STUDIES ON THE ASSESSMENT OF NUTRITIONAL STATUS AMONG THE MUNDA POPULATION OF DELTA REGION, SUNDARBAN, WEST BENGAL, INDIA.

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"Statement of Originality"

I, **Sandhya Mridha** registered on **04.01.2018** do hereby declare that this thesis entitled **"Studies on the assessment of nutritional status among the Munda population of delta region, Sundarban, West Bengal, India"** contains literature survey and original research work done by the undersigned candidate as part of Doctoral studies.

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DEDICATED TO

MY FATHER

LATE NARENDRA NATH MRIDHA

AND

MY MOTHER

LATE BHADRABATI MRIDHA

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ABSTRACT

The science of nutrition covers a wide range of disciplines, including biology, physiology, immunology, biochemistry, education, psychology, sustainability and sociology. It is essential for proper functioning and achieving life's objectives. The entire spectrum of food intake, assimilation, biosynthesis, catabolism, and excretion are covered by nutritional sciences. Macronutrients, such as carbohydrates, fibers, lipids, protein and water are essential for body structure and energy production. Vitamins, minerals, fibers, and water are also necessary for immunity and disease recovery. Child undernutrition is a global issue. Most of the undernourished children are found in Asia and Africa. Nutritional planning can help to reduce malnutrition and under nutrition. A balanced diet should satisfy an individual's nutritional needs and support their current health level. Overnutrition is also a growing threat to everyone's health, affecting the elderly and those with specific ailments. A significant public health problem, undernutrition in children increases the risk of illness and early mortality. Adolescence is a critical stage in life where proper nutrition is required, with the largest demographic cohort of adolescents aged 10–19 years in India. The degree of level of nutritional condition is influenced by elements including genetic, environmental, socioeconomic, demographic, and dietary factors. Undernutrition is a significant health issue in developing countries. Most of the significant causes of undernutrition are underweight, stunting, low BMI, improper diet, low hemoglobin concentration and parasitic loads. The study aims to assess the nutritional status of Munda people living in Sardarpara in the Sundarban region, considering factors like BMI, several health parameters and indexes, dietary intakes and habits, hemoglobin concentration, arterial blood pressure, deficiency and excess consumption of different types of nutrients, and more. The findings will help to develop policies and intervention plans for the Munda population's welfare in the particular region. Malnutrition can lead to various medical problems, including cancer, Alzheimer's disease, psychiatric disorders, chronic pain-causing conditions, and drug side effects. Overnutrition is a widespread problem in some specified country like United States, with overnutrition being a significant risk factor for various illnesses.

The main body of the thesis is divided into nine chapters. The introduction part is included in the **chapter I** which outline of the various aspects of nutrition. The aims and objectives, materials and methods, results and discussion (Section -A and Section -B), ecological impact and ethnography of the current investigations have been discussed in the

Chapter II, Chapter III, Chapter IV, Chapter V, VI respectively. The conclusion and future scope of this thesis are discussed in the **Chapter VII**. Finally, References are given in the last.

Chapter I. Introduction

A group of Munda people migrated from Chotonagpur around 250 years back and presently living at Lahiripur Gram Panchayat under Gosaba Block of Sundarban, the largest mangrove forest on earth in the southern region of West Bengal. They have adapted to a new ecological setting and have to reorganize their lives in terms of occupation and eating habits due to the Sundarban economy.

The nutritional profile of Munda people is rarely studied, and their dietary habits are unique due to their illiteracy, poor economic standing, and dependence on forest resources. Since, the researcher was born and brought up in Gosaba block; she has been closely associated with Munda families from childhood and is interested in conducting multidimensional studies on this unique community. The research methodology includes examining socioeconomic traits, such as the one Angan Wadi center or Integrated Child Development Scheme (ICDS) in Tipligheri Bazar, which provides lunch to Munda children. The Munda community also makes homemade alcohol drinks with special nutritional qualities, which they use as medicine in their native tongue. They live a straightforward life, respecting educated people and other societies with different opinions and observations.

Chapter II. Objectives of the Study

The study focuses on the Munda community of the Sundarban Delta Region in West Bengal, in a remote and deprived area. It includes a diet survey, a health survey, physiological parameters, evaluation of Integrated Child Development Services (ICDS), ecological studies, sanitation facilities, availability of drinking water, medical facilities, demographic conditions, living conditions, eating habits, cleanliness and health. The research aims to design policies that uphold the rights of the Munda, protect them from exploitation, and promote growth within a stable framework.

Chapter III. Materials and Methods

Diet surveys are vital for assessing nutritional health and establishing the link between nutrient intake and illness deficiencies. Techniques for evaluating food intake at various levels include household diet surveys, assessment of dietary intakes by family wise, food records, dietary intake history and quantitative analysis surveys. The weekly diet survey (weighted raw food materials) approach is used in present study. The nutritional value of Indian foods is used to convert raw foods into nutrients. The sufficiency or otherwise of the family's diet is assessed by comparing these to the Indian Council of Medical Research's recommended dietary intakes for several nutrients for sedentary adult both males and females. The study focuses on the nutritional status of the Munda population of study area. Blood samples are screened to estimate hemoglobin content using an instant digital portable hemoglobinometer. Adult nutritional status is assessed using measurements of various health parameters and its indexes. The references as recommended by WHO and other cut-off points are followed in the present study. Demographic profiles, such as age, sex composition, marital status, literacy, and occupation, are considered in the study.

Chapter IV.

Results and Discussion (Section -A)

Demography, Health-parameter and Index

The Munda community in the study area is divided into age and gender categories. The life span of the Munda community is up to 75 years, with no male or female candidate alive after 75 years. The sex ratio in the Munda population is important for analyzing demographic dynamics and influencing marriage rates, death rates, birth rates, and migration rates. The Munda community in Sundarban, West Bengal has an incidence of chronic energy deficiency. The mean BMI values of males and females are 19.68 and 20.28 kg/m^2, respectively. This indicates they have CED Grade I malnutrition among females. The highest BMI values are observed in the age group 39 - 43years, followed by 44 - 48 years and 59 and above years for male. According to WHO, 1995 Grade I, II, and III malnutrition affects more women than men, with a frequency of 15.67% versus 15.57%, respectively. In 167 adult males, 24.55% are CED Grades, while 73.65% are normal. Female overweight cases among the Munda people account for 1.31% of all female cases, and cases of obese nutritional status are nil. The study also shows an incident of malnutrition based on waist circumference cut-offs, with some risk of metabolic

complications among males and females. The Munda community in case of present study has an incidence of undernutrition, particularly among women. Studies have shown a strong correlation between body mass index (BMI) with 20.28 kg/m^2 and MUAC with a 32.03 cm in case of female. However, there is an incidence of malnutrition in women, particularly in terms of BMI and west circumference. Heart attacks, strokes, high blood pressure, cancer, diabetes, osteoarthritis, a fatty liver, and depression are just a few of the health problems associated with excess body fat. In the current study, anemia is also common in the Munda community. But the current study predicted that the Munda community of the Sundarban delta region is in comparatively good condition compared to other Munda populations in the state.

Results and Discussion (Section -B)

Dietary Intakes and Habits

The study reveals that the diet of Munda community in Sundarban is deficient in calories, calcium, vitamin A, and vitamin B_2, with a mean degree of calorie insufficiency varying from 11 to 20 percent of their requirement. In the post-harvest season and pre-harvest season, 56% and 75% of households receive less than 90% of their required calories, respectively. Despite no protein deficiency per capita, approximately twenty-three percent (23%) of households received less than 90% of their actual need. The main sources of vitamin A are leafy vegetables, fruits, and carrots. The calorie deficiency can be compensated by the availability of cereals like rice and wheat, as well as leafy vegetables or fruits. The consumption of drumsticks and larger gourds, abundant locally, may supplement vitamin C. The study also notes that most adult males and females, especially the older generation, drink "Handia," a home-made rice beverage, which is a good source of energy and some B-complex-groups of vitamins.

Chapter V. Ecological Impact on the Munda Community

The Sundarban delta region, the world's largest mangrove forest, is vital for the Munda community, an indigenous group in India. The region's diverse biodiversity provides essential food sources, including fish, crabs, and honeys etc. essential for their diet. The Munda community has developed a deep understanding of the Sundarban' resources, allowing them to utilize various plants and animals for their nutritional needs. However, threats to food security include climate change, sea-level rise, habitat destruction, pollution, and human encroachment. Health and nutrition are directly influenced by the Sundarban ecosystem, and changes can lead

to malnutrition and related health issues. To ensure sustainable nutrition and well-being, conservation efforts, sustainable harvesting practices, and involving local communities in decision-making processes are essential.

Chapter VI. Ethnographical Accountability of Munda Community

The Munda community, an Australoid Kolian ethnic group in West Bengal, is a migrant population spread across three ecosystem zones. They are Mundari speakers and are bilingual, speaking regional languages such as Bengali and Hindi. The Mundas have a history dating back to 1765 and have successfully integrated into the community's environment and economy through urbanization, industrialization, and social assistance measures. The main crop is rice, which they raise through wet cultivation. They rely heavily on forest goods and are connected to the weekly and daily markets. The Munda tribe is organized into totemic tribes, known as 'Kilis', with 329 clans. The Munda clan has one or more lineages, with each name derived from the woman considered the group's ancestress. Marriage is common among the Munda community, and divorce settlements are typically non-existent. The Munda kinship structure is hierarchical, distinguishing between affinal and consanguineal relatives. Pregnant women are not subject to specific dietary or employment restrictions, but they refrain from carrying large weights and abstaining from consuming country liquor while expecting. Marriage in Arandi involves a sacred ritual, with the bride and groom anointed with turmeric paste and celebrated by drinking rice beer, eating a lavish feast, and singing Bala songs. The Munda hold beliefs in witchcraft, black magic, divination, and good and bad women.

Chapter VII. Conclusion and Future Scope

The Munda Community in West Bengal has been studied for its correlation with BMI (body mass index) and age. The study found that all variables are directly or significantly associated with BMI, creating co-morbidities. Skeletal muscle had a highly significant relationship with BMI in both genders. Waist circumference and blood pressure were both significantly influenced by age. The study concludes that focusing on wellness and nutrition is essential for a sustainable future. The same community have changeable health consequences due to the interaction of diet, genetics, environment, and lifestyle.

Nutritional status refers to an individual's degree of nutrition and the types of foods consumed by the body. A balanced diet should satisfy a person's nutritional needs and support their current health level. A balanced diet should contain the recommended amounts of protein,

fat, carbohydrates, minerals, and vitamins, with the Recommended Daily Amount (RDA) varying for various food constituents. Malnutrition is a severe global public health problem that has an impact on people's health. In contrast to overnutrition, which is characterized by excessive nutrient and energy intake, undernutrition is characterized by a lack of nutrients and low energy levels. The health of everyone is at risk from overnutrition, which has an impact on a number of sub-populations including the elderly and those who suffer from particular illnesses.

Sustainability of the food system is essential for maintaining a balance between human existence and the environment's natural resources. A sustainable food system includes not only those who produce and consume food. Undernutrition in children is a major public health issue, increasing the burden of premature mortality and morbidity on everyone's health. The prevalence of Chronic Energy Deficiency grade is influenced by socioeconomic, demographic, environmental, and mental health characteristics. All of those conclusions resulted from an analysis of all the data related to the Munda community in the area under consideration.

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LIST OF ABBREVIATIONS

AIDS	–	Acquired Immune Deficiency Syndrome
AMDR	–	Acceptable Macronutrient Distribution Range
AWC	–	Angan Wadi Center
BMI	–	Body Mass Index
Ca	–	Calcium
CED	–	Chronic Energy Deficiency
CI	–	Conicity Index
CU	–	Consumption Unit
DBP	–	Diastolic Blood Pressure
EJCN	–	European Journal of Clinical Nutrition
FAO	–	Food and Agriculture Organization
Fe	–	Iron
HDL	–	High Density Lipid
IAP	–	Indian Academy of Pediatrics
ICDS	–	Integrated Child Development Scheme
ICMR	–	Indian Council of Medical Research
IOTF	–	International Obesity Task Force
JNC8	–	Eighth Report of Joint National Committee
LDL	–	Low Density Lipid
MSK	–	Madhyamik Sikha Kendra
MUAC	–	Mean Upper Arm Circumference
MV	–	Morphological Variables
NFHS	–	National Family Health Survey
NIH	–	National Institute of Health
NNMB	–	National Nutrition Monitoring Bureau
PCU	–	Per Capita Unit
RDA	–	Recommended Daily Allowance
(r)	–	Pearson’s correlation coefficient
SBP	–	Systolic Blood Pressure

SSK	–	Sishu Sikha Kendra
UNESCO	–	United Nations Educational Scientific and Cultural Organization
UNICEF	–	United Nations International Children's Emergency Fund
Vitamin A	–	Retinol
Vitamin B_1	–	Thiamin
Vitamin B_2	–	Riboflavin
Vitamin B_3	–	Nicotinic Acid
Vitamin C	–	Ascorbic Acid
WC	–	Waist circumference
WHO	–	World Health Organization
WHR	–	Waist-Hip Ratio
WHTR	–	Waist - Height Ratio

PREFACE

The Sundarban Delta region in South 24 Parganas, West Bengal, India, is not only renowned for its rich biodiversity but also for its unique human communities that have coexisted with nature for centuries. One such indigenous community is the Munda tribe, whose ancestral roots in this ecologically diverse region date back generations. The Munda community has been closely tied to the surrounding environment, relying on its resources for sustenance and livelihoods.

In recent years, the Sundarban Delta region has experienced significant socio-economic and environmental changes, which have had a profound impact on the traditional lifestyle and dietary patterns of the Munda community. Modernization, changing agricultural practices, and shifts in food availability have all influenced the nutritional status of this indigenous group.

Recognizing the importance of understanding the nutritional challenges faced by the Munda community, this study aims to shed light on their current dietary practices, food security, and overall nutritional status. By investigating into these aspects, researcher hope to identify potential areas of concern and devise strategies for improving their well-being and health outcomes.

The research presented in this report is the result of a collaborative effort between multiple stakeholders, including researchers, local organizations, and community members. By working together, scholar have attempted to ensure that the findings are accurate, culturally sensitive, and respectful of the Munda community's traditions and way of life.

This report is divided into several sections, each exploring a different aspect of the nutritional status of the Munda community. We begin with an overview of the Sundarban Delta region's ecological context and the historical significance of the Munda tribe in this landscape. Next, investigator delve into the different nutritional health-parameters and their indexes, the dietary patterns and food consumption habits of the community, analyzing how these have evolved over time.

Furthermore, researcher examine the prevalence of malnutrition and its determinants among Munda individuals, including factors such as access to healthcare, education, and economic opportunities. Additionally, the report assesses the impact of various government

and non-government initiatives that have aimed to improve the nutritional status of the Munda community.

It is essential to acknowledge that this study's scope is limited to a specific period, and the findings are subject to the conditions prevailing during the time of research. However, scholar also believe that the insights provided in this report can serve as a valuable foundation for further research, policy development, and community-led initiatives to enhance the well-being and nutritional status of the Munda community.

Investigator express her heartfelt gratitude to the Munda community members who generously shared their knowledge and experiences, making this study possible. She hope that her collective efforts contribute to a better understanding of the nutritional challenges faced by the Munda tribe and pave the way for a more sustainable and equitable future for all communities in the Sundarban Delta region.

The outcome of the study on the nutritional status of the Munda tribes of Sundarban, South 24 Parganas, West Bengal, India, can have several important implications as a public health issue. Here are some potential outcomes that may arise from the study:

Identification of Nutritional Deficiencies: The study can reveal prevalent nutritional deficiencies among the Munda community, such as malnutrition, anemia, vitamin deficiencies, and stunted growth among children. This information is crucial for public health authorities to target specific interventions and design programs that address these deficiencies effectively.

Understanding Dietary Patterns: By analyzing the dietary patterns and food consumption habits of the Munda tribe, the study can identify potential gaps in their diet. Understanding their traditional food practices and knowledge about local resources can inform strategies to promote a balanced and diverse diet, ensuring essential nutrients are incorporated into their daily meals.

Food Security Assessment: The research may shed light on the food security status of the Munda community. It can help ascertain whether the tribe has consistent access to nutritious food and identify any vulnerabilities they face due to environmental factors, socio-economic challenges, or climate-related disruptions.

Implications for Maternal and Child Health: The study may reveal insights into the nutritional status of pregnant and lactating women and its impact on maternal and child health outcomes. This information is vital for designing targeted interventions to improve the health of mothers and children in the community.

Health Promotion and Education: Findings from the study can be used to develop health promotion and educational programs that raise awareness about proper nutrition, hygiene practices, and the importance of a balanced diet. This can empower the Munda community to make informed decisions about their health and nutrition.

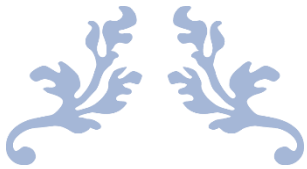
Strengthening Health Systems: The research may identify gaps in healthcare access and services in the Sundarban region. As a public health issue, this can drive efforts to strengthen health systems, enhance healthcare facilities, and train healthcare providers to cater to the specific needs of the Munda community.

Collaborative Partnerships: The study can foster collaborations between researchers, local organizations, and government agencies to address the nutritional challenges faced by the Munda community. These partnerships can facilitate the implementation of evidence-based interventions and community-led initiatives.

Policy Recommendations: Based on the study's findings, policymakers can develop targeted policies and programs that focus on improving the nutritional status of the Munda community. These policies may include initiatives to enhance food security, increase access to nutritious food, and improve healthcare services in the region.

Sustainable Interventions: Understanding the ecological context of the Sundarban Delta region can lead to the development of sustainable interventions that consider the relationship between the Munda community and their environment. This approach can help preserve traditional knowledge and practices while promoting better nutrition and health outcomes.

Overall, the study's outcome as a public health issue can drive evidence-based actions, interventions, and policy changes aimed at improving the nutritional status and overall well-being of the Munda tribes in the Sundarban region of South 24 Parganas, West Bengal, India.



CHAPTER – I

INTRODUCTION

Chapter I Introduction

1.1 Nutrition

The Latin term "nutrire," which gave rise to the English word "nutrition." Originally meant "to nourish" and first appeared in English in 1551. Organisms obtain nutrients and metabolize them to support all of life's operations. Nutrition is now viewed as the culmination of all processes that go into how things are consumed and produced. An inquiry into how an organism is nourished is called nutritional science. combines research on how nutrition influences both individual and societal health. Nutritional science includes a broad range of fields. Nutritional scientists can therefore focus on a specific area of nutrition, such as biology, physiology, immunology, biochemistry, education, psychology, sustainability, and sociology.

The body cannot function properly without enough nutrients. Serious deficiencies in vital nutrients can cause a variety of illnesses and diseases, and even death.

A person who is in good health and able to work hard to accomplish life's objectives can function properly. The ability to wake up, hope, dream, go to school, college, university, or institute to gain knowledge, think clearly, communicate, go to work, earn a livelihood, and do all of these activities depends on good health, which is a result of proper nutrition.

The totality of the actions that an animal, plant, or human takes to consume and utilize food substances is referred to as feeding or being fed. Interactions between nutrients, vital minerals, and other ingredients in the diet in connection to an organism's upkeep, development, reproduction, health, and defense against disease. All of the physiological functions and biochemical developments are interpreted by the large field of nutrition research. The nutritional sciences cover everything from food intake to absorption, assimilation, biosynthesis, catabolism, and excretion.

The availability, preparation, and flavor of the items that an organism can eat heavily influence the diet. The quality of food preparation and storage practices that protect nutrients from oxidation, heat, and discharge while lowering the danger of foodborne illnesses are key components of a healthy diet

The macronutrients include carbs, fiber, lipids, protein, and water. The macronutrients deliver amino acids, which are the building blocks of proteins (fiber and water are excluded).

Body structure is created by proteins, which also create cell membranes and cell walls. Furthermore, in addition to some signaling molecules and caloric value, proteins are also built. Several of the structural components can produce energy internally. When carbohydrates react with oxygen inside of a cell, the energy released is measured in joules or kilocalories. Proteins have about 4 kcal of energy per gramme, whereas fats have about 9 kcal of energy per gramme. However, the amount of energy that either source provides depends on other elements like digestion and absorption. Individual differences in it are quite considerable. Vitamins, minerals, fiber, and water are some of the substances that don't give you energy. They are necessary for a variety of other things, including improvements in immunity, disease recovery, and other beneficial bodily functions.

1.2 World Context

The degree of child undernutrition is still unacceptable everywhere in the world. According to the chronically developing globe, 90% of undernourished (stunted) children reside in Asia and Africa. But, however, undernutrition goes unnoticed and has major negative effects on the community's residents. The survival, growth, and development of women and children in the community is a difficult task. It weakens the resolve and capabilities of the local populace to improve society. Nutrition is a crucial component of human development. The impact of malnutrition and poverty in nations can be lessened through extensive programming about nutritional planning. It can also advance a country's development. Millions of chances to save lives are being lost as a result of the continuous undernutrition in the developing world. Many more children are not reaching their full potential in terms of growth and development.

1.3 Indian Context

On the basis of information from the National Family Health Survey-3, which was conducted in 2005–2006, the study area's nutritional statistics are shown here. Twenty percent of children under the age of five in India suffer from wasting as a result of acute undernutrition. In India, 43% of five-year-old children are underweight. More than one-third of the global population underweight youngsters are found in India. Due to persistent malnutrition, 61 million children (48 percent) are considered stunted. India is home to more than three of every ten stunted children worldwide. Rural areas experience far higher rates of undernutrition than metropolitan areas. A higher frequency of undernutrition is linked to shorter inter-birth intervals. In order to prevent underweight and undernourished children, mother education is

crucial. Children whose mothers lack formal schooling are nearly five times more likely to be extremely underweight. Children with mothers who have completed twelve or more years of education also have a greater rate of underweight offspring.

Children who are undernourished are more likely to be born to mothers who are undernourished (i.e., have a body mass index below 18.5). Almost all anthropometric measurements and indices show that children from scheduled tribes have inadequate nutritional conditions. It is particularly concerning as this group has a significant frequency of waste (28%). India has an estimated 7.4 million low birth weight infants each year, which is the greatest number. Only 25% of newborn babies were breastfed within the first hour of delivery. Children younger than six months are exclusively breastfed in less than half (46%) of cases. Between the ages of 6 and 59 months, 70% of newborns have anemia. Seven times as likely as children who are not anemic are children who have severe anemia. Fifty-one percent of households use salt that has been adequately iodized (half of the total population).

Just 33%, or one third, of Indian children received any services from an Angan Wadi Center (AWC) or the Integrated Child Development Program (ICDS). Less than 25% of those in service receive additional food through the ICDS (Integrated Child Development Scheme). Only 18% of people have taken an AWC weight measurement.

(Supplied by the National Family Health Survey-3) (NFHS 3, 2005–2006).

1.4 Nutrition and Health

Nutrition and Health are strongly tied to one another. The World Health Organization (WHO) has clearly stated that health is the condition of social, mental, and physical well-being, not just the absence of diseases or infirmities.

The definition lists the following as the three primary components of health:

1. Physical well-being

2. Mental health that is in good standing

3. A sense of wellbeing in social situations

Health was defined by the World Health Organization (WHO) in 1946 as the condition of whole physical, mental, and social well-being, not just the absence of illness or infirmity.

One can enumerate the three primary facts of health based on this definition:

1. The first is one's bodily health.

2. Psychological health

3. The state of society

A person is said to be healthy if he or she is in good bodily, mental, and social health.

1.5 Nutrition and health

Nutrition is a field of study that examines the connection between diet and health. The goal of nutritional science is to explain how the body reacts metabolically and physiologically to diet. Evidence-based nutritional therapies and guidance are their area of expertise. They specialise in this field of study and have received the necessary training to act as nutritionists, offering people or communities safe nutritional recommendations.

Unbalances, excesses, and dietary shortages have an impact on health. Obesity, scurvy osteoporosis, diabetes, and cardiovascular disease have all been linked to these diets, as well as behavioural and psychological issues.

Food consumption is used to nourish the body, a process that takes place in nutrition. Healthy nutrition depends on good health. Nutrition plays a crucial role in a person's ability to mature normally and maintain health throughout life. Because they are not eating the right foods, they are not growing normally. His body's organs could malfunction occasionally, or he could contract a sickness. His social and mental health may occasionally be impacted by intermittent malnutrition.

The type and quantity of food that a person eats.

In general, a person's sound health will depend on the type and amount of food he consumes. The appropriate kind of food consumed in the right quantity is crucial for optimal health.

1.6 The Interaction of Diet, Genetics, Environment, and Lifestyle on Health

One area of southern Arizona is home to the Pima Indians. Mexican Pima Indians from the same community also reside there. Both genetically and culturally, they are similar.

Nonetheless, there are a huge number of variances in these two inhabitants' health. The Pima Indians in America have the highest rate of obesity. In addition, they are more likely than any other ethnic group to have Type 2 diabetes.

Nevertheless, type 2 diabetes and obesity are not common among Mexican Pima Indians. Many complicated biochemical interactions between lifestyle, environment, nutrition, and heredity have a role in health-related issues. Along with being hunters and gatherers, the Pima people were farmers. Their meals back then consisted of roughly 70% carbohydrates, 15% protein, and 10% to 15% fat. A common form of society lived as farmers and hunter-gatherers a century ago. They were going through periods of abundance and periods of scarcity at that time. In 1962, James Neel, a biologist, hypothesised that the Pima Indians possessed a "thrifty gene." When there was enough food available, this trait made them exceedingly effective at storing fat. So, despite the lack of food, they were not starving to death.

1.7 Nutritional condition

Now define "nutritional status," a new phrase. The definition of nutrition is well known. There is anything interrelated or associated with nutrition that can be labelled 'nutritional'. The term "status" refers to a place or rank. When the terms "nutritional status" and "status" are combined, it means that an individual's position is tied to or correlated with his nutrition. The term "nutritional status" refers to a person's degree of nutrition. the position or degree at which a person consumes different sorts of food. Nutritional status is defined as the kinds of foods that are consumed by the body and have an impact on an individual's health. The body needed the ideal amount of specific dietary components to provide the necessary nutrients. That will result in good health and a proper nutritional state.

1.8 Dietary balance

The diet must be such that it increases the likelihood of satisfying the person's nutritional needs and supports him in maintaining his current level of health. Also, it would enable the body to store some amounts of nutrients so that it can endure brief periods of reduced nutritional intake. This diet is widely regarded as being balanced. A balanced diet includes a variety of food choices. The foods are provided in adequate quantities to meet the person's needs for the various nutrients. The body stores some nutrients in order to support it. The person can tolerate brief periods of poor nutrition. A balanced diet has the following qualities: A

balanced diet should contain the recommended amounts of protein, fat, carbohydrates, minerals, and vitamins. Sufficient amounts refer to a set quantity required to carry out the body's vital metabolism smoothly. The Recommended Daily Amount (RDA), which varies for various food constituents, is what is prescribed (nutrients).

1.9 Overeating, Undereating and Malnutrition

The word "malnutrition" is sometimes represented by a picture of a youngster in a third-world nation with a swollen abdomen and skinny arms and legs. Yet, this image does not adequately convey the state of starvation.

For instance, a person who weighs 90 kg or more should also be undernourished. Malnutrition is described as not receiving the proper sustenance without distinguishing between the detrimental effects of having too few or too many nutrients, both of which have a negative impact on general health.

Low energy levels and a lack of nutrients are the hallmarks of undernutrition. Overnutrition has characteristics such as an excessive nutrient and energy intake. Overeating is the cause of obesity. It is a growing threat to everyone's health. The metabolic disease known as obesity causes an excessive build-up of fat tissue. Yet, it is not just common in America. similar to how it is in other emerging nations. There are various subpopulations that are impacted by undernutrition. The elderly, persons with specific ailments, people in poverty, and other groups of people are all susceptible to this metabolic disorder. Many people who suffer from ailments may lack an appetite or not be able to digest food adequately. Malnutrition can sometimes be linked to medical problems including cancer, Alzheimer's disease, psychiatric disorders like anorexia nervosa, inflammatory bowel syndrome, AIDS, chronic pain-causing conditions, or drug side effects. Overnutrition is a widespread problem in the United States. It has been found to be a significant risk factor for a variety of illnesses, including cancer, inflammatory disorders, type 2 diabetes, and cardiovascular disease (such as rheumatoid arthritis).

1.10 Sustainability of the food system

The development circumstances encouraged by sustainability allow community members and nature to coexist peacefully in the food system. Maintaining a balance between human existence and the environment's natural resources is the fundamental tenet of

sustainability. The notion that all nutrients required for human survival are derived from the environment.

A sustainable food system includes more than just the people who produce and eat food. Such as farmers and fishermen, but also those who prepare, package, distribute, and control it. Building a sustainable food system has numerous difficulties, including ensuring that food is inexpensive and accessible, providing wholesome, affordable food regardless of socioeconomic level, and altering the methods of food production, processing, and distribution. The difficulties of constructing a sustainable food system have numerous answers. Expanding the infrastructure for locally grown food, enhancing low-income Indians' access to healthy, local food, offering education on the origin and production of food, enhancing the livelihoods of nearby farmers, and using sustainable farming practises are some of the answers. Everybody may help create a sustainable food system by acting locally and independently.

1.11 Public Health Issue

Concerning public health Undernutrition in children is a serious public health problem that increases the burden of premature mortality and morbidity on everyone's health. The persistence of chronic undernutrition and stunting (2 SD of low height for age) is a major public health issue. In many underdeveloped nations, a sizable fraction of the population experiences mild or severe malnutrition during infancy.

The most popular traditional anthropometric index is the prevalence of stunting. It is a longer-term reaction to a lengthy food shortage, disease, or illness, or it is a reflection of chronic long-term undernutrition, linear development failure, and a multifactorial social deficit (WHO 1995; Nandy et al. 2005; Prendergast and Humphrey 2014).

Due to a lack of essential nutrients, community members are more likely to suffer from metabolic diseases as adults and have poorer educational outcomes, body structure formations, reduced intellectual capacity, and decreased offspring birth weight (Blössner and de Onis 2005; Black et al. 2008; Victora et al. 2008; Prendergast and Humphrey 2014).

The prevalence of stunting in individuals and populations was found to be significantly influenced by socioeconomic, demographic, environmental, and maternal characteristics (Mahgoub et al. 2006; Wamani et al. 2007; Abudayya et al. 2009; Mondal and Sen 2010a;

Mushtaq et al. 2011; Leal et al. 2012; Sen and Mondal 2012; Herrador et al. 2014; Keino et al. 2014; Zelellw et al. 2014; Tigga et al. 2015; Tigga et al.

Negative factors include poor socioeconomic conditions, demographic situations, environmental conditions, sanitary conditions, and unfavourable maternal characteristics. A lack of nutrition awareness is blamed for the development of such linear retardation in physical growth attainments or undernutrition (such as stunting) in children and adolescents.

The Commission on Social Determinants of Health has already suggested that actions be taken to enhance these living conditions, address the unequal distribution of economic and political power, and quantify and understand the public health issue (WHO 2008).

As previously reported by researchers (Nandy et al., 2005; Keino et al., 2014; Zelellw et al., 2014), in many settings with limited resources, dietary intakes are consistently insufficient. It has been discovered that infectious diseases are highly frequent, preventing poor catch-up growth attainment and maybe increasing the frequency of stunted children and adolescents.

Adolescence is described as the age range of 10 to 19 years between childhood and maturity, and it is distinguished by an incredibly fast rate of physical development (WHO 1995).

According to estimates, teenagers make up 1.20 billion of the world's population, and India has by far the largest demographic cohort of adolescents, with 243 million (20%) people between the ages of 10 and 19. (UNICEF 2011).

The linear anthropometric measurement of height is generally acknowledged to be impacted by genetic, environmental, socioeconomic, demographic, and dietary factors (Abudayya et al. 2009; Herrador et al. 2014; Keino et al. 2014).

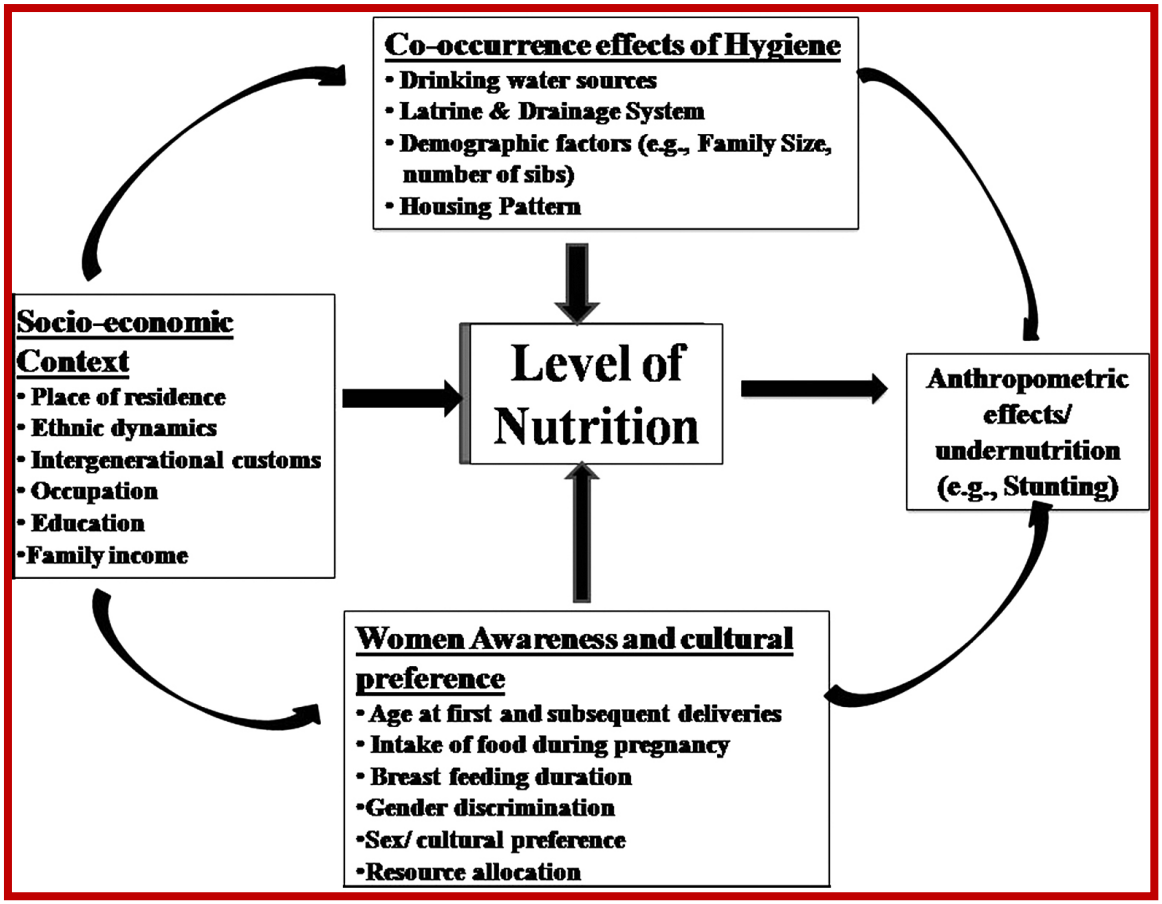


Figure -1. Level of Nutrition

According to research, huge ethnic disparities, unfavourable socioeconomic and demographic circumstances, and persistently unfavourable environmental conditions are the main causes of increased undernutrition in developing countries (e.g., Wamani et al. 2007; Abudayya et al. 2009; Mushtaq et al. 2011; Leal et al. 2012; Keino et al. 2014).

Numerous studies have revealed that the main long-term nutritional deprivation and public health problem is the incidence of stunting.

Figure 1 depicts the socioeconomic and demographic variables that affect the chance of anthropometric failure in Indian children and adolescents, including stunting and concerns with low height for age (Anand et al. 1999; Venkaiah et al. 2002; Deshmukh et al. 2006; Rao et al. 2006; Das et al. 2007; Malhotra and Passi 2007; Haboubi and Shaikh 2009; Prashant and Shaw 2009; Mandol et al. 2009; Mandol et al. 2009; Mandol 2009; Mandol 2009; Mandol).

A large portion of developing Indian teenagers were also found to be nutritionally susceptible, according to studies. Their low socioeconomic level, ignorance, lack of access to

medical treatment, and lack of social support services all contribute to physical growth retardation and chronic nutritional deprivation in the early years of life (Venkaiah et al. 2002; Deshmukh et al. 2006; Rao et al. 2006; Mehdi et al. 2007; Parasuraman et al. 2006; Mehdi et al. 2007; Mehdi et al. 2008; Rao et al.

Therefore, it is crucial and a very difficult task for researchers to pinpoint the main socioeconomic and demographic causes of underweight and stunting, with a particular emphasis on population research, so that preventative action can be taken to lessen these negative nutritional manifestations among vulnerable populations.

The adolescent stage, which is marked by dynamic physical growth attainments and mental development, is often regarded as the most important stage due to the impact of many determining environments and conditions. There are several ethnic groups and indigenous people in India, and there is a tremendous degree of genetic and ethnic variety among them (Indian Genome Variation Consortium 2008).

Anthropometric measurements and body composition differ according to race, sex, and geographic location in this enormous country with diverse climatic circumstances. The Indian population, which numbers more than 1.22 billion, is divided into 4693 communities and thousands of endogamous groups. West Bengal, Bihar, Odisha, and Jharkhand are the four states that make up Eastern India, geographically speaking.

According to earlier studies, the residents of this region are particularly sensitive to undernutrition, public health care, and medical facilities. One of the main public health issues affecting many tribal and non-tribal children in East India is the very high frequency of undernutrition (Medhi et al., 2006; 2007; Maiti et al., 2011; Singh and Mondal 2014; Mondal and Terangpi 2014; Islam et al., 2014). From the information above, it is clear that East India is experiencing a scenario of undernutrition that is essentially identical to what has been documented for the rest of India. Therefore, the goals of the current study were to determine the main socioeconomic and demographic determinants of stunting among adolescents living in rural regions of the Karbi Anglong district of Assam, north-east India, as well as to assess its prevalence. Also, due to India's massive population, inadequate health care facilities, and socio-economic and cultural differences, data on the prevalence of stunting and underweight among adolescents in developing nations like India must be produced for national and worldwide comparisons. Governmental and non-governmental organisations will be able to

develop relevant policies and launch intervention plans for the population's welfare thanks to the findings of the current study.

1.12 Sundarban context

The current research area is Lahiripur Gram Panchayat, which includes the villages of Luxbagan, Parasmoni, and Tipligheri, also referred to as Sardarpara. The majority of the territory is bounded by numerous rivers, primarily by the accumulation of numerous delta islands. Although the land in this area is not very fertile for agriculture, it is nonetheless used for farming. Both the land and the water naturally contain salt. Agriculture and fishing are the people's primary sources of income. The five communities that make up this area are Brahmin, Poundra, Namasudra, Munda, and Santal. Here, only 5% of the Brahmin community is present. This region is primarily populated by Poundra. About sixty percent of the people in the village are Poundra. The Namasudra is approximately seven percent. Twelve percent (12%) of the local population is Santal. The remaining 16% of the Munda community residents reside here.

Munda is a tribal society, and it's fascinating to observe their daily activities. Almost a century ago, they moved from the Chhota Nagpur plateau. Their primary source of income comes from the labour work and forest's resources. The majority of them do not own any land. The nutritional profile of this tribal community has only rarely been studied. The residents of this neighbourhood have adapted to the new surroundings as well. Here, the Santal and Munda tribes are the two most significant tribal groups. The Santal community, which is present in many districts including Birbhum, Bankura, Purulia, and West Medinipur, has been the subject of the majority of studies. There is a lack of literature on the dietary profile of the Munda people. The observed Munda families are also present in this significant geographic area. The fact that this community's residents live in a place that is distant from other communities is another excellent and noteworthy finding. Their homes or territories, specifically Sardarpara, are distinct from those of the other members of their society. The population cluster is distinctive in its character. The majority of them are illiterate, have poor economic standing, and rely heavily on the resources of the forest for their livelihood.

The current researcher lives in this specific, isolated geographic region where the Munda community made adjustments to the supposedly distinct climate and environment after migrating from Chhota Nagpur more than a 250 years ago. She has been observing the Munda community's residents' daily lives since she was a young child. She interacted closely with

these people. She is really eager to conduct multidimensional studies on the residents of this neighbourhood.

The inhabitants of this group are known for not destroying the environment or the natural world, namely the so-called Sundarban, which is known for the Royal Bengal Tiger and the largest mangrove forest on earth. The world's largest delta region is another reason for its fame. The current researcher has a thorough understanding of an additional intriguing aspect, which is represented in her own thoughts and writing in the research term paper and methodology paper.

The current researcher's research methodology and term paper reflect several socioeconomic traits that she has noticed. The Tipligheri Bazar or Market area is home to the One Awan Wadi or ICDS centre. The authority of an ICDS centre, run by the federal government, occasionally provides lunch. Boys and girls from the Munda neighbourhood come to the ICDS centre to participate in the programme and eat lunch. On various days when midday meals are scheduled, a varied menu is available. The majority of dietary items with protein are provided by the government, including Nutrela (soyabean), eggs, green vegetables, etc. Children's drinking water supply comes from tube wells (deep bore water). This helps them keep their children's midday meals and continue living differently. Due to their poor economic standing, very few of the Munda community's youngsters attend secondary school and drop out. Because of their low literacy, they are unaware of the impact of health and hygiene on their daily lives. They therefore consume food and beverages without cleaning their hands first and improperly washing their utensils. That is the primary reason for their parasite burden and lack of general health maintenance, which have an indirect impact on the community's nutritional profile. These viewpoints diverge from those of other members of the community. The current researcher has used scientific observation and study to verify and correct all of those issues.

Community members occasionally make homemade alcohol drinks like "HANDIA" that have special nutritional qualities. Also, it occasionally acts as medicine in their native tongue. Indeed, with the right distillation and dosage, it has a considerable nutritional value and is healthy. They live a straightforward life and are quite honest. They continue to live a daily existence that is distinct from that of the general public in terms of their eating habits, culture (Tusu Puja, Bano-Bibi Puja, Dakshina ray Puja and Ritu Puja), rituals, and dialect. The

Munda community respects educated people and other societies that hold opinions and observations that are different from their own.

The nutritional assessment of the Munda people in the Sundarban region at Gram Panchayat Lahiripur, 24-Parganas (South), in the southern part of West Bengal, is the subject of the thesis. In addition to factors like haemoglobin concentration, arterial blood pressure and others, factors like demography, socioeconomic status, food production, quantitative dietary intake, Health parameters or anthropometric measurements and it's indices, physiological characteristics are also taken into account. Both before and after harvest, the characters are scrutinised twice. They are contrasted in order to comprehend the subsequent impact on physical health brought on by variations in dietary consumption and to provide a broad assessment of the nutritional status of the population under study.

The entire picture in this case suggests that the Mundas are in a nutritionally not so bad situation with regard to dietary consumption. Even if there is a tendency towards hypertension, there are rarely any visible symptoms. The nutritional disorders angular stomatitis and night blindness are also documented in very rare cases.

According to clinical data, the populations' blood haemoglobin concentrations are generally low. Some incidents of anemic states are present among the Munda community. Health-parameters and its indices like body weight, weight-height index and skinfold thickness have been impacted by sometimes inadequate dietary intake. Seasonal variations in dietary intake do not appear to have any appreciable effects on the physical condition of the Munda community under study.

The type and quantity of food are essential components for maintaining the health of all living things. Hence, dietary consumption has a major impact on how well-nourished a population is. To fully understand the community's developmental process, knowledge of the community's feeding level is necessary. Community development encompasses more than just improving socioeconomic conditions or advancing technological endeavours. Unless the community's members can reproduce and maintain balanced levels of mental, bodily, and social well-being, the community's development will not be complete. When a community's evolution is taken into account in its entirety, this fundamental reality is frequently overlooked. Food intake that is proportionate to a person's nutritional needs has a direct impact on their nutritional condition. For body development, maintenance, repair, and reproduction, food is

playing a vital role on it. Also, it aids in creating the right environment for the body's metabolic processes to function properly.

A profile of the Munda people of the Sundarban, who live in Gosaba Block is intended to be presented by the research area under consideration. They are a migrant population that has lived in the Sundarban for many generations after leaving their native Ranchi or Chotanagpur. Hence, the Munda of Sundarban are transplanted people that have adapted to a new ecological setting. They have had to reorganise their lives in terms of occupation and eating habits due to the Sundarban economy. So, it is important to research how occupation, eating habits, and environment interact. This group offers some unique options. By creating a compression of the population's physical condition using the data that is already accessible on the Inhabitants of Sundarban.

1.13 Region Under Study and The People

1.13.1 Sundarban

In Bengali, the word "Sundarban" refers to a lovely woodland. Between the wide Indian Ocean to the south and the lush plain of West Bengal to the north, there are a tremendous number of islands. The Ganges, Brahmaputra, and Meghna rivers and their countless distributaries come together to form this enormous number of tiny deltas. Bangladesh and West Bengal's southernmost regions are where the Sundarban are located. Both the mangrove forest and the delta are the largest on the entire planet. Mangrove forests cover around 10,000 square kilometres in total, with roughly 4200 square kilometres of that land being designated for them (approx. 6000 sq km of reserved forest). This enormous 4262 sq km mangrove forest is located in the southern section of West Bengal, India, with a sizable chunk in the southern part of Bangladesh. The largest tiger reserve in India is located in the Sundarban, a national park in India. It is listed as a UNESCO World Heritage Site. The river Hooghly delineates the Sundarban's western border. The eastern border is formed by the Chittagong Hills, which extend west along the Sandwip Canal. The Indian portion of the Sundarban is where the southern portions of the 24 Parganas North and South districts of West Bengal are situated.

1.13.2 Satjelia

It has a heart-shaped shape, says Satjelia. It is one of the 24 parganas north and south of West Bengal's southernmost populated islands. One of the most recent islands to be

reclaimed and settled is Satjelia. The island of Satjelia is situated in the South 24-Parganas district of West Bengal, on the eastern side of the Gosaba block of the Sundarban. The Gosaba block has the largest island, Satjelia, which is 615 sq km in size and home to 42,000 people (Jalais, 2010). The population density is 68.29 people per square kilometre, which is incredibly low when compared to West Bengal's population density. This is because the Sundarban mangrove forest covers the majority of these islands. Two Gram Panchayats, Lahiripur and Satjelia, are located on the island. There are 14 villages under the Satjelia Gram Panchayat and 11 villages under the Lahiripur Gram Panchayat. From Gosaba to Satjelia, 12.7 kilometres must be travelled. In a motorised boat, the rivers can be traversed in about two hours. The Mundas call the fieldwork done in the village Sardarpara. It is located on the Satjelia island in West Bengal's South 24-Parganas region. Sardarpara, a tribal community, is found Close to Tipligheri Bazar: The Munda village of Sardarpara (the village's official name) is located on the Dutta Nadi riverbank and is quite close to the mangrove forest zone of the Sundarban delta region on the Satjelia island. The village's distinctive topography depicts the usual scenario of this region. They refer to the river as the "Dutta River," and it flows between the settlements and the forest as well as around the village of Sadarpara on the east and south. This village's high earthen embankment served as a barrier between human habitation and the river's tides.

According to the 2021 census, Gosaba had a gender literacy gap of 17.73%, with a male literacy rate of 79.27% and a female literacy rate of 61.54%. Total number of schools upper primary, secondary and higher secondary are five, three and two respectively in Lahiripur gram Panchayat. While all but one had a library, there was only one with computer facilities (lack of electricity was a major constraint). In 2021, there were 15 health sub-centers and 1 rural hospitals or public health centers with 31 beds in Gosaba, serving 122 communities. These facilities also had 5 medical officers, 10 nurses, 18 health assistants, and 4 pharmacists and technicians. Of the 266 habitations that make up the Gosaba CD Block, clean drinking water was present in 38.0% of them (including tube wells and tap water), 41.7% of them were partially covered, and 20.3% were not.

These embankments experienced breaches ranging from 6 km in 2003–2004 to 54 km in 2006–07. The safety of people and the defense of crops against daily tides and tidal surges depend heavily on embankments built along rivers. The embankment structures are outdated technologically, so proper drainage of stored rainwater through sluice gates is required. The risks are also increased by crude cuts made in canals constructed to supply water to huge

fisheries (bheris) and by embankments erected to drain collected rainwater. Threats from tropical depressions and cyclones are frequent.

The embankment was created by the semi-lunar brick path that circles the community and serves as its primary thoroughfare (in Fig. 2.3). This embankment, which has a width of 5 to 6 feet and an increase in height of 10 to 12 feet, was discovered to be in poor shape. The local Panchayat and the state government have come under fire from the Munda people and other communities for delaying the repair of the embankment following the Aila cyclone's devastation in 2009. Below the embankment, the homes of the village's residents are placed in an almost linear way. The western portion of the village of Sardarpara is where the agricultural areas are. A settlement made up of members of the scheduled caste known as the Poundra Namasudra is located on the north side of the village, along with Tipligheri Bazar, a small market. The Munda tribe makes up the majority of the population in Munda village, or Sardarpara. This group of individuals is included in the government's scheduled tribe category. The Mundas in Sundarban were said to be well-known as "Sardars," according to the elderly people. Because Sardars or Mundas were in charge of clearing the forest and constructing the embankments during the British era. The Bengali word "sardar" means "leader" or "captain" in relation to a team. In their daily interactions, the Sardar or Mundas of this village speak Bengali. Using the Bengali language to communicate with them was not difficult for the researcher. The Sardarpara village is a scheduled caste hamlet, according to the state administration. It is located in the Lahiripur Gram Panchayat in the South 24-Parganas district of West Bengal, under the Sadhupur Mouza bearing J.L. No. 48. The mud-built cottages of the villages demonstrated the low economic situation of the locals. Most of the homes were constructed with mud walls and had straw-thatched roofs. On closer inspection, investigators discovered that the majority of Munda people did not own any agricultural land. Instead, many Mundas frequently visited the surrounding Sundarban forest to gather fish, crabs, honey, and some fuel wood. The vast majority of households have limited cultivable agricultural land. There is just one paddy crop per season, and it also depends on rain. Also, it has been observed that some land-owning Munda families lease their property to the Namasudra neighbours on an annual contract basis. Investigators have also seen a number of people, mostly men, leave the village to work as agricultural and non-agricultural labourers in far-off locations outside the hamlet, then come back. Based on this broad backdrop, the researcher will now create the demographic profile of the study hamlet.

1.14 Research Review

In the first ten years of the 20th century, Indian nutritional studies first came to light. McCay started the nutrition research projects in India. The initial subjects of this investigation were the soldiers and detainees. According to Richards (1932), nutrition, not sex, is the most fundamental biological process. Incorrect nutritional intake, according to Mc Carrison, alters the anatomical and functional makeup of the body's organs (Patwardhan, 1954:251). Dietary consumption is an adaptive phenomenon that is regulated by the local biosphere. The hunt for new, high-quality but affordable sources of protein and energy, according to Longvah (2000), "remains a significant concern of all agencies involved in supplying adequate food and improving the nutritional status of the population of the developing countries." India is ranked 112th out of 191 member countries in the World Health Organization's review of the performance of healthcare systems around the world. The survey also considered health disparities or inequities among the populations of each nation (Tandon, 2000).

"Health" is a "quality of life" in its broadest sense. It is a manifestation of progress rather than a component. As a result, it is a treasure that humans can possess. Outside its strict definition, it has additional meaning. The state of a person's health affects all of their activities, which shapes their future. It is the dependable base upon which human happiness is built. "Health is a state of total physical, mental, and social well-being and not only a lack of disease or disability," according to the World Health Organization (1948). Terris modifies this definition (1975). "Health is a state of physical, mental, and social well-being and the ability to operate, and not only the absence of either disease or infirmity," he said. The bio-cultural and theological diversity of human life has a significant impact on a community's level of health. As a result, different cultures have different ideas about health, hygiene, sickness, and treatment. Every culture has a unique understanding of health, cleanliness, disease, and treatment. Only a few have access to contemporary therapeutic techniques, while the majority follow folk customs based on traditional indigenous medical practises. Indians used indigenous systems run by local priests to handle their health care prior to accepting the Western Medicare system. A community's health is influenced by its eating habits, cleanliness, hygiene, immunisation rates, etc.

One of the most significant factors affecting human health is nutrition. A nutritious diet can aid in the prevention and management of a number of non-communicable diseases (NCDs), including diabetes, heart disease, stroke, and some types of cancer, in addition to helping with

the management of weight, blood pressure, and cholesterol. Seven nutrients are important for our bodies. They include omega-3 fatty acids, water, carbohydrates, protein-amino acids, fat, vitamins, and minerals.

The nutritional state of a community has a significant impact on its health. Consequently, determining a country's nutritional condition is crucial, especially in a developing country like India where the majority of the population is undernourished. Such an evaluation is crucial to their health improvement and, in turn, to the community's and nation's general growth. Malnutrition is a disorder that weakens the health and wellbeing of millions of women and adolescent girls worldwide by causing shortages in calories, protein, vitamins, and minerals that combine with infections and other unfavourable health and social situations. In India, it directly contributes to the deaths of 5 million children each year (Parvathi S. et al., 2001). 450 million adult women in underdeveloped nations are thought to be stunted as a result of protein and energy deprivation as children (Sinha A. et al., 2001). Despite the fact that there are a number of ways to evaluate an adult's dietary status, the BMI is the most widely used methodology since it is inexpensive, non-invasive, and suitable for large-scale surveys (Bose K. et al., 2006a; 2006c; 2006d). The main public health problems include low body mass index (BMI) and high levels of undernutrition (based on BMI), notably among the less fortunate and rural populations of developing countries (WHO 1995).

The World Health Organization defines malnutrition as a cellular imbalance between the body's supply of nutrients and energy and its requirements for growth, maintenance, and some physiological processes. Malnutrition is the collective term for any departures from adequate and optimal nutritional status in newborns, children, and adults. It typically implies undernutrition. Underweight and stunting (short stature) are two indications of undernutrition in children, while kwashiorkor, marasmus, or marasmic kwashiorkor are conditions that affect severely undernourished children.

Clinical symptoms of undernourishment absence of more lustrous hair, sparse hair, depigmented hair Flags, the capacity to easily remove them, pale eyes, a moon face edema, angular stomatitis, chilosis papillae atrophic, Dental caries, scuffed enamel Gum disease, gum bleeding, xerosis, and an enlarged thyroid.

One of an organism's fundamental needs in order to develop and maintain life is nutrition. But as an organism gets older, the types and amounts of nutrients needed to support

normal growth and maintain its health over its lifetime change. Growth is more influenced by nutrition later in life; therefore, any significant divergence in nutrient intake, whether in quality or quantity, from its requirements can also have a variety of negative effects on development and life duration (Gopalan et al., 1989).

In the direct evaluation of nutritional status, nutritional anthropometry is now widely acknowledged to play a key role. For research on growth and nutritional health, a variety of anthropometric measurements have been proposed, but the most popular ones include height, weight, mid-upper arm circumference, head circumference, chest, and the fat fold (skin fold) at the triceps.

The most significant contributing variables to the nation's human resource development are nutrition and health (Amirthaveni and Barikor, 2001). Nevertheless, undernourishment remained a serious public health problem that contributed significantly to the annual death rate of children, especially in developing nations like India (Black et al., 2003). Various degrees of protein energy shortage affect huge segments of the Indian population (Gopalan, 2002). For the purpose of creating the health planning and nutritional intervention programme, it is therefore required to periodically collect data particular to the region and community. In order to evaluate the health and nutritional status of the various communities residing in West Bengal's South 24 Parganas district, a cross-sectional survey will be conducted due to the high prevalence of malnutrition among tribal peoples as well as the need for spatial and temporal community-specific data. To gauge the severity and prevalence of malnutrition among them, it is also deemed necessary to compare the statistics with those from other local communities. In the current studies, every community is emphasised with a clear and long-lasting strategy for improving people's conditions, as well as an objective and scientific assessment of their lives. We have never considered investigating the role that these communities played in the development of Indian civilization since they have remained on the periphery of our society. Being a resident of the vast delta region known as Sundarban (a UNESCO World Heritage Site), the current researcher has made the decision to launch an extensive study to establish the nutritional and health status of various groups. This study comprises asking questions about the community members' health and hygiene habits, health-seeking behaviour, dietary status, and overall health. The current researcher decides to conduct fieldwork among various groups in West Bengal as part of this study.

India has been the home of several tribes with unique cultural traditions from the beginning of time. The current researcher has picked Scheduled Tribes, who are economically and socially backward classes in India, in addition to administrative classifications. Human groups and communities that fall under this category have historically come from a variety of cultural and economic backgrounds and were socially stigmatised by the colonial authorities for a variety of reasons. Also, the majority of them are the victims of the feudal social system's cultural and economic dominance in pre-independent India. Due to the application of the ruler's legislation based on their wills and whims, they are obedient and become victims of social injustice. This tribal society is an extremely economically and socially isolated population without access to even the most basic essentials for survival. The citizens of a welfare state will be subject to other fundamental rights and welfare laws for centuries. Its population is not very large, and their literacy rate is poor. More than 500 such settlements can be found throughout the nation in tribal, rural, urban, and even urban edge areas. Sadly, some don't have listings in any categories. They are dispersed across numerous ecological zones outside of the state boundaries, and they have vastly different subsistence practises, levels of technological advancement, lifestyles, and contacts with the outside world than their neighbours, the so-called "mainstream population, who share similar worldviews.

Given the severe dearth of information on this isolated region, the current researcher has been tasked with conducting a thorough investigation. Many communities, including the Brahmin, Poundra, Nama Sudra, Santal, and Munda, can be found in this isolated location. The communities' coping mechanisms, social engineering, subsistence patterns, public health and nutrition perspectives, reciprocity, and societal linkages have not yet been the subject of such an extensive and thorough study. Although there aren't many studies, the ones that do tend to focus on one area or group and have scant data, making it difficult to draw any conclusions. The current study has discovered a thorough nutritional and health study to examine the overall profile of numerous communities' day-to-day living. This is important both academically and in terms of formulating "real" welfare policies for this little-known dispersed population. Under the current study, which focuses on nutrition, dietary intake, community health, illnesses, and hereditary disorders in this region, the many communities in the Sundarban delta region are studied for hygiene and nutritional data with the following research goals in mind.

CHAPTER – II

AIMS AND OBJECTIVES

2. Objectives

2.1 Research Objectives

Name of the community: Munda community

Study Area: Sundarban Delta Region, Lahiripur Gramme Panchayat, Gosaba Block, district South 24 Parganas, West Bengal, India

1. Diet Survey: Intake of different types of foods in both periods' pre- and post-harvest seasons.
2. Health Survey: To create profiles of different health parameters and ind. The Munda's levels of personal hygiene and clinical health status.
3. Measurement of Physiological Parameters: Measurements of blood pressure and haemoglobin percentage.
4. Studies on the functional evaluation of Integrated Child Development Services (ICDS) and Mid-day meal served at the school.
5. Ecological studies on forest resources.
6. Studies on sanitation facilities including the sewage system and rubbish collection.
7. Studies on availability of drinking water and medical facilities.
8. Studies on demographic conditions, such as employment, educational facilities
9. Studies on living circumstances, eating habits, cleanliness, and health.
10. Studies on their sociocultural transformations.
11. To design a policy that upholds their rights, shields them from all forms of exploitation, promotes and their growth within a larger framework of stability and change.

2.2 Significance of the Study

This research has vital significance for a large population in an extremely remote and deprived area. The inputs generated from the present study can have implications for the lives of other populations and have immense value and relevance in the Indian context. There is an acute lack of comprehensive health, hygiene, and nutritional status among several communities in particular. The present study will be of national importance and will shed insight into the lives of the most vulnerable and deprived sections of India today.

CHAPTER – III

MATERIALS AND METHODS

3. Materials and Methods

3.1 Study area

The current study is on Lahiripur Gram Panchyat, Gosaba Block, South 24 Pargana, West Bengal, India. The Sundarban Biosphere Reserve Area contains this place. The world's largest delta and mangrove forests, respectively, are found in West Bengal's Sundarban. The Munda communities of Sardarpara (Tipligheri Bazar Area), Luxbagan and Parasmoni in Lahiripur Gram Panchayat, Gosaba Block, 24 Parganas (South), West Bengal would be the focus of the field inquiry. India's eastern region is where it is. All the information and data are gathered from males and females of various age groups of Munda community of this areas. Pregnant women and healthy peoples are both being investigated.

3.2 Sundarban

The Bengali word for "beautiful woodland" is Sundarban, literally translated. It is a massive archipelago that is sandwiched between the rich Bengal Plateau to the north and the wide Indian Ocean to the south. The Ganges, Meghna, and Brahmaputra rivers, as well as many of their distributaries, came together to form the Sundarban, which are located at the southernmost point of West Bengal and Bangladesh. The mangrove forest in this area, which is scattered across Bangladesh (approximately 6000 sq km of restricted forest), India (about 4200 sq km of reserved forest), and the largest delta in the world, measures about 10,000 sq km. Sundarban is a sizable region with a total area of 4262 square kilometers, including a sizable chunk in Bangladesh. The largest tiger reserve and National Park in India are located on about 2585 square kilometers of the Indian Sundarban. The Sundarban's western boundary is marked by the Hooghly River. The eastern boundary is formed by the Sawndip waterway, which extends west along the Chittagong Hills. The Sundarban is situated within the North and South 24-paraganas districts of West Bengal on the Indian side.

One of the southernmost inhabited islands in the West Bengal Sundarban is Satjelia, which is shaped like a heart. One of the most recent islands to be recovered and populated is this one. The island of Satjelia is located on the eastern side of the Gosaba block of the Sundarban, in the South 24-Parganas district. With a 615 sq km surface area and 42,000 inhabitants, it is the largest island in the Gosaba block (Jalais, 2010). Given that the majority of this island is covered by the Sundarban mangrove forest, the population density, which is

68.29 people per square kilometer, is incredibly low when compared to West Bengal. On the island, there are two Gram Panchayats: Lahiripur and Satjelia. There are 11 villages in Lahiripur Gram Panchayat and 14 villages under the Satjelia Gram Panchayat. The 12.7-kilometer trip in a motorized launch via the rivers from Gosaba to Satjelia takes about an hour. The Mundas refer to the village where researcher performed her fieldwork at Lahiripur Gram Panchayat, and it is situated on the Satjelia island in the South 24-Parganas region of West Bengal.

(A Tribal Village) Sardarpara the settlement of Sardarpara, as it is known officially, is found on the Satjelia island, near the Sundarban mangrove forest zone, on the bank of a river. The village's geography depicts the typical scene for the area. The river, which the locals refer to as the "Dutta River," flows between the villages and the forest while encircling the hamlet on the east and south. The human habitation in the village was shielded from the river's tides by a high earthen embankment.

The embankment created a semilunar mud route that rounds the settlement and serves as its primary thoroughfare (see Fig. I). The embankment was discovered to be in poor condition and climbs up to 10–12 feet tall with a width of 5–6 feet. The residents complained that the government and the local Panchayat had neglected to restore the embankment since the devastation brought on by the Aila cyclone in 2009.

The agricultural fields are located on the western side of the settlement, and the residences are organized in an almost linear pattern below the embankment. On the north side of the hamlet, there is a tiny market area called Tipligheri and a town called Poundra that is home to members of the scheduled caste known as the Namasudra. The Munda group of tribal people, who fall into the government's scheduled tribe category, make up the majority of the population in Sardarpara. The Mundas in Sundarban are said to have been referred to as "Sardars" by the locals since, during the British era, they were in charge of clearing the forest and constructing the embankments. The Bengali word "Sardar" refers to a team's captain or leader. The Mundas in this area regularly speak Bengali; therefore, we had no trouble getting our point across to them when we tried to do the same. Sardarpara village, which is officially a scheduled caste settlement, is located in the Lahiripur Gram Panchayat in the South 24-Parganas district of West Bengal and is part of the Sadhupur mouza bearing J.L. No. 48.

The village's homes revealed the residents' precarious financial situation. The majority of the homes had mud walls and straw-thatched roofs. During further investigation, we discovered that the majority of the Munda villagers didn't own any agricultural land and that many of them frequently went to the neighboring forest to gather crabs, fish, honey, and some fuel wood. Most families with land for farming used to grow just one crop every season that was dependent on rainwater. It was also discovered that some of the land-owning Munda households had annual lease agreements with their Namasudra neighbors. We have also discovered a number of locals, mostly men, who left the hamlet to work as agricultural and non-agricultural laborers in far-off places outside the community before returning. We will now create the demographic profile of the study hamlet using this general background information.

Figure 3.1 Position of West Bengal in India

Figure 3.2 Position of Sundarban in West Bengal

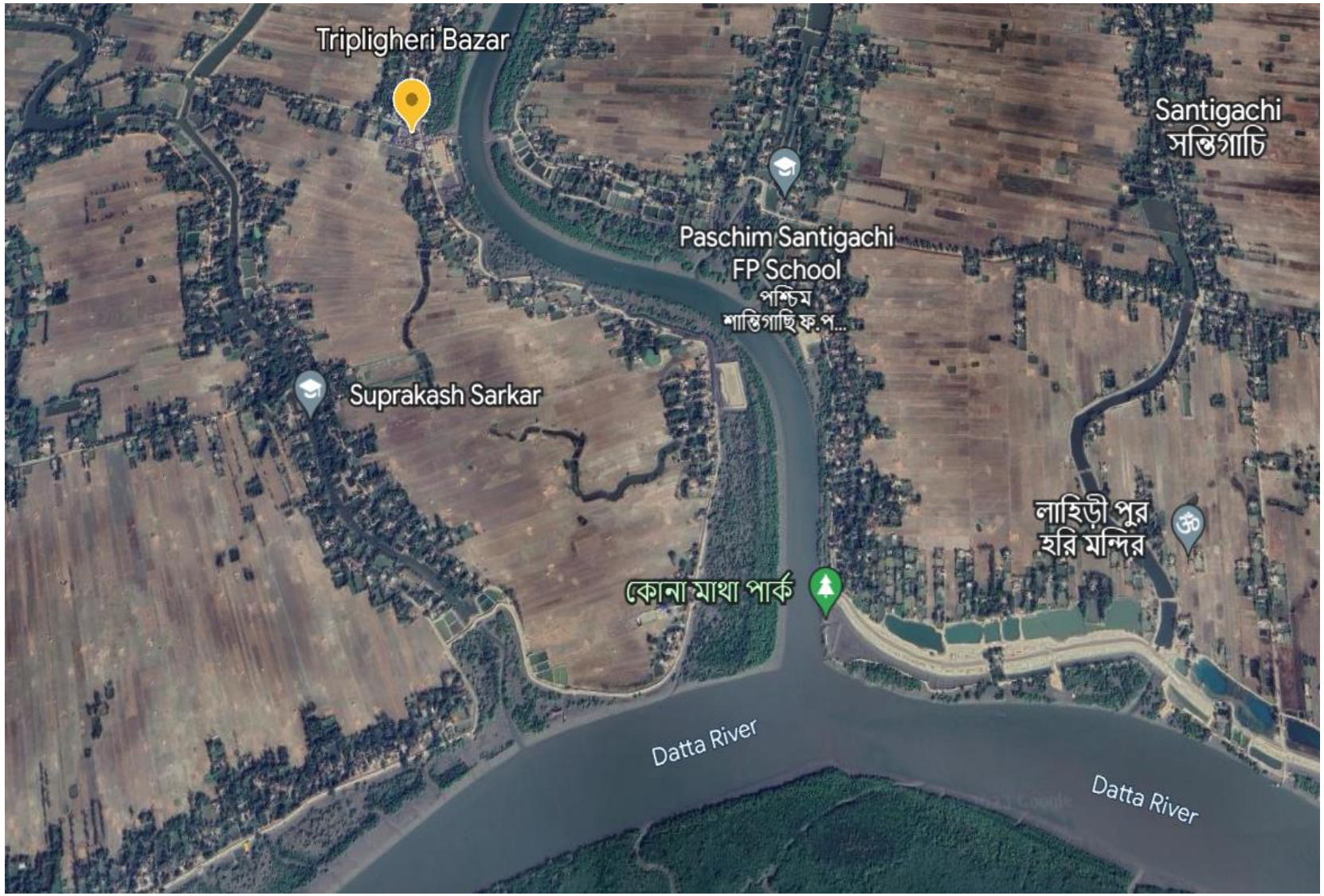


Figure 3.3 Village map of study area of Sundarban in West Bengal

3.3 Evaluation of dietary intake

Forty-five households were considered in three rounds for dietary survey. Fifteen households were covered in each phase. Prior to each household's cooking for five days in a row, at least two visits were made to each as part of the dietary survey. A portable single-pan digital salter balance was used to measure the ingredients for the food that needed to be cooked for each home.

For dietary assessment, surveys of five days' worth of diets were undertaken. A diet survey is defined as weighing the total amount of food consumed by all of the family members in the community using any digital scale. Diet surveys are frequently an integral aspect of regular nutrition surveys. Reliable data on community food habits would be useful for assessing people's nutritional health as well as establishing the link between nutrient intake and illness deficiencies. They would aid in comprehending the community's diet survey in comparison to other markers of nutritional status, such as clinical symptoms of deficiency or biochemical measures. To determine whether a subject's diet is adequate for any modifications, nutritional assessments of subjects in institutions like hostels or prisons may occasionally be necessary. Planning programs to combat diet-related illnesses and promote nutrition in general would involve an evaluation of the dietary adequacy of communities. For the purpose of determining minimum wages and household rations, quantitative information on population nutritional intake is taken into account. In the recent past, analysis of dietary energy consumption patterns was used to gauge the severity of poverty.

Dietary intakes can be statistically evaluated at the individual or family level. Occasionally, surveys of institutional diets are crucial for learning more about the food habits of people living in sizable institutions. Now, discuss popular research techniques for evaluating food intake at various levels.

3.4 The techniques applied in the present study

3.4.1 Household diet survey

Family-focused diet surveys gather data on diet at the household's level. Results are provided in terms of consumption units or per capita after analysis of the data and construction of the dietary intake table format. It is possible to determine the intakes of all physiological groups or age groups in surveys using these daily diet survey methods. 24-hour recall diet

surveys of the person are also the easiest, but researcher did not follow that protocol. This approach used in many nutritional studies, and routine diet surveys. This diet survey method also uses weighing techniques and consumption expenditure surveys. Let's discuss about daily weighing of raw food materials by portable single-pan digital salter balance.

Information on numerous food items is gathered from different houses at the family level about their diet. The units for expressing dietary survey results are per consumption unit and per capita unit. Researchers collected data on the intakes of all physiological groups or age groups in surveys using this seven-day diet survey method. In this procedure, the researcher collected data on the raw food materials before lunch and dinner for thirty households.

3.4.2 Weighing of Raw food materials by Digital Single Pan Salter Balance

A specific weighing of different types of raw food materials on a specific day is part of the diet survey's weighing process or methodology. Before the food was cooked, researchers visited selected households for five days. At that point, weigh everything that each and every family prepared for that day using a digital salter balance.

The five-day weighing method was once used to weigh raw food materials over the course of five consecutive days. Logistically, the five-day diet survey method required more time and effort. For this reason, cooperation between the chosen homes and researchers is very important. After comparing the findings of the five-day dietary survey, if there was no dietary variation, there was no need for the subsequent five-day diet survey. It was present in rural Indian diets in the 1960s. In order to avoid following the same diet for more than three or five days, the survey approach was used. If there was no change in diet, it was determined to use one- or two-day weighted diet surveys to determine the dietary status of families in villages. Since there is greater variety in these diets today, the three-day weighted diet survey approach is now used in metropolitan areas. All raw food items that are edible are weighed using the weighment method in accordance with the meal pattern (i.e., breakfast, lunch, evening tea, and supper). A digital single pan salter balance and a local digital balance were also used for measurements on the survey day. Information is gathered about every family member who eats the meal that day, according to age and physiological condition. In the case of young children, methodically gathering data on complementary feeding habits and breastfeeding is also done. The respondent (a housewife) was asked by the investigator to provide all the raw ingredients for dinner that day. The first portion of the day is lunch, and the second part is dinner. Every

single food item is thoroughly weighed, and the weights are recorded in a predetermined pro forma. The researcher told the housewife who was chosen to participate in the study that she anticipated visiting the home as often as food was prepared. Researchers weigh all the food items for the meal using a salter balance or another type of common digital balance. Practically speaking, a three- or five-day diet survey is doable if a limited number of households are taken. If the investigator chooses 45 households to work on this type of daily diet survey, then it is also possible. This is frequently not possible because the family only has enough food for one meal, and food for the evening meal may only be purchased after the day's earnings have been collected. The researcher was required to accept the information regarding the meal portions that the family members would consume. They are obtained from the households' respondents. Also, it is difficult for the investigator to get data on meals consumed away from home, extra food provided to small children, and food that is left over at the end of the day. The researcher noted that rice, chapatis (roties), or any cereal food is commonly eaten as tiffin in this region. At the very least, there was an overconsumption of food items, so this kind of data was also gathered. The researcher places a high priority on the poll not being conducted on holy days or when people are fasting. Likewise, when a particular kind of guest is present, the diet may not accurately reflect what the family actually consumes. The information is gathered in the study areas over the course of five days. A sedentary adult male's intake is represented by the consumption unit (CU), which is the standard unit of measurement for nutritional intake. These consumption units are computed using calorie factors that have been proposed in light of research on the calorie needs of various age, sex, and physiological groups. One consumption unit requires 2400 kcal. The following calorie coefficients are those that the Indian Council of Medical Research (ICMR) suggests, based on the value for a sedentary adult male of 1.

Table 3.1 Assessment of Nutritional Status based on Consumption Unit

Type of worker	Consumption Unit (CU)	Age and Gender
Sedentary Worker	1.00	Adult Man
Moderate Worker	1.20	Adult Man
Heavy Worker	1.60	Adult Man
Sedentary Worker	0.80	Adult Woman
Moderate Worker	0.90	Adult Woman
Heavy Worker	1.20	Adult Woman
12 to 21 years	1.00	Adolescent
9 to 12 years	0.80	Child
7 to 9 Years	0.70	Child
5 to 7 years	0.60	Child
3 to 5 years	0.50	Child
1 to 3 years	0.40	Child

A male adult who is sedentary has a calorie coefficient of 1 in respect to consumption units (CU) for age, sex, and activity levels.

The Gender, degree of activity, and physiological state of each family member are used to establish the total number of consumption units (CUs) in the specific family. There will be fewer consumption units consumed than there are total family members. Use the following formula to determine how much of each food is consumed per consumption unit:

$$\text{Intake of each food/CU per day} = \frac{\text{Raw amount of different type of food items}}{\text{Consumption units in total}}$$

An illustration helps to make things obvious. Let's say a home has a family of four, consisting of two parents and two kids. The total consumption units should then be calculated as per the table below.

Table 3.2 Total consumption units are calculated for a household of four family members

Physical characteristics	Adult man	Adult Woman	Children (Three Years)	Children (Seven Years)
Composition of the households	1.00	1.00	1.00	1.00
Category of worker	Moderate worker	Moderate worker		
State of Physiology		(Non-pregnant, non-lactating)		
Corresponding consumption Unit (CU)	1.20	0.90	0.40	0.60

The total consumption units (CUs) for this family are 3.1, as seen in the table above. Now, using the family's use of rice as an example, it is possible to determine how much rice the family consumes each day (in CU) as follows: Intake of rice/CU/day = total intake of rice/total CU = 400/3.1 = 129.03 if the family's total daily intake of rice is discovered to be 400 g during the survey. The researcher will then be able to calculate the family's daily intake of each meal (CU).

The nutritional value of Indian foods, published by the National Institute of Nutrition in 2004, provides the nutrient content of frequently eaten Indian cuisines and is used to convert raw foods into nutrients. The sufficiency or otherwise of the family's diet is then assessed by comparing these to the Indian Council of Medical Research's (ICMR) recommended dietary intakes for several nutrients for sedentary adult males. To determine the average intakes of the community questioned, the data collected on all the families is then added up. The method's primary flaw is that it computes consumption units under the assumption that all nutrients' calorie coefficients are constant. In some circumstances, the information is also provided per capita (per head). It is calculated by dividing the total amount of food consumed by the number of household members. The participated in the meal (every member is regarded equally, regardless of age, gender, or physiological status).

The investigator used weighment method and per-consumption unit notion after reading the explanation above.

Figure 3.4 General socioeconomic, cultural and environmental condition of study area

Table 3.3 Indian nutrition program

.	Name of the Ministry	Name of the Programs
A.	Ministry of Health and Family Welfare	Vitamin A prophylaxis program
B.	Ministry of Health & Family Welfare	Prophylaxis counter to nutritional anemia
C.	Ministry of Health & Family Welfare	Iodine insufficiency disorders control program
D.	Ministry of Social Welfare	Special nutrition program
E.	Ministry of Social Welfare	Balawadi nutrition program
F.	Ministry of Social Welfare	ICDS program
G.	Ministry of Education	Midday meal program in School.

3.5 General Health, Hygiene, and Socio-Economic Data

The information on age, education, occupation, monthly income, marital status, age at marriage, family type, number of family members, addictions (smoking, chewing, alcohol consumption, and *gutka*), sanitation and hygiene, menstrual hygiene, disease/morbidity, personal hygiene, and household are to be collected as per the pre-designed schedule, which is largely based on the guidelines set out for conducting the study. Mostly, interview and observation methods are adopted for data collection by house-to-house visits. Case-study and non-participant observation methods are also adhered to. In order to evaluate the demographic characteristics, family composition, type of family, household size, etc. will also be noted.

3.6 Measurements of health parameters or anthropometric measurement

According to the IBP's recommendation (Weiner and Lourie, 1981), the anthropometric measurements of adults (19 years and older) include height, weight, mid-upper arm circumference, waist circumference, hip circumference, and calf circumference. Five different fat fold thicknesses at the biceps, triceps, calf, subscapular, and suprailiac skin folds were taken. In order to gauge height or stature, an anthropometric rod employed. To the nearest 0.5 cm, the reading is obtained. Weight will be measured while wearing the bare minimum of clothing using a portable body fat monitor machine, and it is recorded to the nearest 0.5 kg. People are asked to take off their shoes before being measured for height and weight. Mid-upper arm circumference, waist, hip, and calf circumference measurements are all done with anthropometric tape. These measurements of girth are all taken down to the nearest millimeter. Biceps, triceps, calves, subscapular, and suprailiac skinfold thicknesses are all measured with a Haltain skinfold caliper and recorded to the nearest 0.1 mm. A transportable body fat monitor has also been used to measure the percentage of body fat, visceral fat level, skeletal muscle, and resting metabolism.

3.7 Age Estimation

Depending on what is available, participants' voter cards or Aadhaar cards are used to determine their ages. The ages of the majority of adults are determined and double-checked in relation to occasions like significant festivals, storms, floods, etc. Along with the ward members and the clan chief, the elderly residents of the houses and villages also proved to their ages. The individual's age is specified in full years. Age groups created for the scrutiny of the data based on the age at the last day of birth. All participants who have reached the age of 20

but are under 21 are grouped together as 20-year-olds, and age groups will also be determined in this manner. The recollection method will occasionally be used to determine age. The age is given in whole years.

3.8 Physiological attributes

Recently, medical professionals and nutritional experts have realized the usefulness of physiological variables like blood pressure, hemoglobin content, lung functions, oxygen consumption, breathing rate, pulse rate, body temperature, etc. for understanding human adaptation. The reports on physiological variables are taken, and the majority of them are on blood pressure, pulse rate, breathing rate, and hemoglobin content because of their utility in the health assessment. Out of all these variables, blood pressure has attracted much attention because of its association with several forms of cardiovascular diseases (Nirmala and Reddy, 1991). When determining a population's health state, physiological characteristics are extremely important. For the purpose of the present investigation, three physiological attributes, i.e., hemoglobin content, blood pressure (systolic blood pressure and diastolic blood pressure), and pulse rate, are taken into consideration for assessing the health status of the studied the Munda population group.

3.9 Blood pressure and pulse rate

A blood pressure reading was taken between 7 a.m. and noon in the morning. A Japanese-made automatic digital electronic OMRON blood pressure monitor (arm type) is used to measure blood pressure and pulse rate. The accuracy of the reading will occasionally be verified with a blood pressure monitor (sphygmomanometer) made by Doctor Branded. The following safety measures are implemented during data collection to ensure accurate blood pressure readings. For 30 minutes prior to taking blood pressure readings, participants are asked to refrain from having a shower, consuming alcohol or caffeine, smoking, engaging in strenuous activity, and eating. The participants rested for 10 minutes before the blood pressure measurements, and at the time of the measurements, they were entirely at ease and not engaged in any stressful activity. To prevent white coat hypertension, measurements are obtained in their peaceful natural resting location.

The participants are asked to take off their arm-tight apparel. With the subjects seated and the lower end of the left arm lying on the table top at heart level, all measurements are obtained on the left arm. Participants are at a comfortable room temperature in their seats. They

are instructed to take a seat on a chair with their feet flat on the floor and their legs uncrossed. Participants are asked to sit upright with their arms at their sides. At the same level as their heart, the arm cuff is positioned on the subject's arm. It is taken care not to let the participant's arm rest on the air tube.

Three consecutive readings will be recorded for each of the systolic and diastolic blood pressures, and the averages will be considered.

3.10 Biochemical Test

The blood samples of individuals are screened to estimate haemoglobin content. Estimation of hemoglobin level is performed using an instant digital portable hemoglobinometer (finger prick method).

3.11 Analysis

The data are divided into five-years age group intervals. The mean, standard deviation, standard error, maximum value, minimum value, and percentage of the data will be calculated and summarized in tables. Adult nutritional status is assessed using anthropometric measurements and references as recommended by WHO and other cut-off points (WHO, 1995; BMI cut-offs based on Asia-Pacific, 2000; MUAC cut-off points, 1994; WHR cut-offs based on WHO, 2008; BMI cut-off point of Z-Score based on National Centre for Health Statistics, 1977). Collected data are to be analyzed following suitable diagnostic and statistical tools and subsequently presented in tabular form. The parameters will be analyzed by age group and by gender at the community level, and the trends will be clarified. An attempt will be made to see the magnitude of interrelatedness of the health-related measurements and physiological parameters by means of correlation studies. Standard techniques of statistical analysis of the data will be used to derive the summary statistics of the parameters and perform hypothesis testing for the equality of the distribution between comparable sets of data. The data to be collected in the present study are subjected to appropriate statistical analysis using Statistical Product and Service Solutions version 25 (SPSS v. 25). The health parameters and physiological parameters are to be analyzed by age group and gender, and the movements are interpreted. The central tendencies of the data subsets (by gender and age) will be compared pairwise in order to distinguish differences in the distribution of these parameters and appropriately discussed. Bi-Gender and Gender-wise intergroup differences are evaluated by means of t - tests.

3.12 Assessment of Hypertension

Blood pressure will be classified in Adults (age ≥18 years) as: (1) Normal: SBP < 120 mmHg and DBP < 80 mmHg; (2) Pre-Hypertension SBP 120 - 139 mmHg and DBP 80 - 89 mmHg; (3) Stage I hypertension SBP 140 - 159 mmHg and DBP 90 - 99 mmHg; (4) Stage II hypertension SBP ≥160 mmHg and DBP ≥100 mmHg; and finally, (5) Isolated Systolic Hypertension SBP ≥ 140 mmHg and DBP < 90 mmHg, according to the recommendations proposed by the Joint National Committee, JNC, 8 (Eighth R The above classification will be used to find out how common hypertension is in the population being studied.

3.13 Assessment of Anemic Status

The classification of hemoglobin level will be followed as per the recommendation of the World Health Organization (2017) to detect normal, mild, moderate, and severe anemia among the population, and thereby the health condition will be assessed.

3.14 Assessment of Pulse Rate

In order to examine the pulse rate, a vital component of health, the normal heart and pulse rates proposed by the National Institutes of Health (NIH) are considered. The following table lists the NIH's (2006) recommendations for normal pulse rates at various ages.

Table 3.4 Age-wise normal pulse rates (National Institutes of Health, 2006)

Age	Standard pulse rate (BPM)
up to 1 month	70 -- 190
From 1 -- 11 months	80 -- 160
From 1 -- 2 years	80 -- 130
From 3 -- years	80 -- 120
From 5 -- 6 years	75 -- 115
From 7 -- 9 years	70 -- 110

3.15 Assessment of the co-morbidities risk for developing metabolic complications The following cut off points for identifying future health risks used in this study.

This was thoroughly discussed in the term paper.

- The World Health Organization's planned waist circumference cutoff limit from 2000.

- The World Health Organization's cutoff for waist-to-hip ratio in 2008.
- Waist-to-hip ratio ratings: the World Health Organization's cutoff point for the ratio as of 2008.
- The waist-to-height ratio's cutoff point.

3.16 Conicity Index

It is used to explore central body fat deposition, which creates a risk of developing metabolic complications, including cardiovascular diseases. The following formula is used to determine the conicity index using waist circumference, height in meters, and weight in kg.

$$\text{Conicity Index} = \frac{\text{Waist circumference (meter)}}{0.109 \sqrt{(\text{Weight in Kilograms/Height in Meters})}}$$

3.17 Demographic profiles

The nutritional status of a population is very much related to its demographic characteristics. The study of nutritional status therefore remains incomplete unless some of the important demographic features of the population, such as age and sex composition, marital status, literacy, and nature of occupation, are taken into consideration. During the present study, a household-to-household census operation will be surveyed or conducted in the villages, and demographic information as stated will be collected from households.

3.18 Household Size

The average household size of Munda community under the study area is indicated by the number of individuals per household, which is reflected in the nutritional status.

3.19 Status of Literacy

Additionally, literacy is crucial in the evaluation of nutrition.

3.20 Living Condition

Nutritional status also depends on the living conditions.

3.21 Livelihood and Economic Activities

Inhabitants of Sundarban in present study area are engaged in diverse occupations. A great majority of them remain involved in agricultural activities during paddy season (July to December) and work as agricultural laborers.

Gosaba being the gateway to many islands in the Sundarban, there is scope to work as head load labourers in the jetty. As a result, wage labour has become the primary source of livelihood for many able-bodied people in several communities. Mechanized and country boats serve the purpose of transport for the inter- and intra-island movement. A good number of people are found to be involved in this activity as well. Many men, mainly young and adolescent boys and girls, are found to be engaged in catching prawn seedlings in the river with nylon nets during high tide. Prawn seedlings have a good market in Gosaba. As a result, prawn catching contributes significantly to their economy. The preparation and sale of homebrewed rice beer ("Handia") have become the primary source of income for some of them. Though in a small way, they rear pigs and chickens for business.

Different developmental program like the Integrated Rural Development Project, the Tribal Development Project, Food for Work, the Community Development Project, etc. are in operation in the study area. Several communities are also actively involved in such projects. They work as labour on various types of development projects in exchange for cereals (wheat) and cash. Under the development programs, they also get loans from the government as an agriculture subsidy to set up small enterprises and purchase equipment, etc. This adds to their economy. Some people are found to be absorbed into local government or semi-government offices, while a few of them work in the neighbouring urban centers.

In order to access the general economic condition as reflected in their land holding and its products, the information on household food production has been graded in five categories according to the degree of annual production. It appears that 38.50 percent of households are either unable to produce or their products are not even sufficient for a month. There are only 6.8 percent of households that produce food grains sufficient for more than ten months per year.

3.22 Different statical methods used for analysis

For the investigation of the fundamental properties of all the variables, descriptive statistics like mean, standard deviation, minimum, and maximum were used. The statistical differences between distinct categories were assessed using the 't' test and one-way analysis of variance (ANOVA). By using an unpaired student t-test, baseline characteristics were compared between subjects who were male and female.

The SPSS statistical program for Windows and GraphPad, versions 16.0 (SPSS Inc., Chicago, IL, USA), was used for all statistical analysis.

The two-tailed P value for statistical significance was fixed at 0.05.

a) Mean = $\sum xi/n$

b) Standard Deviation = $\sqrt{1/n\sum(x-xi)2}$

c) Variance (V) =SD^2

d) S.E. of (X) = $SD/\sqrt{n}$

e) Chi - Square test: It is performed to test the level of significance of agreement among the set of observed value and to estimate the difference from the expected value in ‘r x c’ contingency table

$$X^2 \text{ (Chi-square)} = \sum \frac{(\text{Observed value} - \text{expected value})^2}{\text{Expected value}}$$

The degree of freedom = (r - 1) x (c - 1)

Where r = number or rows in the table

c = number of columns in the table.

f) ‘t’ test: It is applied to estimate the level of significance in difference between two uncorrelated mean values when N is less than 50. The modified formula can be applied when any one of the sets is having sample size less than 50 (Garret and Woodworth 1971)

$$\text{SD of difference} = \frac{\{SD_1^2 (N_1 - 1)\} + \{SD_2^2 (N_2 - 1)\}}{(N_1 - 1)(N_2 - 1)}$$

Where SD_1, N_1 and SD_2, N_2 are the standard deviation and sample sizes of sample set 1 and sample set 2 respectively.

$$\text{SE of difference} = \frac{N_1 + N_2}{N_1 \times N_2} \times \text{SD of difference}$$

$$\text{'t'} = \frac{(X_1 - X_2)}{\text{SE of difference}}$$

Where X_1 and X_2 are the mean values of sample sets 1 and 2 respectively

Degree of freedom = $(N_1 - 1) + (N_2 - 1)$

g) Z | values: This was applied to test the difference between two sets of proportions (Gupta 1973).

$$|Z| = \frac{(p_1 - p_2)}{\text{SE of difference}} \quad \text{--------- (1)}$$

Where, $p_1 = x_1 / N_1$, $p_2 = x_2 / N_2$ --------- (2)

And x_1, N_1 and x_2, N_2 are the absolute numbers and sample sizes of the two sample sets respectively.

$P = (x_1 + x_2) / (N_1 + N_2)$ --------- (3)

$Q = (1 - P)$ --------- (4)

SE of difference $= \sqrt{PQ \{(1/N_1) + (1/N_2)\}}$ -----(5)

If the value of |Z| is more than 1.96, the two sets of data are concluded as significantly different at 5% level of confidence.

CHAPTER – IV

RESULT AND DISCUSSION

(Section -A)

Demography, Health Parameters and Index

4. Demography, Health Parameters and Index

4.1 Age and Gender distribution

In this section, the Munda population is divided into age and gender categories. The building blocks of population structure are different individuals of different ages and sexes. The composition of a population is constructed by the mixture of different age and sex groups. The field study was conducted in August, 2019 to July, 2022**.**

Table 4.1 depicts the age structure and sex distribution in Gram Panchayat Lahiripur. The villages covered by this Gram Panchyat are Tipligheri (Sadarpara), Luxbagan, and Parasmoni. The total population structure shows that the male and female members are almost the same. Total males are 245 and total females are 237. The total population is 482.

Table 4.1 depicts the age and sex-wise distribution of the Munda population at the present study area. For the nutritional study, the total sample includes 482 individuals, comprising 245 males and 237 females. The data are divided into 4-year age group intervals. There are 50.83% males and 49.17% females preferred for the present study. Healthy people and non-pregnant women are studied for measurements of health-parameters. The number of individuals for the study is determined purposefully.

As a man gets older, the number of people in his age group goes up steadily, from 0–4 years old to 10–14 years old. The total number of individuals has decreased from the post-reproductive age group for males and females. There was no male or female candidate alive after 75 years of age. Males and females have only one member who differs in the age groups 35–39 and 40–45. It is very interesting to observe that the life span of the Munda community is up to 75 years. After that, they do not survive due to some unknown reason.

4.2 Sex-ratio

According to Misra (1982), "The study of the sex ratio in a population is important in large part for two reasons: first, the analysis of the sex ratio can help in drawing several inferences regarding the dynamics of demographic phenomena; and second, it has bearing upon the marriage rate, death rate, birth rate, and even directly on the rate of migration." Sex ratios are frequently used to gauge a population's relative male and female numerical strengths.

Demographics, genetics, and epidemiology all use this as a fundamental metric. The sex ratio in the current study was calculated as the number of men for every 1000 women [(Males/Females) ×1000]. From the 0–4 to the 10–14 age group, a rising trend in sex-ratio values can be seen. It varies from the 15–19 age group to the 45–49 age group.

Table 4.1 Age and sex-wise distribution of the studied Munda population

Age Group (in years)	Male		Female		Total		Sex Ratio
	No	%	No	%	No	%	
0-4	9	3.67	19	8.02	28	5.81	473.68
5-9	27	11.02	29	12.24	56	11.62	931.03
10-14	27	11.02	28	11.81	55	11.41	964.29
Total	63	25.71	76	32.07	139	28.84	828.95
Sex-ratio=828.95							
15-19	32	13.06	20	8.44	52	10.79	1600.00
20-24	28	11.43	18	7.59	46	9.54	1555.56
25-29	16	6.53	11	4.64	27	5.60	1454.55
30-34	15	6.12	20	8.43	35	7.26	750.00
35-39	18	7.35	19	8.02	37	7.68	947.37
40-44	19	7.76	18	7.59	37	7.68	1055.56
45-49	25	10.20	15	6.33	40	8.30	1666.67
Total	153	62.45	121	51.04	274	56.85	1264.46
Sex-ratio=1264.46							
50-54	5	2.04	14	5.91	19	3.94	357.14
55-59	4	1.63	8	3.78	12	2.49	500.00
60-64	8	3.27	9	3.80	17	3.53	888.89
65-69	11	4.49	5	2.11	16	3.32	2200.00
70-74	1	0.41	4	1.69	5	1.04	250.00
75-79	0	0	0	0	0	0	0
80-84	0	0	0	0	0	0	0
85-89	0	0	0	0	0	0	0
90-94	0	0	0	0	0	0	0
95-99	0	0	0	0	0	0	0
100 & above	0	0	0	0	0	0	0
Total	29	11.84	40	16.88	69	14.32	725.00
Sex-ratio=725.00							
Total	245	50.83	237	49.17	482	100.00	1033.76

Sex ratio of post-reproductive, reproductive, and pre-reproductive age groups:

The sex ratio values of the post-reproductive (50 years and older), reproductive (15–49 years), and pre-reproductive (0–14 years) age groups are 725.00, 1264.46, and 828.95,

respectively. The sex ratio of the reproductive age group is higher than that of the pre-reproductive and post-reproductive age groups. The post-reproductive (male: 11.84; female: 16.88) age group of individuals has the lowest percentage. The age group (0–14 years) (male: 25.71; female: 32.07), which presents itself in the pre-reproductive category. The sex ratio between pre-reproductive and reproductive age groups is increasing. The reproductive (male: 62.45; female: 51.04) age group of individuals has the highest percentage.

4.3 Population pyramid

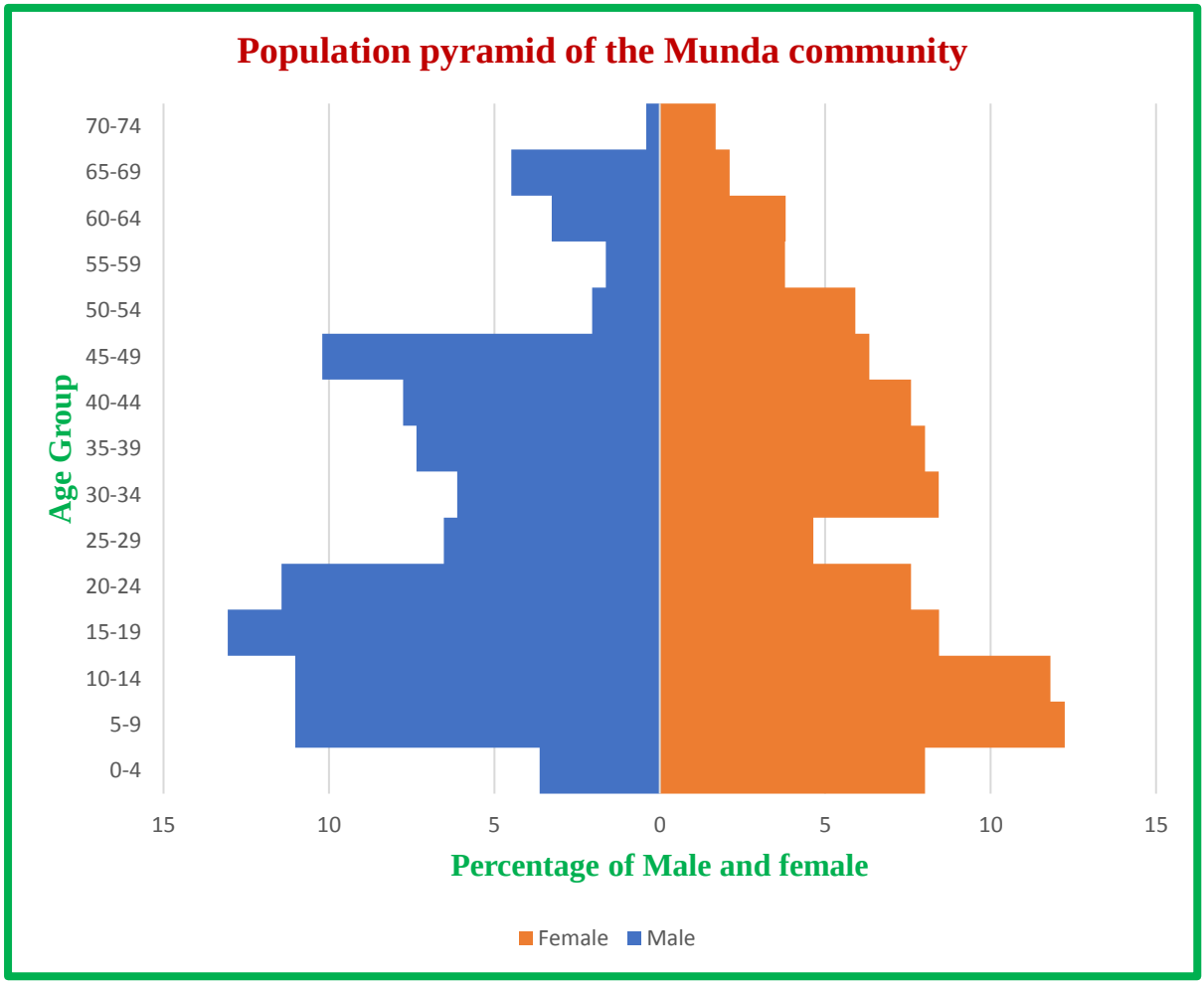


Figure 4.1 Population pyramid of studied Munda community

Population pyramid of Sardarpara, Luxbagan, and Parasmoni under Lahiripur Gram Panchayet, Gosaba Block, South 24 Parganas, West Bengal. The distribution of the Munda community's population by age group suggests a progressive category of population growth. The picture of the village's age pyramid (Figure 1) makes it simple to understand visually. A

narrowing at the base of the population pyramid, however, points either to a recent fall in fertility or an increase in infant mortality.

4.4 Child Nutrition

The measurement of child malnutrition is assessed using the Gomez and Indian Academy of Paediatrics (IAP) (1972, 1974) standards. The mid-arm circumference was measured to adopt a three-fold classification:

1. Normal (greater than 13.5 cm)
2. Borderline (13.5–12.5 cm)
3. Malnourished (below 12.5 cm)

Table 4.2 Screening of child nutritional status among the studied Munda children on the basis of MUAC cut-off points (Age 8 to 18 years)

Category	Male (n=70)	Female (n=61)
1.Normal (Greater than 13.5 cm)	82.31	80.62
2.Borderline (13.5-12.5 cm)	15.00	15.38
3.Malnourished (below 12.5 cm)	2.69	4.00

Note: The values are expressed in percentages.

Table 4.2 shows the very high frequency of normal children in both groups (males and females). However, the children are in a better position in a nutritional context.

Table 4.3 Mean value and standard deviation of measurements of health parameters and indices of the children of the studied Munda Population (Age 8 to 18 years)

Age, Body measurement and indices	Boys (N=70)		Girl s(N=61)	
	Mean	SD	Mean	SD
Age (Year)	12.94	1.58	12.34	1.54
Height (cm)	147.75	11.55	137.14	14.55
Weight (Kg)	31.47	2.94	26.88	4.14

Age, Body measurement and indices	Boys (N=70)		Girl s(N=61)	
	Mean	SD	Mean	SD
Arm Circumference	19.96	1.17	17.89	1.45
BMI	14.07	1.48	14.06	2.03
Weight / Height Index	18.75	1.64	16.60	1.51

The mean value and standard deviation of measurements of health-parameters and indices of the children (ages 8-18)) of Lahiripur Gram Panchayet, South 24 Parganas, boys have a mean height of 147.75 cm and girls have a mean height of 137.14 cm. The weights of boys and girls are 31.47 kg and 26.88 kg, respectively. Boy's arm circumference is 19.96 cm and girl's arm circumference are 17.89 cm. The BMIs of boys and girls are 14.07 and 14.06 respectively.

Table 4.4 Age-specific distribution of weight and height of the children (0–7 years)

Age in year	Boy			Girl		
	N	Height (mm)	Weight (Kg)	N	Height (mm)	Weight (Kg)
2.0 --- 2.9	6	900.14	11.85	4	862.25	11.25
3.0 ---3.9	4	983.00	14.50	7	959.57	13.71
4.0 --- 4.9	4	989.67	14.89	6	999.00	15.16
5.0 --- 5.9	5	1014.75	15.50	8	1066.45	18.34
6.0 --- 6.9	3	1101.00	16.75	8	1102.00	16.87

Table 4.4 revealed the age-specific distribution of weight and height for boys and girls.

4.5 Adult Nutrition

Age-group and gender-wise distributions of mean BMI, along with SD, SE, maximum, and minimum values, have been computed in Table 4.4. It defines that the mean BMI values among observed males and females in present studied area are 19.68 (SD ± 2.33) and 20.28 (SD ± 2.66), respectively. This is observed from the table: the mean BMI value is normal among males, while among females in the Munda community, the mean BMI value is lower

than the standard range of 18.5 to 24.9 Kg/m^2. It is indicating some incident of CED Grade malnutrition.

Table 4.5 Gender and age-group-wise descriptive statistics of BMI

Age Group	Male					
	No. of Male	Mean	SD	SE	Max.	Min.
19 – 23	31	17.64	1.65	0.36	22.48	15.97
24 – 28	15	19.76	2.05	0.47	22.71	15.90
29 – 33	16	19.63	1.45	0.25	20.58	14.85
34 – 38	20	19.59	3.04	0.57	26.72	15.52
39 – 43	16	20.35	2.87	0.70	25.91	15.35
44 – 48	28	20.26	2.57	0.55	26.41	14.95
49 – 53	5	19.57	1.97	0.66	22.97	15.90
54 – 58	4	20.11	2.25	0.68	21.51	14.94
59 & Above	20	20.23	2.45	0.61	23.12	14.87
Total	155	19.68	2.33	0.18	26.72	14.85
	Female					
	No. of Female	Mean	SD	SE	Max.	Min.
19 – 23	18	20.11	2.80	0.47	30.24	13.41
24 – 28	11	19.83	2.81	0.60	25.70	14.76
29 – 33	19	20.41	2.17	0.54	22.85	14.63
34 – 38	20	19.90	3.44	1.15	23.94	15.13
39 – 43	17	19.66	2.59	0.78	25.29	15.14
44 – 48	14	21.18	2.85	0.86	23.31	14.61
49 – 53	15	19.84	2.57	0.74	22.15	13.46
54 – 58	9	20.47	2.21	0.64	24.72	14.67
50 & Above	18	21.13	2.23	0.62	22.13	12.22
Total	141	20.28	2.66	0.22	30.24	12.22

Age-group and gender-wise distributions of mean BMI, along with SD, SE, maximum, and minimum values, have been computed in Table 4.5. It defines that the mean BMI values among observed males and females in present studied area are 19.68 (2.33) and 20.28 (2.66) respectively. This is observed from the table that mean BMI value is normal among males.

While among females in the Munda community, the mean BMI value is lower than the standard range of 18.5 to 24.9 Kg/m^2. It is indicating 15.45 percent CED Grade 1 malnutrition.

Table further reveals that mean values of BMI have not shown any clear trend; sometimes it varies directly with age and sometimes inversely. By and large, it can be inferred that up to age 38, it varies directly with age, and thereafter, mean BMI varies inversely with age. The same trend has been noticed in respect of the female series data as well. The highest mean value (20.35) is recorded among the age group 39 -43 years, followed by the age groups 44–48 years (20.26) and 59 and above years (20.23), respectively, in the case of males. But in the case of females, the highest mean value (21.18) is noticed in the age group 44–48 years. It is surveyed by the age groups 54–58 years (20.47) and 29–33 years (20.41), respectively. Here, the lowest BMI value (19.66) is observed in the age group 39 -43 and above years among females, and the 19-23 years age group of males records the lowest BMI value (17.67).

Table 4.6 Distribution of Body Mass Index (Kg/m^2)

Category	Range (Kg/m^2)	MALE (N=167)		FEMALE (N=153)	
		No. of Male	%	No. of Female	%
CED Grade III	< 16.0	8	4.79	9	5.88
CED Grade II	16.0 – 16.9	7	4.19	11	7.19
CED Grade I	17.0 – 18.4	26	15.57	24	15.67
Normal	18.5 – 24.9	123	73.65	107	69.93
Overweight	25.0 – 29.9	3	1.80	2	1.31
Obese	≥ 30.0	0	0.00	0	0.00

Body Mass Index or BMI (Kg/m^2) cutoffs according to WHO (1995)

CED = Chronic Energy Deficiency, Ref: The physical status of the WHO (World Health Organization): interpretation and the use of anthropometric measurements Expert consultant for a WHO report. Series of Technical Report Number 854 Geneva: World Health Organization, 1995.

The BMI, or body mass index, is a good health index based on height and weight.

Therefore, Body Mass Index (BMI) = body weight (kg)/height^2 (meters).

Body Mass Index, or BMI, is the most extensively established health index. It is used for the classification of body adiposity in adults. Body mass index, or BMI, is very much age- and gender-specific. This is a widely used and well-known screening tool to identify individuals who are suffering from malnutrition. Therefore, this tool has been useful to estimate the status of nutrition among the adult Munda population of the studied area.

Table 4.6 shows this classification among adults in the present study area based on their BMI in various nutritional status categories as per the 1995 WHO classification.

The table clearly shows that 24.55% of the 167 adult males are Chronic Energy Deficiency (CED Grade I, II and III) categories, while 73.65% are indicated to be in the normal range. Male members who are malnourished have a CED Grade I malnutrition rate of 15.57 percent, a CED Grade II malnutrition rate of 4.19 percent, and a CED Grade III malnutrition rate of 4.79 percent. Additionally, 1.80 percent are reported to be overweight. There are no men among the group who are obese.

However, only 69.93 percent of women are classified as normal. Whereas 28.74 percent of women are indicated to be undernourished out of 153 adult females. Undernourished women represent 15.67% of the CED Grade I category. The percent of female adults with a CED grade in the II category is 7.19. It should be highlighted that in this community, 5.88 percent of females had CED Grade III malnutrition. Table 1 further shows that just 1.31 percent of Munda females fall into the category of overweight nutrition status. In contrast, no one was found to fall into the obese nutritional status category. Grade I malnutrition affects more men than women (15.57 percent). The prevalence is higher in women than in men (7.19 percent, 5.88 percent) and follows in the categories of Grade II and Grade III, respectively. In comparison to men, who make up 50% of the population, it shows that 28.74% of women are undernourished. Hence, among the Munda population residing in the present study area, females suffer more from nutritional conditions than their male counterparts.

The NNMB (1994; 1996) found that statistically, women with better nutritional status (BMI of 18.5-24.9 kg/m^2) had better neonatal health status. The health of the mother, fetus, and kid are all negatively impacted by nutritional deficiency (Winikoff, 1990).

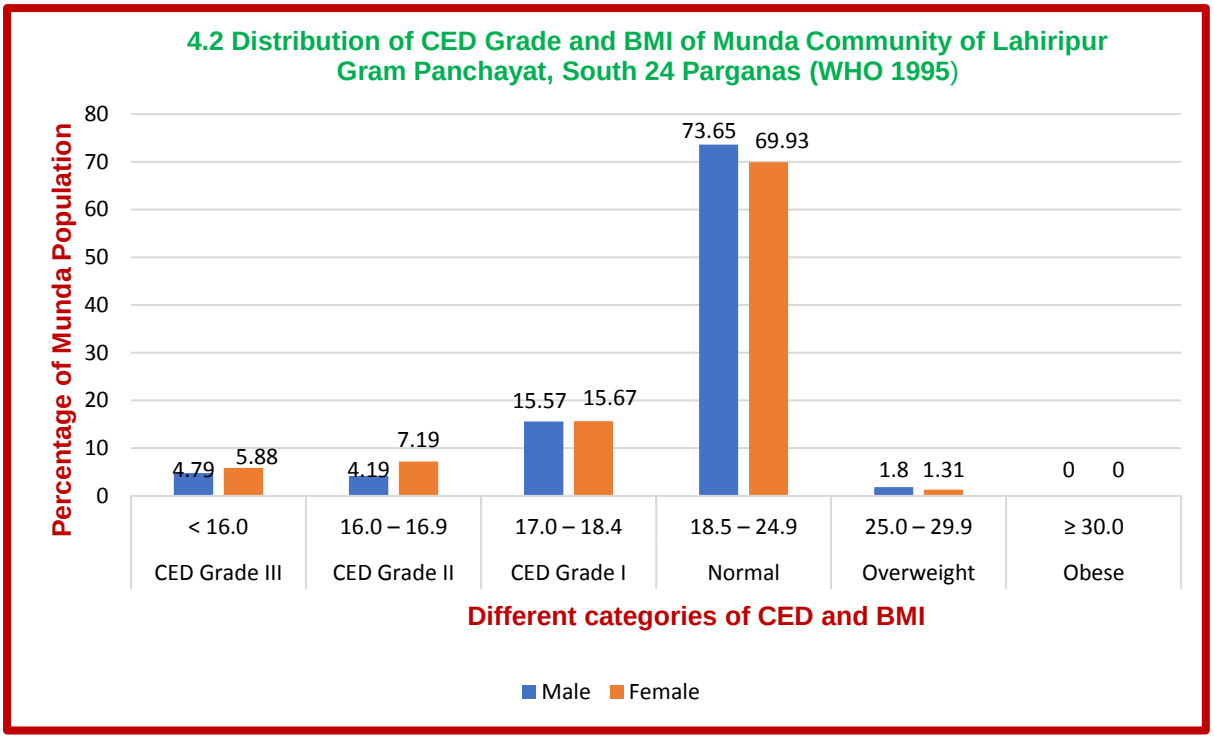


Figure 4.2 Distribution of different Chronic Energy Deficiency (CED) Grade and Body Mass Index (BMI) of the Munda Community, WHO,1995.

The WHO 1995 Body Mass Index (BMI) and Chronic Energy Deficiency (CED) bar diagram is shown in Figure 4.2 for better comprehension.

For the classification of adult Munda of present study area based on their BMI in various nutritional status categories according to the Asia-Pacific (2000) classification, the results are further analyzed and summarized in Table 4.7.

Table 4.7 Distribution of chronic energy deficiency (CED) and body mass index (BMI) (Kg/m^2)

Category	Range (Kg/m^2)	MALE(N=167)		FEMALE(N=153)	
		No.	%	No	%
CED Grade III	< 16.0	8	4.79	9	5.88
CED Grade II	16.0 – 16.9	7	4.19	11	7.19
CED Grade I	17.0 – 18.4	26	15.57	26	16.99
Normal	18.5 – 22.9	119	71.26	87	56.86
Overweight	23.0 – 24.9	6	3.59	18	11.76
Obese	≥ 25.0	1	0.60	2	1.31

Body Mass Index (Kg/m^2) cut-off values according to Asia-Pacific (2000)

The data shows that, of the 167 adult males, 24.55 percent are in the Chronic Energy Deficiency (CED Grade I, II, and III) categories, while 71.26 percent are found to be in the normal range. Male members who are malnourished are found to have a CED Grade I malnutrition rate of 15.57 percent, a CED Grade II malnutrition rate of 4.19 percent, and a CED Grade III malnutrition rate of 4.79 percent. Overall, 3.59 percent and 0.60 percent of adult males are in the overweight and obese categories, respectively.

On the other hand, only 29.26 percent of females are determined to be in the Chronic Energy Deficiency (CED Grade I, II, and III) category, whereas only 56.86 percent of females are classified as being in the normal category. 16.99 percent of malnourished females are within the CED Grade I category. 7.19 percent of adult females are CED Grade II overall. Table 4.7 depicts that 5.88 percent of females in this Munda population have CED Grade III malnutrition.

In Table 4.7, it is also shown that female Mundas revealed that 11.76 percent of those with an overweight nutritional status and 1.31 percent of those with an obese nutritional status.

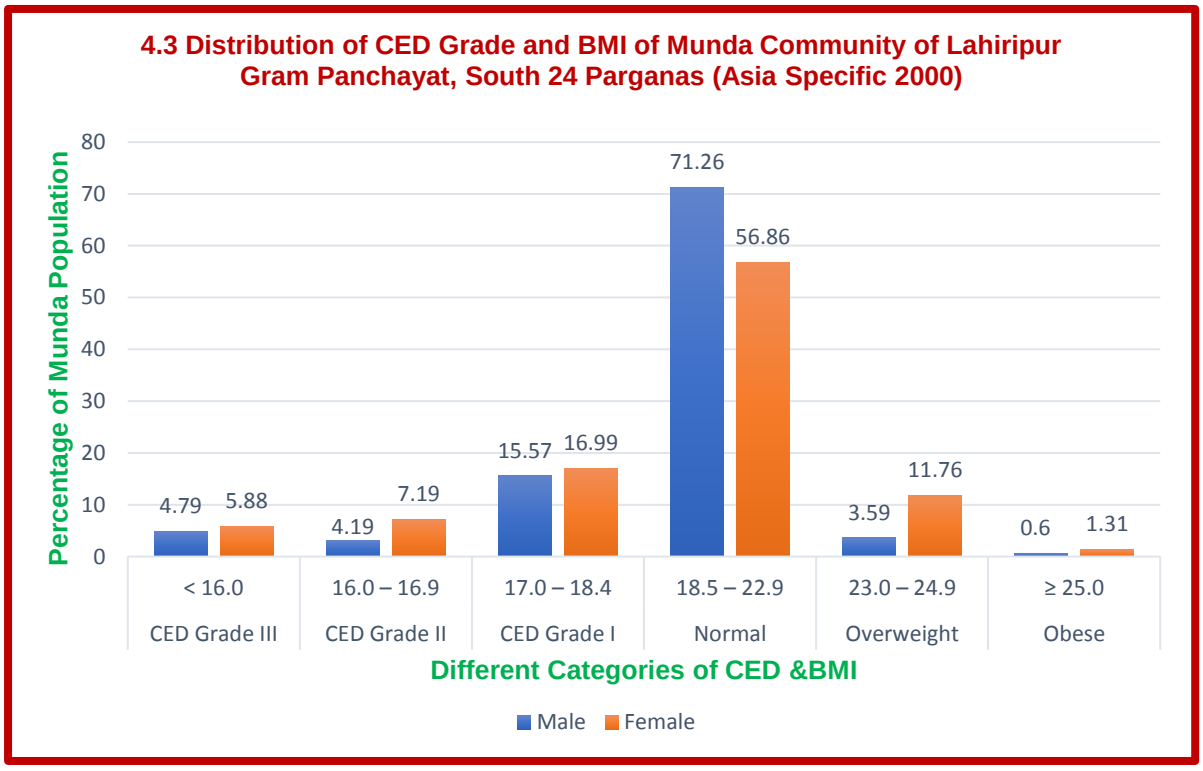


Figure 4.3 Distribution of different Chronic Energy Deficiency (CED) Grade and Body Mass Index (BMI) of the Munda Community, Asia-pacific, 2000.

Table 4.8 Screening of nutritional status on the basis of MUAC cut–off points

Male	Nutritional Status	No.	%
MUAC < 23.0 cm	Malnutrition	39	23.35
MUAC ≥ 23.0 cm	Normal Value	128	76.65
Female		No.	%
MUAC < 22.0 cm	Malnutrition	49	32.03
MUAC ≥ 22.0 cm	Normal Value	104	67.97

Ref: James W.P.T. et al. (1994). In assessing chronic energy deficiency, the value of upper mid-arm circumference measurements in third-world adults European Journal of Clinical Nutrition, 48:883–894.

Table 4.8 represents the screening of nutritional status among Munda male and female of present study area, and the southern part of West Bengal on the basis of MUAC cut-off points. It is found that only 39 males (23.35%) are found to be malnourished, and among females, 32.03 (49 females) are found to be malnourished, whereas 76.65% of males and 67.97% of females represent the normal category of nutritional status. The association between low MUAC and low BMI has been examined in very few other studies (Chakraborty et al. 2009; Bisai et al. 2009; Gartner et al. 2001). Significant and strong associations between MUAC 23 cm and BMI 18.5 were found by all. The present reading reveals that, both for BMI and MUAC, there is a significant malnutrition rate among the women of the Munda community.

Table 4.9 Co-morbidities and risk associated with waist circumference

Sex	Cut off point of Waist Circumference	Risk of Co-morbidities	No.	%
Male	< 90	Low	161	96.41
	≥90	Increased	6	3.59
Female	< 80	Low	133	86.93
	≥ 80	Increased	20	13.07

Reference: The Asia-Pacific Perspective: Redefining Obesity and Treatment World Health Organization, International Association for This Study of Obesity, and International Obesity Task Force February, 2000.

Table 4.9 shows the Comorbidities Risk of Developing Metabolic Complications among adult males and females in the Munda community based on waist circumference cut-offs. The earlier studies (Mckeigue et al., 1991; Banerji et al., 1999; Enas et al., 1992) showed that in Asian populations, the risk of metabolic problems arises at lower levels of BMI than in the white population. This is because people with metabolic difficulties tend to have an uneven distribution of body fat, and the related BMI values are substantially lower than the obese thresholds suggested by Western norms. In spite of having a thin BMI, Asian Indians frequently have higher visceral adipose tissue (Mckeigue et al., 1991; Banerji et al., 1999; Enas et al., 1992; Chandalia et al., 1999). Therefore, cut-off values for normal WC have also been calculated in this investigation.

On the basis of the cut offs for waist circumference, 3.59% of males and 13.07% of females have an increased risk of developing metabolic complications. 96.41% of males and 86.93% of females have a low-to-moderate increased risk of developing metabolic complications. This indicator clearly suggests that maximum Mundas, irrespective of gender, may be out of danger from metabolic complications in the future based on their waist circumference. However, females are at higher risk of developing metabolic complications compared to males. The findings of the current study are in line with those of a previous study (Ahmad, 2016), which found that Asian cut-off points for WHR revealed a greater incidence of abdominal obesity among female respondents. Using WC and WHR instead of BMI in our study resulted in a lower prevalence of abdominal obesity. However, it can be seen from the analysis that, as per BMI classification and waist circumference, waist-hip ratio, and mid-upper arm circumference cut-offs, the prevalence of undernutrition is reasonable among the Munda of Lahiripur Gram Panchayat, district of West Bengal.

Table 4.10 Waist-hip ratio (WHR) cut-offs according to WHO (2008)

Sex	Cut off point of Waist – Hip Ratio	Category	No.	%
Male (No.=167)	< 0.95	Normal	147	88.02
	≥ 0.95	Centrally Obese	20	11.98
Female (No.=153)	< 0.85	Normal	95	62.09
	≥ 0.85	Centrally Obese	58	37.91

Waist-Hip Ratio (WHR) = waist circumference (cm) / hip circumference (cm)

Ref: Waist Circumference and Waist-Hip Ratio: Report of a WHO Expert Consultation, Geneva, 8–11 December 2008.

Table 4.10 exhibits the risk of developing metabolic complications based on waist-hip ratio (WHR) cut-offs among adult males and females in the Munda community. In this study, the WHR of each individual has also been calculated to examine the effects of the waist–hip ratio (WHR) on metabolic complications in the population. According to the World Health Organization (2008), waist-hip ratio (WHR) cutoffs are considered.

On the basis of cutoffs for waist–hip ratio, 11.98% of males and 37.91% of females are centrally obese, indicating an increased risk of developing metabolic complications. 88.02% of males and 62.09% of females have been categorized as having a normal waist-hip ratio (WHR), demonstrating that they are out of danger in terms of metabolic complications.

Both indicators clearly suggested that a few members of the Munda community may develop metabolic complications based on their future waist circumference and waist-hip ratio. However, females are at sensible risk of developing metabolic complications compared to males. The findings of the current study are in line with those of a previous study (Ahmad, 2016), which found that Asian cut-off points for WHR revealed a greater incidence of abdominal obesity among female respondents. Using WC and WHR instead of BMI in our study resulted in a lower prevalence of abdominal obesity.

Table 4.11 Waist-Hip Ratio (WHR) ratings for increased health risk

Sex	Cut off point of Waist – Hip Ratio	Category	No.	%
Male (No. =167)	< 0.90	Lowest	103	61.68
	0.90-0.95	Moderate	49	29.34
	>0.95	Highest	15	8.98
Female (No. =153)	< 0.80	Lowest	78	50.98
	0.80 – 0.85	Moderate	50	32.68
	>0.85	Highest	25	16.34

Table 4.11 shows the results of a more in-depth analysis of the data to prove that there is a higher risk of getting metabolic problems. This table evaluates waist-hip ratio (WHR) ratings for increased health risk among the Munda community. Another cut-off point for waist-hip ratio (WHR), according to the World Health Organization (2008), is followed. The majority of the male members (61.68%) among the Munda community are in the safe zone for future health risk in respect of developing metabolic complications, followed by 29.34% of the male members who are in the moderate category for developing the increased health risk. Only 8.98% are identified as the highest category according to waist-hip ratio (WHR) ratings for increased health risk among the Munda community in connection with developing metabolic complications. Therefore, these 8.98% Munda males are at risk for future health risks with respect to metabolic complications. On the other hand, in respect of females, a different picture is being observed here: the highest percent, i.e., 16.34% of females, have the highest increased risk of developing metabolic complications. Secondly, 32.68% of females have a moderately increased risk of developing metabolic complications, whereas 50.98% of females who belong to the Munda community are in the lowest category in support of a rating for increased health risk and are considered to have no health risk in respect of metabolic complications in the future.

From a comparison across males and females (Table 4.11), it can be said that females have a slightly higher percentage among the highest and moderate categories of the waist-hip ratio rating for increased health risk in comparison to their male counterparts. The Table implied that women are more likely than men to experience metabolic issues in the future.

Table 4.12 Waist - Height Ratio (WHTR) cut-offs

Sex	Waist circumference to height ratio	Category	No.	%
Male (N=167)	< 0.50	Normal	141	84.43
	>0.5	Centrally Obese	26	15.57
Female (N=153)	< 0.50	Normal	120	78.43
	>0.5	Centrally Obese	33	21.57

The waist circumference divided by height equals the waist height ratio (WHTR).

Obesity has detrimental effects on one's health. Low levels of HDL (high-density lipid), or "good" cholesterol, and high levels of LDL (low-density lipid), or bad- cholesterol, are linked to it. It reduces the body's capacity to react to insulin, resulting in an increase in blood sugar and insulin levels. Excess body fat increases a number of serious illnesses and ailments, such as heart attacks, strokes, high blood pressure, cancer, diabetes, osteoarthritis, a fatty liver, and depression. The key factor in determining a person's health is belly fat, not weight. Health is negatively impacted by central overweightness. Central obesity has been intimately linked to metabolic and vascular problems, cardiovascular disease, and Alzheimer's disease. Type 2 diabetes mellitus has a significant correlation with central abdominal fat. The waist-to-height ratio (WHTR), which is more precise, offers a good approximation of central body fat. In Table 4.12, the waist-to-height ratio (WHTR) is discussed. Out of 167 males in Lahiripur Gram Panchayat, surprisingly, 84.43% are in the normal category for this index, and the remaining 15.57% are in the centrally obese male population, with alarmingly serious consequences for future health. In comparison, of the 153 females studied, 78.43% are in the normal category of health status, while the remaining 21.57% are in the centrally obese category, putting them at risk for future health problems. It is clear from the above facts that among females, the centrally obese category shows a higher percentage as compared to that of males. So, females are more susceptible than males in respect of health.

Table 4.13 Conicity Index (CI) among the studied Munda community

Sex	Cut off point of Conicity Index	Category	No.	%
Male (No. =167)	< 1.25	Normal	120	71.86
	≥1.25	Increased	47	28.14
Female (No. =153)	< 1.18	Normal	100	65.36
	≥ 1.18	Increased	53	34.64

Conicity Index (CI) = Waist Circumference (meters) / 0.109SQRT (Weight in Kg/Height in meters)

Ref: Valdez, Seidell JC, Ahn YI, and Weiss KM (1993). An updated measure of unusual adiposity as a predictor of cardiovascular disease risk a population-wide analysis. Int. J. Obes Realt Metab Discord 17(2): 77–82.

Central obesity is an emerging public health problem. Conicity Index (C.I.) is a simple health parameter measure to assess central adiposity. Rodolfo Valdez introduced the Conicity Index (CI) to measure obesity and body fat distribution in 1991 on the theory that cardiovascular illnesses are more likely to be linked to central obesity than to overall obesity. As a result, the conicity index is the most often employed and acknowledged instrument for estimating and measuring central obesity. The following formula is used to determine it using waist circumference, height in meters, and weight in kg.

$$\text{Conicity Index} = \frac{\text{Waist circumference (meter)}}{0.109\ \text{SQRT (Weight in kilograms/Height in meters)}}$$

This index has been utilized for classifying central adiposity. Table 4.13 explores the risk of developing metabolic complications based on the conicity index (CI) among the adult males and females of the Munda community residing in Lahiripur Gram Panchayat, West Bengal. On the whole, out of 167 males, 28.14% have been reported in the category of "increased health risk," showing the risk of developing metabolic complications, including cardiovascular diseases, while the majority (71.86%) of the male members of this community are out of danger, locating in the normal category of health in this table. This table further reveals that there is a spike in females. The number of such cases in the increased category of

health risk to 65.36%, meaning the risk of developing metabolic complications, including cardiovascular diseases, while the percentage of the normal category of health went down to 65.36% with reference to female series data, as the table illustrates. Thereby, it is observed from the table that females (34.64%) are more susceptible as compared to males (28.14%) in relation to the risk of developing metabolic complications, including cardiovascular diseases.

Table 4.14 The minimum BMI for a Z-score among the studied Munda community

Sex	Cut off point of Z-Score	Category	No.	%
Male (No. = 167)	+ 2 to -2	Normal	156	93.41
	-2 to -3	Moderate	11	6.59
	-3 and above	Sever	0	0.00
Female (No. = 153)	+ 2 to -2	Normal	140	91.50
	-2 to -3	Moderate	13	8.50
	-3 and above	Sever	0	0.00

NCHS stands for National Centre for Health Statistics.

A raw score's standard deviation from or excess over the mean of the thing being observed or evaluated is referred to as the standard score in statistics. Standard scores are positive for raw scores above the mean and negative for raw scores below the mean. A positive z-score indicates that the raw score is higher than the mean average. A z-score of +1, for instance, indicates a value that is one standard deviation above the mean. If the z-score is low, the raw score is below the mean average. A z-score of -2, for instance, indicates that the outcome is two standard deviations below the mean.

Here, Z-score = (individual BMI value – mean BMI value of total population)/ SD

In order to confirm the nutritional status of adult Munda in the participants in the current study region in reference to the standard deviations, data are further reviewed, and a Z-score by sex has been carried out.

The results are shown in Table No. 4.14, which is below. According to the table, 93.41% of males and 91.50% of women fall into the category of normal nutritional status. Modest malnutrition affects just 8.50 percent of women.

Table 4.15. Prevalence of Chronic Energy Deficiency (CED) and Mean Body Mass Index amongst several tribal people of Paschim Bangla (W.B.)

Name of the communities	Name of the Districts	Total number of Subjects	Chronic Energy Deficiency Percentage (%)		Mean Body Mass Index (kg/ m^2)		Reference
			Men	Women	Men	Women	
Kora-mudis	Bakura	500	48	56.4	18.6	18.2	Bose et al, 2006b
Santals	Bakura	800	55	52.5	-	-	Ghosh & Malik, 2007
Kora-mudis	Bakura	123	55.3	-	18.3	-	Bisai & Bose, 2009
Sabars	Bakura	226	46.8	56.5	19	18.4	Ghosh et al., 2018
Santals	Birbhum	251	30.5	38.5	20.5	19.5	Mukhopadhyay A, 2010
Oraons	Jalpaiguri	350	47.0	30.7	18.8	19.7	Mittal & Srivastava, 2006
Mundas	Calcutta	234	67.9	-	17.7	-	Ghosh & Bharati, 2006
Santals	Paschim Midnapur	410	31.5	41.8	20.0	19.0	Bose et al., 2006a
Lodhas	Paschim Midnapur	157	45.2	-	19.5	-	Bose et al., 2008
Bhumijs	Paschim Midnapur	161	48.4	-	18.6	-	Bose et al., 2008
Mundas	West Midnapur	106	35.8		19.3	-	Bose et al., 2011
Mundas	Paschim Midnapur	106	50.0	-	18.4	-	Das et al., 2013a
Oraons	Paschim Midnapur	104	37.5	-	19.4	-	Bose et al., 2011
Bhumijs	Paschim Midnapur	195	52.3	-	18.6	-	Ghosh & Bose, 2015

Name of the communities	Name of the Districts	Total number of Subjects	Chronic Energy Deficiency Percentage (%)		Mean Body Mass Index (kg/ m^2)		Reference
			Men	Women	Men	Women	
Oraons	Paschim Midnapur	100	72.0	40	17.8	19.96	Mahapatra et al., 2021
Oraons	Paschim Midnapur	104	-	-	19.4	-	Bose et al, 2011
Santals	Purulia	513	30.6	63.4	19.5	18.1	Das & Bose, 2010
Birhors	Purulia	72	19.4	-	20.5	-	Das et al., 2013b
Sabars	Purulia	307	47.2	-	19	-	Das et al., 2020
Dhimals	Siliguri	305	27	46.4	19.5	19.1	Banik et al., 2007
Mundas	24 Parganas (S)	306	37	43	19	18.11	Present Study, 2023

Overall, a comparison of both genders' data shows that Female have greater rates of Chronic Energy Deficiency (CED) grade I malnutrition (16.99%), grade II malnutrition (7.19%), and grade III (5.88%) than do male (15.57, 4.19, and 4.79 percent, respectively, in the previous Table 4.7). It demonstrates that women have chronic energy deficiency (grades I, II, and III) at a rate of 30.06 percent related to male. The prevalence of chronic energy insufficiency in males in grades I, II, and III is 24.55%. As a result, the quality of the Munda people's nutrition is poorer for women than it is for men in Lahiripur Gram Panchayat.

People who are constantly hungry but are not offered food have a very easy time becoming undernourished. Body mass index (BMI) is used to assess adult malnutrition, and a BMI of less than 18.5 indicates a sustained lack of calories. In the states of Karnatak, Gujarata, M.P. and Odisha, adult malnutrition is a major issue. In Odisha, Gujarat, Madhya Pradesh, and Karnataka, more than half of adults are underweight (18.5), (FAO 2010). The highest mean BMI (20.5 kg/m^2) is found in the West Bengal among the adult Santal male people (Mukhopadhyay 2010:118). The male Warli community of Maharastra has the lowest mean BMI (BMI = 16.8 kg/m^2), as per Adak et al. (2006). In a similar vein, Jarowa women have the highest BMI of any ethnic group (BMI = 19.8 kg/m^2) (Sahani 2003: 52). All the investigated tribal populations, the female Munda population in West Bengal had the lowest mean BMI (BMI = 17.7 kg/m^2) (Table 4.15).

Numerous reasons may be responsible for the varied prevalence rate of undernutrition. The limited sample size, non-representative sampling, and other variables are mostly responsible for the difference in the incidence rate of undernutrition. The diverse West Bengalee tribes' dietary conditions are not very excellent. Knowing the morbidity and mortality rates as well as the health profiles of the various West Bengal tribes is essential and unpleasant. Nearly all of the tribes (Table No. 4.15), with the exception of a few cities in the northeastern region of the nation, displayed high rates of CED, or chronic energy deficit. Before a more complete picture can be created, it is legitimate to say that inquiry among numerous indigenous tribes from various parts of India is required.

In India, there are 28.1% more overweight women than overweight males, according to the National Family Health Statistics-3 report (NFHS-3, 2005-2006). The BMI and CED are tools for assessing nutritional status. The Munda people in Sundarban has a superior health profile than other West Bengal's tribes.

Table 4.16 Frequency distribution of different Class of hypertension by age among the studied Munda male

Age Group in Years	Normal SBP <120 & DBP > 80		Prehypertension SBP 120 –139 or DBP 80 -- 89		Stage – I SBP 140 -159 or DBP 90 --99		Stage – II SBP ≥160 Or DBP ≥ 100		ISH SBP ≥140 & DBP ≥ 90.	
	N	%	N	%	N	%	N	%	N	%
19 –23	8	4.76	11	6.55	0	0.00	1	0.59	1	0.59
24 – 28	3	1.79	7	4.17	5	2.98	1	0.59	3	1.79
29 – 33	4	2.38	13	7.74	6	3.57	1	0.59	1	0.59
34 – 38	6	3.57	13	7.74	2	1.19	4	2.38	3	1.79
39 – 43	3	1.79	5	2.98	5	2.98	3	1.79	1	0.59
44 – 48	3	1.79	8	4.76	4	2.38	6	3.57	0	0.00
49 -- 53	1	0.59	4	2.38	2	1.19	0	.00	2	1.19
54 -- 58	2	1.19	6	3.57	2	1.19	1	0.59	0	0.00
59 & above	3	1.79	3	1.79	3	1.79	3	1.79	4	2.38
Total	33	19.64	70	41.67	29	17.26	20	11.90	15	8.93

Table 4.17 Frequency distribution of different Class of hypertension by age of the studied Munda females

Age Group In Years	Normal SBP <120 \ & DBP > 80		Prehypertension SBP 120 --139 or DBP 80 -- 89		Stage – I SBP 140 --159 or DBP 90 -- 99		Stage – II SBP ≥160 or DBP ≥ 100		ISH SBP ≥140 & DBP ≥ 90.	
	No.	%	No.	%	No.	%	No.	%	No.	%
19 –23	8	5.23	20	13.07	6	3.92	0	0.00	1	0.65
24 – 28	7	4.58	12	7.84	2	1.31	1	0.65	0	0.00
29 – 33	4	2.61	9	5.88	2	1.31	1	0.65	0	0.00
34 – 38	2	1.31	2	1.31	5	3.27	0	0.00	0	0.00
39 – 43	3	1.96	4	2.61	2	1.31	1	0.65	1	0.65
44 – 48	2	1.31	7	4.58	1	0.65	1	0.65	0	0.00
49 -- 53	4	2.61	0	0.00	2	1.31	5	3.27	1	0.65
54 -- 58	1	0.65	9	5.88	5	3.27	6	3.92	3	1.96
59 & above	1	0.65	3	1.96	1	0.65	4	2.61	4	2.61
Total	32	20.91	66	43.14	26	16.99	19	12.42	10	6.54

4.6 Hypertension

Adult blood pressure is classified in accordance with guidelines from JNC8 (the Eighth Report of the Joint National Committee), published by the World Health Organization (2015).

The frequency distributions of different classes of hypertension by age among males and females have been delineated in Tables 4.16 and 4.17. These tables show that in both sexes, hypertension increases with age. In the case of males, out of 168 individuals, there are altogether 65 (38.69%) cases of hypertension. The 59 and older age group has the highest frequency of isolated systolic hypertension cases (2.38%). In the age group of 24-28 years, there are 2.98% stage 1 and in the age group of 34-38 years, there are 2.38% stage 2 hypertension cases. Surprisingly, there are also 1.79% of individuals in the 24–28-year age group who are suffering from isolated systolic hypertension. Out of 168 males, there are altogether 65 (38.69%) hypertension cases, out of which 17.26% are suffering from stage 1 hypertension, 11.90% are suffering from stage 2 hypertension, and 9.52% have isolated systolic

hypertension. In the case of stage 1 hypertension, the highest percentage was found in the age group 29-33 years (3.57%), followed by 24-28 years (2.98%), 39-43 years (2.98%), and 44-48 years (2.38%). Out of total stage 2 hypertension cases (11.90%), a remarkable percentage (3.57%) fall in the 44–48-year age range, followed by the in the 44–48-year age range. Another notable feature noticed is that out of total isolated systolic hypertension individuals (9.52%), the 59 and older age group exhibits the highest percentage (2.38%) of isolated systolic hypertension subjects, followed by the age groups of 24-28 years (1.79%), 34-38 years (1.79%), and 49-53 years (1.19%).

On the other hand, in the case of females, Table No. 4.17 shows that out of 153 samples, there are 55 (34.95%) cases of hypertension in total. The age 49–53 and onwards has the highest incidence of hypertension cases. Out of total individuals with hypertension, 55 individuals (35.95%) are suffering from stage 1 hypertension, 12.42% are suffering from stage 2 hypertension, and 6.54% are suffering from isolated systolic hypertension. In cases of stage I hypertension, the highest incidence is found in the 44–48-year age range (3.92%), trailed by 34–38 years (3.27%), and 54–58 years (3.27%). In cases of total stage 2 hypertension in individuals, 12.42% have the highest incidence (3.92%), followed by the age group 49–53 years (3.27%). Out of total no. of isolated systolic hypertension cases (6.54%), age group 59+ years has the highest incidence of isolated systolic hypertension cases (2.61%), followed by age group 54-58 years (1.96%). Each age group (19-23), 39-43, and 49-53) has 0.65% of cases of isolated systolic hypertension.

From a comparison across sexes (Tables 4.16 and 4.17), it can be said that males have a higher percentage of stage I hypertension cases in the total population. But if we examine age groups wise, then the table depicts that females have a higher percentage of stage I hypertension in the age groups of 19–23, 34–38, 49–43, and 54–58 years. In the remaining age groups, males have outnumbered their female counterparts. In respect to stage II hypertension cases, females outnumbered the males. Age group wise distribution shows that older female age groups are more suffering than males. Comparatively, males' percentage of isolated systolic hypertension cases is higher.

Table 4.18. Descriptive Statistic of Systolic Blood Pressure among the studied Munda Male

Age Group in Years	No.	Mean	SD	SE	Max.	Min.
19 –23	21	126.29	13.02	2.84	169	110
24 – 28	19	132.37	13.36	3.06	156	108
29 – 33	25	130.20	12.75	0.71	155	103
34 – 38	28	133.04	25.13	4.75	216	96
39 – 43	17	137.47	20.15	4.89	174	104
44 – 48	21	140.55	22.60	4.82	189	104
49 -- 53	9	133.89	12.70	4.23	150	117
54 -- 58	11	131.45	20.06	6.04	171	97
59 & above	16	136.94	19.10	4.77	176	110
Total	168	133.44	18.73	1.44	216	96

Table 4.19. Descriptive Statistic of Systolic Blood Pressure among the studied Munda Female

Age Group in Years	No.	Mean	Standard Deviation (SD)	Standard Error (SE)	Max.	Min.
19 –23	35	125.71	12.31	2.08	159	99
24 – 28	22	122.91	10.47	2.23	147	103
29 – 33	16	124.00	14.38	3.59	156	108
34 – 38	9	127.56	7.37	2.45	138	116
39 – 43	11	128.18	13.40	4.04	146	108
44 – 48	11	127.18	15.70	4.53	161	109
49 -- 53	12	136.50	22.96	6.63	169	103
54 -- 58	24	144.13	20.41	4.16	199	118
59 & Above	13	147.23	18.46	5.11	168	105
Total	153	132.88	21.28	1.27	199	99

4.6.1 Blood pressure

"Blood pressure is a dynamic physiological function that varies with each heart beat" (James and Baker, 1995). "Blood pressure is the sum of the output of the heart and the resistance of the blood vessels to flow throughout the body" (Lifdton, 1996). The circulatory system is impacted by a variety of physiological processes, polymorphic proteins, and vasoactive hormones to maintain blood flow and the genesis of tissues and cells. Variations in blood pressure from one moment to the next depend on how these factors interact at each specific moment. The two different types of blood pressure are systolic blood pressure and diastolic blood pressure.

4.6.2 Systolic Blood Pressure (SPB)

The average, SD, and SE, along with the max. and min. value for systolic blood pressure among males according to age groups in Sadarpara (Lahiripur) among the Munda, are presented in Table No.4.19. This table clearly shows that in the case of males, the SBP gradually increases with advancement of age from 126.29 mm Hg (19-23 years age group) to 140.55 mm Hg (44-48 years age group), thereafter; it decreases gradually (131.45 mm Hg) up to the age group 54-58 years.

SBP increases again in the concluding age group, i.e., in the 59 and above years. However, the total change in SBP for males is 14.26 mm Hg. The average SBP among males in the Lahiripur Gram Panchayat is 133.44 mm Hg 18.73, which falls incidentally into the pre-hypertension class for this trait, and it varies from 96 mm Hg (34–38year age group) to 216 mm Hg (34–38 year age group). Intriguingly, maximum and minimum values were found in the same age group. Maximum deviation from the mean value was noticed in age group 34–38 years (25.13 mm Hg), followed by age group 44–48 years (22.60 mm Hg), and 39–43 years (20.15 mm Hg). On the other hand, in the case of females, Table No. 4.19 clearly delineates that the SBP also gradually increases with advancing age, from 122.91 mmHg (for the 24–28year age group) to 147.23 mmHg (for the 59+ year age group). Here, the total change in SBP for females is 24.32 mm Hg. A fact deserving of consideration is that inter-age group changes are very high in this area. The average SBP among females is 132.88 mm Hg (21.28), which also displays remarkable pre-hypertension class for this trait and it varies from 99 to 199 mm Hg. In females, the age range of 19–23 years had the lowest value while the age range of 54–58 years showed the greatest value. Maximum deviation from the mean value was noticed in the age group 49–53 years (22.96 mm Hg), followed by the age group 54–58 years (20.41 mm

Hg). Comparison across sexes shows that males have higher mean values at all age groups up to the age group of 44–48 years and thereafter a reverse trend is observed. It indicates that females have higher mean values in older age groups.

Table 4.20. Descriptive Statistics of Diastolic Blood Pressure among the studied Munda Male

Age Group in Years	No.	Mean	Standard Deviation SD	Standard Error SE	Max.	Min.
19 –23	21	77.14	10.31	2.25	109	63
24 – 28	19	84.04	9.64	2.11	101	67
29 – 33	25	83.80	9.39	1.88	109	68
34 – 38	28	84.18	11.52	2.18	114	65
39 – 43	17	88.53	13.97	3.39	121	68
44 – 48	21	87.82	13.05	2.78	108	67
49 -- 53	9	78.00	9.92	3.30	96	63
54 -- 58	11	84.36	15.62	4.70	118	58
59 & above	16	83.25	12.16	3.04	107	64
Total	167	83.74	11.89	0.92	121	58

Table 4.21. Descriptive Statistic of Diastolic Blood Pressure among the studied Munda Female

Age Group in Years	No.	Mean	Standard Deviation SD	Standard Error SE	Max.	Min.
19 –23	35	80.86	8.20	1.39	98	60
24 – 28	22	82.00	8.97	1.91	105	68
29 – 33	16	82.56	9.26	2.31	100	69
34 – 38	9	86.67	5.61	1.87	93	77
39 – 43	11	83.09	11.81	2.92	102	64
44 – 48	11	84.09	11.48	3.46	109	70
49 -- 53	12	90.25	13.96	4.03	121	73
54 -- 58	24	87.92	11.44	2.75	119	74
59 & Above	13	87.62	12.63	3.50	122	69
Total	153	84.35	10.52	0.85	122	60

4.6.3 Diastolic Blood Pressure (DBP)

The average, S.D., and S.E., along with the maxi. and mini. value for diastolic blood pressure among males and females according to age groups, are depicted in the previous table. This table 4.20 clearly shows that a clear-cut increase in DBP levels is observed with increase in age from 77.14 mm Hg (19-23 years) to 88.53 mm Hg (39-43 years), with an exception slightly in the 29-33year age group; thereafter, it decreases (72.32 mm Hg) gradually till the age range of 49 to 53 years; again, it increases in the next age group (54-58 years); finally, a slight decrease is observed in the 59 and above years age group among males. However, the total change in DBP for males is 11.39 mm Hg. The average DBP among males of the Munda is 83.74 mm Hg11.89, which exhibits eventually nearer to the accepted standard of 80 mm Hg for this trait, and it varies from 58 to 121 mm Hg. The age category of 39 to 43 years had the highest value, and the age category of 54 to 58 years had the lowest value. Maximum deviation from the mean value was noticed in the age group 54–58 years (15.62 mm Hg), followed by the age group 39–43 years (13.97 mm Hg). On the other hand, in the case of females, table no. 15 shows that DBP also increases with advancing age, gradually, from 80.86 mm Hg (19-23 years) to show a maximum value (90.25 mm Hg) at the age group 49–43 years, and thereafter, it decreases (87.92 mm Hg) at the age group 54–58 years and (87.62 mm Hg) at the age group 59 and above (5 years). However, the total change in DBP for females is 9.39 mm Hg. The average DBP among female Munda is 84.35 mm Hg 10.52, and surprisingly, it also falls above the accepted standard of 80 mm Hg for this trait. It varies from 60 mm Hg to 122 mm Hg. In females, the age category (19-23 years) had the lowest value and the age category 59 years and older had the highest value. Maximum deviation from the mean value was noticed in the age group 49–53 years (13.96 mm Hg), followed by the age group 59+ years (12.63 mm Hg). A comparison of male and female series data shows that females have higher mean values than the males at age groups (19-23 years) and (34-38 years), then from (49-53 years), (54-58 years), and finally at the (59 and above years) age group. In the remaining age groups, males have higher mean values than females.

Table 4.22. Classification of hemoglobin level among studied Munda communities as per WHO, 2017 guide-line

Female				Male		
Female >15 years		No.	%	Male >15 years	No.	%
Non-anemia	≥12 gm/dl	68	44.44	≥13 gm/dl gm/dl	119	71.69
Mild anemia	11.0 -11.9 gm/dl	27	17.65	11-12.9 gm/dl	32	19.28
Moderate anemia	8.0 -10.9 gm/dl	56	36.60	8.0 -10.9 gm/dl	15	9.03
Severe anemia	<8 gm/dl	2	1.31	<8 gm/dl	0	0
Total		153	100.00	Total	166	100.00

4.7 Hemoglobin content

Hemoglobin content is one of the most important physiological variables. Hemoglobin carries and supplies oxygen to our cells and thus keeps us alive because without oxygen we cannot survive. So, it is very important to know the contents of hemoglobin in our populations living in various ecological zones of our country. Age, sex, altitude, pregnancy, and disease may have an impact on the hemoglobin values. The present study aims to assess the anemic status of the Munda community, which resides in Lahiripur Gram Panchayat, district of West Bengal.

4.7.1 Assessment of Anemic Status

The World Health Organization defines anemia as a hemoglobin level that is less than 13 gm/dl in males over the age of 15, below 12 gm/dl in non-pregnant women over the age of 15, and below 11 gm/dl in pregnant women (WHO, 2017). The prevalence of anemia among the Munda community is estimated using the reference standards recommended by the World Health Organization (2017). WHO recommended the following criteria (Table 4.22) for the estimation of anemia in individuals based on their hemoglobin level (g/dl).

4.7.2 Prevalence of anemia

Based on the 2017 WHO classification, Table 4.22 shows the number of men and women in the Munda community who have anemia by sex. The Munda people are found to have anemia at a rate of 41.38 percent of the total population. Females showed a higher prevalence of anemia (55.56%) as compared to males (28.31%).

Table 4.22 also shows the percentages of both men and women in the Munda community who have severe anemia. It can be seen from the table that, out of 41.38% of anemic cases, the majority of males and females suffer from mild or moderate anemia. Only two individuals (1.31%) among the women have severe anemia. Severe anemia cases have not been recorded among the male series data. It is further evident from the table that, among females, 55.56% are suffering from anemia. Within these anemic females, 36.60% fell under the category of moderate anemia, whereas 17.65% fell under the category of mild anemia. In the case of male Munda, out of a total of 166 males, 28.31% were found to be anemic. Out of which, 19.28% of males suffer from mild anemia, while 9.03% belong to the category of moderate anemia. Thus, the Munda community represents 71.69% and 44.44% of males and females, respectively, under the category of non-anemia**.**

But when compared to the national data (NFSH-4, 2016), both male and female Munda are less healthy. According to national data, urban women had a somewhat lower likelihood of being anemic (51% vs. 54%) than those who live in rural areas. Men are more likely to have anemia in rural areas (25%) than in urban ones (19%). Additionally, women are more likely to have anemia in Jharkhand, Haryana, West Bengal, Bihar, and Andhra Pradesh than they are in Mizoram (25%), Manipur (26%), Nagaland (28%), and Goa (31%), where the prevalence is less than one-third. Extremely high anemia rates can be seen in the union territories of Dadra and Nagar Haveli (80%) and the Andaman and Nicobar Islands (66%). Out of a total of 47 males, 28.31% of the male Munda were determined to be anemic.

Table 4.23. Descriptive Statistics for all Morphological Variables among the studied Munda Community

Variable	Men		Women		t-test	p-value	Mean Difference
	X	S D	X	SD			
Weight	49.41	7.34	41.00	6.30	11.04	<0.0001	8.41
Height	160.98	5.18	150.03	4.85	19.56	<0.0001	10.95
MUAC	24.14	2.20	20.80	2.22	13.52	<0.0001	3.34
BMI	19.68	2.33	20.28	2.66	3.25	0.0013	0.60
Waist Circumference	73.37	7.13	69.09	8.28	4.94	<0.0001	4.28
Hip Circumference	82.91	4.92	82.39	5.67	0.87	0.3850	0.52
Calf Circumference	30.30	2.26	27.88	2.33	9.43	<0.0001	2.42
Biceps Skinfold	3.57	0.98	4.88	1.83	-7.88	<0.0001	-1.31
Triceps Skinfold	5.26	1.59	8.05	2.98	-10.32	<0.0001	-2.79
Subscapular Skinfold	8.21	2.84	10.56	3.59	-6.46	<0.0001	-2.35
Suprailiac Skinfold	7.88	4.02	13.39	4.74	-11.18	<0.0001	-5.51
Calf Skinfold	5.49	2.12	7.99	2.94	-8.66	<0.0001	-2.50
Pulse Rate	89.12	15.55	95.64	16.41	-3.65	0.0003	6.52
Body fat	16.38	5.10	11.88	5.30	7.74	<0.0001	4.50
Visceral Fat	3.61	2.55	2.2	1.76	5.81	<0.0001	1.41
Skeletal Muscle	38.49	2.99	39.62	2.95	-3.41	0.0007	-1.13
Resting Metabolism	1322.51	94.06	1258.29	77.06	6.71	<0.0001	64.22

*$p < 0.05$

In Table 4.23, the descriptive statistics for all morphological and physiological variables among the Munda Community of West Bengal are summarized by gender. It is evident from the table that the mean BMI value is normal among males, while among females in the Munda community, the mean BMI value is lower than the standard range (18.5–24.9 kg/m^2), indicating 100 percent CED Grade 1 malnutrition. However, mean values of physiological variables are incidentally nearer the accepted standard in respect of male members, whereas in the case of females, the mean values of physiological variables are slightly lower than the accepted standard of their respective parameters, except skeletal muscle. The mean differences of all variables have been calculated and presented in the table. Table suggests that in respect of all skinfold thickness and skeletal muscle, females surpass their male counterparts. Therefore, except for all skinfold thickness and skeletal muscle, males have outdone their female counterparts in the mean values of the remaining parameters. The t - test was used to determine whether differences between two mean values (men and women) were statistically significant. Statistics show that the gender differences between the two groups'

mean values for the majority of the parameters are significant (p 0.0001). There are no statistically significant sex differences in mean skeletal muscle.

Table 4.24. Correlation coefficient of Pearson (r) between Body Mass Index and other morphological and physiological variables among both gender of the studied Munda Community

Variables	BMI	
	Male (168)	Female (153)
	r (p-value)	r (p-value)
Age	0.025 (0.747704)	-0.030 (.712784)
Weight	0.900(<.00001)	0.840(<.00001)
Height	0.164(.033652)	-0.021 (.796674)
Mid-Upper Arm circumference	0.819 (<.00001)	0.798 (<.00001)
Waist Circumference	0.872 (<.00001)	0.711 (<.00001)
Hip Circumference	0.849 (<.00001)	0.827 (<.00001)
Calf Circumference	0.835 (<.00001)	0.824 (<.00001)
Biceps Skinfold Thickness	0.505 (<.00001)	0.663 (<.00001)
Triceps Skinfold Thickness	0.592 (<.00001)	0.704 (<.00001)
Subscapular Skinfold Thickness	0.629 (<.00001)	0.768 (<.00001)
Suprailiac Skinfold Thickness	0.700 (<.00001)	0.645 (<.00001)
Calf Skinfold Thickness	0.534 (<.00001)	0.590 (<.00001)
Body Fat	0.837 (<.00001)	0.826 (<.00001)
Visceral Fat	0.878 (<.00001)	0.833 (<.00001)
Skeletal Muscle	-0.678 (<.00001)	-0.630 (<.00001)
Resting Metabolism	0.880 (<.00001)	0.834 (<.00001)
Pulse Rate	0.003(0.969214)	-0.204 (.011429)

*p < 0.05, **< 0.01

To evaluate body mass index in relation to age, body morphological, and physiological variables, an analysis of age and body mass index are correlated by Pearson's coefficient (r). and selected body morphological and physiological variables have been done separately and are displayed in Table 4.24 among both sexes of the Munda Community, West Bengal. The correlation coefficient (r) calculations have been performed separately by sex, as well, as shown in the table. Body morphology and physiology included weight, height, body fat,

visceral fat, skeletal muscle, resting metabolism, waist circumference, hip circumference, mid-upper arm circumference, calf circumference, pulse rate, and skin fold thickness (biceps, triceps, calf, subscapular, supra-iliac). Here, p-values have been calculated and displayed in the table. It is evident from the table that significant effects of morphological and physiological variables clearly exist on body mass index for both sexes, obviously, with some exceptions, i.e., age, height, and pulse rate. Here, age, height, and pulse rate are *not* significant at the p .05 level. Therefore, it can be stated that except for age, height, and pulse rate, all the selected body morphological and physiological variables are directly or significantly associated with body mass index to create co-morbidities. This should be a cause for concern for future research. However, there was an inverse but highly significant relationship between skeletal muscle and BMI (r = -0.678** for men and r = -0.630** for women) in both genders. In males, weight showed the highest correlation with BMI (r =Anthropological, and physiological variables, an analysis of Pearson's correlation coefficient (r) between body mass index and age and selected body morphological and physiological variables have been done separately and are displayed in Table 20 among both sexes of the Munda Community, West Bengal. The correlation coefficient (r) calculations have been performed separately by sex, as well, as shown in the table. Body morphology and physiology included weight, height, body fat, visceral fat, skeletal muscle, resting metabolism, waist circumference, hip circumference, mid-upper arm circumference, calf circumference, pulse rate, and skin fold thickness (biceps, triceps, calf, subscapular, supra-iliac). Here, p-values have been calculated and displayed in the table. It is evident from the table that significant effects of morphological and physiological variables clearly exist on body mass index for both sexes, obviously, with some exceptions, i.e., age, height, and pulse rate. Here, age, height, and pulse rate are not significant at the p .05 level. Therefore, it can be stated that except for age, height, and pulse rate, all the selected body morphological and physiological variables are directly or significantly associated with body mass index to create co-morbidities. This should be a cause for concern for future research. However, there was an inverse but highly significant relationship between skeletal muscle and BMI (r = -0.678** for males and r = -0.630** for females) in both genders. In males, weight showed the highest correlation with BMI (r =.90**), followed by resting metabolism (r =.880**), visceral fat (r =.878**), waist circumference (r =.872**), hip circumference (r =.849**), and so on. However, age, height, and pulse rate do not show any significant relation with BMI in males. While, among females, weight (r = 0.840**) shows the highest correlation with BMI, followed by resting metabolism (r =.834**), visceral fat (r =.833**), hip circumference (r = 0.827**), and so on. However, age, height, and pulse rate do not show any significant relation with BMI in females either.

Table 4.25. Correlation Coefficient of Pearson (r) between blood pressure and other Variables among both gender of the studied Munda Community

Variables	Male (No. = 168)		Female (No. = 153)	
	SBP	DBP	SBP	DBP
Age	0.17	0.11	0.47	0.28
Weight	0.15	0.09	-0.09	-0.11
Height	-0.06	-0.08	-0.28	-0.16
MUAC	0.16	0.05	0.04	0.01
Waist Circumference	0.31	0.25	0.10	0.08
Calf Circumference	0.10	0.03	0.00	-0.01
Hip Circumference	0.19	0.12	0.00	-0.02
Biceps Skinfold Thickness	0.14	0.06	-0.01	0.02
Triceps Skinfold Thickness	0.12	0.09	0.07	0.02
Sub-scapular Skinfold Thickness	0.23	0.12	0.03	0.04
Supra iliac Skinfold Thickness	0.18	0.15	0.14	0.07
Calf Skinfold Thickness	0.00	-0.01	-0.04	-0.06
Pulse rate	0.18	0.25	0.09	0.31
Body fat (%)	0.08	0.04	-0.11	-0.11
Visceral Fat	0.14	0.10	-0.08	-0.03
MUSCLE	-0.18	-0.15	0.02	-0.07
Resting metabolism	0.14	0.09	-0.10	-0.06
BMI	0.22	0.16	0.02	-0.03

To evaluate blood pressure in relation to age, body morphological and physiological variables, and to analyze Pearson's correlation coefficient (r) between blood pressure and age, blood pressure and selected body morphological and physiological variables have been done separately and are displayed in Table 4.25 among both sexes of the Munda Community, West Bengal. The correlation coefficient (r) calculations have been performed separately by sex, as well, as shown in the table. Body morphology and physiology included weight, height, body fat, visceral fat, skeletal muscle, resting metabolism, waist circumference, hip circumference, mid-upper arm circumference, calf circumference, pulse rate, and skin fold thickness (biceps, triceps, calf, subscapular, supra-iliac).

It is evident from the table that a significant effect of age exists on SBP and DBP for both sexes (Male: for SBP, r = 0.17; for DBP, r = 0.11; Female: for SBP, r = 0.47; for DBP, r = 0.28).

A significant effect of weight (Male: for SBP, r = 0.15), waist circumference (Male: for SBP, r = 0.31; for DBP, r = 0.25; Female: for SBP, r = 0.10), hip circumference (Male: for SBP, r = 0.19; for DBP, r = 0.12), mid-upper arm circumference (Male: for SBP, r = 0.16), calf Circumference (Male: for SBP, r = 0.10), supra iliac skinfold thickness (Male: for SBP, r = 0.18; for DBP, r = 0.15; Female: for SBP, r = 0.14), pulse rate (Male: for SBP, r = 0.18; for DBP, r = 0.Furthermore, BMI also has an effect on SBP in males only (r = 0.22). As a result, age, weight, waist circumference, hip circumference, mid-upper arm circumference, calf circumferences, suprailiac skinfold thickness, pulse rate, visceral fat, BMI, and resting metabolism are found to have a substantial relationship with blood pressure. Other morphological variables showed either a negative correlation or a low positive correlation.

4.8 Important aspects related to Nutrition

Nutrition also indirectly related to some other important phenomena which tables and discussion are mentioned below.

4.8.1 Family-size

Table 4.26. Frequency Distribution of family-size of the Munda Community (N=110)

Various type of Family Size	Frequency (N)	Percentage (%)
Small (1 – 4)	59	53.64
Medium (5 – 9)	50	45.45
Large (10 – 14)	1	0.91
Very Large 15+	0	0.00
Total	110	100.00

A small family size means the family contains one to four family members. Similarly, a medium family contains five to nine family members. Rest others are followed like this.

This table revealed that 53.64% of the Munda community has a small family size. The remaining 45.45% and 0.91% of Munda people have medium and large family sizes, respectively. Distribution of daily cooked foods depends on family members and gender as well.

4.8.2 House-Type

Table 4.27. Frequency Distribution of Type of Houses in the Munda Community (N=110)

House Type	Frequency (N)	Percentage (%)
Kachha	80	72.73
Semi-pucca	21	19.09
Pucca	5	4.54
Others (Tents, Temporary Sheds.)	4	3.64
Total	110	100.00

This table revealed that 72.73% of the Munda community is living in Kachha houses. The remaining 19.09% and 4.54% of people are living in the semi-pucca and pucca houses, respectively. The financial condition of the community is not so good. Most of the houses are not so clean and in hygienic conditions.

4.8.3 Access to sanitation

Table 4.28. Availability of Bath room facility in the households of Munda community

Bathroom facility	Frequency	Percentage (%)
Within the house	2	1.82
Within the premises	28	25.45
No Bathroom facility	80	72.73
Total	110	100.00

The bathroom facility is not available in 80 (72.73%) households. They use the field for defecation purposes. A bathroom facility within the premises is present in 28 (25.45%) households. There were fewer bathroom facilities observed within the house due to their economic backwardness.

4.8.4 Access to drinking water facilities

Table 4.29. Source of drinking water in the households of Munda community

Drinking Water Source		Frequency	Percentage (%)
Improved Source	Piped water of dwelling/yard/plot	38	34.54
	Public tap/standpipe	0	0
	Tube well or borehole	72	65.45
Unimproved Source	Surface water	0	0
	Unprotected dug well	0	0

Drinking Water Source		Frequency	Percentage (%)
	Unprotected spring	0	0
	Tanker truck	0	0
	Total	110	100.00

The number of households using government tube-wells as a source of drinking water is 72 (65.45%). The remaining 38 (34.54%) households use piped water.

Table 4.30. Mode of Drinking in the households of Munda community

Mode of Drinking Water	Frequency	Percentage (%)
Boil	0	0
Use ceramic, sand, or other water filter	0	0
Electronic purifier	0	0
No treatment/ any other specify	110	100.00
Total	110	100.00

There was no treatment done to the mode of drinking water by the households in the Munda community.

4.8.5 Education

Education is an important element for every nation, which not only pushes forward an individual but also has a collective benefit for the whole society or nation. Previously, they were almost illiterate. Today, they are attending school and colleges. They are one of the most deprived communities in South 24 Parganas. Both boys and girls attend school. Five male candidates have completed the graduate degree course. Another four male and four female candidates are doing their undergrad course. One completed a basic teacher's training and works as a primary school teacher; another member of the family took training at the Industrial Training Institute and works as an electrician. They cannot access books and other facilities, such as libraries and computer facilities, since there are none in the village. Compared to boys, girls have less access to education. Sexual discrimination and exploitation were not found in the community. Most of the families in the Munda community spend their money on food and festivals, compared to education and health.

Sarva Shiksha Abhiyan has been implemented to meet the goal of Education for All, which focuses on providing the availability of infrastructure, classrooms, teachers, separate

toilets for boys and girls, and so on. Children in the community get the facility of a mid-day meal program. Anganwadi Kendra provides nutrition and health education to pregnant mothers. Some families get education scholarships from state governments once every two years.

Table 4.31. Educational status of Munda Community

Educational status		Gender		Total(N=478)
		Male	Female	
Not going to School	f	15	25	40
	%	3.13	5.23	8.36
Non literate	f	31	126	157
	%	6.48	26.35	32.84
Literate without educational level	f	0	0	0
	%	0	0	0
Below Primary	f	4	3	7
	%	0.83	0.62	1.46
Primary Class 1-5	f	96	44	140
	%	20.08	9.20	29.28
Middle Class 6-8	f	63	27	90
	%	13.18	5.65	18.82
Matriculation/Secondary Class 9-10	f	18	8	26
	%	3.76	1.67	5.43
Higher Secondary Class 11-12	f	9	3	12
		1.88	0.63	2.51
Non-technical diploma or certificate not equal to degree	f	0	0	0
	%	0	0	0
Technical diploma or certificate not equal to degree	f	1	0	1
	%	0.21	0	0.21
Graduation and above	f	5	0	5
	%	1.05	0	1.05
Total	f	241	237	478
	%	50.41	49.58	100.00

This table depicts the educational status of the Munda community. It shows that the maximum number of male and female individuals passed the primary level (Class I–V). The educational status of male and female individuals in the category of secondary level is 3.76% and 1.67%, respectively. The total percentage of the higher secondary level of male and female individuals' education in the studied community is 2.51. There were no technical or non-technical diploma holders in the study. According to the census of 2021, the male literacy rate in rural South 24 Parganas is 79.27%, and the female literacy rate in rural areas is 61.54%. Therefore, the findings of our study suggest that the male and female literacy rates in the community are in very poor condition.

4.8.6 Livelihood and Economic status

The livelihood is defined as the way that you earn the money. A key theory of sustainable development is meeting the unmet employment needs of people. The problem is more severe in rural area. The scope of employment in agriculture sector catering to majority of population is diminishing. A large part of rural population is not formally educated. Thus, lack of skills for conventional job market.

Table 4.32. Primary Occupational status of the Munda Community

	Occupational Diversity		Gender		Total(N=468)
			Male	Female	
Self Employed	Agriculture	f	3	0	3
		%	1.24	0	1.24
Casual Labour / Daily Wage	Agriculture and other labour work	f	92	81	173
		%	38.17	34.18	36.19
Regular Wage / Salary Earning	State Government Service Group A	f	0	0	0
		%	0	0	0
	State Government Service Group B	f	1	0	1
		%	0.41	0	0.21
	State Government Service Group C	f	0	0	0
		%	0	0	0
	Central Government Service Group A	f	0	0	0
		%	0	0	0
	Central Government Service Group B	f	0	0	0
		%	0	0	0
	Central Government Service Group C	f	0	0	0
		%	0	0	0
	House wife	f	0	41	41
		%	0	17.30	8.58
Other Occupation (Fishing)		f	72	31	103
		%	29.88	13.08	21.55
Not Working		f	73	84	157
		%	30.29	35.44	32.85
Total		f	241	237	478
		%	100.00	100.00	100.00

The table depicts the primary occupational status of the Munda community. The primary occupations of the community are labour work, agricultural labour work, and fishing. One male individual is engaged in the teaching profession, and one female individual is in electrical work.

(Section - B

Dietary Habits and Intakes

4.9. Dietary Habits and Intakes

4.9.1 Food Security of the Munda Community

Food security refers to whether or not staple foods (such as rice and wheat) and other foods such as potatoes and pulses are sufficient for the entire year.

Table 4.33. Degree of self-sufficiency of staple food (paddy) in terms of annual production by households (N=110) in percent

Staple food (Rice) production around the year				
Ten months and above	Seven to nine months	Four to six months	One to three months	Less than one-month
6.8	3.8	26.1	24.8	38.5

*N= Total number of households

Food security is defined as the sufficiency of the staple food (Cereal food items as for example rice, wheat) and others food like potatoes, pulses for the whole year. It can be seen from Table 4.33 that more than 38.5 percent of the Munda households having less than one-month food sufficiency i.e., they fall in the category of not producing at all. However, one fourth of the Munda households have 1-3- or 4-6-months food sufficiency. Near about four percent (3.8%) of the Munda households have 7-9 months food sufficiency and 6.8 percent of the households have ten and above months food sufficiency.

This situation is presented graphically in Figure 5.1.

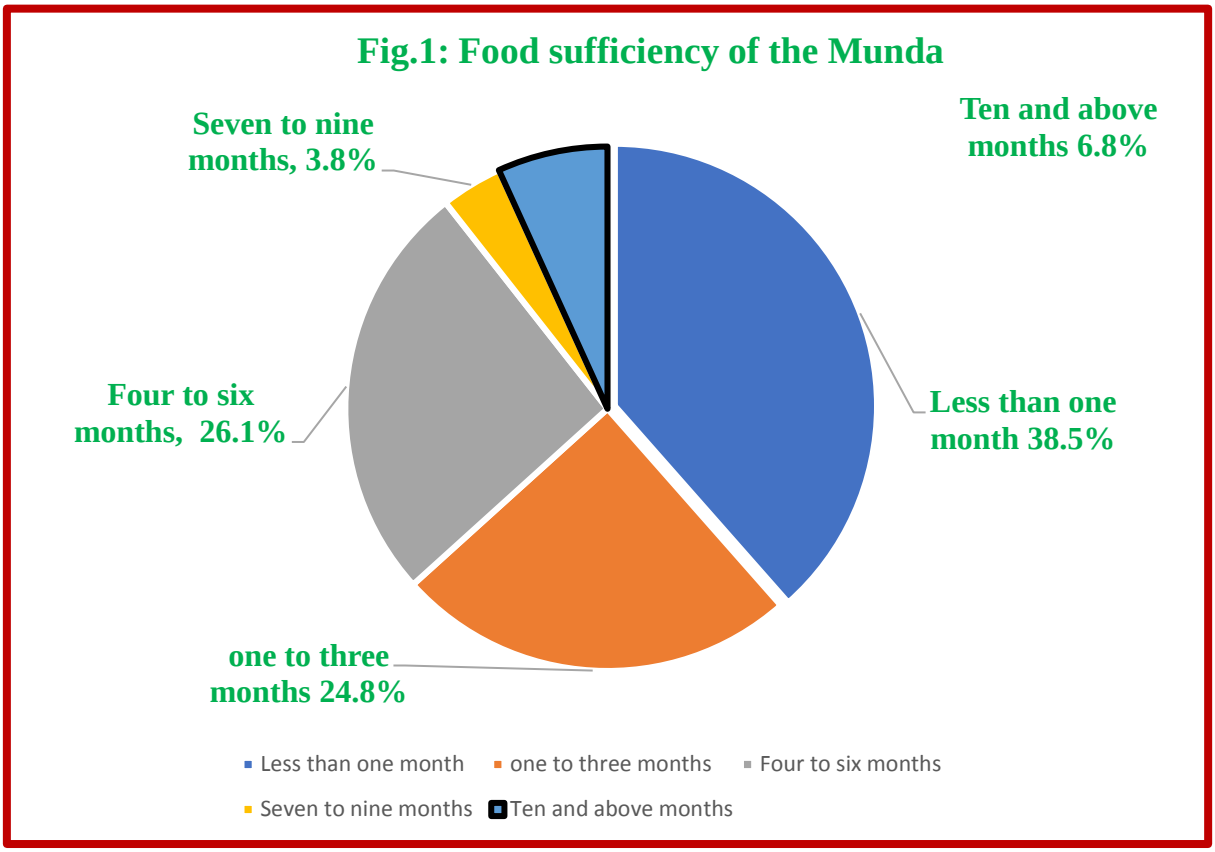


Figure 4.4 Food Sufficiency of the Munda Community

4.9.2 Dietary Habits

The staple food is rice for all the communities in the Sundarban. However, they are also habituated to eating wheat, which they receive from various agencies (both government and non-government) in exchange for their labour under the Food for Work programs. There are a few households where both rice and wheat are consumed as staple foods. Due to their underprivileged financial condition, the Mundas are unable to buy pulses regularly, and as such, this item is consumed occasionally.

They consume regularly common local seasonal vegetables that are readily available either from their kitchen garden or from the market at a cheaper rate. They usually consume pumpkin, brinjal, cauliflower, ladies' finger, different leguminous vegetables like beans and peas, and leafy vegetables like sweet and sour varieties of spinach, cabbages, etc. Fish, mainly the small ones, are consumed only on festive occasions. Sometimes, they take eggs as a substitute for fish. Milk is almost absent from their diet. The different food items other than the staple foods have been grouped into four categories, such as pulses, vegetables, including leafy

vegetables, fish, meat, eggs, and milk, which gives us a better insight about the intake of these food items.

This table contains information with regard to the mood of variation in the consumption of food items in the households under study. It appears that vegetables, including leafy vegetables and animal proteins like fish, are taken regularly by a large majority of households under study. Pulses are consumed occasionally by more than 75 percent of the households, and milk appeared to be the most ignored food item.

Table 4.34. The percentage distribution of households in different food groups consumption classes, except cereal food (N=No. of households = 110).

Food groups	Eating regularly (At least 3 days in a week)	Eating frequently once in a week	Eating occasionally often once or twice in a month or never
Pulses	5.60	19.90	74.50
Vegetables including leafy vegetables	94.50	5.50	--
Fish and Egg (occasionally)	84.50	15.50	--
Milk	1.20	3.10	95.70
Sweets	--	14.77	85.23
Fruits	--	20.50	79.50
Handia/Desi Alcohol	67.98	32.02	--

As stated earlier, rice was the staple food, and they primarily consumed boiled rice. Rice is boiled in water, and excess water is drained off. The stained rice water is used as food for the domestic animals. Rice is usually taken with curry, which is prepared out of fish as well as vegetables. Fish, mostly small, is fried in a small amount of oil (rapeseed or mustard) and sometimes with vegetables. Common condiments like turmeric, chilies, salt, cumin, ginger, and coriander are used daily for the preparation of dishes. On festive occasions, delicious dishes are prepared, depending upon the economic condition, using condiments like cardamom, clove, onion, and garlic. Pulses are prepared as a soup. Some households sun dried small fish and consumed them during the lean season. Handmade bread (chapati) is prepared from wheat flour. In the event of a severe fuel shortage, small doughs of wheat flour are boiled with rice. These doughs are consumed separately during subsequent meal times. It saves a considerable

quantity of fuel that is necessary for the preparation of chapati. Chapatis are usually taken with vegetable curry, fish curry, jaggery, sugar, and, in occasional cases, pulses.

In extreme cases of poverty, chapatis are their only meal item, with handmade pickles or achar. In events like weddings, rice, mutton curry, vegetable curry, and sometimes pulses are prepared. It is said that pork was used on one such occasion. Handia (homemade rice beverage) is an essential item for festive and ceremonial occasions. But in recent days, the younger generation is said to have developed a dislike for drinking due to preparation in unhygienic conditions. Almost all people over the age of forty are habitual drinkers, and the frequency and quantity of their drinking are primarily determined by their financial situation.

Below the table, researcher get an idea about the consumption of different food groups (mean in grammes) in the surveyed households (N = 45) in two different seasons, viz., preharvest and postharvest.

Table 4.35. Different food groups (mean in gram) consumed by Munda peoples are expressed in terms of per capita consumption as well as per capita unit during the pre-harvest and post-harvest seasons.

	Seasons	Pre-harvest		Post-harvest	
Food groups Consumed in gm	Expressed in	Per consumption unit per Capita	Per Capita	Per consumption unit per Capita	Per Capita
	Cereal mainly rice & wheat	576.4	464.5	642.5	509.9
	Pulses	5.6	4.4	7.6	6.0
	Leafy vegetables	23.5	19.0	44.4	34.0
	Other vegetables	69.6	56.0	67.4	54.0
	Roots & Tubers	96.9	78.8	98.1	77.8
	Milk & Milk-product	1.6.	1.4	1.8	1.6
	Fish and Egg	54.3	43.4	43.5	34.4
	Oil and Fat	7.4	6.0	6.0	4.9

It appears that there is a reduction of about 10 percent (10%) in the consumption of cereal food during the pre-harvest season compared to the post-harvest season. Similarly, consumption of leafy vegetables in the post-harvest season is noticeably high. There is no significant seasonal change in the food consumed, like dal (pulses), leafy vegetables, non-leafy vegetables, roots, and tubers (mainly potato and onion). The intake of animal proteins such as fish (mainly small), meat, and eggs is comparatively high in the pre-harvest season. The use of oils and fats also appeared to be higher during the preharvest season.

The low consumption of staple diet during the pre-harvest season is the result of inadequacy of stored staple food as well as comparatively high market prices, which compel people to seek an alternative diet that can be easily procured from the market with the limited resources they have. The post-harvest period provides the people with varieties of leafy vegetables like spinach, cabbage, lettuce, etc., which are produced abundantly in the surveyed area and whose market price is within their reach. This is precisely the reason for the relatively increased consumption of leafy root vegetables in that post-harvest period. The relatively low consumption of leafy vegetables during the preharvest period is to some extent compensated by the relatively higher consumption of fish and meat. A slight increase in oil and fat consumption in the pre-harvest period also reduces the margin of differences in terms of calorie intake.

The seasonal variation in the consumption of food items has an eventual effect on calorie intake. An idea of calorie intake provides a baseline for understanding the nutritional status of a population. The data has therefore been analyzed separately for each season to get an idea of seasonal variation in calorie intake and is presented in the earlier table. It shows that there is about a ten percent decrease in calorie intake in the preharvest season compared to the postharvest season. This corresponds to the variation in consumption of staple foods. Cereals, mainly rice, being the staple food of the several communities of the Sundarban, are the basic source of calories and to a great extent of protein. The lower intake of cereal during the preharvest season has resulted in a 10% decrease in total protein intake. The slight increase in animal protein intake is due to an increase in fish consumption during the preharvest season.

Calcium intake is found to be higher during the preharvest period, which is due to increased consumption of fish. The consumption of vitamin A during the pre-harvest season was much higher than that of the post-harvest season. Such an increase in vitamin A intake during the preharvest season is the result of the consumption of a considerable quantity of pumpkin, which was a major food item for the people of this area during the scarcity period. A

high standard deviation also indicates a greater degree of variation in vitamin A intake among households.

Other than animal protein, fat, and vitamin A, the consumption of other nutrients was relatively low in the preharvest season. The data indicate considerable seasonal variation in terms of vitamin C consumption. This vitamin was found to be consumed in more than double the quantity at the post-harvest time of year than at the pre-harvest time. This was due to the easy availability of various leafy and non-leafy vegetables such as spinach, tomatoes, drumsticks, etc., which are the main source of vitamin C. During the post-harvest season, these vegetables are produced in plenty in this area and are available at a cheaper rate. These part, there are other essential nutrients such as iron, vitamin B_1, vitamin B_2, nicotinic acid which were found to be relatively lower in consumption during preharvest season.

Nutrient intake in terms of quantity:

So far, researcher observed about seasonal variations in foods and nutrient intake in general. This information needs to be examined in relation to the actual requirements of the Munda population under study, considering households as units.

Table 4.36. Mean values of consumption of different nutrients with standard deviation at pre-harvest and post-harvest seasons

Nutrients	Post-harvest unit: Per consumption unit	Per capita	Pre-harvest Per consumption unit	Per capita	Recommended allowance ICMR (1987) per male adult
Calorie	2492 ± 446	1977±419	2266±433	1827±420	2800
Protein (gm) Animal	7.2±6.0	--	9.3±6.5	7.5±5.2	
Protein (gm) Vegetable	54.8±13.1	--	46.3±12.2	37.4±11.0	
Total Protein (gm)	62.0±14.8	49.7±13.0	55.6±14.3	44.9±12.6	55.0
Fat (gm)	12.5±4.7	10.1±4.4	13.6±4.6	11.0±4.0	--
Calcium(mg)	305±147	245±126	403± 238	323±194	400-500
Iron (mg)	40.1± 11.3	31.8±9.6	35.1±10.7	28.3±9.5	24
Vitamin A (microgram)	702±543	555±439	1205±1653	948±1436	3000
VitaminB_1(mg)	1.95±0.50	1.55±0.44	1.60±0.48	1.29±0.43	1.4
Vitamin B_2(mg)	0.80±0.36	0.63±0.30	0.63±0.30	0.51±0.26	1.7

Nutrients	Post-harvest unit: Per consumption unit	Per capita	Pre-harvest Per consumption unit	Per capita	Recommended allowance ICMR (1987) per male adult
Nicotinic acid(mg)	26.9±5.0	21.3±4.6	24.4±4.8	19.7±4.7	19
Vitamin C(mg)	86.6±52.0	69.2±43.8	40.5±24.2	32.5±20.3	40

Table 4.37. Consumption of different nutrients with recommended allowance in pre-harvest season

Nutrients	Pre-harvest						Recommended daily allowance ICMR (1987) per adult
Expressed in different units	Per consumption unit			Per capita			
	Mean	SD	Deficiency or excess of the nutrients (in CU)	Mean	SD	Deficiency or excess of the nutrients (in per capita)	
Net energy (cal)	2266	433	534	1827	420	973	2800
Protein (gm) Animal	9.3	6.5	-	7.5	5.2	-	-
Protein (gm) Vegetable	46.3	12.2	-	37.4	11.0	-	-
Total Protein (gm)	55.6	14.3	*	44.9	12.6	10.1	55.0
Fat (gm)	13.6	4.6	26.4	11.0	4.0	29	40
Calcium(mg)	403	238	97	323	194	177	500
Iron (mg)	35.1	35.1	*	28.3	9.5	*	19.0
Vitamin A Retinol (microgram)	1205	653	*	948	1436	52	1000
Vitamin B_1 Thiamin (mg)	1.60	0.48	0.2	1.29	0.43	1.37	1.8
Vitamin B_2 Riboflavin (mg)	0.63	0.30	1.87	0.51	0.26	1.99	2.5
Vitamin B_3 Nicotinic acid (mg)	24.4	4.8	*	19.7	4.7	*	18
Vitamin C Ascorbic Acid (mg)	40.5	24.2	39.5	32.5	20.3	47.5	80

*Excess consumption in terms of recommended allowance

In Table 4.37 consumption of different nutrients is shown in terms of recommended allowance during pre-harvest season among the Munda. A high level of deficit is noticed for per consumption unit (534 K Cal) and per capita unit (973 K Cal) in terms of net energy (K Cal). Deficit is noticed for per consumption unit for the nutrients like fat (26.4 gm), calcium (97 gm), vitamin B1 (0.2 mg), vitamin B_2 (1.87 mg) and vitamin C (39.5 mg). Side by side, deficit is noticed for per capita unit for the nutrients like total protein (10.1 gm), fat (29gm), calcium (177 gm), vitamin A (52 microgram) vitamin B_1 (1.37 mg), vitamin B_2 (1.99 mg) and vitamin C (47.5 mg). In case of other nutrients excess consumption is noticed in terms of recommended allowance.

In Table 4.38 consumption of different nutrients is shown in terms of recommended allowance during post-harvest season among the Munda. Like pre-harvest season in this season also a high level of deficit is noticed for per consumption unit (308 K Cal) and per capita unit (534 K Cal) in terms of net energy (K Cal). Deficit is noticed for per consumption unit for the nutrients like total protein (3.0 gm), fat (27.5 gm), calcium (195 gm), vitamin A (298 microgram) and vitamin B_2 (1.7 mg). Side by side, deficit is noticed for per capita unit for the nutrients like total protein (5.3 gm), fat (29.9 gm), calcium (255 gm), vitamin A (445 microgram) vitamin B_1 (0.25 mg), vitamin B_2 (1.87 mg) and vitamin C (11 mg). In case of other nutrients excess consumption is noticed in terms of recommended allowance.

Table 4.38. Consumption of different nutrients with recommended allowance in post-harvest season

Nutrients	Post-harvest						Recommended daily allowance ICMR (1987) per adult
Expressed in different units	Per consumption unit			Per capita			
	Mean	SD	Deficiency or excess of the nutrients (in CU)	Mean	SD	Deficiency or excess of the nutrients (per capita)	
Net energy (Kcal)	2492	446	308	1977	419	534	2800
Protein (gm) Animal	7.2	6.0	-	-	-	-	-
Protein (gm) Vegetable	44.8	13.1	-	-	-	-	-
Total Protein (gm)	52.0	14.8	3.0	49.7	13.0	5.3	55.0

Nutrients	Post-harvest						Recommended daily allowance ICMR (1987) per adult
Expressed in different units	Per consumption unit			Per capita			
	Mean	SD	Deficiency or excess of the nutrients (in CU)	Mean	SD	Deficiency or excess of the nutrients (per capita)	
Fat (gm)	12.5	4.7	27.5	10.1	4.4	29.9	40
Calcium(mg)	305	147	195	245	126	255	500
Iron (mg)	40.1	11.3	*	31.8	9.6	*	19.0
Vitamin A Retinol (microgram)	702	543	298	555	439	445	1000
Vitamin B_1 Thiamin (mg)	1.95	0.50	*	1.55	0.44	0.25	1.8
Vitamin B_2 Riboflavin (mg)	0.80	0.36	1.7	0.63	0.30	1.87	2.5
Vitamin B_3 Nicotinic acid (mg)	26.9	5.0	*	21.3	4.6	*	18
Vitamin C Ascorbic Acid (mg)	86.6	52.0	*	69.	43.8	11	80

*Excess consumption in terms of recommended allowance

When the recommended daily allowance and actual consumption of nutrients per consumption unit by the different communities of Eastern India is taken into consideration it is found that the study population Munda shows lesser value than most of the eastern Indian populations (Table 4.39). As this Table is quite self-explanatory it needs no further description.

Table 4.39. Recommended daily allowance and actual consumption of nutrients per consumption unit by the different communities of eastern India

Community	Calorie Cal	Protein (gm)	Fat (gm)	Calcium (mg)	Iron (mg)	Vitamin A mg	Vitamin B_1 mg	Vitamin B_2 mg	Niacin mg	Vitamin C mg	Reference
Pasi	2476	55	29	234	33	423	1.9	0.6	24	57	Chowdhury & Haque, 2009
Brahmakalpit Brahman	2536	66	41	761	44	1130	2.3	1.2	22	45	Haque & Chowdhury, 2009
Bhumihar	3273	89	36	582	43	1086	2.6	1.3	32	70	Chowdhury & Chowdhury, 2009
Gorait	2350	60	14	207	23	1595	1.8	0.9	26	71	Bhattacharya & Chowdhury, 2009
Ghasi	1995	41	9	153	25	1279	1.3	0.4	21	53	Chowdhury & Bhattacharya, 2009
Bauri	2494	55	14	437	33	637	1.9	0.5	27	32	Haque & Samanta, 2009
Kora	2860	62	18	257	35	1049	1.9	0.6	30	70	Samanta & Haque, 2009
Munda	2138	59	19	329	18	837	1.8	0.8	22	39	Haque, Mandal, Bhattacharya,2009
Oraon	2395	62	20	324	17	984	2.0	0.8	24	33	Bhattacharya, Mandal, Haque, 2009
Chasa	2413	54	15	275	19	932	1.8	0.6	27	99	Bhattacharya & Chowdhury, 2009
Pano	2027	42	10	119	8	645	1.3	0.4	21	42	Chowdhury Bhattacharya &, 2009, NSIP: Eastern India.

Community	Calorie Cal	Protein (gm)	Fat (gm)	Calcium (mg)	Iron (mg)	Vitamin A mg	VitaminB_1 mg	VitaminB_2 mg	Niacin mg	Vitamin C mg	Reference
Saora	2742	56	17	204	34	810	1.7	0.5	28	30	S.K. Chowdhury & Chowury,2009
Ganda	2843	58	25	216	35	919	1.7	0.5	27	42	Chowdhury& , Chowdhury,2009
Kuikhond	2322	57	9	728	11	95	1.1	0.6	18	4	Bhattacharya & Haque, 2009
Domo	2419	57	16	440	12	418	1.0	0.7	13	33	M. Haque & Bhattacharya, 2009
Munda (Preharvest)	2266	5.6	13.6	03	35.1	1205	1.60	0.63	24.4	40.5	Present Study
Munda (Post harvest)	2492	62.0	12.5	05	40.1	702	1.95	0.80	26.9	86.6	Present Study
Munda	2486	58	20	351	26	856	1.74	0.98	25	51	Present Study
Recommended Allowance	2875	60	20	400	28	2400	1.4	1.6	18	40	

Table 4.40. Excess of mean values of consumption of different nutrients in consumption unit and per capita unit of Munda community at pre-harvest and post-harvest seasons

Nutrients	Pre-harvest season		Post-harvest unit Season		Recommended allowance ICMR (1987) per male adult
	Per consumption unit	Per capita	Per consumption unit	Per capita	
Net Energy (K.Cal)	534	420	308	534	2800
Total Protein (gm)	*	10.1	3.0	5.3	55.0
Fat (gm)	26.4	29.0	27.5	29.9	
Calcium(mg)	97.0	177.0	195.0	255.0	400-500
Iron (mg)	*	*	*	*	24
Vitamin A Retinol(µgm)	*	52.0	298.0	445.0	3000
VitaminB_1 Thiamine (mg)	0.20	1.37	*	0.25	1.4
VitaminB_2 Riboflavin(mg)	1.87	1.99	1.70	1.87	1.7
Vitamin B_3Nicotinic acid(mg)	*	*	*	*	19
Vitamin C Ascorbic acid(mg)	39.50	47.50	*	11.0	40

*Excess nutrients in corresponding units

Table 4.41. Deficiency of mean values of consumption of different nutrients in consumption unit and per capita unit of Munda community at pre-harvest and post-harvest seasons

Nutrients	Pre-harvest season		Post-harvest unit Season		Recommended allowance ICMR (1987) per male adult
	Per consumption unit	Per capita	Per consumption unit	Per capita	
Net Energy (KCal)	^	^	^	^	2800
Total Protein (gm)	0.6	^	^	^	55
Fat (gm)	^	^	^	^	
Calcium(mg)	^	^	^	^	400-500
Iron (mg)	16.1	9.3	21.1	12.8	24
Vitamin A Retinol(µgm)	205	^	^	^	3000
VitaminB_1 Thiamine (mg)	^	^	0.18	^	1.4
VitaminB_2 Riboflavin(mg)	^	^	^	^	1.7
Vitamin B_3Nicotinic acid(mg)	6.4	1.7	8.9	3.3	19
Vitamin C Ascorbic acid(mg)	^	^	6.6	^	40

^ Deficient nutrients in corresponding units

As those Tables are quite self-explanatory it needs no further description.

4.9.3 Calorie intake

Previous Table 4.35 shows that the mean intake of calories in the post-harvest period is about 2492 calories per consumption unit. This is significantly less than the recommended allowance of 2800 calories for a moderately active 25-year-old man weighing 55 kg (Gopalan et al. 1987). In the preharvest period, calorie intake in Munda community came down to 2266 calories, which is 9 percent less than that of the postharvest season. In general, the Munda community of this area are suffering from a deficiency in calorie intake as compared to the recommended allowances of the ICMR. It is lower by about 19% and 11% during pre-harvest and post-harvest times of the year, respectively. The mean body weight of the several communities during the period of sufficiency, i.e., the post-harvest season, was 52 kg, and the average height for males was 1613 mm.

The calorie need of an individual is estimated by the formula (Calorie=152×W× 0.33), where W is the body weight (FAO, 1957). The calorie needs of an adult normal male having 55 kg of body weight are 2800 calories (Gopalan et al. 1987), which closely approximate the same when estimated by the formula recommended by the FAO. Because the average body weight of the various communities under study is 52 kg, the need is approximately 2720 calories as calculated by the aforementioned formula (FAO,1957). But the question now is whether the 52 kg average body weight of the Munda community can be considered a standard even when they are subjected to varying degrees of stress and strain. This issue becomes pertinent when we examine the data on other populations who are under adequate or near adequate dietary conditions. Contextually, it may be mentioned that when the average height of the Nicobarese (Roy & Roy, 1967) and Lakshadweep islanders varies between 1590 and 1606 mm, they exhibit an average body weight of 55 kg. It may therefore be deduced that the several communities under study, having an average stature of 1613 mm, should have a body weight of 55 kg, requiring 2800 calories in general to maintain nutritional equilibrium. Further, the calorie needs of an individual mainly depend upon two factors, such as basal metabolism and the nature of physical activities. Our information on the nature of the activities of these people places them in the moderate working group. Therefore, the standard value of calorie intake as recommended by the ICMR appears to remain suitable for the Munda community. According to the ICMR standard, the various communities receive 10% fewer calories during the period of sufficiency, i.e., the post-harvest season, and the situation deteriorates further during the lean period, i.e., the preharvest season, when they receive 20% fewer calories than their usual requirement.

Table 4.42. Distribution of Munda households in different calorie consumption categories

Season	Getting less than 30% of their requirement	Getting 30 to 59% of their requirement	Getting 60 to 89% of their requirement	Getting 90% and above of their requirement
Postharvest	0	7.00	49.10	43.90
Preharvest	0	8.80	66.70	24.50

The observation with regard to calorie intake remain incomplete unless it is examined in the context of the calorie requirement of each household. The data on calorie intake of each household were therefore analyzed in relation to the calorie requirements, which have been presented in previous Table 4.35. During the post-harvest season, approximately 43.90 percent of households have the required or near-required quantity of calories, compared to 24.50 percent during the pre-harvest season. Nearly 49.10 percent and 66.70 percent of households get only 60 to 89 percent of their calorie intake during the post- and pre-harvest seasons, respectively. There are about 7 percent of households in post-harvest season and 8.80 percent of households in pre-harvest season that get 30 to 59 percent of their daily calorie requirement. As a result, it appears that the Sundarban's Munda community are perpetually calorie deficient, both in lean and in sufficiency periods.

Table 4.43. Distribution of the households in percent in different calorie consumption classes (N = 110)

Range	Number of Households	Percentages (%)
Up to 1300 Calories	0	0
1301 – 2000 Calories	4	3.36
2001 – 2500 Calories	76	69.09
2501 –3000 Calories	30	27.27
3001 – 3500 Calories	0	0
Above 3501 Calories	0	0
Mean consumption per consumption unit = 2492 Kcal (Post-harvest Session)		

Table 4.43 depicts the distribution of 110 households in different calorie consumption classes in percent. Most of the households (76, or 69.09%) are in the 2000–2500 calorie consumption class. Thirty households (27.27%) fall in the range of 2500 to 3000 calorie consumption classes. The mean consumption of the Munda community is 2492± 446 calories per consumption unit and 1977±419 calories per capita unit in the post-harvest season. The mean consumption of the Munda community is 2266± 433 calories per consumption unit and 1827±420 calories per capita unit in pre-harvest season. The recommended daily allowance of calories is 2800 calories ICMR (1987) per male adult.

Table 4.44. Consumption units of different food groups by the people of Eastern India (gm)

Community	Cereals	Pulses	Leafy Vegetables	Non-leafy Vegetables	Roots & Tubers	Fruits	Milk and Milk Products	Fats & Oil	Sugar and Jaggery	Fish, Meat & Egg	Reference
Pasi	547	35	4	62	162	0	44	21	19	9	Chowdhury&Haque,2009
Brahmakalpit Brahman	457	38	6	118	109	21	280	17	56	0	Haque &Chowdhury,2009
Bhumihar	632	101	8	324	-	0	239	16	66	2	Chowdhury &Chowdhury, 2009
Gorait	575	18	64	38	158	0	0	8	8	10	Bhattacharya &Chowdhury, 2009
Ghasi	507	11	56	51	117	0	0	5	5	10	Chowdhury& Bhattacharya, 2009
Bauri	610	2	7	50	112	16	6	14	6	45	Haque & Samanta, 2009
Kora	699	9	15	246	158	8	6	13	13	39	Samanta & Haque, 2009
Munda	522	20	27	60	108	0	69	10	3	18	Haque,Mandal,Bhattacharya,2009
Oraon	590	19	30	50	96	0	92	10	8	6	Bhattacharya,Mandal, Haque,2009
Chasa	533	38	9	171	107	10	2	12	26	15	Bhattacharya& Chowdhury,2009
Pano	529	19	25	80	45	0	0	8	6	2	Chowdhury Bhattacharya &, 2009, NSIP: Eastern India.
Saora	681	32	14	31	80	--	---	13	20	2	S. K. Chowdhury & Chowury,2009
Ganda	655	44	14	70	73	--	--	21	38	3	Chowdhury & Chowdhury, 2009
Kuikhond	646	4	3	14	16	0	0	3	0	36	Bhattacharya & Haque, 2009
Domo	544	52	14	108	70	0	11	10	21	5	M. Haque & Bhattacharya,2009
Munda	577	30	20	98	101	11	83	12	21	14	Present Study

Table 4.45. Different calorie consumption classes, mean consumption, and percent of RDA of different populations compared with the present study of Eastern India

Community	Calorie Consumption Class						Mean Consumption kcal	Percent of RDA	Reference
	Below 1300	1301-2000	2001-2500	2501-3000	3001-3500	3501 & Above			
Pasi	0	25	30	25	15	5	2476	86.12	Reference
Brahmakalpit Brahman	0	25	25	25	10	15	2536	88.21	Chowdhury&Haque,2009
Bhumihar	--	--	--	--	--	--	3273	113.84	Haque &Chowdhury,2009
Gorait	5	25	30	35	0	5	2350	82.00	Chowdhury &Chowdhury, 2009
Ghasi	0	57	33	5	5	0	1995	71.30	Bhattacharya &Chowdhury, 2009
Bauri	0	8	42	42	0	8	2494	86.75	Chowdhury& Bhattacharya, 2009
Kora	0	5	10	45	40	0	2860	99.48	Haque & Samanta, 2009
Munda	0	45	45	10	0	0	2138	74.37	Samanta & Haque, 2009
Oraon	0	15	50	30	5	0	2395	83.33	Haque, Mandal, Bhattacharya,2009
Chasa	5	15	30	35	15	0	2413	83.94	Bhattacharya, Mandal, Haque,2009
Pano	15	35	20	25	5	0	2027	70.50	Bhattacharya& Chowdhury,2009
Saora	0	10	15	50	25	0	2742	95.37	Chowdhury Bhattacharya &, 2009, NSIP: Eastern India.
Ganda	0	5	20	20	50	5	2843	98.89	S.K.Chowdhury& Chowury,2009
Kuikhond	0	35	25	30	10	0	2322	80.76	Chowdhury&, Chowdhury,2009
Domo	5	10	40	25	20	0	2419	84.132	Bhattacharya & Haque, 2009
Region	2	22	30	29	14	3	2486	86.47	M.Haque& Bhattacharya,2009
Munda	0	4	76	30	0	0	2492		Present Study

4.9.4 Protein intake

An adult's protein requirement per day is generally recommended to be one gramme per Kg of body weight. According to the ICMR (Gopalan et al. 1987), the protein requirement of a reference man of 55 kg body weight is 55 gm per day.

The data under analysis reveal that the mean intake of protein per consumption unit is 62 gm per day in the post-harvest season, while it decreases to 56 gm in the pre-harvest season. It is to be mentioned that the total amount of protein intake in both seasons also contains some animal protein. Though the quantity of protein intake is decreased in the pre-harvest season, the consumption of animal protein was found to have relatively increased. As animal protein contains some of the essential amino acids, the intake of animal protein therefore plays an important role in nutrition.

Apparently, the average daily consumption of 62 gram and 56 gram of protein in two seasons speaks of a hundred percent fulfilment of the protein requirement of the population in general. But when the data are computed on the basis of intake and requirement of protein for every single individual in a household according to age, sex, stage of pregnancy, or lactation, the overall picture is somewhat different. (Presented in previous Table 4.35).

Table 4.46. Distribution of the households in percent in different protein consumption classes based on their requirements

Protein consumption classes				
Season	Getting less than 30% of their requirement	Getting 30 to 59% of their requirement	Getting 60 to 89% of their requirement	Getting 90 and above of their requirement
Post-harvest	0	1.80	21.00	77.20
Pre-harvest	0	5.30	36.80	57.90

A careful examination of Table 4.46 indicates that during the post-harvest season, 77.20% of the households get 90% and above of the protein requirement. while it decreases and get 57.90% during the pre-harvest season. Thus, though the protein consumption of the population in general is found to be satisfactory, closer analysis does not corroborate the general observation. Therefore, it may naturally be presumed that some of the protein burns out to provide energy for physical activities instead of its normal physiological functions such

as growth, maintenance, and repair of the body cell. Thus, the resulting adverse effect on the normal condition of the body.

4.9.5 Consumption of Calcium

It appears from the analysis that the mean daily intake of calcium per consumption unit in the post-harvest season is 305 mg. which is far below the daily allowance of 400 to 500 mg. The daily intake of calcium in the pre-harvest season is 403 mg per day consumption unit, which is within the range of the recommended standard. At this stage, it will not be appropriate to draw any inferences unless the materials are analyzed at the level of household members. The requirement for calcium does not depend on age or sex, but it has a direct bearing on the pregnancy and lactation stages of women. Considering the importance of the factors mentioned above, the requirement of calcium was estimated for each household and is presented in earlier Table 4.35.

It appears from the table that only 8.8% of the households in the post-harvest season and 21.1% of the households in the pre-harvest season get adequate or near-adequate quantities of calcium. Furthermore, more than 66.7% or (19.3+47.4) % and 49.1% or (19.3+29.8)% of households consume up to 60% of their daily calcium requirement.

Table 4.47. Distribution of the households in percent in different calcium consumption classes based on their requirements

Calcium consumption classes				
Season	Getting less than 30% of their requirement	Getting less than 30 to 59% of their requirement	Getting less than 60 to 89% of their requirement	Getting less than 90 and above of their requirement
Post-harvest	19.30	47.40	24.50	8.80
Pre-harvest	19.30	29.80	29.80	21.10

4.9.6 Consumption of Iron

The recommended allowance of iron is 24 mg per day per adult male (Gopalan et al., 1987). The current study indicates that the mean consumption of iron per consumption unit per

day is 40 mg in the post-harvest season and 35 mg in the pre-harvest season which is mentioned in earlier Table 4.35. Thus, during both the seasons, the daily consumption per unit of this nutrient is quite above the recommended allowance. But when the consumption of this nutrient is examined in relation to their needs, it is observed that all the households under study do not get adequate or near adequate quantities of iron. Therefore, the requirements of each of the households were determined based on the age, sex, and physiological condition of the members of the households. Table 4.48 shows the circulation of households (in percent) in diverse categories of iron consumption during the preharvest and postharvest seasons separately.

Table 4.48. Distribution of the households in percent in different iron consumption classes based on their requirements

Iron consumption classes				
Season	Getting less than 30% of their requirement	Getting 30 to 59% of their requirement	Getting 60 to 89% of their requirement	Getting 90 and above of their requirement
Post-harvest	0	1.80	22.80	75.40
Pre-harvest	0	10.50	29.80	59.70

It appears that 75.40% of the households in post-harvest and 59.70 percent of the households in the pre-harvest season get adequate quantities of iron. It is to be noted that the average intake of iron is fairly higher than the recommended allowance.

However, in terms of iron intake, the population under study have a satisfactory situation. On the other hand, it reflects a better situation during the postharvest season.

4.9.7 Consumption of Vitamin A or Retinol

The mean consumption of vitamin A per consumption unit in the post- and pre- harvest seasons is 702 µgm and 1205µgm, respectively, depicted in previous Table 4.49, as against the recommended allowance of 3000 µgm per adult male (Gopalan et al., 2021). It is apparent from the average intake value that there are very few households that get adequate or near-adequate quantities of this vitamin A in the post-harvest season. Though the average intake of this vitamin is relatively higher in the preharvest than the post-harvest season. It is still only 40 percent of the recommended allowance get in the post-harvest seasons.

Table 4.49. Distribution of the households in percent in different vitamin A consumption classes based on their requirements

Vitamin A consumption classes				
Season	Getting less than 30% of their requirement	Getting 30 to 59% of their requirement	Getting 60 to 89% of their requirement	Getting 90 and above of their requirement
Post-harvest	73.70	24.50	1.80	00
Pre-harvest	61.40	15.80	12.30	10.50

It appears from Table 4.49 that only 10.50 percent of the households in the preharvest season get an adequate or near-adequate quantity of vitamin A, while household adequacy in vitamin A is totally absent during the post-harvest seasons. During times of famine, the Munda community of Sundarban relies heavily on pumpkin, which is high in vitamin A content. The analysis of diet survey in the present study indicates an acute deficiency of vitamin A during both seasons. However, the negative effects of vitamin deficiency are barely noticed among the population of other communities. On inquiry, it has been reported that they consume a considerable quantity of leafy vegetables, which are available locally and at a cheaper rate during the period other than the pre- and post-harvest seasons. This has possibly helped the population maintain a balanced condition so far as vitamin A is concerned.

4.9.8 Consumption of Thiamine or Vitamin B_1

The mean consumption per consumption unit of vitamin B_1 is 1.95 and 1.60 mg per day in post-harvest and pre-harvest seasons, respectively as depicted in previous Table 4.50. This value is greater than the recommended allowance of 1.4 mg per consumption unit per day (Gopalan et al., 2021). But these average values do not verify the actual situation when it is examined across households. In fact, there are few households that consume much above the required quantity, which is overstating the average. In order to get an idea about the degree of consumption of vitamin B_1 in different households, the data have been computed and presented in previous Table 4.35.

Table 4.50. Distribution of the households in percent in different vitamin B_1 consumption classes based on their requirements

Vitamin B_1 consumption classes				
Season	Getting less than 30% of their requirement	Getting 30 to 59% of their requirement	Getting 60 to 89% of their requirement	Getting 90 and above of their requirement
Post-harvest	0	0	14.00	86.00
Pre-harvest	0	5.30	24.50	70.20

It shows that about 86.0% and 70.20 percent of households get 90% or more of their required quantity of vitamin B_1 during both seasons. During the post-harvest season, there appear to be no households that consume less than 60 percent of their required amount. In general, it has been observed that the intake of vitamin B_1 by the population under study is quite satisfactory.

4.9.9 Consumption of Vitamin B_2 or Riboflavin

The mean consumption of vitamin B_2 per consumption unit per day in the post-harvest and pre-harvest seasons is 0.83 mg and 0.63 mg, respectively, as revealed in the previous Table 4.35. These values are much below the recommended allowance of 1.70 mg per consumption unit (Gopalan et al., 2021). As stated earlier, rice is the staple food of several communities, though sometimes they take wheat as a substitute. These cereals are poor sources of vitamin B_2, and a diet rich in such cereals combined with rare associations of meat, liver, fruits, and so on results in vitamin B_2 deficiency. The distribution of households consuming different degrees of vitamin B_2 is furnished in the Table 4.51. Each household member's requirement is estimated based on their age, gender, and other characteristics.

Table 4.51. Distribution of the households in percent in different vitamin B_2 or riboflavin consumption classes based on their requirements

Vitamin B_2 consumption classes				
Season	Getting less than 30% of their requirement	Getting 30 to 59% of their requirement	Getting 60 to 89% of their requirement	Getting 90 and above of their requirement
Post-harvest	26.30	54.40	14.00	5.30
Pre-harvest	47.40	43.90	7.00	1.70

According to Table 4.51, the percentage of households receiving an adequate or near-adequate amount of vitamin B_2 in both seasons is insignificant. Only 54.40% of the households in the post-harvest season and 43.90% percent of households in the pre-harvest season get 30 to 59% of their actual need of vitamin B_2. Similarly, Table 4.51 depicts the number of households that get their corresponding required percent of vitamin B_2 consumption.

4.9.10 Consumption of Nicotinic acid or Niacin or Vitamin B_3

In the postharvest and preharvest seasons, the mean consumption of nicotinic acid or niacin per day consumption unit is 26.90 and 24.40 mg, respectively as presented in the previous Table 4.35. These values are more than the recommended allowance of 19 mg per day (Gopalan et al., 2021). Though the average consumption is higher than the recommended allowance in both seasons, it was observed on further analysis that there are few households which fail to procure hundred percent of their requirement. Table 4.52 presents the distribution of households in different niacin consumption classes.

Table 4.52. Distribution of the households in percent in different Niacin consumption classes based on their requirements

Niacin consumption classes				
Season	Getting less than 30% of their requirement	Getting 30 to 59% of their requirement	Getting 60 to 89% of their requirement	Getting 90 and above of their requirement
Post-harvest	0	0	5.30	94.70
Pre-harvest	0	0	8.80	91.20

Table 4.52 revealed that 94.70% of households in post-harvest and 91.20% of households in pre-harvest seasons are getting 90 percent or more of their requirement of vitamin B_3 or niacin or nicotinic acid. In this context, it may also be taken into consideration that dietary tryptophan is partly converted to niacin in the body, as referred to by Gopalan et al. (1997). 60 mg of tryptophan are equivalent to 1 mg of niacin. The amount of niacin from dietary protein will not be less than 10 mg for each consumption unit. Therefore, it may be inferred that there is hardly any deficiency of niacin in surveyed households. Likewise, Table 4.52 reveals the number of households that get their corresponding required percent of vitamin B_3 consumption.

4.9.11 Consumption of Vitamin C or Ascorbic acid

The requirement of vitamin C per consumption unit as recommended by the ICMR (Gopalan et al., 1921) is 40 mg per day. The mean intake per day per consumption unit of the surveyed population is 86.60 and 40.50 mg in the post-harvest and pre-harvest seasons, respectively as presented in the previous Table 4.35. Higher mean consumption of vitamin C in the post-harvest period does not necessarily signify that all the households under study get more than their actual needs. This phenomenon is reflected when the data are analyzed in terms of the distribution of households in different consumption classes of vitamin C (mentioned in Table 4.53).

Table 4.53. Distribution of the households in percent in different Vitamin C consumption classes based on their requirements

Vitamin C consumption classes				
Season	Getting less than 30% of their requirement	Getting 30 to 59% of their requirement	Getting 60 to 89% of their requirement	Getting 90 and above of their requirement
Post-harvest	5.30	3.50	14.00	77.20
Pre-harvest	12.30	26.30	29.80	31.60

It appears from Table 4.53 that only 77.20 percent of the households consumed an adequate or near-adequate amount of vitamin C in the post-harvest season. While 5.30 percent of households fail to meet even 30 percent of their actual needs. In the pre-harvest season, only 31.60 percent of households get adequate quantities of vitamin C. While 12.30 percent of households consumed less than their required amount. Therefore, it may be concluded that in the pre-harvest season, Munda community suffer from a moderate deficiency of Vitamin C.

4.9.12 Conclusion on the basis of dietary habits and intakes

An analysis of their daily consumption of food items collected during the post- and pre-harvest seasons revealed that their diet is deficient in calories, calcium, vitamin A, and vitamin B_2. The mean degree of calorie insufficiency varies from 11 to 20 percent of their requirement. Fifty-six percent of households in the post-harvest season and seventy-five percent in the pre-harvest season get less than 90% of their required amount of calories. Despite the fact that there appears to be no protein deficiency on a per capita basis. When protein protein requirements

are examined on the basis of each household's requirements (on each individual need), the overall situation is unsatisfactory. It was discovered that approximately 23% of households in the post-harvest season received less than 90% of their actual need. In both seasons, they consume some amount of animal protein by virtue of eating small fish. In both seasons, there is a severe calcium deficiency in their diet. This is due to a low intake of foods containing calcium, like leafy vegetables and milk. Excess consumption of iron is marked in both seasons. The main sources of vitamin A are leafy vegetables, fruits, carrots, etc. During the present study, researcher found that they consumed very little of the aforementioned food items.

However, according to the questionnaire, they do not consume leafy vegetables in other seasons, particularly in the post-winter and rainy seasons. When the above vegetables are locally available and cheap. As a result, the deficiency of vitamin A in post- and pre-harvest seasons is compensated during other seasons, particularly during the rainy season. Vitamin B_1 (thiamine) deficiency is not so marked in any season. Vitamin B_2 (riboflavin) deficiency is very common in both seasons. Riboflavin deficiency has been found to manifest clinically in Munda community as angular stomatitis. Nicotinic acid or niacin, another B-group vitamin, is found to be well consumed by Munda people. Vitamin C deficiency is found to be relatively more prevalent in the pre-harvest season. The reason we get more vitamin C in the pot-harvest season is due to the consumption of drumsticks in that season, which are rich in vitamin C.

The diet of Munda communities in Sundarban is deficient mainly in calories, calcium, vitamin A, and vitamin B_2. The calorie deficiency may be compensated by the ready supply of cereals like rice and wheat. the extent of 100 gram per day per individual during post-harvest and 200 gram per individual per day during pre-harvest season, in addition to what they consume at present. The addition of some leafy vegetables or fruits (Jackfruits, guava, mango, etc.) may remove the deficiency of calcium, vitamin A, and vitamin C in both seasons. They could be persuaded to take drumsticks and larger gourds. These are abundant locally and may survive as a supplement to vitamin C.

It needs to be mentioned here that most of the adult males and females (especially the older generation) are in the regular habit of drinking "Handia," the homemade rice beverage. The amount and frequency of drinking are totally unpredictable.

Handia is a good source of energy as well as some B-complex groups of vitamins. Six hundred grammes (600gm) of rice are used to make one liter of handia. Therefore, a person

consuming two glasses (150 to 200 ml) of Handia in addition to his daily meal can hardly have any deficiency of energy.

Alcoholic beverage, rice (sake) contains 0 g of saturated fat and 0 mg of cholesterol per serving. 29.10 g of Alcoholic beverage, rice (sake) contains 0.00 mcg vitamin A, 0.0 mg vitamin C, 0.00 mcg vitamin D as well as 0.03 mg of iron, 1.46 mg of calcium, 7.30 mg of potassium.

Source from Nutritive value of Indian food, Gopalan, NIN, Hydrabad,2021.

CHAPTER – V

ECOLOGICAL IMPACT ON THE MUNDA COMMUNITY

Chapter V Ecological Impact on the Munda Community Regarding Nutritional Aspect

5. Ecological impact on the Munda community regarding Nutritional aspect

The Sundarban, located in the delta region of the Bay of Bengal, is the largest mangrove forest in the world. It is a UNESCO World Heritage Site and a critical ecosystem that supports a diverse range of flora and fauna, including the Munda community, an indigenous group living in the region.

The ecological impact of Munda community in Sundarban is profound and multifaceted, particularly regarding their nutritional assessment. Here are some key aspects to consider:

Biodiversity and Food Resources: The Sundarban provide a rich biodiversity of plant and animal species that are vital for the Munda community's food security and nutritional needs. The mangrove ecosystem offers various edible plant species like Kewra, fish, crabs, mollusks, and other marine life that constitute a significant part of their diet. The Sundarban ecosystem provides a diverse range of food resources for the Munda community. The region is home to numerous plant species, some of which are edible and used for medicinal purposes. Additionally, the mangrove forests support various fish, crustaceans, and mollusks that form an essential part of the Munda people's diet.

Traditional Knowledge and Practices: The Munda community has developed a deep understanding of the Sundarban' resources over generations, enabling them to utilize various plants and animals for their nutritional requirements. Their traditional knowledge about the properties of different plants and their sustainable harvesting practices are crucial for maintaining ecological balance and ensuring a steady supply of food resources.

Climate Flexibility: The Sundarban play a vital role in mitigating the impact of extreme weather events like cyclones and storms. The mangroves act as a natural buffer, protecting the Munda community and their food resources from the worst effects of these disasters, which can otherwise disrupt their food supply and access to nutrition.

Threats to Food Security: The Sundarban ecosystem faces several threats, including climate change, sea-level rise, habitat destruction, pollution, and human encroachment. These

factors can negatively impact the availability of food resources for the Munda community and threaten their nutritional security.

Health and Nutrition: The health of the Sundarban ecosystem directly influences the health and nutrition of the Munda community. Changes in the ecosystem, such as declining fish populations or increased salinity, can lead to malnutrition and related health issues in the community.

Cultural Significance: For the Munda community, the Sundarban are not just a source of nutrition but also hold cultural and spiritual significance. Their traditional practices and beliefs are deeply rooted in their relationship with the mangrove forest, and any ecological changes can affect their cultural identity and well-being.

To ensure the sustainable nutrition and well-being of the Munda community in the Sundarban, it is essential to focus on preserving the ecological integrity of the mangrove ecosystem. This includes implementing conservation measures, promoting sustainable harvesting practices, raising awareness about the importance of biodiversity, and involving local communities in decision-making processes related to natural resource management. By safeguarding the Sundarban, we can safeguard the health and nutritional needs of the Munda community and other inhabitants of the region.

The Sundarban, located in the coastal region of Bangladesh and India, is the world's largest mangrove forest and an ecologically significant area. The ecosystem of the Sundarban has a profound impact on the Munda community, an indigenous group residing in the region. One critical aspect of this impact is the nutritional assessment of the Munda community, which can be affected by various ecological factors.

Food Availability: The Sundarban rich biodiversity, including numerous fish species, crustaceans, and edible plants, provides a diverse array of food sources for the Munda community. Their traditional diet often consists of fish, crabs, honey, wild fruits, and tubers gathered from the forest. The abundance and variety of food available directly influence the nutritional status of the Munda people.

Livelihood and Food Security: Many members of the Munda community are dependent on the Sundarban for their livelihood, engaging in activities such as fishing, honey collection, and gathering forest produce. The success of these livelihoods directly impacts their food

security. If the Sundarban face ecological challenges such as habitat destruction, pollution, or overexploitation, it can affect the availability of food resources for the Munda community. Sometimes the Munda community is leading to food insecurity and malnutrition.

Climate Change and Cyclones: The Sundarban are vulnerable to the impacts of climate change, including sea-level rise and extreme weather events like cyclones. Such events can disrupt the availability of food resources, damage agricultural lands, and lead to a scarcity of food for the Munda community. Additionally, cyclones can also result in significant loss of lives and property, affecting the community's overall well-being and access to food.

Water Quality and Contamination: Pollution from various sources, including wastage of running mortised boat, some small industrial waste and agricultural runoff, can degrade the water quality in the Sundarban and its surrounding areas. Contaminated water can affect the fish populations and other aquatic life, which, in turn, can negatively impact the traditional food sources of the Munda community. Consuming polluted food can lead to health issues and malnutrition.

Health and Nutrition Awareness: The Munda community's nutritional status can also be influenced by their awareness of nutrition and health practices. Access to proper healthcare facilities and nutrition education programs can play a crucial role in improving the community's overall well-being and nutritional intake.

It is essential to conserve and sustainably manage the Sundarban to ensure that the Munda community can continue to benefit from its ecological resources and maintain their nutritional well-being. Efforts to address environmental issues, promote sustainable livelihoods, and provide access to healthcare and nutrition education can contribute to the overall improvement of the Munda community's nutritional status and quality of life.

The Sundarban is a unique and ecologically significant region located in the delta of the Ganges, Brahmaputra, and Meghna rivers, spanning parts of India and Bangladesh. It is the largest mangrove forest in the world and serves as a critical ecosystem for a wide variety of flora and fauna, including the Munda community.

The Munda people are an indigenous community living in the Sundarban region. Like many other indigenous communities, they have a deep connection with the natural environment

and depend on it for their livelihoods, including food resources. Here's a look at the ecological impact of the Sundarban on the Munda community regarding nutritional assessment:

Fishing and Gathering: Fishing is a significant economic activity for the Munda community. They engage in traditional fishing practices, including net fishing and crab catching, which rely on the abundant fish and crustacean populations found in the Sundarban' waterways. The availability of these resources directly impacts the nutrition and dietary habits of the Munda people.

Agricultural Practices: Apart from fishing and gathering, the Munda community practices small-scale agriculture. The fertile soils in the Sundarban delta support the cultivation of crops like rice, vegetables, and fruits. The agricultural produce contributes to the nutritional intake of the community.

Climate Change and Food Security: The Sundarban region is vulnerable to the impacts of climate change, including rising sea levels, increased cyclonic activities, and changes in rainfall patterns. These environmental changes can disrupt food availability, affect fish migration patterns, and lead to saltwater intrusion into agricultural lands. Such factors can have adverse effects on the nutritional security of the Munda community.

Human-Wildlife Conflict: The Sundarban is also home to the Bengal tiger, which sometimes comes into contact with the Munda community. These encounters can lead to human-wildlife conflicts, affecting the safety and livelihoods of the Munda people. Such conflicts may also disrupt traditional practices, like fishing and gathering, impacting the community's nutritional resources.

Conservation Efforts: The ecological integrity of the Sundarban is crucial for the sustained well-being of the Munda community. Conservation efforts that preserve the biodiversity and natural habitats in the region are essential to ensure the availability of food resources and maintain the traditional lifestyles of the indigenous community.

It is crucial to recognize the importance of the Sundarban ecosystem in supporting the nutritional needs and cultural practices of the Munda community. Sustainable management of this unique habitat and its resources is vital to safeguard both the environment and the well-being of the indigenous population.

The Sundarban, located in the delta region of the Bay of Bengal, is the largest mangrove forest in the world and spans across parts of Bangladesh and India (West Bengal). It is an ecologically rich and biodiverse region, supporting a wide array of flora and fauna. The Sundarban also plays a crucial role in the livelihoods of local communities, including the Munda community.

The Munda people are one of the indigenous communities residing in the Sundarban area, particularly in the Indian state of West Bengal. They have a deep-rooted connection with the forest and depend on its resources for their sustenance, including nutritional needs.

Biodiversity and Food Sources: The Sundarban' diverse ecosystem provides a variety of food sources for the Munda community. It offers fish, crabs, shrimp, mollusks, and other aquatic species, which form a significant part of their diet. Additionally, the forest provides edible plants, fruits, honey, and other forest produce that contribute to their nutritional intake.

Fishing and Agriculture: The Munda people heavily rely on fishing as a primary livelihood activity. The rivers, water bodies, and mangrove swamps in the Sundarban provide ample opportunities for fishing, which is essential for meeting their protein and nutritional requirements. Additionally, some Munda community members may also practice small-scale agriculture in the area to supplement their diet.

Traditional Knowledge and Ethnobotanical Practices: The Munda community possesses extensive traditional knowledge about the use of various plants and herbs in the Sundarban for medicinal and nutritional purposes. They have learned to identify edible plants and fruits, and their traditional knowledge plays a crucial role in maintaining their health and well-being.

Climate Change and Impact on Food Security: The Sundarban, like many other regions globally, is facing the impacts of climate change, including rising sea levels, extreme weather events, and changes in precipitation patterns. These changes can affect the availability of food resources and disrupt the traditional food-gathering practices of the Munda community, potentially leading to food insecurity and malnutrition.

Conservation Efforts and Restrictions: In recent years, there have been conservation efforts to protect the Sundarban' fragile ecosystem. These efforts sometimes involve

restrictions on activities like fishing and collecting forest resources, which can affect the Munda community's access to their traditional food sources and nutritional intake.

In conclusion, the Sundarban' ecological impact on the Munda community regarding nutritional assessment is significant. The rich biodiversity of the region provides the Munda people with essential food sources, and their traditional knowledge and practices are closely tied to the forest's resources. However, challenges such as climate change and conservation efforts may pose threats to their food security and nutritional well-being. It is crucial to consider the needs and traditional practices of indigenous communities like the Munda while implementing conservation and development strategies in the Sundarban region.

CHAPTER – VI

ENTHNOGRAPHICAL ACCOUNTABILITY OF MUNDA COMMUNITY

Chapter VI Ethnographical Accountability of the Munda Community

6. Ethnographical accountability of the Munda community

One of the Kolian ethnic groups that lives in the Chotonagpur plateau is the Mundus. They are primarily a migrant population in West Bengal. The word Munda has Sanskrit roots. It has the practical meaning of "headman of the village" and is used by both tribal members and outsiders. Yet, they refer to themselves as Horo-Ko, which is Japanese for "man" or "human" (Bhowmik, 1980: 70). The Munda are mostly found in Bihar, West Bengal, and Orissa and are an Australoid race. They are spread across three distinct eco-system zones in West Bengal: (1) the western part of Midnapur, an extension of the Chotonagpur plateau, where easy and spontaneous migration has occurred; (2) the deltaic part of lower Bengal, in particular the South 24-Parganas, where the Munda initially settled as indigo plantation labourers before being recruited as regular labourers; and (3) the North Bengal region, where the Munda were recruited as tea plantation labourers. 2,30,016 people made up the whole Munda population in West Bengal as of the 1981 Census. The Mundas are Mundari speakers. One of the Munda group of languages, which is a member of the Austric linguistic family's Austro-Asiatic linguistic subfamily, is Mundari (Grierson, 1904; Chatterjee, 1958: 63). Being a bilingual group, they also talk in the regional tongues, including Hindi and Sadani in Bihar, Oriya in Orissa, and Bengali in West Bengal. A portion of the Munda in West Bengal lost their native language as a result of prolonged contact with the Bengali people. In West Bengal, 11.84% of the Mundas are literate, according to the 1981 census.

Based on their mythology, Roy (1912: 10) places the Munda's original settlement in a region with eighty-one uplands and eighty-three raised rice fields. Roy further mentioned that 2100 additional Mundas initially resided at the village of Murma, close to Ranchi, including a Munda Sardar named Risa Munda. On the basis of Munda tradition, Sachhidananda (1979: 61) contends that Mundas migrated from the southern region of North India to contemporary Bundelkhand and Central India, then dispersed throughout Rajasthan and North Western India before finally entering Chotonagpur through contemporary Rohilakhand. Rohtak and the Kaimur Hills were the last locations they dispersed to. They eventually reached Sikharbhum after crossing the Damodar (modern Hazaribagh in Bihar). They then travelled through Manbhum (modern-day Purulia in West Bengal) and the Santal Parganas before arriving in Ranchi, Bihar. They then relocated to a number of locations in West Bengal and Orissa. The Munda have enjoyed a somewhat steady lifestyle in Chotonagpur since 1765, or since the reign

of Nagabansi Maharaja of Chotonagpur (Chaudhury, 1977: 2). Five distinct eras can be distinguished in the history of the Munda. The initial settlers were housed at the Khunt-Katt' settlement during the first phase. The "Khunt-Katti" Muudas are viewed as a group that is somewhat honourable. Mundas were a people who were somewhat cut off from outside influences since the beginning of time. The Nagabansi kings who ruled over the Munda during the second phase also encouraged other non-tribal peasant communities to dwell in their realm. It caused tribal society to develop into a condition of feudalism or a superstructure, which warped the tribal polity, which is characterised by common ownership of land. The traditional socio-economic system has further broken down in the third phase of Mundari history. The Nagabansi dynasty ruler was overthrown by Mughal forces in the latter part of the sixteenth century and carried as a prisoner to Akbar's court in Delhi. He was later freed, and upon his return to Chototonagpur, he started to emulate the Mughal court system of governance. Many Hindu temples were consequently constructed. Muslim and Hindu caste residents who possess tenancies in this region also settled there. Businessmen, moneylenders, and religious experts from the upcountry moved here in great numbers. The original settlers in many places later lost their ownership rights over their villages and became common tenants. Also, it encouraged the formation of tiny urban centers, the Sanskritization of the language, and the expansion of trade and business. All of these survived, much like the Sphinx, on the remains of the Khunt-Katti system. Oraons, who drove Mundas out of many Ranchi neighbourhoods, exhibited a preference for kinship growth and had no interest in the agrarian system (Singh, 1966, 1983, 1985). That might have been another element that caused the Khunt-Kati system to fall apart. The feudal system of land tenure persisted during the fourth era of British colonial authority. Around 1917, the East India Company gained full administrative control over the Munda nation. The spread of Sanskritization was a distinctive feature of the colonial regime. In addition, the widespread Christian influence brought about by missionary interactions had a negative impact on their old social structure. As a result, the Munda nation experienced a number of socio-economic upheavals during the colonial era. Yet, in different areas of the Munda County, infra-, proto-, and sub-nationalism have been observed since independence. Aside from that, their traditional ways of life have been changed by widespread urbanization, industrialization, and the widespread adoption of social assistance measures.

The Munda live in cottages that are entirely composed of mud, coated with a mixture of cow dung and clay, and have thatched roofs. The huts' ground floors are typically rectangular and have lengthy verandahs running the length of them. There are times when the hut's

chambers are divided by low mud walls. A separate cowshed, a kitchen garden, a courtyard, and a manure pit are frequently also included with the hut. They have a variety of brass, aluminium, and stainless-steel cooking and eating utensils in addition to numerous kinds of earthen pots and pans. They have furniture for their homes, such as chairs, tables, and beds constructed of "Sabui" grass, or Ichoemum augustfolium.

They are settled farmers, and farming is what they do for a living. They mostly use hoes, ploughs, sickles, and other agricultural instruments. They either buy these items from the neighbourhood blacksmiths or the local market. They occasionally go fishing using different types of nets, baskets, and traps. Yet, when they do go hunting, it's usually with bows and arrows. Males typically wear a loincloth or a crude Dhuti, while females typically wear a crude Sari.Males currently wear a variety of modern ready-made clothing items, such as shorts, better shirts, trousers, and shoes, while females wear a nicer choice of suits, blouses, etc. The use of gold, silver, rolled gold, plastic, and copper ornaments is particularly popular among women. People occasionally have tattoos done on certain bodily areas.

Agriculturists in Mundas have successfully integrated themselves into the community's environment and economy. The majority of them are bargadars as well as small and marginal farmers. A couple of them are also major or medium-sized farmers. The majority of Munda people work as farm labourers. They either work as non-agricultural labourers in villages during the non-agricultural season or are employed as contract labourers locally or overseas. A small number of Mundas work mostly in the railroad industry. They occasionally work as shopkeepers. A portion of this group engages in some construction work while travelling as seasonal migrants to nearby areas like the 24-Parganas (North), Calcutta, Howrah, etc. Several Mundas work in many industries as well. Their young kids frequently work as bagal (cattle herders), and they also work as domestic servants under the names Bhatua, Munish, Kamin, and Baromesia, among others. Their main crop, rice, is raised via wet cultivation. In addition to farming paddy, some of them also grow jute, wheat, legumes, oil seeds, etc. In the months following a wet season, people primarily fish for their own needs and occasionally for sale. The Mundas, who live in the sylvan environment, rely heavily on forest goods like fuel, timber, building supplies for homes, honey, etc. In addition, they use the forest for grazing and gather Kendu leaves, edible roots, and tubers to sell in the neighbourhood market. The tribe hunts small animals, but they hardly ever venture into the forest in Narayangarh for the ceremonial communal hunting. The connection between a sizable portion of the Munda people and the

forest, however, has almost completely been broken by their uncontrolled logging of forest trees. Mundas are directly connected to the weekly and daily markets. Daily payments of cash, rice, paddy, and puffed rice are made to agricultural workers as well as a little quantity of tobacco or bidi and cash. The majority of non-agricultural sector workers' wages are paid in cash. The Munda people exchange agricultural labor. They devote a sizable portion of their cattle, paddy or rice, rice beer, and money to religious ceremonies related to life-crisis events and guest entertainment.

Thirteen sub-tribes were identified by Risley (1981) as a result of the affiliation of the tribes with a certain location or status. The Munda tribe is organised into a number of totemic tribes, known as 'Kilis," which are exogamous. Risley (1981) goes on to claim that there are 329 clans. Hoffmann (1950: 2411) lists 106 clans, although Roy (1912) only specifies around 50. The majority of his names were taken from botanical and animal names. A few clans have names that are also adjectives or inanimate objects. About 41 clans were located by Bhowmik (1980: 77) in various regions of West Bengal. There are 152 clans listed in Sachhidananda's (1979: 341-42) list of names. Under the caste system with Hindu influence, certain clan names have been changed to "Gotra" names. For instance, the Sandilya "Gotra" has replaced the Samdi tribe. Clan members might be linked together via common ancestry. In a traditional context, distinct clans frequently have their own graveyards. Roy (1912) notes that Mundas value and revere these cemeteries. However, no such cremation ground was identified throughout the current study. Each clan has one or more lineages, such as Khunt or Bansha', within it. Exogamy within the lineage is strictly upheld. According to Bhowmick (1980: 79), each lineage's name derives from the woman who is regarded as the group's ancestress. Yet, Roy (1912) notes that a new lineage name known as "Mahato has arisen for effective control of the affairs of the village ties to the new landlord. According to Hoffmann (1950:2381), Mahato Khunt was named because the Mahato once assisted the Munda and developed from the third or fourth generation of the initial inhabitants. The lineage is once more broken into sublineages, some of whose names may have been derived from the ancestress's husband (Bhowmick, 1976:515). Although the majority of families are nuclear, Sachhida-Nanda (1979) notes that several of the families are patrilineal extended families. Moreover, there are polygamous and fraternal joint families, in which a man's multiple wives and their separate offspring reside under the same roof. In certain circumstances, the husband and his other wife and children reside in the town or location where the husband works, while one wife and her children reside in the hamlet. The woman who lives in the village tends the village's property

and farm. The husband occasionally travels to the village, where he spends time with his wife. The union of a man and one or more women is called an ardi (marriage). While monogamy is typically the norm, polygamy is not forbidden. cross-cousin Mar, junior Sororate, and junior Levirate Although such marriages are not unheard of, triages are uncommon. Both males and females marry when they reach puberty. Currently, the only frequent varieties among them are sanga (widow remarriage), love marriages (Raji Khusi), and arranged weddings with bride fees. But according to Sachhidananda (1964: 45), marriages via capture and intrusion are also popular in their community. For reasons like idleness, widow remarriage, extramarital amorous intrigue, cruelty, chronic communicable diseases like leprosy and phthisis, etc., or if the wife is labelled as a witch, any side can perform divorce among the tribe members with social acceptance. Divorce is ultimately decided by the Panchayet. Alimony or divorce settlements are typically non-existent. If the woman leaves her husband's home, the guardian of the bride is responsible for paying the fine. The husband's bride price is forfeited if he is proven guilty. He occasionally gives his ex-maintenance wife's money for a year or six months in the form of paddy. Nonetheless, if the husband is the one who feels wronged, the wife's parents must return the bride money. The older children typically stay with either their mother or their father, while infants typically stay with their mother. The Munda kinship structure is hierarchical. They clearly distinguish between affinal and consanguineal relatives. They use terminology like Jhiari, Putra, and other native Bengali phrases, as well as Mundari kinship terms. Also, they forge ceremonial relationships with the Sangi, people from their own or nearby groups. The alleged kinsmen go by the names Sangi, Sai, etc.

The pregnant women are not subject to any specific dietary or employment restrictions. Only they refrain from carrying large weights and abstain from consuming country booze while expecting. Some of them adhere to particular taboos regarding what they can eat and do while pregnant. Due to the influence of the nearby villages, they hardly ever practice "Sadh" (prenatal eating of desired foods). Typically, delivery takes place in a section of the room that has been set aside specifically for the purpose. Women who are Dai by caste are Hari or Ghasi (midwives). In their residence, the placenta is buried in the ground. On the eighth day after the baby's birth, the father presents Sing Bonga with chicken and rice beer. A few members of the lineage house deliver some prepared food to the new mother on the same day, and on the ninth day, Narta is done. The baby's father also serves the ancestral spirits chicken and rice beer. To help the mother and the child, a barber and a washerman are summoned. The barber trims the nails while the washerman washes the dirty garments. In addition to taking a bath, the new

parents of the baby bring some water in a sal leaf cup. It is covered with a few tulsi (holy basil) leaves. The house and all those present during the ritual are then sprayed with water. Both lineage and non-lineage individuals share a separate pot of rice beer. A feast follows. The birth pollution has now come to an end. The newborn is given a name the following day during a ritual called Tuchauli.

Both males and females may choose to have their ears pierced before reaching puberty. This procedure is optional. Boys and girls experience puberty in different ways. The girls are, however, viewed as polluted throughout each menstrual cycle. They are prohibited from going into the kitchen or working in the field at this time. They refrain from doing religious ceremonies, taking a bath, washing their clothes, or even sleeping with their spouses during this time.

Marriage is a holy connection between a man and a woman. The boy's guardian and other senior villagers visit the bride's home as part of the pre-marriage rite to choose the wife. The bridegroom may or may not join the celebration. They research the portents and omens as they travel. The marriage cannot take place until and unless the women are in their favor. The next preliminary ceremony is called "Marang-para," and it is during this time that the bride's guardian and many family members visit the bride-home groom's and the Bala, or betrothal, takes place. The womens are discussed by both parties at that time, and if the women are deemed satisfactory, the *gonong* (bride-price) is set. The groom's family members sing Bala songs. The *Lohada* ceremony is done before the wedding. The girl's guardian performs the ceremony of salutation known as Johar. Following specific rites, the village's "Deora" or *sorceror* sacrifices three cockroaches and frequently a goat. On the day before the wedding, when the bride and the groom are both anointed with turmeric paste in their respective homes, everyone celebrates by drinking rice beer, eating a lavish feast, and singing Bala' songs. The bride's home has a wedding booth installed. The ritual services are performed by a barber. The bridegroom leaves for the bride's house with his male and female relatives and acquaintances, called the barat (wedding party). A music festival frequently leads the Barat. The groom is initially led to a mango tree on the route. He wraps a thread around the tree's stem, spreads rice flour on it, and circles the tree three times anticlockwise. The bride's man welcomes the wedding party at the village's gate, and he then leads them to the bride's home. The Mandap is where the actual marriage ceremony is held (the marriage booth). In the mandap, the bride and the groom are seated side by side. There is a brass plate there with certain items on it. The

marriage is solemnised by a Brahman priest who chants incantations. First, the bride's forehead and the place where her hair is parted get ceremonial vermilion marks from the groom. The bride then returns the favour to the bridegroom. The priest then knots the ends of their clothing. The bride's gifts and presents are then ceremonially presented to the groom's guardian by the bride's parents, who were asked to display them for the bride. The priest then breaks the knot by reciting some incantations. In the name of God, a ritual fire offering is made. Following that, a wedding feast is planned for the groom's party and the townspeople that evening. The following day, the bride and groom travel to the village of the groom to participate in the Chuman ritual. Elderly members of the groom's family perform ritual greetings, kiss foreheads, sprinkle turmeric mixed with Arua rice on the coupe, and distribute gift pots. A handful of the bride's family pay a visit to the groom's home the next day. Any bride's relative returns the newlyweds to the bride's home after the eighth day for a brief stay.

According to the Mundas, death results from the Jiu (soul) leaving the body for good. Natural forces or other spirits' actions can result in death. They practise both burial and cremation. The dead body is cleaned and applied with turmeric paste before being disposed of. The male group members transport the body to the cremation site. For members of the bloodline, ten days are regarded as filthy. A barber trims the nails of the deceased's female lineage members and shaves the heads of the male lineage members during the purificatory ceremony. It is referred to as "Kamana". Members of the bloodline have their clothes washed by a washerman. The Brahman priest participates in the Sradh ceremony and presents the deceased person's soul with several items, including pinda (rice balls). Also, he offers an homa (fire sacrifice) to stop the spread of death. On the same evening, a cock is sacrificed in order to call the soul back. Within a year following a death, "Umbal-adar" is frequently carried out. The departed person's ghost is summoned back to the house at this celebration so that he can coexist with other ancestor spirits. Wealthy Mundas create a commemorative monument where the cremation takes place.

"Panch" or "Panchayet" is the name of the customary village council. At the village level, the council handles disagreements, infractions of the peace, and social offenses. The Munda, or headman, the "Mahato," or messenger, the Pahan, or priest, and the Pujari, or priest's assistant, are the major office holders of the Panchayet.

The Munda revere Sing Bonga as their highest divinity. Their hamlet has several deities, such as Desauli Bonga, Devi Bonga, Baram, and Garam. Marang Bonga, Gonra Bonga, and

other famous household deities are among them. In addition to them, they also adore or worship Chandi Bonga, Bir Bonga, Sitala, Manasa, and other pantheon goddesses like Durga and Lakshmi. They have a strong belief in bad spirits like "Dakin" and "Jugin," as well as in terrible winds and possessions. Moreover, they hold beliefs in witchcraft, black magic, divination, and good and bad omens. Also, they hold faith in holy professionals such as witch doctors, sorcerers, and gunin. They have trust that native medicine men can protect them from evil spirits, deities, and other hostile forces.

The Mundas perform in Bengali and Mundari, singing Bala songs, wedding songs, and festival music. The music played at festivals includes bandana songs, "Tusu" songs, and Karam songs. Males and females both take part in group dancing, particularly in Jatra dance companies that put on Bengalee and Mundari performances. Football, cricket, ha-du-du, and card games are played frequently in the majority of the Munda settlements being studied.

CHAPTER – VII

CONCLUSION AND FUTURE SCOPE

7. Conclusion and Future Scope

7.1 Conclusion about health-parameter and index

Analysis of Pearson's correlation coefficient (r) between BMI or body mass index and age to evaluate BMI or body mass index in relation to age, body morphological, and physiological variables BMI, or body mass index, and selected morphological characteristics of the body and physiological variables have been studied separately among both sexes of the Munda Community in West Bengal. According to gender, the correlation coefficient (r) calculations have been performed separately and also illustrated in table form. Body morphology and physiology included weight, height, visceral fat, body fat, skeletal muscle, resting metabolism, hip circumference, waist circumference, mid-upper arm circumference, calf circumference, pulse rate, and skin fold thickness (triceps, biceps, calf, supra-iliac, and subscapular). Here, p-values have been calculated and displayed in the table. It is evident from the table that significant effects of morphological and physiological variables clearly exist on body mass index for both sexes, obviously, with some exceptions, i.e., age, height, and pulse rate. Here age, height and pulse rate are *not* significant at $p < 0.05$ level. Therefore, it can be stated that except for age, height, and pulse rate, all the selected body morphological and physiological variables are directly or significantly associated with body mass index to create co-morbidities. This should be a cause for concern for future research.

However, there is an inverse but highly significant relationship between skeletal muscle and BMI in both genders. In males, weight shows the highest correlation with BMI. However, there is an inverse but highly significant relationship between skeletal muscle and BMI in both genders. In males, weight shows the highest correlation with BMI (r =.90**), followed by resting metabolism (r =.880**), visceral fat (r =.878**), hip circumference (r =.849**), waist circumference (r =.872**), and so on. In males, however, age, height, and pulse rate have no significant relationship with BMI. While, among females, weight (r = 0.840**) shows the highest correlation with BMI, followed by resting metabolism (r =.834**), visceral fat (r =.833**), hip circumference (r = 0.827**), and so on. However, age, height, and pulse rate have no significant relationship with BMI in females.

To assess blood pressure in relation to age, body morphology, and physiological variables. Analysis of coefficient (r) of Pearson's correlation between blood pressure and age Blood pressure and selected body morphological and physiological variables have been done separately and are displayed in Table 4.23 among both sexes of the Munda Community, West Bengal. The correlation coefficient (r) calculations were also done separately for the sexes, as shown in the table. Body morphology and physiology included weight, height, body fat, skeletal muscle, visceral fat, resting metabolism, hip circumference, waist circumference, mid-upper arm circumference, calf circumference, pulse rate, and skin-fold thickness (triceps, biceps, calf, supra-iliac, and subscapular). It is evident from the table that a significant effect of **age** exists on DBP and SBP for both genders (Male: for DBP, r = 0.11; for SBP, r = 0.17; Female: for DBP, r = 0.28; for SBP, r = 0.47).

7.2 Building a sustainable future today by focusing on wellness and nutrition.

In the world of nutrition and health, it's essential to change one's lifestyle now for improved health and wellness tomorrow. Acceptable behavior can go a long way towards assisting people in achieving optimal health while also assisting in preserving the health of the world. Remember that sustainability means meeting today's nutritional needs while conserving resources for tomorrow. It includes both the techniques and practices used in agriculture and the choices made by consumers when they purchase food. Sustainable practices should ideally involve actions that promote good health, protect the environment, safeguard animals, respect workers in the food sector, pay farmers a fair salary, and support farming communities. When a practice or method is sustainable, it can be sustained for decades or even centuries.

7.3 Sustainability of the food system

Sustainability encourages the development of environments that allow for peaceful coexistence between humans and nature. Its foundation is the idea that everything necessary for human existence depends on the natural world. In addition to people who produce, process, package, distribute, and control food (such as farmers and fishers), a sustainable food system also includes those who consume it. The difficulties in creating a sustainable food system are numerous, ranging from providing food that is accessible and cost-effective to providing food that is nourishing, high-quality, and inexpensive irrespective of socioeconomic status to changing the methods of food production, processing, and distribution.

The difficulties of constructing a sustainable food system have numerous answers. In order to improve low-income Indians' access to healthy, locally grown food, expand the infrastructure for regional food production, educate people about the origins and production of food, improve native agriculturalists' livelihoods, and use sustainable farming practices.

7.4 Nutrients are most important for metabolism and blood function.

The estimate of the optimum amount of energy from protein, lipids, and carbohydrates for a balanced diet is known as the acceptable macronutrient distribution range (AMDR). People who fall short of the AMDRs for their target demographic have a higher risk of suffering from health issues. The type of worker, their age, and their weight are taken into account when determining the necessary daily amount (RDA).

7.5 Medicine is food, and food is medicine

"Make food thy medicine, and medicine thy food," a proverb goes. Hippocrates, a Greek physician who lived over two thousand years ago, expressed these ideas in these terms, and they are still very relevant to today's food choices and how they affect health. The studied community now agrees with Hippocrates' observation since it acknowledges some foods as useful foods.

Purposeful foods are "whole foods and fortified, enriched, or enhanced foods that have a potentially favorable influence on health when consumed as part of a diverse diet on a regular basis, at effective levels," according to the Academy of Nutrition and Dietetics.

Elie Metchnikoff, a Russian immunologist, was fascinated by the long-life spans of the tribes living in the northern Caucasus Mountains at the end of the nineteenth century. The resistance to fatal diseases allowed them to live such lengthy lives. A potential contributing factor was unwrapped in a leather bag used to transport soured milk. Mohammed, the great prophet of Islam, is said to have given this recipe to Traditional believers on the understanding that they would not give it to anyone who did not have the same views. Mohammed instructed the tribes to combine a small amount of milk and white grains resembling broccoli. This bag was hanged from a doorway at a house so that anybody who passed would hit it, mixing the contents. The outcome was a tasty beverage with tangy undertones that was creamy, slightly carbonated, and refreshing.

7.6 Outcome of the research work

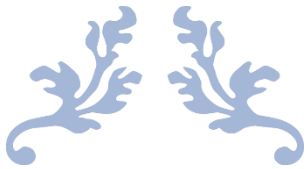
This study could provide insight into the big picture and everyday life in the well-known delta region of the world. Additionally, it indicates a wide range of other significant elements that are closely related to the growth of the entire area, such as literacy levels, socioeconomic standing, mortality and morbidity rates, and a great number of others. The researcher was raised in this delta region; as a resident now, she feels that improvements, new amenities, and general growth are required. Holly, I finally understood the people, place, and way of life. Finally, I'll discover the identity, environment, social structure, economy, connections, and developmental profiles of the locals. These insightful findings will be reflected in both the quantitative and qualitative characteristics of life.

7.7 Changing the behavior pattern

It is challenging to live sustainably and experience optimal health. To take action to exercise more, eat healthier meals, and work harder to prevent food contamination, considerable life changes may be required. However, change is a process, and scholars have long studied both the various stages of this process as well as the elements that either promote or block development. The population's chances of success are improved by their level of preparation as well as their understanding of the method of preparing the foods. Change is challenging to establish and put into effect. Additionally, there are times when the various stages of a behavioral pattern are impacted by the type of food consumed.

7.8 Start for a Sustainable Future

Begin the Sustainable Future: Making a conscious effort to live sustainably today can benefit everyone. Obtaining Optimal Health: Nutrition and Wellness Let's talk about ways to change our lifestyles today to assure improved health and wellness tomorrow. As the community draws to a close on their adventure through the worlds of nutrition and health. Adopting sustainable practises can significantly improve their health and contribute to the protection of the environment. Keep in mind that sustainability entails providing for current dietary demands while protecting resources for the future. It comprises the methods and procedures used in agriculture as well as the decisions made by customers when they buy food. Ideally, sustainable practices involve actions that promote health, protect the environment, safeguard livestock, and uphold human rights.



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Dietary intake during pre- and post –harvest season among the Munda of Sundarban, West Bengal, India

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ABSTRACT

Background and objectives

Unhealthy living conditions, and limited access to health care are the main causes of under nutrition in developing nations. The studied population Munda is a socio-economically background tribe who are landless and depend upon different kind of occupation for their subsistence economy. In this study food security and dietary intake (during pre- and post-harvest period) has been examined among the Munda tribe of Sundarbans, Southern Bengal, India.

Material and Methods

Forty-five households were considered in three rounds for dietary survey. Fifteen households werecovered in each phase. Prior to each household's cooking for five days in a row, at least two visits were made to each as part of the dietary survey. A portable single-pan digital salter balance was used to measure the ingredients for the food that needed to be cooked for each home.

Results

Consumption of different nutrients is shown in terms of recommended allowance. Like pre-harvest season in post-harvest season also a high level of deficit is noticed for per consumption unit and per capita unit in terms of net energy (K Cal). Total calorie intake is much lower among them in terms of recommended daily allowance as recommended by ICMR (2017).

Conclusion

The studied population Munda is a socio-economically background tribe who are landless. It can be noted that more than 38 percent of the Munda households having less than one-month food sufficiency i.e. they

fall in the category of not producing at all. As expected, net energy (K Cal) deficiency is much lower in pre-harvest period than that of post-harvest period. This is true for both per consumption unit and per capita unit.

Keywords: *Diet. Different seasons. Calorie intake. Munda tribe. West Bengal.*

INTRODUCTION

In Indian tribes, malnutrition affects adults at a constant rate (NFHS-III, 2009). According to the FAO (2011), malnutrition is an abnormal physiological condition brought on by unacceptable, out-of-balance, or excessive consumption of the micronutrients (vitamins and minerals) necessary for physical and cognitive development as well as the macronutrients (carbohydrates, proteins, and fats) that provide dietary energy. The numerous burdens of malnutrition which often result in undernourishment and under nutrition, deficiencies in micronutrients, and overweight and obesity forcefully impose high intensity. In other circumstances, the degree of malnutrition was influenced by the economic and social positions of numerous nations. Different types of malnutrition may coexist in the same nation, state, district, neighbourhood, home, or individual, and both their prevalence and the way food systems are organised are changing quickly (FAO, 2013). The most current FAO assessments show that 8.68 billion individuals worldwide, or 12.5% of the population, are undernourished in terms of energy intake, yet these numbers only represent a small portion of the global malnutrition burden (FAO 2013).

Food consumption that is insufficient to meet dietary energy requirements for an active and healthy life is referred to as undernourishment. According to estimates from 1990 to 1992, there were 852million fewer undernourished individuals in developing nations, and the frequency of undernourishment dropped from 23% to 15% (FAO et al. 2012). According to a recent proportionate risk assessment by the World Health Organisation (WHO, 2002), undernutrition is by far the biggest cause of the disease's worldwide burden. Since 1981, hunger and undernutrition have decreased in the majority of Asia, where the Green Revolution increased food supplies (Gupta 2004). Despite the abundance of food grains in South Asia and India, the region still has high rates of malnutrition and hunger (Gupta, 2004). According to Das and Bose (2012), it can be split into unbalanced diets and particular food deficits. Food security, household diet surveys, biochemical evaluation (estimation of physiological parameter or index), anthropometric measures, sociodemographic profiles, and ecological studies methodologies are just a few of the ways that nutritional screening and assessment can be found. According to Mitra (1985) and the World Health Organisation (1990), poverty, unsanitary living conditions, and limited access to health care are the main causes of under nutrition in developing nations. In this study food security and dietary intake (during pre- and post-harvest period) has been examined among the Munda tribe of Sundarbans, Southern Bengal, India.

MATERIALS AND METHODS

In three rounds, 45 households were considered for dietary survey. Each phase covered 15 households. Prior to each household's cooking for five days in a row, at least two visits were made to each as part of the dietary survey. A portable single-pan digital salter balance was used to measure the ingredients for the food that needed to be cooked for each home. Visitors who shared food from the home and family members who ate outdoors while away on the day of the investigation were also noted. Information on cooked or uncooked food waste was also documented. The amount of intake of fats, oils, sugar, jaggery, and other ingredients was calculated based on their weekly or monthly use. Based on the food consumption tables included in the ICMR publication (Gopalan, 2017), the nutritional value of the

ingested food item was computed. Each household's daily average intake of various foods and nutrients was calculated. It enables us to compute the consumption of various foods and nutrients per capita and per consumption unit. The basis for estimating the consumption unit is the individual's calorie need. Therefore, a healthy working reference man with a body weight of 55 kg is used as the benchmark. The moderately active reference man needs 2800 calories, which is equal to one consumption unit. Therefore, a person who needs X calories represents X 2800 units. The calorie requirements of each household's members were used to calculate the consumption unit. For the purpose of estimating calorie requirements, the woman's pregnancy and lactation status were also taken into account.

RESULTS

Table 1 depicts that more than 94 percent of the households eat vegetables including leafy vegetables regularly. And more than 84 percent of the households eat fish and egg regularly. It is interesting to note that about 68 percent of them consume handia (country liquor) regularly. Whereas,they consume fruits and pulses once in a week. They consume handia once in a week. However, a very high percent of them consumes milk, pulses, fruits and sweets once in a month.

Consumption of different food groups (in gm) in pre- and post-harvest season is expressed in terms of per consumption and per capita unit for the Munda in Table 2. It can be seen that most of them consumed cereals, mainly rice and wheat during pre- and post-harvest season. As a result, per consumption and per capita unit both are very high in this category. However, they consume different vegetables, roots and tubers in considerable percentage. However, they consume pulses and different kinds of milk product in lesser amount. When compared to the post-harvest season, itappears that there is a reduction in cereal food consumption of roughly ten percent (10%). Similar to this, the post-harvest season sees a considerably higher intake of green vegetables. Consumption of dietary groups such as pulses, non-leafy vegetables, roots, and tubers (primarily potato and onion) doesnot alter significantly with the seasons.

Table 1. The consumption of various food groups in the studied households (N = 30) during two distinct seasons, namely pre-harvest and post-harvest (mean in gm)

Food groups	Eating regularly (at least 3 days in a week)	Eating frequently (at least once in a week)	Eating occasionally often once or twice in a month or never
Pulses	5.6	19.9	74.5
Vegetables including leafy vegetables	94.5	5.6	--
Fish and Egg (occasionally)	84.5	15.5	--
Milk	1.2	3.1	95.7
Sweets	--	14.9	87.23
Fruits	--	23.9	79.50
Handia/ Country Liquor	67.98	34.6	--

Table 2. Consumption of different food groups (in gram) expressed in terms of per consumption and per capita unit

	Seasons	Post-harvest		Pre-harvest	
	Expressed in	Per consumption unit per Capita	Per Capita	Per consumption unit per Capita	Per Capita
Consumption of food groups in gm.	Cereal mainly rice& wheat	642.5	509.9	576.4	464.5
	Pulses	7.6	6.0	5.6	4.4
	Leafy vegetables	44.4	34.0	23.5	19.0
	Other vegetables	67.4	54.0	69.6	56.0
	Roots & Tubers	98.1	77.8	96.9	78.8
	Milk & Milk-product	1.8	1.6	1.6.	1.4
	Fish and Egg	43.5	34.4	54.3	43.4
	Oil and Fat	6.0	4.9	7.4	6.0

Quantitative aspect of nutrient intake:

It can be seen from Table 3 that in case of all the nutrients the calorie value calculated to be lower than recommended value. This is true for protein, calcium, fat, iron and vitamin A, B and C. However, in post-harvest season calculated calorie value is found to be higher than that of pre-harvest season.

Table 3. Mean values of consumption of different nutrients with standard deviation in pre-harvest and post pre-harvest among the Munda

Nutrients	Post-harvest				Pre-harvest				Recommended Daily Allowance ICMR (1987) per adult
Expressed in	Per consumption unit		Per capita		Per consumption unit		Per capita		
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
Calorie	2492	446	1977	419	2266	433	1827	420	2800
Protein (gm) Animal	7.2	6.0	--	--	9.3	6.5	7.5	5.2	
Protein (gm) Vegetable	54.8	13.1	--	--	46.3	12.2	37.4	11.0	
Total Protein (gm)	62.0	14.8	49.7	13.0	55.6	14.3	44.9	12.6	55.0
Fat (gm)	12.5	4.7	10.1	4.4	13.6	4.6	11.0	4.0	--
Calcium(mg)	305	147	245	126	403	238	323	194	500
Iron (mg)	40.1	11.3	31.8	9.6	35.1	35.1	28.3	9.5	24
Vitamin A (microgram)	702	543	555	439	1205	653	948	1436	3000
Vitamin B_1(mg)	1.95	0.50	1.55	0.44	1.60	0.48	1.29	0.43	1.4
Vitamin B_2 (mg)	0.80	0.36	0.63	0.30	0.63	0.30	0.51	0.26	1.7
Nicotinic acid (mg)	26.9	5.0	21.3	4.6	24.4	4.8	19.7	4.7	19
Vitamin C (mg)	86.6	52.0	69.	43.8	40.5	24.2	32.5	20.3	40

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Table 4: Consumption of different nutrients with recommended allowance: pre-harvest season
*Excess consumption in terms of recommended allowance

Nutrients Expressed in different units	Pre-harvest						Recommended daily allowance ICMR (1987) per adult
	Per consumption unit			Per capita			
	Mean	SD	Deficiency of the nutrients (in CU)	Mean	SD	Deficiency of the nutrients (in per capita)	
Net energy (Kcal)	2266	433	534	1827	420	973	2800
Protein (gm) Animal	9.3	6.5	-	7.5	5.2	-	-
Protein (gm) Vegetable	46.3	12.2	-	37.4	11.0	-	-
Total Protein (gm)	55.6	14.3	*	44.9	12.6	10.1	55.0
Fat (gm)	13.6	4.6	26.4	11.0	4.0	29	40
Calcium(mg)	403	238	97	323	194	177	500
Iron (mg)	35.1	35.1	*	28.3	9.5	*	19.0
Vitamin A Retinol (microgram)	1205	653	*	948	1436	52	1000
Vitamin B_1 Thiamin (mg)	1.60	0.48	0.2	1.29	0.43	1.37	1.8
Vitamin B_2 Riboflavin (mg)	0.63	0.30	1.87	0.51	0.26	1.99	2.5
Vitamin B_3 Nicotinic acid (mg)	24.4	4.8	*	19.7	4.7	*	18
Vitamin C Ascorbic Acid (mg)	40.5	24.2	39.5	32.5	20.3	47.5	80

In Table 4 consumption of different nutrients is shown in terms of recommended allowance during pre-harvest season among the Munda. A high level of deficit is noticed for per consumption unit (534 K Cal) and per capita unit (973 K Cal) in terms of net energy (K Cal). Deficit is noticed for per consumption unit for the nutrients like fat (26.4 gm), calcium (97 gm), vitamin B1 (0.2 mg), vitamin B_2 (1.87 mg) and vitamin C (39.5 mg). Side by side, deficit is noticed for per capita unit for the nutrients like total protein (10.1 gm), fat (29gm), calcium (177 gm), vitamin A (52 microgram) vitamin B1 (1.37 mg), vitamin B_2 (1.99 mg) and vitamin C (47.5 mg). In case of other nutrients excess consumption is noticed in terms of recommended allowance.

In Table 5 consumption of different nutrients is shown in terms of recommended allowance during post-harvest season among the Munda. Like pre-harvest season in this season also a high level of deficit is noticed for per consumption unit (308 K Cal) and per capita unit (534 K Cal) in terms of net energy (K Cal). Deficit is noticed for per consumption unit for the nutrients like total protein (3.0 gm), fat (27.5 gm), calcium (195 gm), vitamin A (298 microgram) and vitamin B_2 (1.7 mg). Side by side, deficit is noticed for per capita unit for the nutrients like total protein (5.3 gm), fat (29.9 gm), calcium (255 gm), vitamin A (445 microgram) vitamin B_1 (0.25 mg), vitamin B_2 (1.87 mg) and vitamin C (11 mg). In case of other nutrients excess consumption is noticed in terms of recommended allowance.

Table 5: Consumption of different nutrients with recommended allowance: post-harvest season

Nutrients	Post-harvest						Recommended daily allowance ICMR (1987) per adult
Expressed in different units	Per consumption unit			Per capita			
	Mean	SD	Deficiency of the nutrients (in CU)	Mean	SD	Deficiency of the nutrients (in per capita)	
Net energy (Kcal)	)2492	446	308	1977	419	534	2800
Protein (gm) Animal	7.2	6.0	-	-	-	-	-
Protein (gm) Vegetable	44.8	13.1	-	-	-	-	-
Total Protein (gm)	52.0	14.8	3.0	49.7	13.0	5.3	55.0
Fat (gm)	12.5	4.7	27.5	10.1	4.4	29.9	40

Calcium(mg)	305	147	195	245	126	255	500
Iron (mg)	40.1	11.3	*	31.8	9.6	*	19.0
Vitamin A Retinol (microgram)	702	543	298	555	439	445	1000
Vitamin B_1 Thiamin (mg)	1.95	0.50	*	1.55	0.44	0.25	1.8
Vitamin B_2 Riboflavin (mg)	0.80	0.36	1.7	0.63	0.30	1.87	2.5
Vitamin B_3 Nicotinic acid (mg)	26.9	5.0	*	21.3	4.6	*	18
Vitamin C Ascorbic Acid (mg)	86.6	52.0	*	69.	43.8	11	80

*Excess consumption in terms of recommended allowance

When the recommended daily allowance and actual consumption of nutrients per consumption unit by the different communities of Eastern India is taken into consideration it is found that the study population Munda shows lesser value than most of the eastern Indian populations (Table 6). As this Tableis quite self-explanatory it needs no further description.

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Table 6. Recommended daily allowance and actual consumption of nutrients per consumption unit by the different communities of Eastern India

Community	Calorie kcal	Protein (gm)	Fat (gm)	Calcium (mg)	Iron (mg)	Vitamin A (mg)	Vitamin B1 (mg)	Vitamin B2 (mg)	Vitamin B3 (Niacin) (mg)	Vitamin C (mg)	Reference
Pasi	2476	55	29	34	33	1423	1.9	0.6	4	57	Chowdhury&Haque,2009
Brahmakalpit Brahman	2536	66	41	61	44	1130	2.3	1.2	22	45	Haque&Chowdhury,2009
Bhumihar	3273	89	36	82	43	1086	2.6	1.3	2	70	Chowdhury&Chowdhury,2009
Gorait	2350	60	14	207	23	1595	1.8	0.9	6	71	Bhattacharya &Chowdhury, 2009
Ghasi	1995	41	9	53	25	1279	1.3	0.4	21	53	Chowdhury & Bhattacharya, 2009
Bauri	2494	55	14	437	33	637	1.9	0.5	7	32	Haque & Samanta, 2009
Kora	2860	62	18	257	35	1049	1.9	0.6	30	70	Samanta & Haque, 2009
Munda	2138	9	19	329	18	837	1.8	0.8	2	39	Haque, Mandal, Bhattacharya,2009
Oraon	2395	2	20	24	17	984	2.0	0.8	24	33	Bhattacharya,Mandal Haque,2009
Chasa	2413	4	15	75	19	932	1.8	0.6	27	99	Bhattacharya&Chowdhury,2009
Pano	2027	2	10	119	8	645	1.3	0.4	21	42	Chowdhury & Bhattacharya , 2009, NSIP: Eastern India.
Saora	2742	6	17	04	34	810	1.7	0.5	28	30	S. K. Chowdhury&Chowury,2009
Ganda	2843	8	25	16	35	919	1.7	0.5	27	42	Chowdhury & Chowdhury,2009
Kuikhond	2322	7	9	28	11	995	1.1	0.6	18	4	Bhattacharya& Haque, 2009
Domo	2419	7	16	40	12	418	1.0	0.7	13	33	M.Haque &Bhattacharya,2009
Munda (Preharvest)	2266	5.6	13.6	03	35.1	1205	1.60	0.63	24.4	40.5	Present Study
Munda (Post harvest)	2492	62.0	12.5	05	40.1	702	1.95	0.80	26.9	86.6	Present Study
Region	2486	8	20	51	26	856	1.74	0.98	25	51	Eastern India
Recommended allowance	2875	60	20	00	28	2400	1.4	1.6	18	40	Adult

DISCUSSION

The main food consumed by all Munda household in Sundarban is rice. However, they have grown accustomed to receiving wheat from various organizations (both government and non-government) in exchange for their employment as part of the *Food for Work* schemes in modern times. Few households consume rice and wheat as their primary sources of sustenance. They can't afford to buy pulses frequently because of their dire financial situation, so they eat them sometimes only. They regularly eat inexpensive local seasonal vegetables which are easily accessible from their kitchen garden or surrounding. Typical vegetables they eat include pumpkin, brinjal, cauliflower, ladies' finger, various legumes including beans and peas, and leafy vegetables like sweet and sour spinach, cabbage, and other vegetables. Meat is consumed only on certain occasions, and most of the people eat tiny fish. They occasionally eat eggs in place of fish. Milk and milk products are consumed occasionally only.

In the months leading up to harvest, there is a relatively high diet of animal proteins such as meat, eggs, and fish (mostly small fish) among the Munda. During the pre-harvest season, it also looked like more oils and fats were being used. Due to inadequate storage of staple foods and relatively high market prices, which force people to choose an alternative diet that can be easily obtained from the market with the limited resources they have, there is a low consumption of staple foods during the pre-harvest season. The post-harvest season gives the population access to a variety of leafy vegetables, including spinach, cabbage, latus, etc., which are abundantly grown in the study region and whose market prices are affordable. In the post-harvest season, green vegetables are specifically consumed at a substantiallyhigher rate for this reason. A portion of the pre-harvest period's relatively low consumption of leafy vegetables is made up for by the period's relatively higher consumption of fish and meat. The margin of variance in terms of calorie intake is also reduced by a slight increase in the consumption of oils and fats in the pre-harvest phase.
The fluctuation in food consumption by season eventually has an impact on caloric intake. To understand a population's nutritional condition, a basic understanding of calorie intake is necessary. To further understand the seasonal change in calorie consumption, the data were analysed independently for each season. It demonstrates that the amount of calories consumed during the pre-harvest season is around 10% lower than during post-harvest season. This is consistent with the difference in staple food consumption. The main source of calories and, to a large extent, protein for the various communities in Sundarban is cereals, primarily rice. As a result of eating less cereal during the pre-harvest season, 10% less total protein was consumed. The modest rise in fish consumption during the pre-harvest season is the cause of the slight increase in animal protein intake.

Pre-harvest calcium intake has been discovered to be higher than usual, which can be attributed to a significantly higher fish intake. Pre-harvest season consumption of vitamin A was significantly higher than post-harvest season consumption. The consumption of a significant amount of pumpkin, which was a staple meal for the locals during the time of scarcity, is what led to this rise in vitamin A intake during the pre-harvest season. A high standard deviation also suggests more diversity in vitamin A intake between households.

The pre-harvest season saw relatively low consumption of other nutrients outside of animal protein, fat, and vitamin A. The findings show that vitamin C consumption varies significantly by season.

It was discovered that people took this vitamin more than twice as much in the post-harvest season than they did in the pre-harvest season. This was caused by the simple accessibility of numerous leafy and non-leafy vegetables, which are the main source of vitamin C and include spinach, tomatoes, drumsticks, etc. These vegetables are abundantly grown in this region during the post-harvest season and are offeredat lower prices. Other important nutrients like iron, vitamin B_1, vitamin B_2, and nicotinic acid were discovered to be consumed at substantially lower levels during the pre-harvest season.

It appears from the present study that calorie deficit is more pronounced in pre-harvest season than that of post-harvest season. This corroborates the availability of food items in more quantity in post-harvest season than that of pre-harvest season among the studied population Munda.

CONCLUSION

The studied population Munda is a socio-economically background tribe who are landless and depend upon different kind of occupation for their subsistence economy. It can be noted that more than 38 percent of the Munda households having less than one-month food sufficiency i.e. they fall in the category of not producing at all. Total calorie intake is much lower among them in terms of recommendeddaily allowance as recommended by ICMR (2017). As expected, net energy (K Cal) deficiency is much lower in pre-harvest period than that of post-harvest period. This is true for both per consumption unit and per capita unit.

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Ethics-approved

Verbal agreement from local administrators and members of the community

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Nutritional status according to body mass index among the adult Munda population of Sundarban, West Bengal, India

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***Abstract*---**Background: In India, the profile of body mass index and chronic energy deficiency in tribal society is a significant issue. In terms of various facilities, tribal people are separated from the general population. This paper examines the health structure of adult males and females from Munda tribes. Materials and Methods: A cross- sectional community-based study was directed among the Munda tribe (N = 110) of Gram Panchayat Lahiripur, Sundarban, Block Gosaba, 24 Parganas (South), and Southern Bengal. Results: The proportion of Munda people who were malnourished (BMI 18.5) was very low. The WHO classifies men as undernourished at 23.72% and women as undernourished at 27.53%. According to Asia specific, the percentage of male under nutrition is 23.71, and the percentage of female under nutrition is 28.77. Conclusion: In both classifications, the incidence is lower in men than in women. This population has good nutritional status compared to the other tribes of the eastern part of the country.

***Keywords*---**chronic energy deficiency, body mass index, nutritionalstatus, Z-core, Munda tribe.

Introduction

One of the most reliable markers of an adult's nutritional status is the quetlet or body mass index (BMI), which is universally regarded (James et al. 1988; Ferro-Luzzi et al. 1992; Shetty and James 1994; Naidu 1994; Bailley and Ferro-Luzi 1995). Despite significant diversity in weight and height between human populations, BMI may be nutritionally rather than genetically connected (Rolland & Chachera 1993). (Eveleth and Tanner 1990; Maunder et al. 1990). So, in a nation with a variety of ethnic groups, like India, the use of BMI as an anthropometric indication of nutritional status may be more appropriate (Khongsdier 2001). (cf. Adak et al. 2006).

Malnutrition affects people of every country. The cause of malnutrition is not only the excess or lack of nutrition, but it is also affected by social condition. The best way to depict the scope and distribution of undernourishment using anthropometric markers is to characterise the nutritional status of communities. In many field situations with severely limited resources, anthropometry can be used as a screening tool to identify people at risk of undernutrition. After this preliminary diagnosis, additional methods can be used to undertake a more thorough investigation. Body mass index (BMI) is an age independent nutritional index. It is used effectively to evaluate status of nutrition in any population group. Living conditions of the tribal people in our country are deplorable in general, characterized with marked poverty, lack of sewage and housing. Level pf socio-economic development is relatively low among them when compared to the non-tribal groups. The prevalence of malnutrition among adult members of Indian tribes varies (NFHS-III, 2009). It is an abnormal metabolic condition brought on by unacceptably high, unevenly distributed, or excessive macronutrient intake. In this study, nutritional status is examined according to Body Mass Index among the adult Munda population of Sundarbans, West Bengal, India.

Material and Methods

Sunderban of West Bengal is the largest mangrove forest and the largest delta in the world. The study area comprises three villages, Sadarpara (Tipligheri Bazar area), Luxbagan, and Parasmoni of the World Heritage Sundarban, Gosaba Block, south 24 Parganas district, West Bengal, India

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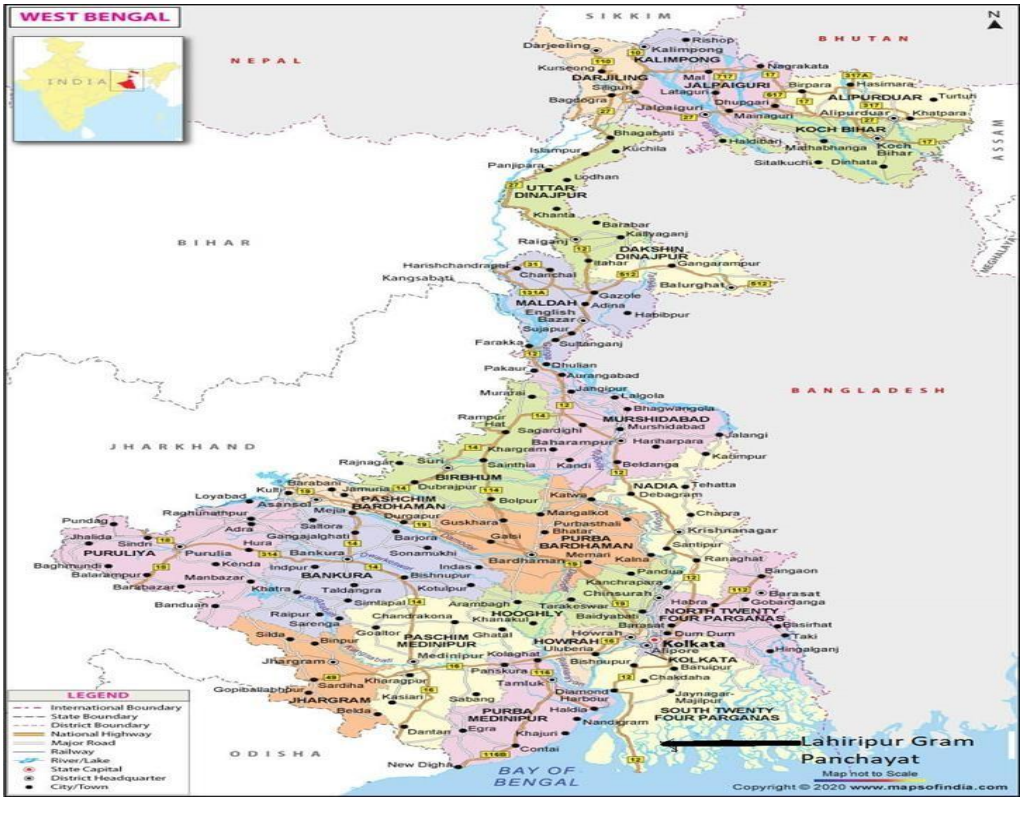
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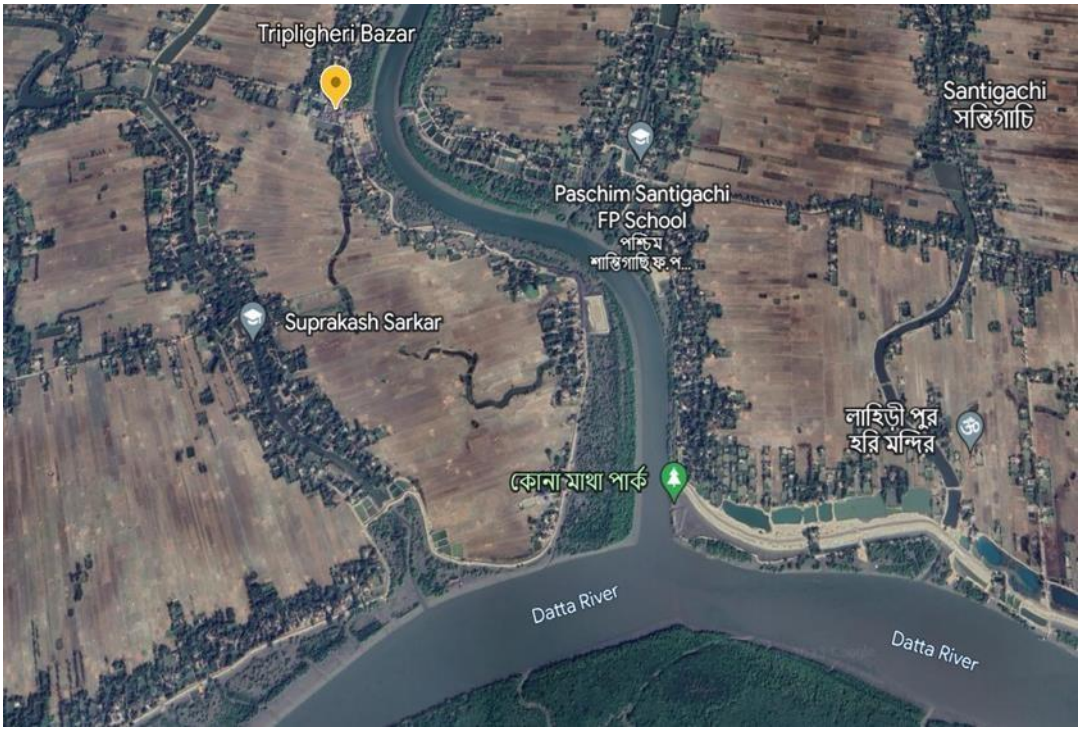

The poor economic condition of the inhabitants was presented by the mud-built houses of the villagers. The vast majority of the houses were made of mud and had straw-thatched roofs. Investigators discovered that most Munda villagers did not own agricultural land, and that many Mundas used to visit the nearby Sundarban forest to collect fish, crabs, honey, and some fuel wood.

The overall number of households in the studied tribe is one hundred and ten (110). The entire number of individuals studied is three hundred and five (305). The total number of individuals available is 156 adult males and 149 adult females. Only adults (above 18.0 years of age) were considered for this study. Subjects were recruited from their respective villages to participate in this investigation on the basis of ethnicity. Munda peoples gave their written consent to participate in this study. Anthropometry: Anthropometric measurements such as height, weight, chest girth (for males only) was taken according to Singh andBhasin (1989).

Internationally accepted BMI guidelines are used to evaluate nutritional status (WHO 1990). For CED and BMI, the following cutoff values were applied: Normal: BMI = 18.5 24.9 kg/m^2, CED: BMI 18.5 kg/m^2. BMI = 25.0 kg/m^2. The World Health Organization's 1995 designation of the issue of low BMI as a public health issue was applied to adult populations all across the world. This classifies the occurrence of BMI 18.5 kg/m^2 according to the percentage of a population as follows: The situation is critical (very high (40%)).
Medium (10–19%): the situation is poor.
Low (5–9%): Monitoring is required; follow the warning sign.

Results and Discussion

The classification of adult Munda males based on their BMI into different nutritional status categories as per the WHO classification (1995) is shown in Table 1.

Table 1: Distribution of Body Mass Index (Kg/m^2) among the Munda Community

Category	Range (Kg/m^2)	MALE (N=156)		FEMALE (N=149)	
		No. of Male	%	No. of Female	%
CED Grade III	< 16.0	7	4.49	8	5.37
CED Grade II	16.0 – 16.9	6	3.85	10	6.71
CED Grade I	17.0 – 18.4	24	15.38	23	15.45
Normal	18.5 – 24.9	117	75.00	106	71.14
Overweight	25.0 – 29.9	2	1.28	2	1.34
Obese	≥ 30.0	0	0.00	0	0.00

It is evident from the table that out of 156 adult males, 25 percent are malnourished, compared to 75 percent who are found to be normal. Within malnourished males, 15.38 percent are found to be CED Grade 1, and 15.38 percent are found to be CED Grade II, whereas 3.85 percent of male members are suffering from CED Grade III malnutrition. It is also found that 1.28 percent are overweight. No male member is in the obese category.

On the other hand, only 71.14 percent of females are categorised as "normal," compared to 28.86 percent of females who are found to be malnourished. Within malnourished females, 15.45 percent of females fall under the category of CED Grade 1. Overall, 6.71 percent of adult females are CED Grade II. It is to be noted that 5.37 percent of females in this country suffer from CED Grade III malnutrition. Table 1 also delineates that the Munda females represent only 1.34 percent in the category of overweight nutrition status. Whereas, in the case of obese nutritional status, no one was detected as being in the obese category. A comparison of both genders reveals that women have a higher prevalence of grade I (15.45%), grade II (6.71%), and grade III (5.37%) malnutrition than men, at 15.38 percent, 3.85 percent, and 4.49 percent, respectively. It depicts that 28.86 percent of women are malnourished as compared to 25 percent of males. Therefore, the females are the worse sufferers in terms of nutritional status in comparison to their male counterparts among the Munda population residing in Lahiripur Gram Panchayat. Women with better nutritional conditions (BMI of 18.5-24.9 kg/m^2) historically have had better baby health status, according to the NNMB (1994; 1996). The mother's health, as well as the health of the foetus and child, are all negatively impacted by nutritional deprivation (Winikoff 1990).

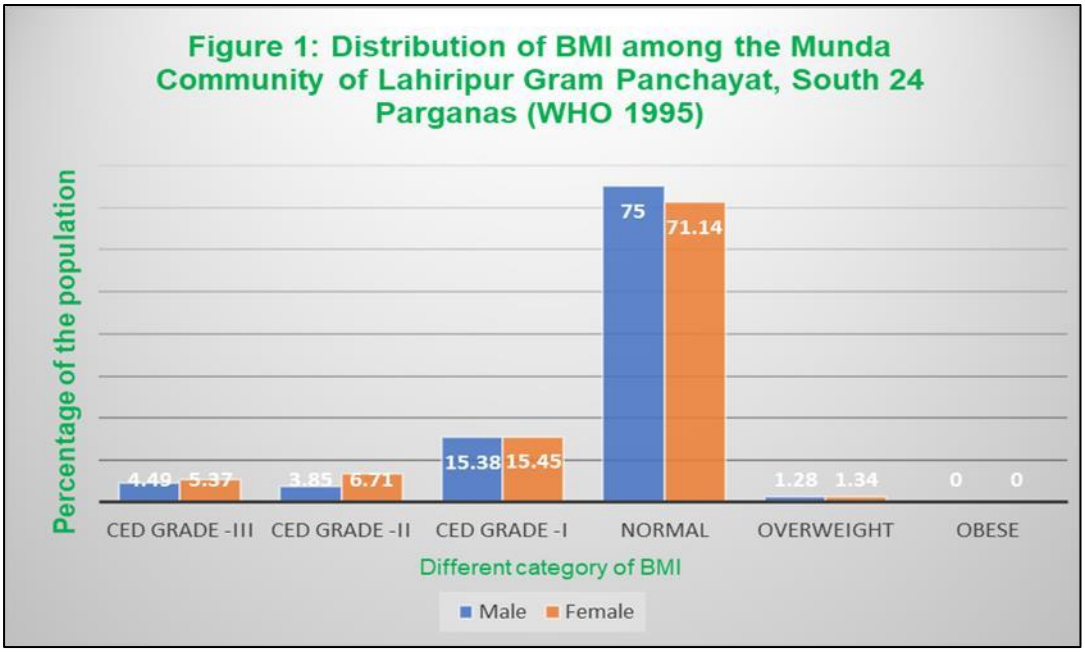

Figure 1: Distribution of Body Mass Index (BMI) and different Chronic Energy Deficiency (CED) Grade of the Munda Community, WHO,1995.

Figure 1 is the bar diagram of the Body Mass Index (BMI) and Chronic Energy Deficiency (CED), WHO, 1995, which is for a clearer understanding.

Data are further analyzed, and the Z-score has been performed by sex to verify the adult nutritional status of Munda of Gram Panchayat Lahiripur, Gosaba, 24-Parganas (South), and the southern part of West Bengal within those individualsin relation to the standard deviations. The results have been presented in Table 2.

Table 2: Body Mass Index cut – off point of Z-Score among studied Munda

Sex	Cut off point of Z-Score	Category	No.	%
Male (No. = 156)	+ 2 to -2	Normal	156	95.84
	-2 to -3	Moderate	0	0.00
	-3 and above	Sever	0	0.00
Female (No. = 149)	+ 2 to -2	Normal	148	86.29
	-2 to -3	Moderate	1	0.59
	-3 and above	Sever	0	0.00

Source: NCHS -- National Centre for Health Statistics. (1977)

It is observed from the table that 95.84 percent of males fall into the category of normal status of nutrition, whereas 86.90 percent of females fall into the normal category of nutrition. Only 0.59 percent of females are suffering from moderate malnutrition.

The data are further analyzed and summarized in Table 3 for the classification of adult Munda of Lahiripur Gram Panchayat, based on their BMI in different nutritional status categories as per Asia–pacific (2000) classification.

Table 3: Distribution of Body Mass Index among the Munda according to Asia Pacific (2000) classification

Category	Range (Kg/M²)	MALE(N=156)		FEMALE(N=149)	
		No.	%	No	%
CED Grade III	< 16.0	7	4.49	8	5.36
CED Grade II	16.0 – 16.9	6	3.85	10	6.71
CED Grade I	17.0 – 18.4	24	15.38	25	16.77
Normal	18.5 – 22.9	115	73.71	86	55.13
Overweight	23.0 – 24.9	4	2.56	18	12.08
Obese	≥ 25.0	0	0.00	2	1.28

It is evident from the table that out of 156 adult males, 26.29 percent of males are malnourished as compared to 73.71 percent male, who are found to be Normal. Within malnourished males' 15.38 percent are found to be CED Grade I and 3.85 percent are found to be CED Grade II, whereas, 4.49 percent male members are suffering from CED Grade III malnutrition. Overall, 2.56 are in the overweight and obese category is zero percentage of adult males. Other side, only 55.13 percent females are categorized as Normal as compared to 44.87 percent females, who are found to be malnourished. Within malnourished female's 16.77 percent fall under the category of CED Grade 1. Overall, 6.71 percent adult females are CED Grade II. Notable, mater of concern over here is 5.36 percent females are suffering from CED Grade III malnutrition. Table 3 also delineates that the Munda female represents 12.08 percent in the category of overweight status of nutrition, whereas, in case of obese nutritional status, alarming frequency is also noticed (1.28 percent).

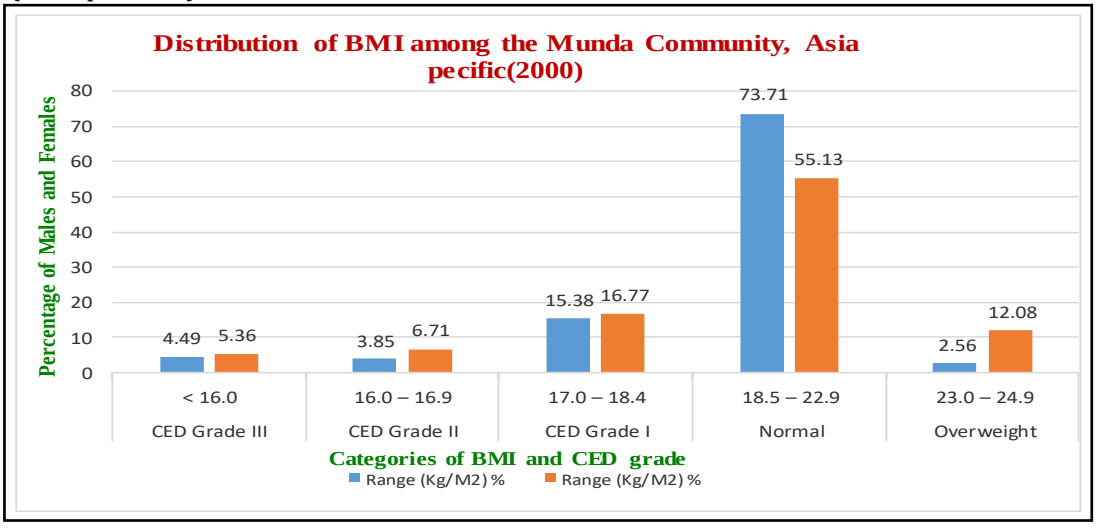

Figure 2: Distribution of Body Mass Index (BMI) and different Chronic Energy Deficiency (CED) Grade of the Munda Community, Asia-pacific, 2000.

Figure 2 is the bar diagram of the Body Mass Index (BMI) and Chronic Energy Deficiency (CED), Asia-pacific, 2000, which is for a clearer understanding.

Table 4: Prevalence of CED (based on BMI) and Mean BMI among several tribes of West Bengal
M: Male; F: Female

Researcher Name	Study area	No. Of Individuals	Mean BMI (Kg/ m^2)		CED (%)		Tribe's name
			Male	Female	Female	Male	
Bose et al (2006b)	Bankura	500	18.6	18.2	56.4	48	Kora-mudi (M& F)
Ghosh & Malik (2007)	Bankura	800	-	-	52.5	55	Santal (M& F)
Bisai & Bose (2009)	Bankura	123	18.3			55.3	Kora-mudi (F)
Ghosh et al. (2018)	Bankura	226	19	18.4	56.5	46.8	Sabar (M& F)
Mukhopadhyay A (2010)	Birbhum	251	20.5	19.5	38.5	30.5	Santal (M& F)
Mittal & Srivastava (2006)	Jalpaiguri, WB	350	18.8	19.7	30.7	47.0	Oraon (M&F)
Ghosh & Bharati (2006)	Kolkata	234	17.7	-	-	67.9	Munda (F)
Bose et al. (2006a)	West Medinipur	410	20.0	19.0	41.8	31.5	Santal (M& F)
Bose et al. (2008)	West Medinipur	157	19.5	-	-	45.2	Lodhas (M)
Bose et al. (2008)	West Medinipur	161	18.6	-	-	48.4	Bhumij (M)
Bose et al. (2011)	West Medinipur	106	19.3	-		35.8	Munda (M)
Das et al. (2013a)	West Medinipur	106	18.4	-	-	50.0	Munda (M)
Bose et al. (2011)	West Medinipur	104	19.4	-	-	37.5	Oraon (M)
Ghosh & Bose (2015)	West Medinipur	195	18.6	-	-	52.3	Bhumij (M)
Mahapatra et al. (2021)	West Medinipur	100	17.8	19.96	40	72.0	Oraon (M& F)
Bose et al (2011)	West Medinipur	104	19.4	-	-	-	Oraon (M)
Das & Bose (2010)	Purulia	513	19.5	18.1	63.4	30.6	Santal (M&F)
Das et al. (2013b)	Purulia	72	20.5	-	-	19.4	Birhor (M)
Das et al. (2020)	Purulia	307	19	-	-	47.2	Sabar (M)
Banik et al. (2007)	Siliguri	305	19.5	19.1	46.4	27	Dhimal (M&F)
Present Study (2022)	South 24 Parganas	306	19	18.11	43	37	Munda (M&F)

On the whole, a comparative study, from both the genders, Table 3 revels that the women show higher prevalence of grade I (16.77 percent), grade II (6.71 percent)and grade III (5.36 percent) malnutrition compared to 15.38, 3.85 and 4.49 percent of males, respectively. It shows that compared to men, who are

malnourished at a rate of 26.29 percent, women are at 44.87 percent. Therefore, among the Munda people living in Lahiripur Gram Panchayat, the ladies are worse off nutritionally than their male counterparts.

Conclusion

Undernutrition is extremely easily caused when people are continually hungry but aren't given anything to eat. The Body Mass Index (BMI) measures adult malnutrition, and a BMI below 18.5 indicates a persistent energy deficiency. People in the states of Karnataka, Gujarat, Madhya Pradesh, and Odisha suffer from severe adult malnutrition. More than half of adult individuals in Karnataka, Gujarat, Madhya Pradesh, and Odisha have a BMI under 18.5. (FAO 2010). The male Santal population of West Bengal has the highest mean BMI (20.5 kg/m^2) (Mukhopadhyay 2010:118). The male Warli population of Maharastra has the lowest mean BMI (BMI = 16.8 kg/m^2) (Adak et al. 2006: 12). Similarly, Jarowa women have the highest BMI (BMI = 19.8 kg/m^2) of any ethnic group (Sahani 2003: 52). The lowest mean BMI of any of the examined tribal communities is seen in the female Munda community of West Bengal (BMI = 17.7 kg/m^2) (Table4).

There are many reasons for the inconsistent prevalence rate of undernutrition. The limited sample size, non-representative sampling, and other factors are the main contributors to the disparity in the incidence rate of undernutrition. The various West Bengali tribes' nutritional status is not great. The morbidity and mortality rates, as well as the health profiles, of the various West Bengali tribes are crucial and disturbing. With the exception of a few towns in the country's northeast, almost all of the tribes (Table No. 4) showed high rates of CED or chronic energy deficiency. It is reasonable to state that investigation among many tribal people from other regions of India is necessary before a more complete picture can be developed.

In India, there are 28.1% more women than men who are underweight, according to the National Family Health Statistics-3 report (NFHS-3, 2005–2006). Tools for evaluating nutritional status include chronic energy deficiency and the body mass index. The Munda community in West Bengal, India, has a better health profile than other tribes.

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PHOTOGRAPHS

Study Area: Lahiripur Gram panchayat (Sardarpara, Luxbagan and Parasmoni three villages) Gosaba Block, South 24 Parganas.

Name of the community: Munda

Photograph 1. The researcher takes the data from community people.

Photograph 2. The researcher takes the data from the people of the Munda community in the presence of Joint Supervisor Prof. B.C. Ray, Former Professor, Department of Chemistry, Jadavpur University.

Photograph 3. Measurement of height of a female individual

Photograph 4. Measurement of height of an adult male and female

Photograph 5: Measurement of MUAC of adult male

Photograph 6. Tricep-skin fold measurement of an adult female

Photograph 7. Focus group discussion with the headman of the community

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Photograph 9. Measurement of blood pressure in an adult female of the community

Photograph 10. Photograph of a Kachha house used by Munda community members at Sadarpara Village in Tipligheri Bazar Area of Lahiripur Grampanchayat, Gosaba Block, South 24 Parganas.

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Photograph 12. Photograph of a semi-pucch house-built community

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Photograph 15. Tipligheri F.P. School, which is located in the Tipligheri Bazar of Lahiripur Grampanchayat, Gosaba Block, South 24 Parganas.

Photograph 16. A government-subsidized RO-big-size water purifier system is located in the Tipligheri Bazar of Lahiripur Grampanchayat, Gosaba Block, South 24 Parganas.

Photograph 17. A government-subsidised LPG dealer shop, which is located in the Tipligheri Bazar of Lahiripur Grampanchayat, Gosaba Block, South 24 Parganas.

Photograph 18. Mahatma Gandhi Gramin Sarak Joyojna

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Photograph 33. Mangrove trees and it’s big size air-root in deep forest

Photograph 34. Very old Kewra tree and still it gives fruits

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