2.1.4.1. Body Mass Index (BMI)

The **body mass index** (**BMI**), or **Quetelet index**, is a heuristic proxy for estimating human body fat based on an individual's weight and height. BMI does not actually measure the percentage of body fat. It was devised between 1830 and 1850 by the Belgian polymath AdolpheQuetelet during the course of developing "social physics".Body mass index is defined as the individual's body mass divided by the square of his or her height. The formulae universally used in medicine produce a unit of measure of kg/m^2

Body Mass Index (BMI) is a number calculated from a person's weight and height. BMI provides a reliable indicator of body fatness for most people and is used to screen for weight categories that may lead to health problems.

BMI is determined by a person's height and weight. Because the BMI calculation requires only height and weight, it is inexpensive and easy to use. BMI is used as a method of screening for weight categories that may lead to health problems

There are three ways to determine your BMI:

- Calculate BMI using the BMI formula
- Use the BMI chart
- Use the BMI calculator.

Any of these three methods will get the same BMI result. Everyone can use one of these three methods regardless of age, gender, race, or ethnicity. There is no specific BMI chart for women or men.

Body Mass Index, or BMI, is a tool that helps you measure the amount of body fat you have based on your height and weight. It's very easy to calculate yourself! Simply measure your height (in inches) and weight (in pounds). Multiply your weight by 703. Multiply your height times itself. Now divide the first answer by your height times itself. For example, say you are 5'3" tall (63 inches), and 130 pounds. The first multiplication is simple: (703 x 130 = 91,390). Now do the second multiplication: (63 x 63 = 3,969). Finally, the division: (91,390 / 3,969 = 23). Your BMI is 23.

BMI measures height and weight, and is used as an estimate of fatness. It is calculated by the
Equation:
$$BMI = \frac{weight \ (kg)}{height \ (m)}$$
BMI is a better indicator of fatness than weight alone, and is commonly used in nutritional assessment tools. It is considered to be a stable, easily performed and sensitive measure of malnutrition, including for the hospitalised and frail elderly. However, the fi gures should be interpreted with caution in this age group, as the published norms are based on young adults. In the elderly, there is often reduced muscle mass as well as fat, and therefore ranges are slightly higher than published norms.

1.1.5.2. Classification of BMI

The following classification of BMI was provided by WHO.

Nutritional status	Range of BMI
Under weight	Below 18.5
Normal weight	18.5-24.9
Over weight	25-29.9
Mild obesity	30-34.9
Moderate obesity	35-39.9
Severe obesity	More than 40

2.2. Rational of the study

In Bangladesh tribal populations are minority. They live in a separated community with their own language and unique food consumption. Usual people of this country know very little about this tribal population and their dietary habit. Lack of dietary diversity obviously is a problem of this community, because their diets were dominated by starchy food intake.

Infrequent protein consumption occurs here and protein consumption from animal was very little. Few fruits and vegetables were consumed, depending on seasons and availability. Most of the adult women in the community were unemployed, therefore contributing to poverty and poorly diversified diets. There were many people who just eat what is available at the time. The people living in this community lack of lacked knowledge about food and nutrition, and were generally ignorant regarding the value of food in their lives. It is important to develop strategies that will facilitate the accessibility of food at individual and household levels. It is important to know how the different food accessing strategies contribute to the dietary diversity of a specific community. It is particularly important to understand whether dietary diversity has an effect on the weight status of the individuals in a household. This information will help the program managers and policy makers to understand what levels of reduction in malnutrition they can achieve from poverty alleviation and dietary diversification interventions.

2.3. Objectives of the study
2.3.1. General objectives

To study the household dietary diversity, food security situation and nutritional status among the selected tribal households of MadhupurUpazilla of Tangail District, Bangladesh.

2.3.2. Specific objectives
- To study the socioeconomic condition of the selected tribal households.
- To study the hygienic condition of the selected tribal households.
- To study the food production pattern of the households.
- To study the food purchase pattern of the households.
- To study the dietary diversity of the selected households.

2.4. Limitations of the study

We faced some limitations in this study. Some limitations are listed out below-

- We did not get enough time for this study.
- We did not take the entire household from the selected area.
- There were some climatic problems when we worked in the field like rain.
- We did not have any financial support from any organization.
- We faced serious problem to understand their local language.
- Some household were disagree to co-operate with us.

3.1. Type of study

Across sectional studywas carried out among the selected tribal households of Modhupurupazilla inTangail district.

3.2. Basis for selection of study place

- Well communicated.
- Assurance from the authority for full co-operation.
- Not so far from the Tangail city.

3.3. Study population

The study population was resident garo and koch households of the selected Pirgacha village of Modhupurupazilla..

3.4. Sample Size

There were 530 tribal households in Pirgacha village. Among them we purpusively selected 98 households for our study.

3.5. Study period

The study was conducted from July 2012 to December 2012. During this period standard questionnaire development, data entry & analysis and final report writing were completed.

3.6. Study instruments

3.6.1. Development of the questionnaire

A standard questionnaire was developed to collect required data on the 98 households. The questionnaire included the biographic, socioeconomic, hygienic, food access and dietary diversity information. It captured data on specific variables, including age, gender, religion, height, weight, BMI, marital status, having children, number of children, family member, educational background, occupation, earning person, total income, total expenditure, total saving, house quality, lighting system in the house, kitchen room, cooking fuel, cooking water, separate bathroom, using shoes at all time or at toilet or dirty place, washing hand, cutting nail, taking bath, area of the land, agricultural land, vegetables production, fruits production, having livestock animal, having pond, cultivation of fish in the pond, place of buying food, times of buying food, taking of meals by adults and children per day. The biographic information gathered, was important to understanding the backgrounds of the respondents. For household dietary diversity we used 24 hour recall method.

3.6.2. Measuring instrument

a) Bathroom scale/Salter scale: Weight measurement
b) Modified tape: Height measurement

3.6.3. Pilot study

A pilot study to test and evaluate the ease of content, wording and expression, the topical sequence of questions and duration of interview and the reliability, suitability, clarity and value of the measuring instruments, was conducted among 10 households of Pirgacha village of Modhupur in Tangail district two weeks prior to the actual field work.. After pretest, the individual questionnaire which were related for quantitative data collection were improved and reformed to ensure content coverage, the reliability and validity of the study.

3.6.4. Consent

The purpose and nature of the study was explained to the chairman and member of the union council of pirgacha village and after having permission from them a questionnaire for each respondent was filled up by asking questions to the respondents. After getting the verbal consents then the respondents were recruited in the study.

3.7. Data collection

Questionnaire was asked passively and cautiously not to influence the respondents.

3.7.1. Collection of anthropometric data

The anthropometric data were collected based on standard methods. The following anthropometric data were collected-

3.7.1.1. Body weight

A bathroom scale was used to measure body weight of the study respondents. The scale was placed on an even floor. Respondents were weighed with light underclothes without shoes. Respondents stood upright in the middle of the scale, facing the field worker and looking straight ahead. They stood with feet flat and slightly apart until the measurement was recorded on the Personal Information questionnaire (Demographic questionnaire). The scale was calibrated to zero reading before each weighing session by the researcher. Body weight was recorded to the nearest 100 g (0.1kg), repeated and the average of the two measurements recorded.

3.7.1.2. Height

A modified tape measure was used to measure the height of the respondents. Height was measured, with the respondents facing the field worker, shoulders relaxed, buttocks and heels touching the wall. The respondent's arms were relaxed at the sides, legs straight and knees together and head in the Frankfort's plane. Each respondent's height was taken barefooted. A direct reading of height was recorded to the nearest five millimeters (0.5 cm) and then repeated and the average of the two measurements recorded.

After measuring weight and height BMI was calculated by using the following formula: Wt (in kg) / Ht (in m2) = BMI (in Kg / m2).

3.7.2. Collection of socio-economic and demographic information

All of the respondents were interviewed about socioeconomic and demographic information. All of the information's were recorded in the respective places of the questionnaire.

3.7.3. Collection of hygienic information

All of the respondents were interviewed about hygienic information's like cooking water, separate bathroom, using shoes or slipper at all time or when going to toilet or dirty places, washing hand, cutting nail, taking bath etc. All of the

information's were recorded in the respective places of the questionnaire.

3.7.4. Food production information

In order to estimate the food production information questionnaire was filled by asking the respondents about agricultural land, vegetables production, fruits production, having livestock animals, having pond and cultivation of fish in the pond.

3.7.5. Food purchasing information

For food purchasing information questionnaire was filled by asking the respondents about place of buying foods, times of buying foods etc.

3.7.6. Collection of dietary information

For evaluating dietary diversity 24 hour recall method was used. Along with this dietary information other information say- how frequently they intake the foods, commonly eating food, eating of snacks, times of eating snack, snack types, eating of foods outside home, lunch box for won and husband when going to work, lunch box for children when going to school also collected.

3.8. Data verification

Questionnaires were checked each day after interviewing and again these were carefully checked after completion of all data collection and coded before entering into the computer. The data was edited if there was any discrepancy (doubt entry, wrong entry etc).

3.9. Statistical analysis

All of the statistical analysis and all other data processing were done by using SPSS 16.0 windows program. For tabular, charts and graphical representation Microsoft Word and Microsoft Excel were used.

3. Results & Discussion

Table 1: Percent distribution of the households by sex, marital status, having children

Variable	Category	Frequency	Percent
Sex	Male	27	27.6
	Female	71	72.4
Marital status	Single	6	6.1
	Married	92	93.9
Having children	Yes	88	89.8
	No	10	10.2

Table 1 shows the percent distribution of the households by sex, marital status and having children. Among the respondents 27.6% were male and 72.4% were female. 6.1% respondents were single and 93.9% were married. Among

those respondents 89.8% had children and 10.2% didn't have any children.

Figure 7 shows the percent distribution of the respondents by age. Among the respondents 17.3% were within 19-25 years, 20.4% were within 26-35 years, 29.6% were within 36-45 years, 19.4% were within 46-55 years, 8.2% were within 56-65 years and 5.1% were within 66 and above.

Table 3: Percent distribution of the respondents by education

Variable	Category	Frequency	Percent
Educated person	Yes	46	46.9
	No	52	53.1

Table 3 shows the percent distribution of the respondents by education. It shows that about 46.9% respondents were educated and 53.1% respondents were uneducated among the overall respondents.

Table 2: Percent distribution of the respondents by BMI

Variable	Category	Frequency	Percent
BMI	Very severely underweight	0	0
	Severely underweight	0	0
	Underweight	8	8.2
	Normal	84	85.7
	Overweight	6	6.1
	Moderately obese	0	0
	Severely obese	0	0
	Very obese	0	0

Table 2 depicts the percent distribution of the respondents by BMI. Among the respondents 8.2% were underweight, 85.7% were normal, 6.1% were overweight and there was no any respondent in other categories listed in the table like very severely underweight, severely underweight, moderately obess, severleobess and very obese.
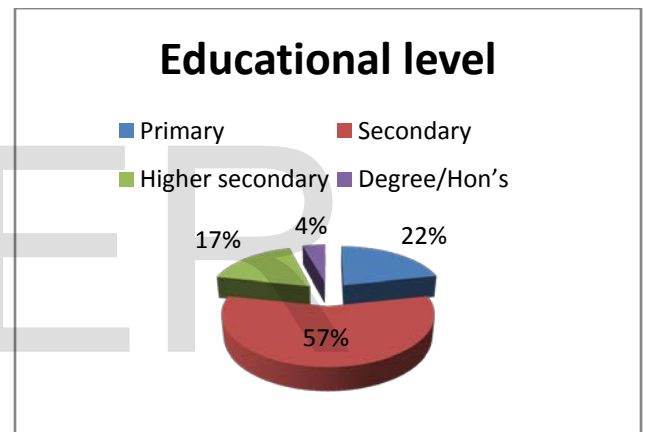

Figure 8: Percent distribution of the households by education level

Figure 8 shows that among the educated respondents 10.2% respondents had primary educational level, 26.5% respondents had secondary educational level, 8.2% respondents had higher secondary educational level and 2% respondents had degree/hon's degree.

Table 4: Percent distribution of the households by family member and number of children

Variable	Category	Frequency	Percent
Number of family member	2-5	50	51.0
	6-9	39	39.8
	10-13	6	6.1
	14 & above	3	3.1
No of children	No children	10	10.2
	Children no 1-2	45	45.9
	Children no 3-4	35	35.7
	Children no 5-6	4	4.1

	Children no 7 & above	4	4.1

25001-30000 tk	2	2.0
>30000tk	1	1.0
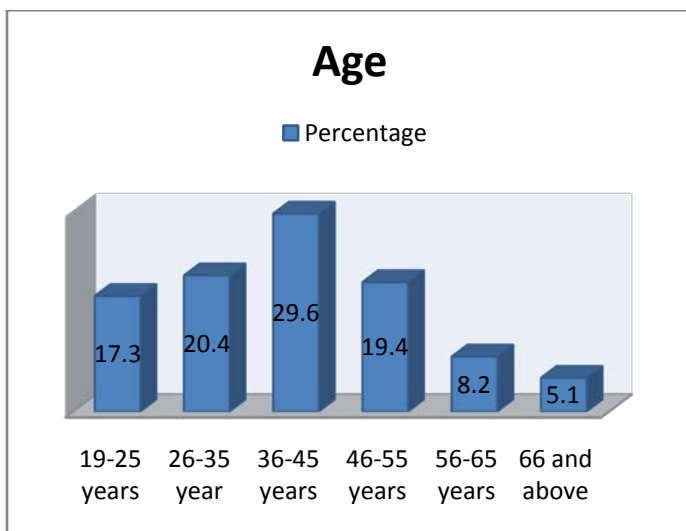
Table 4 depicts that 51% households had 2-5 members in their family, 39.8% households had 6-9 members, 6.1% households had 10-13 members and 3.1% households had 14 and above family members. The table also shows the number of children of the respondents. From this table 10.2% respondents did not have any children, 45.9% respondents had 1-2 children, 35.7% respondents had 3-4 children, 4.1% respondents had 5-6 children and 4.1%v respondents had 7 and above children.

Table 6 shows the percent distribution of the households by number of earning person and total income. It shows that 9.2% households had 1 earning person, 51% households had 2 earning persons, 36.7% had 3 earning persons and 3.1% had 4 earning persons. The table also shows that 27.6% families had total income within 5000-10000 tk, 34.7% families had total income within 10001-15000 tk, 26.5% families had within 15001-20000 tk, 8.2% had within 20001- 25000 tk, 2% families had within 25001-30000 tk and only 1 familiy had total income more than 30000 tk per month.

Table 5: Percent distribution of the respondents by occupation

Variable	Category	Frequency	Percent
Occupation	Farmer	35	35.7
	Business man	11	11.2
	Carpenter	1	1.0
	Service holder	1	1.0
	Beautician	8	8.2
	Housewife	21	21.4
	Teacher	7	7.1
	Rickshaw/van driver	4	4.1
	Handicraftsman	5	5.1
	Student	3	3.1
	Unemployed	2	2.0

Table 5 depicts the percent distribution of the respondents by occupation. Among the respondents 35.7% respondents were farmer, 11.2% were business man, 1% were carpenter, 1% were service holder, 8.2% were beautician, 21.4% were housewife, 7.1% were teacher, 4.1% were rickshaw/van driver, 5.1% were handicraftsman, 3.1% were students and 2% were unemployed.

Table 6: Percent distribution of the households by no. of earning person and total earning

Variable	Category	Frequency	Percent
Number of earning person	1	9	9.2
	2	50	51.0
	3	36	36.7
	4	3	3.1
Total income	5000-10000 tk	27	27.6
	10001-15000 tk	34	34.7
	15001-20000 tk	26	26.5
	20001-25000 tk	8	8.2

Table 7: Percent distribution of the households by total expenditure and total saving

Variable	Category	Frequency	Percent
Total expenditure	5000-10000 tk	32	32.7
	10001-15000 tk	34	34.7
	15001-20000 tk	27	27.6
	20001-25000 tk	4	4.1
	>30000 tk	1	1.0
Total saving	0-4999 tk	92	93.9
	5000-10000 tk	5	5.1
	>10000 tk	1	1.0

Table 7 depicts the percent distribution of the households by total expenditure and total saving. Among the households 32.7% families expended about 5000-10000 tk, 34.7% families expended about 10001-15000 tk, 27.6% families expended about 15001-20000 tk, 4.1% families expended 20001-25000 tk and 1% familiy expended more than 30000 tk per month. The table also shows that 93.9% families had less than 5000 tk total saving, 5.1% families had about 5000-10000 tk total saving and 1% families had more than 10000 tk total saving per month.

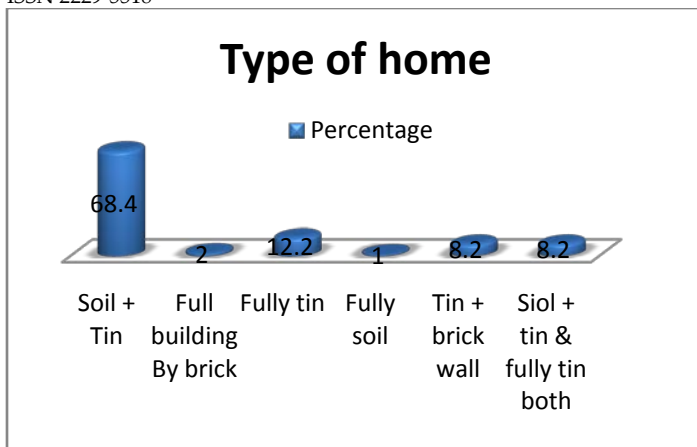**Figure 9:** Percent distribution of the households by types of home

Type of home

Figure 9 shows the percent distribution of the households by types of home. It shows that among the households 68.4% families made their home by soil with tin roof, 2% families had building, 12.2% families made their home by tin, 1% families made their home by soil, 8.2% families made their home by brick wall with tin roof and 8.2 family had both soil with tin roof and fully tin home.

Table 8: Percent distribution of the households by rain removing capacity of the roof, protecting capacity of house from the attack of storm and safety at the abnormal condition

Variable	Category	Frequency	Percent
Rain removing capacity of the roof	Yes	93	94.9
	No	5	5.1
Protecting capacity of house from the attack of storm	Yes	80	81.6
	No	18	18.4
Safety at the abnormal condition	Yes	74	75.5
	No	24	24.5

Table 8 shows the percent distribution of the households by rain removing capacity of the roof, protecting capacity of house from the attack of storm and safety at the abnormal condition. From this table 94.9% families thought that the roof of their home have rain removing capacity and 5.1% thought the roof of their home do not have rain removing capacity. The table shows that 81.6% families thought that their house protect them from the storm and 18.4% thought that their house do not have protecting capacity from the storm. The table also shows that 75.5% families felled save at the

abnormal condition and 24.5% families did not fell save at the abnormal condition.

Table 9: Percent distribution of the households by lighting condition in the house, having kitchen room, cooking fuel and cooking water source

Variable	Category	Frequency	Percent
Light condition in the house	Electrical light	6	6.1
	Lamp	61	62.2
	Solar light	31	31.6
Having kitchen room	Yes	81	82.7
	No	17	17.3
Cooking fuel	Gas	5	5.1
	Wood ,tree leaf etc	93	94.9
Cooking water source	Tube well	98	100

Table 9 depicts the percent distribution of the households by lighting condition in the house, having kitchen room, cooking fuel and cooking water source. Among the households 6.1% families had electrical light in their house, 62.2% families used lamp as their lighting source in their house and 31.6% families had solar light in their house. The table explains that 82.7% families had kitchen room and 17.3% families did not have any kitchen room. The table shows that 5.1% families used gas as their cooking fuel and 94.9% families used wood, tree leaf etc. as their cooking fuel. The table also shows that 100% families used tube well water for cooking.

Table 10: Percent distribution of the households by having separate bathroom, using shoes or slipper at all time and using shoes or slipper at toilet or dirty places

Variable	Category	Frequency	Percent
Having separate bathroom	Yes	58	59.2
	No	40	40.8
Using shoes or slipper at all time	Yes	38	38.8
	No	29	29.6
	Use somebody	31	31.6
Using shoes or slipper at toilet or dirty place	Yes	52	53.1
	No	8	8.2
	Use somebody	38	38.8

Table 10 shows the percent distribution of the households by having separate bathroom, using shoes or slipper at all time and using shoes or slipper at toilet or dirty places. From the table 59.2% families had separate bathroom and 40.8% families did not have separate bathroom. It shows that all family member of 38.8% families used shoes or slipper at all time, 29.6% families did not use shoes or slipper at all time and in 31.6% families some members used shoes or slipper and some did not use. The table also shows that all family member of 53.1% families used shoes or slipper at toilet or

dirty places, 8.2% families did not use shoes or slipper at toilet or dirty places and in 38.8% families some members used shoes or slipper and some did not use when going to toilet or dirty places.

Table 11: Percent distribution of the households by washing hand by soap or ash before eating or after coming from toilet, cutting or cleaning nail regularly and taking bath regularly

Variable	Category	Frequency	Percent
Washing hand by soap or ash	Yes	49	50.0
	No	11	11.2
	Wash somebody	38	38.8
Cutting or cleaning nail regularly	Yes	55	56.1
	No	25	25.5
	Cut somebody	18	18.4
Taking bath regularly	Yes	73	74.5
	No	16	16.3
	Take somebody	9	9.2

Table 11 explains the percent distribution of the households by washing hand by soap or ash before eating or after coming from toilet, cutting or cleaning nail regularly and taking bath regularly. From this table 50% families washed their hand by soap or ash before eating and after coming from toilet, 11.2% families did not wash and in 38.8% families some members washed and somebody did not wash their hand. Among the households 56.1% families cut their nail regularly, 25.5% families did not cut regularly and in 18.4% families some members cut and somebody did not cut their nail regularly. The table also explains 74.5% families took bath regularly, 16.3% families did not take bath regularly and in 9.2% families somebody took bath and somebody did not take bath regularly.

Table 12: Percent distribution of the households by having agricultural land or garden plot, vegetables production and fruits production

Variable	Category	Frequency	Percent
Having agriculture land or garden plot	Yes	67	68.4
	No	31	31.6
Vegetables production	Yes	70	72.4
	No	27	27.6
Fruits production	Yes	78	79.6
	No	19	19.4

Table 12 depicts the percent distribution of the households by having agricultural land or garden plot, vegetables production and fruits production. Among the households 68.4% families had agricultural land or garden plot and 31.6% families did not have 71.4% families produced vegetables and 27.6% did not produce vegetables. The table also shows that 79.6% families produced fruits and 19.4% families did not produce any fruits.

Table 13: Percent distribution of the households by name of the vegetables produced

Serial No.	Name of the Vegetables	Number of Household	Percentage (%)
1	Potato	36	36.73
2	Bringal	28	28.57
3	Pumpkin	32	32.65
4	Gourd	29	29.59
5	Radish	26	26.53
6	Bitter-gourd	7	7.14
7	Arum	16	16.33
8	Stem	17	17.35
9	Green plantain	8	8.16
10	Lady's finger	16	16.33
11	Cauliflower	24	24.49
12	Cabbage	27	27.55
13	Carrot	8	8.16
14	Bean	26	26.53
15	Spinach	15	15.31
16	Basil	20	20.41
17	Celery	19	19.39
18	Cucumber	18	18.37

Table 13 depicts that 36.73% households produced potato, 28.57% households produced bringal, 32.65% households produced pumpkin. About 29.59%, 26.53%, 7.14%, 16.33%, 17.35%, 8.16%, 16.33%, 24.49%, 27.55%, 8.16%, 26.53%, 15.31%, 20.41%, 19.39% and 18.37% households produced gourd, radish, bitter-gourd, arum, stem, green plantain, lady's finger, cauliflower, cabbage, carrot, bean, spinach, basil, celery and cucumber respectively.

Table14: Percent distribution of the households by name of the crops produced

Serial No.	Name of the Crops	Number of Household	Percentage (%)
1	Paddy	36	36.73
2	Wheat	16	16.33

Table 14 shows that 36.73% households produced paddy and 16.33% households produced wheat.

Table15: Percent distribution of the households by name of the spices produced

Serial No.	Name of the Spices	Number of Household	Percentage (%)
1	Turmeric	22	22.49
2	Ginger	22	22.49
3	Onion	18	18.37
4	Garlic	12	12.24

5	Green chili	6	6.12
6	Cumin seed	11	11.22
7	Coriander seed	8	8.16

Table 15 depicts that 22.49% households produced turmeric, 22.49% households also produced ginger, 18.37% households produced onion. About 12.24%, 6.12%, 11.22% and 8.16% households produced garlic, green chili, cumin seed and coriander seed respectively.

Table16: Percent distribution of the households by name of the fruits produced

Serial No.	Name of the Fruits	Number of Household	Percentage (%)
1	Pineapple	46	46.94
2	Banana	44	44.90
3	Mango	52	53.06
4	Guava	42	42.86
5	Papaya	21	21.43
6	Jackfruit	44	44.90
7	Litchi	12	12.24
8	Palm	7	7.14
9	Chinese-gose-berry	9	9.18
10	Berry	7	7.14
11	Coconut	16	16.33
12	Amla	5	5.10
13	Plum	16	16.33
14	Pome granate	2	2.04
15	Hog-plum	5	5.10
16	Lemon	10	10.20
17	Wood apple	7	7.14
18	Olive	8	8.16
19	Custard	7	7.14

Table 16 shows that 46.94%, 44.9%, 53.06%, 42.86%, 21.43%, 44.90%, 12.24% and 7.14% household produced pineapple, banana, mango, guava, papaya, jackfruit, litchi and palm respectively. They also produced many other fruits. About 9.18% family produced Chinese-gose-berry, 7.14% family produced berry, 16.33% family produced coconut, 5.10% household produced amla, and 16.33% household produced plum. From the table 2.04%, 5.10%, 10.20%, 7.14%, 8.16% and 7.14% household produced pome granate, hog-plum, lemon, wood apple, olive and custard respectively
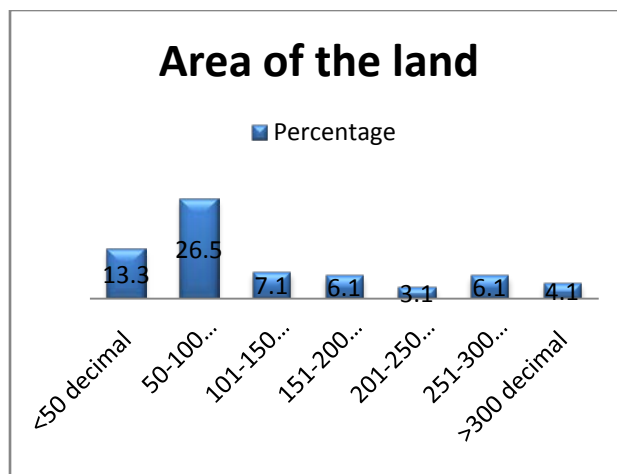

Figure 10: Percent distribution of the households by area of the land

Figure 10 shows the percent distribution of the households by area of the land. 13.3% families had less than 50 decimal land, 26.5% had about 50-100 decimal land, 7.1% families had about 101-150 decimal land, 6.1% families had about 151-200 decimal, 3.1% families had 201-250 decimal land, 6.1% families had 251-300 decimal land and 4.1% families had more than 300 decimal land.

Table 17: Percent distribution of the households by having livestock animal, having pond and cultivation of fish in pond

Variable	Category	Frequency	Percent
Having livestock animal	Yes	79	80.6
	No	19	19.4
Having pond	Yes	22	22.4
	No	76	77.6
Cultivation of fish in pond (N=22)	Yes	19	86.36
	No	3	13.64

Table 17 explains the percent distribution of the households by having livestock animal, having pond and cultivation of fish in pond. From this table 80.6% families had livestock animal and 19.4% families did not have livestock animal. 22.4% families had pond and 77.6% families did not have pond. 86.36% families cultivated fish in the pond and 13.64% did not cultivate fish in the pond.

Table18: Percent distribution of the households by name of the livestock's had

Serial No.	Name of the Livestock's	Number of Hou
1	Cattle	26
2	Chicken	70
3	Goats	19
4	Sheep	19
5	Pig	20

6	Duck	14	

Table 18 depicts that 26.53% household had cattle, 71.43% household had chicken, 19.39% household had goat, 19.39% house had sheep, 20.41% household had pig and 14.29% household had duck as livestock animal.

Table19: Percent distribution of the households by name of the fishes cultivated

Serial No.	Name of the Fishes	Number of Household	Percentage (%)
1	Rui	14	14.29
2	Carp	16	16.33
3	Puti	9	9.18
4	Climbing fish	4	4.04
5	Pangas fish	4	4.04
6	Catfish	5	5.10
7	Trout	6	6.12
8	Mackerel	7	7.14
9	Telapia	11	11.22

Table 19 shows the name of fishes cultivated in the pond of the household. From this table 14.29% family cultivated salmon fish, 16.33% household cultivated carp fish, 9.18% household cultivated fry fish, 4.04% family produced climbing fish. About 4.04%, 5.10%, 6.12%, 7.14% and 11.22% household cultivated pangas fish, catfish, trout, mackerel and tilapia fish respectively.

Table 20: Percent distribution of the households by place of buying food and times of buying food

Variable	Category	Frequency	Percent
Place of buying food	Local shop	66	67.3
	Market	28	28.6
	Local shop + market both	4	4.1
Times of buying food	Everyday	10	10.2
	Once a week	40	40.8
	3-4 times a week	35	35.7
	Once a month	13	13.3

Table 20 shows the percent distribution of the households by place of buying food and times of buying food. 67.3% families bought their food from the local shops, 28.6% families bought from the market and 4.1% families bought their food from both local shop and market. Among the families 10.2% families bought their food every day, 40.8% families bought their food once in a week, 35.7% families bought their food 3-4 times in a week and 13.3% families bought their food once in a month.

Table 21: Percent distribution of the households by adult's meal and children meal

Variable	Category	Frequency	Percent
Taking of meals per day by adults	Twice	2	2.0
	Thrice	96	98.0
Taking of meals per day by children	Thrice	97	99.0
	More than thrice	1	1.0

Table 21 depicts percent distribution of the households by adult's meals and children's meals. From this table, adults of 2% families ate meals twice per day and adults of 98% families ate thrice meals per day. The children of 99% families ate thrice meals per day and 1% family ate more than thrice meals per day.

Table 22: Name of the common foods eaten by the household

Serial No.	Name of the food items	Number of Household	Percentage (%)
1	Rice	98	100
2	Bread	54	55.10
3	Beef	27	27.55
4	Mutton	53	54.08
5	Pork	34	34.69
6	Poultry	69	70.41
7	Egg	58	59.18
8	Milk	32	32.65
9	Pulse	67	68.37
10	Fish	82	83.67

11	Dried fish	32	32.65
12	Kuicha	26	26.53
13	Frog	13	13.27
14	Crab	8	8.16
15	Seasonal Vegetables	91	92.88
16	Seasonal green leafy vegetables	75	76.53
17	Seasonal Fruits	67	68.37

Table 22 shows the percentage of the common foods eaten by the selected household. From this table 100% family ate rice, 55.10% household ate bread, 27.55% household ate beef, 54.08% ate mutton, 34.69% ate pork, 70.41% ate poultry, 59.18% ate egg, 32.65% ate milk and 68.37% household ate pulses. About 83.67%, 32.65%, 26.53%, 13.27%, 8.16%, 92.88%, 76.53% and 68.37% household ate fish, dried fish, kuicha, frog, crab, seasonal vegetables, seasonal green leafy vegetables and seasonal fruits redpectively.

Table 23: Name of the snack foods eaten by the household

Serial No.	Name of the Snacks type	Number of Household	Percentage (%)
1	Biscuits	49	50.00
2	Chanachur	39	39.80
3	Fried rice	41	41.84
4	Beaton rice	24	24.49
5	Cake	2	2.04
6	Chips	11	11.22
7	Singara	15	15.31
8	Puri	13	13.27
9	Fastfood	6	6.12
10	Tea	56	56.12
11	Coffee	7	7.14

Table 23 shows that 50% household ate biscuits as snack foods, 39.80% family ate chanachur, 41.84% household ate fried rice, 24.49% household ate Beaton rice and 2.04% household ate cake. About 11.22%, 15.31%, 13.27%, 6.12%, 56.12% and 7.14% household ate chips, singara, puri, fastfood, tea and coffee respectively as snack foods.

Table24: Descriptive statistics of the household dietary diversity score

Household dietary diversity score	No. of households (N)	Minimum	Maximum	Mean	Std. deviation
	98	4	10	7.5408	1.40814

Table 24 shows that minimum value for household dietary diversity score was 4 and maximum value was 10. Mean (±SD) value for HDDS was 7.54 (±1.40).
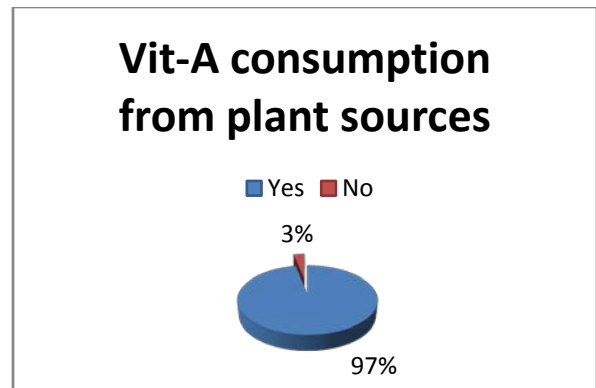

Figure 11: Percent distribution of the households by eating vitamin A containing foods from plant sources

Figure 11 shows that 97% households consumed vitamin-A containing foods from the plant sources and 3% households did not consume.
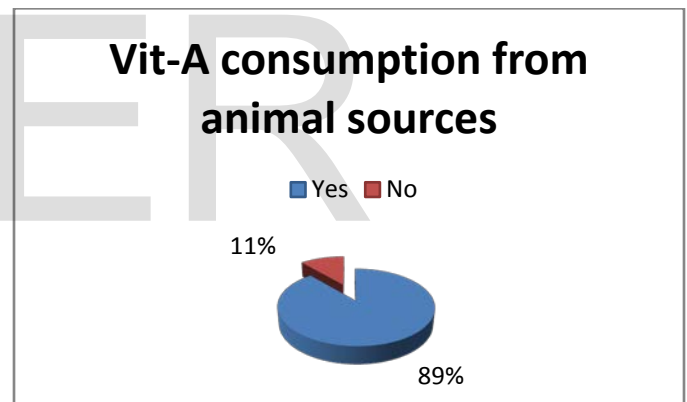

Figure 12: Percent distribution of the households by eating vitamin A containing foods from animal sources

Figure 12 shows that 89% households consumed vitamin-A containing foods from the animal sources and 11% households did not consume vitamin-A from the animal sources.
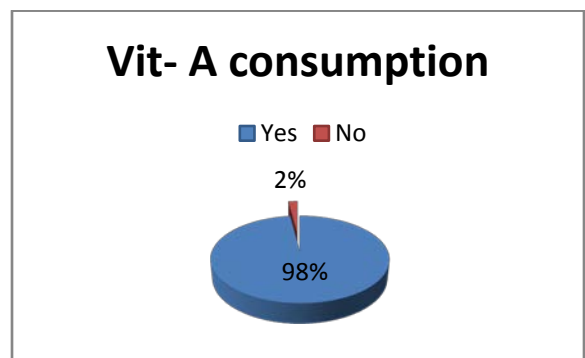
Figure 13: Percent distribution of the households by eating vitamin A containing foods

Figure 13 shows that total 98% households consumed vitamin-A containing foods from either animal sources or plant sources or from both but 2% households did not consume vitamin-A from any sources.
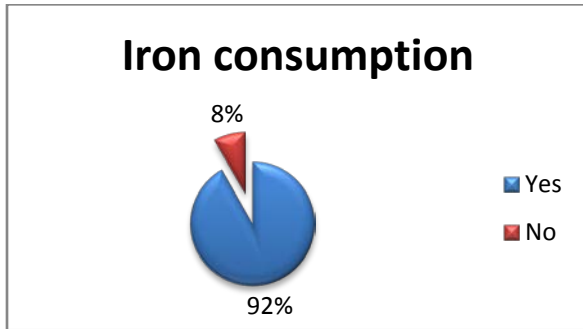

Figure 14: percent distribution of the households by eating iron containing foods

Figure 12 shows that total 92% households consumed iron containing foods but 8% households did not consume any iron containing food

Table 25: Cross table with Chi-square test

Dependent variable	Independent variable	P-value
	Sex	0.298
	Marital Status	0.587
	Having Children	0.395
	Occupation	0.082
	Type of home	0.628
	Lighting system in home	0.570
	Kitchen room	0.396
	Fuel used in cooking	0.645

	Separate bathroom	0.588
	Using shoe or slipper at all time	0.442
	Using shoe or slipper at toilet or dirty places	0.050
	Washing hand before eating & after coming from toilet	0.014
BMI	Agricultural land or Garden plot	0.572
	Production of vegetables	0.482
	Having livestock animal	0.258
	Production of fruits	0.308
	Having pond	0.431
	Adults meal per day	0.844
	Educational level	0.000
	Children category	0.525
	Age	0.904
	Family member	0.610
	Total income	0.985
	Total expenditure	0.953
	Total saving	0.540
	Area	0.267

Table 25 shows the association between nutritional status and different other variable. From above table it is obvious that variable (educational level) is statistically significant with nutritional status at 1% level of significance. And variable (washing hand before eating and after coming from toilet) is statistically significant with nutritional status at 5% level of significance. And occupations, using shoe or slipper at toilet or dirty places variables are statistically significant at 10% level of significance. And for other variables there is no association.

4. Conclusion

In this cross sectional study all of the 98 respondents were Garo and Koch. Among them 72 respondents were Garo who were Christian and 26 respondents were Koch who were Hindu.. Among them 27.6% of the respondents were male and 72.4% were female. The BMI was normal for 85.7% respondents, underweight for 8.2% respondents and overweight for 6.1% respondents. Around 9.2% households had one earning person, 51% had two earning persons, 36.7% had three earning persons and 3.1% had four earning persons. More than half 68.4% households had agricultural land and 31.6% households did not have any land. Among them 71.4% households produced vegetables and 27.6% households did not produce any vegetables. 79.6% households produced fruits and 19.4% did not produce fruits. 80.6% households had livestock animal and 19.4% did not had. Small amount of households (22.4%) had pond and majority households (77.6%) did not have any pond. Among the households 86.36% households who had pond cultivate fish and others (13.64%) did not cultivate in their ponds. Among the all households majority households (67.3%) bought their foods from local shop, 28.6% households bought from market and 4.1% households bought their foods from both local shop and market. All of the respondents (100%) ate rice, 91% ate seasonal vegetables, 75% ate

seasonal green leafy vegetables, 67% ate seasonal fruits, About 27.55%, 53%, 69%, 58%, 32%, 67% and 82% households ate beef, mutton, poultry, egg, milk, pulses and fish respectively. They also ate pork, frog and crab. 97.96% households ate vitamin-A containing foods. Among them 96.94% households ate vitamin-A containing foods from plant sources and 88.78% ate from animal sources. 91.84% households ate iron containing foods.

5.   Recommendations

On the basis of the finding of this study the following recommendation are put forward for consideration of the policy maker, nutritionist and future researcher.

➢ Education about other different food accessing strategies as well as teaching them about bartering, or other known food accessing strategies, should be taught in order for them to practice during different seasons. Improved practices would also aid in improved dietary diversity and household food security.

➢ National food based dietary guidelines should include indigenous plants as they play an important role in dietary diversity. This will help nutritionists to identify and promote the indigenous nutritious food items most prevalent in each area of the country.

➢ More research should be done to identify different food accessing strategies and to provide agricultural skills for households to help in improving their gardening skills, in order to have a variety of food items in their households.

➢ To ensure longer-term availability of protein in the community, distribution or micro-lending of livestock, poultry, or fish fingerlings should be introduced .

➢ Agricultural skills about crops cultivated and harvested during different seasons should be improved. This can also include preservation skills about fruit and vegetables.

➢ A well-organized and monitored distribution process can rapidly correct micro-nutrient deficiencies, through selection of enriched foods, such as vitamin-A enriched rice, iron-fortified grains, or multivitamin sprinkles.

➢ Probe for snacks eaten between main meals.

➢ Probe for special foods given to children or lactating/pregnant women.

➢ Probe for added foods such as sugar in tea, oil in mixed dishes or fried foods.

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