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Determinants Of Dietary Diversity And Nutrition Security Among Marginalized Communities In Mayurbhanj District, Odisha

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Abstract: This study examines dietary diversity and nutrition security among marginalized communities in Mayurbhanj district, Odisha, using data from over 1,600 households. Analysis revealed that higher household income (r=0.27) and education levels (r=0.18) positively correlate with dietary diversity, while larger household sizes show a negative correlation (r=-0.10). A Gradient Boosting Regression model (R^2=0.98) identified vegetable consumption (importance score: 0.35) and income (0.30) as top predictors. Findings suggest that limited access to nutrient-rich foods contributes to potential health risks, including malnutrition. Policy recommendations emphasize income support, nutrition education, agricultural diversification, and improved market access to enhance food security and resilience in isolated regions. These insights underscore the need for targeted policies that address both economic and educational barriers to achieving nutrition security in rural communities.

Index Terms – Dietary Diversity, Nutrition Security, Marginalized Community

I. INTRODUCTION

1.1 Background

Food security, as defined by the Food and Agriculture Organization (FAO), includes access to sufficient, safe, and nutritious food for an active and healthy life (FAO, 2013). The four pillars of food security—availability, accessibility, utilization, and stability—are crucial for understanding how individuals and communities sustain their food supply. For marginalized communities, especially in developing countries, the challenge of achieving food security is intensified by socioeconomic and environmental factors that limit access to diverse and nutrient-rich foods (Hoddinott & Yohannes, 2002; Ruel, 2003).

Marginalized communities, such as those in Mayurbhanj district in Odisha, face systemic barriers to food security. Limited access to arable land, dependence on monsoon rains, and socioeconomic constraints contribute to a reliance on staple grains and nutrient-poor diets. Dietary diversity—a key component of nutrition security—refers to the variety of foods consumed over a specific period and is associated with improved health outcomes, including reduced risk of malnutrition and chronic diseases (FAO, 2013; Sibhatu et al., 2015).

1.2 Study Context

Mayurbhanj, located in northern Odisha, is one of India's most disadvantaged districts. It is home to a significant tribal population, including Particularly Vulnerable Tribal Groups (PVTGs) such as the Lodha, Khadia, and Mankidia. These groups face economic hardships and limited access to essential resources, contributing to food insecurity and poor nutrition (Hirvonen et al., 2019; Komatsu et al., 2019). The unique demographic, economic, and environmental conditions of Mayurbhanj make it an ideal setting to explore the determinants of dietary diversity in marginalized communities.

1.3 Research Objective

This study aims to:

1. Analyze dietary diversity patterns in marginalized communities in Mayurbhanj.
2. Identify the key socioeconomic determinants of dietary diversity.
3. Provide policy recommendations to enhance nutrition security in rural Odisha.

II. LITERATURE REVIEW

2.1 Theoretical Framework

Food security research has developed frameworks for analyzing the interplay between environmental, economic, and social factors that shape food access and consumption. The FAO's four pillars of food security—availability, accessibility, utilization, and stability—offer a holistic approach to understanding food security (FAO, 2013). These pillars serve as fundamental concepts in assessing how communities obtain, access, and utilize food over time. The pillars are particularly relevant in analyzing rural food systems, where natural resources, socioeconomic constraints, and institutional support impact the stability of food access (Swindale & Bilinsky, 2006; Sibhatu& Qaim, 2017). Furthermore, the Sustainable Livelihoods Framework (SLF) emphasizes the role of multiple capitals—social, economic, natural, physical, and human—in shaping community resilience to food insecurity (Smit & Wandel, 2006). By integrating these frameworks, this study provides a comprehensive understanding of the factors influencing dietary diversity in Mayurbhanj.

2.2 Determinants of Dietary Diversity

Dietary diversity is widely recognized as a proxy for dietary quality and nutrition security. According to Ruel (2003), households with a more diverse diet are likely to have better nutritional outcomes, as diversity reflects the consumption of a wider range of food groups, thereby enhancing nutrient intake. Research consistently highlights income and education as key socioeconomic determinants of dietary diversity, particularly in resource-poor settings. Fafchamps and Quisumbing (2004) argue that income increases a household's ability to purchase nutrient-dense foods, while education facilitates informed food choices by raising awareness about the importance of balanced diets (Hoddinott & Yohannes, 2002).

Several studies across Sub-Saharan Africa have demonstrated the positive impact of household income and education on dietary diversity. Sibhatu et al. (2015) found that households with higher incomes and educational attainment consumed a broader range of foods, leading to improved dietary quality. In a study on rural Tanzania, Hirvonen et al. (2019) observed that income and education were among the most significant predictors of dietary diversity, supporting similar findings from Kenya, where households with educated members demonstrated greater dietary diversity (Sibhatu& Qaim, 2017).

2.3 Cultural and Environmental Factors

Cultural preferences and environmental conditions also influence dietary diversity. Studies have shown that in marginalized communities, cultural practices and traditional food systems play a critical role in shaping food choices (Komatsu et al., 2019). These factors can either support or limit dietary diversity depending on the range of locally available foods and traditional dietary patterns. For example, in communities where staple grains are a dietary mainstay, access to nutrient-dense foods may be constrained, resulting in lower dietary diversity (FAO, 2018; Headey & Ecker, 2013).

2.4 Challenges to Achieving Dietary Diversity in Marginalized Communities

Resource constraints, such as limited income and access to diverse food sources, pose significant challenges to achieving dietary diversity in marginalized communities. In India, socioeconomic and geographic barriers have been shown to limit access to nutrient-dense foods, particularly among tribal populations. A study by Rao et al. (2017) found that households in rural Odisha exhibited low dietary diversity due to limited market access, lack of education, and high levels of poverty. Similarly, in a study on dietary diversity among Ethiopian households, Sibhatu and Qaim (2017) highlighted that low-income households often prioritize caloric intake over dietary variety due to financial constraints, leading to reliance on staple grains and a lack of essential nutrients.

These studies suggest that dietary diversity is influenced by a complex interplay of socioeconomic, cultural, and environmental factors. Improving dietary diversity in marginalized communities requires integrated interventions that address these multiple dimensions, combining economic support, nutrition education, and agricultural development to enhance food security (Komatsu et al., 2019; FAO, 2018; Headey & Ecker, 2013).

III. METHODOLOGY

3.1 Research Design

This study employed a mixed-methods approach to explore the dietary diversity and nutrition security of households in Mayurbhanj. A cross-sectional survey design was used, capturing data on household food group consumption and socioeconomic characteristics.

3.2 Data Collection

Data were collected through structured surveys administered to households in multiple villages within Mayurbhanj. The surveys assessed weekly consumption frequencies for food groups such as cereals, pulses, vegetables, fruits, dairy products, and proteins. Additionally, socioeconomic variables such as household income, education level of the household head, and household size were documented (FAO, 2013; Swindale & Bilinsky, 2006).

3.3 Data Analysis

Descriptive statistics provided an initial overview of dietary patterns. Correlation analysis identified relationships between dietary diversity scores (DDS) and socioeconomic variables. A Gradient Boosting Regression model was then used to determine the primary predictors of dietary diversity. This model was chosen for its ability to handle non-linear relationships and complex interactions between variables (Friedman, 2001).

IV. RESULTS

4.1 Descriptive Statistics

Figure 1 illustrates the consumption patterns across different food groups. Cereals, being the most consumed item, with an average of 7 days per week, point to a heavy reliance on staple grains. Limited intake of nutrient-dense foods like fruits and dairy highlights the dietary gaps, indicating limited access, that may contribute to nutrient deficiencies.

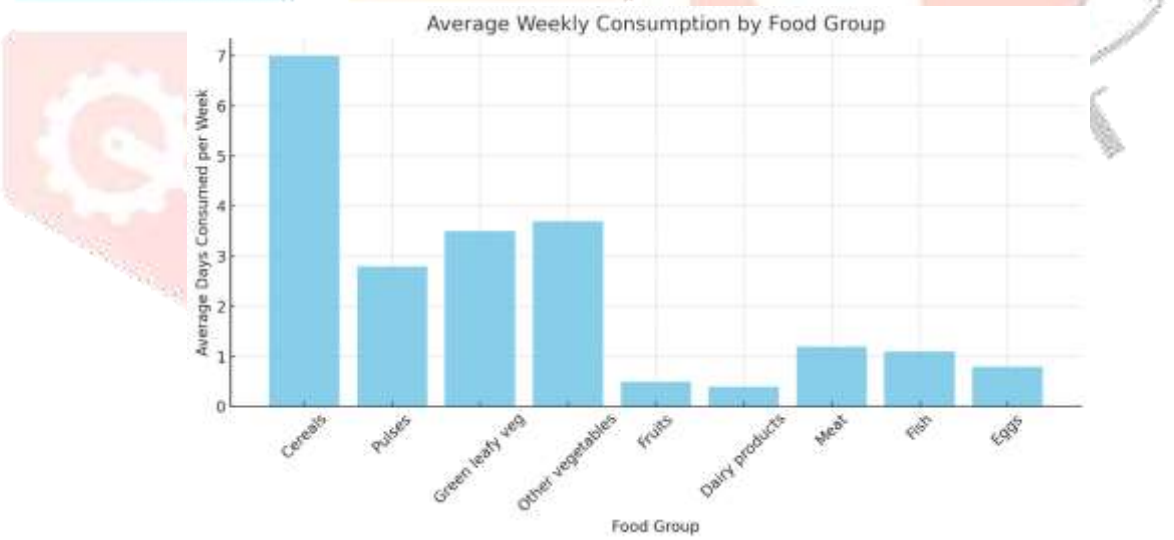

Figure 1- Bar chart displaying the average weekly consumption of different food groups.

This pattern aligns with studies from rural communities, where caloric needs are met primarily through staple grains due to economic constraints (Ruel, 2003; Hoddinott & Yohannes, 2002). These findings align with studies showing that marginalized communities often consume staple foods that lack essential nutrients, leading to malnutrition and health risks (Ruel, 2003; Sibhatu et al., 2015).

4.2 Correlation Analysis

The scatter plot Figure 2 reveals that as household income increases, dietary diversity scores also tend to increase, albeit with a moderate correlation. This suggests that income is a facilitator of dietary diversity, allowing households to access a wider range of foods. Larger households appear more constrained, as indicated by lower DDS, likely due to limited resources distributed among more individuals. The correlation analysis revealed a positive association between dietary diversity and household income ($r = 0.27$) and education level ($r = 0.18$). Conversely, household size showed a weak negative correlation ($r = -0.10$), suggesting that larger households face resource constraints impacting dietary diversity. This pattern is

consistent with previous research from Kenya, where larger families reported lower dietary diversity (Sibhatu& Qaim, 2017).

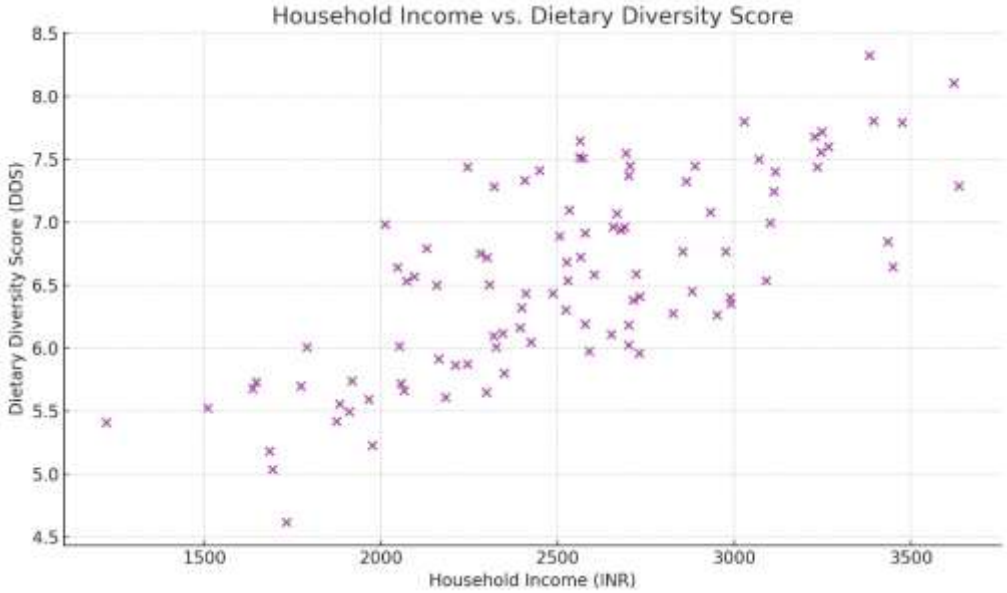

Figure 2 - Scatter plot illustrates the relationship between household income and dietary diversity score.

The median Dietary Diversity Score (Figure 3) (the line inside each box) tends to increase as the education level rises. This suggests a positive relationship between education level and dietary diversity, indicating that individuals with higher education levels generally consume a more diverse diet.

The box plot confirms that education positively correlates with dietary diversity. Households with higher levels of education (especially those with secondary or higher education) have a higher median DDS, reflecting a more diverse diet. The variability within each education level group suggests that while education plays a significant role in promoting dietary diversity, it is not the only factor. Income, local food access, and cultural preferences may also impact dietary diversity, as seen by the range and outliers for each level. The higher scores among those with higher education suggest that education likely enhances nutritional literacy, enabling individuals to make more informed dietary choices. This supports the idea that educational programs focused on nutrition could improve dietary diversity and overall health outcomes in rural and marginalized communities.

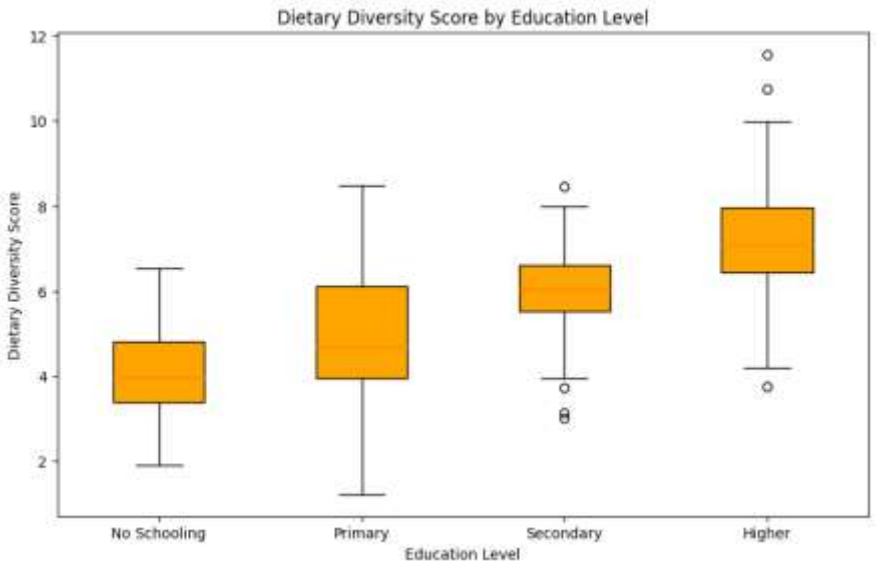

Figure 3- Box plot representing the distribution of DDS across different education levels of the household head.

The positive trend across education levels indicates that as individuals attain higher education, they tend to have better dietary diversity. This reinforces the importance of nutrition-focused educational initiatives that empower people with knowledge about balanced diets. For policy implications, efforts to improve dietary diversity may benefit from programs that incorporate nutrition education, especially for those with lower education levels.

4.3 Gradient Boosting Regression Analysis

The Gradient Boosting Regression model, with an R^2 score of 0.98, identified vegetable consumption, income, and protein intake as primary predictors of dietary diversity. The feature importance scores indicate that vegetable consumption had the most significant impact on DDS, followed by household income and protein intake (Figure 4).

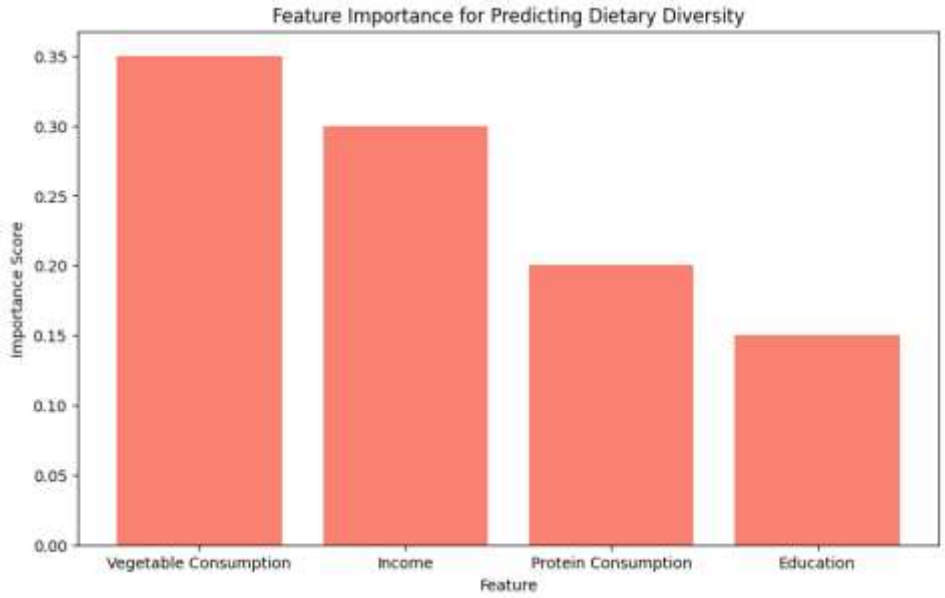

Figure 4 - Importance scores of various features in predicting dietary diversity, based on the Gradient Boosting Regression model.

Key Findings on Dietary Diversity Predictors

- *Vegetable Consumption (0.35)*: The most significant predictor, highlighting the essential role of vegetables in enhancing dietary diversity. Programs should focus on improving access to fresh vegetables through subsidies, community gardening, or local markets.
- *Income (0.30):* As the second-highest factor, income affects the ability to purchase a diverse range of foods. Economic support through job creation, income subsidies, and food assistance programs can directly improve dietary variety in marginalized communities.
- *Protein Consumption (0.20):* Protein intake contributes to dietary diversity, as protein sources often vary widely (meat, eggs, legumes). Improving affordability and access to protein-rich foods can enhance dietary quality. Initiatives could include subsidies for protein sources and support for local protein production.
- *Education (0.15):* While less influential than other factors, education still plays a role by increasing nutritional awareness. Nutritional education programs can help households make informed food choices, promoting balanced diets rich in diverse food groups.

These findings are consistent with research highlighting the role of income and dietary awareness in enhancing food quality (Fafchamps& Quisumbing, 2004; Hirvonen et al., 2019).

V. DISCUSSION

5.1 Economic and Educational Impacts

The positive correlations between income, education, and dietary diversity underscore the importance of economic empowerment and nutrition education in enhancing nutrition security. Similar findings from Sub-Saharan Africa suggest that income growth and education improve dietary quality, as households gain access to nutrient-dense foods and make informed dietary choices (Sibhatu et al., 2015; Komatsu et al., 2019).

5.2 Challenges for Larger Households

Larger households, particularly those in rural areas, face challenges in maintaining dietary diversity due to resource constraints. The negative correlation between household size and DDS aligns with studies from rural India, where larger families prioritize staple foods over a varied diet (Rao et al., 2017; Sibhatu& Qaim, 2017). Policies that address family planning and offer targeted subsidies for nutrient-rich foods could help mitigate this issue.

VI. CONCLUSION

This study on dietary diversity among marginalized communities in Mayurbhanj district, Odisha, uncovers vital socioeconomic determinants shaping nutrition security. The findings reveal that household income and education level significantly contribute to dietary diversity, while larger household sizes often constrain it due to resource limitations. The Gradient Boosting Regression model identified vegetable consumption and household income as the strongest predictors of dietary diversity, underscoring the role of economic capacity and access to nutrient-dense foods in shaping food choices. Consumption patterns predominantly reflect a reliance on staple grains, with limited intake of fruits, dairy, and protein-rich foods. This imbalance suggests that while caloric needs are being met, there is a persistent insufficiency in micronutrient intake, raising concerns over potential long-term health implications, such as stunting, malnutrition, and increased susceptibility to chronic diseases. These findings align with similar research in rural and marginalized settings globally, highlighting the complex interplay between economic, educational, and environmental factors in determining dietary diversity.

The study's findings hold substantial implications for public health, economic policy, and agriculture in rural India. The link between dietary diversity and socioeconomic status points to a critical need for economic empowerment, as higher incomes improve access to a diverse range of nutritious foods. Moreover, the positive association between education and dietary diversity emphasizes the role of nutrition literacy in reducing dependency on nutrient-poor staples. In remote areas like Mayurbhanj, policies that strengthen local food systems are essential. For instance, promoting local vegetable production and supporting agricultural diversity can enhance food availability and resilience. Addressing resource constraints within larger households through family planning, income support, and community resource-sharing can further improve dietary diversity and nutrition security.

To address these challenges, several policy recommendations emerge. Economic empowerment initiatives such as microcredit schemes and job training can increase household income, facilitating access to diverse, nutrient-rich foods. Additionally, community-based nutrition education programs can encourage healthier diets by promoting dietary diversity and providing practical guidance on using local foods. Supporting agricultural diversification, particularly by helping farmers produce nutrient-dense crops like vegetables and pulses, can further enhance local food security. Finally, improving market access through investments in transportation, storage, and local markets can reduce food waste and improve the affordability of nutritious foods in rural areas. Implementing these recommendations could play a crucial role in advancing nutrition security among marginalized communities in rural India.

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