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Dietary Diversity Among Tribal Adolescents in Pune District, Maharashtra

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Abstract: Dietary diversity includes various food groups in daily consumption, ensuring adequate nutrient intake for growth and development. Adolescence is a critical life stage that demands a nutritionally rich and well-balanced diet comprising essential food groups such as vegetables, fruits, grains, and animal products. However, many tribal communities primarily depend on monotonous, starchy diets, which often lack diversity and contribute to micronutrient deficiencies and malnutrition. Limited access to diverse food sources and socio-economic constraints exacerbate these nutritional challenges.

This study aims to assess the dietary diversity among adolescent students from tribal ashram schools in Pune district, Maharashtra, to identify prevalent dietary patterns and associated factors influencing their food consumption.

A cross-sectional research design involved 1,292 adolescent students from tribal ashram schools. Dietary intake data were collected using the 24-hour dietary recall method, supplemented by demographic questionnaires and structured interviews. The data collection process was facilitated through the Epicollect5 online platform, ensuring systematic and efficient data management. Post-collection, the data underwent a thorough cleaning process before being analyzed using SPSS (Version 2021) and Microsoft Excel.

The findings indicate notable gender-based differences in dietary habits. Female students demonstrated a more balanced dietary intake, exhibiting greater dietary diversity than their

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male counterparts. In contrast, male students consumed more oily foods and displayed fewer protein sources, potentially affecting their nutritional status. Specifically, 32.97% of girls achieved a high dietary diversity score compared to 24.15% of boys. Meanwhile, 41.72% of students, 18.27% of boys, and 23.45% of girls fell into moderate dietary diversity. A small fraction (1.16%) exhibited low dietary diversity, with 0.31% of boys and 0.85% of girls falling into this group. These findings suggest that while dietary diversity is relatively moderate among many students, there remains a need for targeted interventions to improve overall nutritional intake.

This study highlights that female students tend to prefer a more diverse and balanced diet, whereas male students tend toward diets high in fats and lower in protein variety. Food availability and personal choices significantly influence these consumption patterns. The results underscore the necessity for nutrition-focused programs and interventions to enhance dietary diversity among tribal adolescents to improve their overall health and well-being.

Keywords: Dietary Diversity, Adolescent Nutrition, Tribal Communities, Ashram Schools, Food Consumption Patterns

Introduction

Dietary diversity is a key indicator of diet quality and nutritional sufficiency. The Food and Agriculture Organization (FAO) defines it as the variety of food groups consumed within a specific timeframe (FAO, 2020). A higher level of dietary diversity is associated with improved micronutrient intake, better health outcomes, and a lower risk of malnutrition (Chaudhary et al., 2022). Ensuring a diverse diet is particularly important during adolescence as it supports physical growth, cognitive development, and immune function.

Among tribal adolescents, diets are often heavily reliant on staple grains such as rice, wheat, and millets, with limited inclusion of protein-rich foods, dairy products, and fresh fruits and vegetables. Studies indicate that traditional tribal diets frequently lack essential micronutrients like vitamin A, iron, and zinc, increasing the risk of anaemia and other deficiencies (Bhise et al., 2013). Additionally, dietary practices in tribal communities are shaped by cultural traditions, seasonal food availability, and economic constraints.

Several factors influence dietary diversity, including household income, parental education, and access to food. Financial limitations often lead to restricted food

choices, particularly among families with lower socioeconomic status (Nandre & Kulkarni, 2011). Cultural norms and food taboos can further limit dietary options, especially for adolescent girls, potentially impacting their overall nutritional health. Research in India suggests that boys tend to have greater access to protein- and vitamin-rich foods than girls, highlighting gender-based disparities in dietary intake (Aurino, 2017).

Ashram schools significantly impact students' dietary habits since school-provided meals are a primary source of nutrition for students. Evaluating the variety and nutritional adequacy of these meals is essential. Previous research suggests that while ashram schools offer staple foods, their meals often lack diversity, particularly in protein and micronutrient-rich options (Agrahar & Murugkar, 2005). Additionally, students' perception of school meals can influence their dietary intake, with some choosing to skip meals if they find them unappealing.

Dietary diversity is fundamental in determining household and individual food consumption patterns, directly influencing nutrient intake and overall nutritional outcomes. As per the World Health Organization (WHO), nutrition encompasses the relationship between food intake and the body's dietary requirements. Optimal nutrition involves a well-balanced diet complemented by regular physical activity, serving as a cornerstone of good health. Conversely, inadequate nutrition can compromise immune function, heighten illness susceptibility, impede physical and cognitive development, and reduce productivity (Adolescent Health | WHO, 2024). Dietary diversity refers to including various food groups in daily consumption. Among tribal adolescents, socioeconomic conditions, food availability, traditional dietary customs, and school-provided meals shape dietary diversity.

Tribal communities often face distinct nutritional challenges, largely shaped by their geographical isolation and economic constraints. Many reside in remote regions with limited access to diverse food sources, restricting their dietary options. In the Pune district, rice is the primary staple food among tribal groups. Their diet typically consists of cereals, leafy vegetables, roots and tubers, oilseeds, fruits, dairy products, fish, meat, and various spices and condiments. Although wild roots and tubers are consumed, their intake remains infrequent. Seasonal fruits, particularly those found in the wild, form an essential part of the diet, while various green leafy vegetables are collected, preserved through drying, and stored for consumption during periods of food scarcity, especially in the monsoon season (Shedage & Kulkarni, 2011).

Enhancing dietary diversity is recognized as a cost-effective approach to mitigating malnutrition. The erosion of dietary diversity has far-reaching consequences for rural populations' health and economic stability, including diminished income opportunities and a decline in the consumption of nutritionally diverse foods (Ghosh-Jerath et al., 2016). Food insecurity, seasonal fluctuations in food availability, and infrequent consumption of nutrient-dense foods heighten the risk of micronutrient deficiencies, compromising adolescent growth, immune response, and overall well-being. Investigating dietary diversity among tribal adolescents enrolled in ashram schools offers critical insights into their nutritional status, underscoring the need for targeted policy interventions.

Despite global initiatives aimed at improving adolescent nutrition, a significant gap persists in understanding the dietary behaviors of tribal students, particularly those residing in ashram schools. Given their reliance on school-provided meals, these residential institutions play a crucial role in shaping students' dietary habits. However, the quality and diversity of these meals vary, raising concerns about their adequacy in meeting the students' nutritional requirements (Florence et al., 2008). This study seeks to bridge this gap by comprehensively analyzing dietary diversity among adolescent students in tribal ashram schools within Pune district, Maharashtra.

Method

Study Setting and Duration

This research was conducted in the Tribal Sub-Plan (TSP) area of Pune district, Maharashtra, India, a region designated for targeted tribal development due to its substantial tribal population (50% or more). The study focused on tribal ashram schools within two tribal-dominated administrative blocks. Data collection was carried out over ten months, from June 2019 to March 2020.

Study Design

A cross-sectional research design was employed to capture a comprehensive study of dietary diversity among tribal adolescents.

Study Population

The study encompassed 1,292 adolescent students aged 10 to 19 years who were enrolled in selected tribal ashram schools.

Eligibility Criteria

Inclusion Criteria: Participants were required to attend school actively during the data collection period and belong to recognized tribal communities. Both male and female students were included in the study, provided they had received consent from their parents or guardians and approval from the school authorities.

Exclusion Criteria: Students who were absent from school at the time of data collection or who declined to participate were excluded from the research.

Data Collection Methods and Tools

Sampling Approach

To ensure representative participation, a multistage stratified random sampling method was utilized. Schools were selected based on key factors such as geographical distribution, student population, and accessibility.

Data Collection Process

Data collection was conducted using a combination of structured questionnaires and interviews, designed to capture multiple dimensions of students' dietary patterns. The tool for data collection included:

- 24-Hour Dietary Recall: Students were asked to report all foods and beverages consumed in the previous 24 hours, which were then categorized into standard food groups.
- Demographic Questionnaire: Information related to students' socioeconomic background, parental education levels, and duration of residence in ashram schools was recorded.
- School Meal Assessment: Students provided feedback regarding the availability, quality, and frequency of school-provided meals.

Dietary Diversity Score (DDS) Calculation: Dietary diversity was measured following the Food and Agriculture Organization (FAO) guidelines. A dietary diversity score (DDS) was calculated by assigning one point per food group consumed within the 24-hour recall period. The DDS was categorized into three levels:

- Low dietary diversity: DDS < 4
- Moderate dietary diversity: DDS 4–6
- High dietary diversity: DDS > 6

Data Analysis

The collected data were analyzed using SPSS software (Version 21). Descriptive statistics such as means, standard deviations, and frequency distributions were used to summarize dietary diversity patterns. Chi-square tests were applied to examine associations between dietary diversity and categorical variables, including gender and socioeconomic factors. Additionally, logistic regression analysis was performed to identify key predictors of dietary diversity, such as parental education, household income, and students' satisfaction with school-provided meals.

Rsesults and Discussions

Dietary Diversity Scores

The dietary diversity score (DDS) among the 1292 students was divided into three categories, such as 6.96 ± 1.23, indicating a generally high level of dietary diversity. However, 9.4% of students, consuming fewer than four food groups, exhibited low dietary diversity. The majority (90.6%) consumed a diverse diet, with a DDS above six.

Table 1 : Dietary Diversity Score

Dietary Diversity Score	Boy	Girl	Grand Total
High dietary diversity	24.15%	32.97%	57.12%
Low dietary diversity	0.31%	0.85%	1.16%
Moderate dietary diversity	18.27%	23.45%	41.72%
Grand Total	42.72%	57.28%	100.00%

The table presents that 32.97% of girls have a high dietary diversity score compared to 24.15% of boys. A considerable proportion of boys (18.27%) and girls (23.45%) fall under moderate dietary diversity. This accounts for 41.72% of the study population, indicating that nearly half of the students have neither too high nor too low dietary diversity. Only 1.16% of the total students exhibit low dietary diversity, with boys at 0.31% and girls at 0.85%.

Gender Differences in Dietary Diversity

Overall, the study includes a higher percentage of girls (57.28%) than boys (42.72%). The trend of higher dietary diversity among girls could be influenced by cultural, household, or behavioral factors, such as better dietary habits, food preferences, or caregiving patterns.

The data suggests that dietary diversity is relatively better among girls than boys, with more than half (57.12%) of the total students having a high dietary diversity score. The low dietary diversity group is minimal (1.16%), indicating that most students can access various food sources. However, the moderate dietary diversity category is substantial (41.72%), highlighting a scope for nutritional interventions to improve dietary diversity, particularly among boys.

Food Group Consumption Patterns

To understand dietary diversity consumption pattern, the data collected from a 24-hour diet recall were converted into 17 food groups and consumed by the students. These food groups include grains, roots, cereals, dry fruits, milk products, meat, fish, eggs, Green leafy vegetables, fruit vegetables, proteins, oil, oily food, sugar products, sugar drinks, spices, and other food items.

Table 2 : Food Group Consumption

Sr. No.	*Food Groups*	*Boys*		*Girls*	
		No	*Yes*	*No*	*Yes*
1	Grains	0.00%	42.70%	0.20%	57.00%
2	Roots	0.80%	42.00%	2.90%	54.30%
3	Cereals	0.20%	42.50%	0.50%	56.70%
4	Dry Fruits	34.20%	8.50%	48.70%	8.60%
5	Milk products	29.00%	13.70%	43.00%	14.30%
6	Meat	42.00%	0.70%	55.70%	1.60%
7	Fish	42.50%	0.20%	57.20%	0.10%
8	Eggs	38.20%	4.50%	48.30%	9.00%
9	Green leafy Veg	39.30%	3.40%	51.20%	6.00%
10	Fruit veg	16.00%	26.70%	22.80%	34.50%
11	Proteins	42.50%	0.20%	57.20%	0.10%
12	Oil	0.50%	42.20%	1.20%	56.10%
13	Oily food	42.50%	0.20%	56.40%	0.90%
14	Sugar Products	35.30%	7.40%	43.00%	14.20%
15	Sugar Drinks	32.60%	10.10%	46.00%	11.30%
16	Spices	0.60%	42.10%	1.20%	56.10%
17	Other	31.10%	11.60%	41.70%	15.60%

The table presents that girls consume slightly more grains and cereals than boys. 42% of boys consumed grains and cereals, and 0-0.8% did not consume

them. Also,57% of girls consumed 0-0.5% do not consume. Also, Girls show higher consumption of roots and tubers. 42% of boys consumed roots and tubers, and 0.8% did not. Also 56% of girls consumed it and 0.2% did not. The dry fruit consumption is relatively low in both groups. 8.5% boys consumed dry fruits and 34% did not. Also, 8.6% girls consume and 43% do not. Girls have a lower intake of dairy compared to boys. 13% of boys consumed milk and milk products, and 29% did not. Also, 14% of girls consumed and 43% did not. Meat and fish consumption is higher among girls than boys. Among boys, 0.7% consume meat, while 42% do not, whereas among girls, 1.4% consume meat, and 55% do not. Similarly, 4.2% of boys consume fish, 42% abstaining, 9.0% of girls consume fish, and 48% do not. Slightly more girls consume eggs than boys. Among boys, 4.5% consume eggs, while 38% do not, whereas among girls, 6.0% consume eggs, and 39% do not. More girls consume green leafy vegetables than boys. Among boys, 3.4% consume them, while 39% do not, whereas among girls, 6.0% consume them, and 41% do not. Girls consume more fruits and vegetables than boys. Among boys, 16% consume them, while 22% do not, whereas among girls, 22% consume them, with the same 22% not consuming them. Both boys and girls have low protein intake, with girls consuming slightly more. Among boys, 0.5% consume protein, while 42% do not, whereas among girls, 0.6% consume it, and 50% do not. Boys consume more oily food than girls. Among boys, 35% consume it, while 0.2% do not, whereas among girls, 14% consume it, with only 0.1% not consuming it. Girls have a higher sugar intake than boys. Among boys, 7.4% consume sugar products, while 0.2% do not, whereas among girls, 14.0% consume them, with only 0.1% not consuming them. Similarly, 10% of boys consume sugary drinks, with 0.6% abstaining, while 11% of girls consume them, with the same 0.6% not consuming them. There is no significant difference between the two groups about sugar drinks. Among boys, 10.2% consume, while 0.6% do not, whereas among girls, 11.0% consume, with the same 0.6% not consuming. Boys consume more miscellaneous food items than girls. Among boys, 31% consume them, while 0.6% do not, whereas among girls, 15% consume them, with the same 0.6% not consuming them.

Dietary diversity refers to the variety of foods consumed across different food groups. Among boys, there is an increased consumption of oily foods and other miscellaneous food items, while the intake of green leafy vegetables, fruits, and dairy is lower. Additionally, boys show a reduced preference for protein sources such as meat, fish, and eggs. On the other hand, girls exhibit a more balanced intake,

including grains, roots, cereals, and vegetables. They consume meat, fish, and eggs more than boys, with a moderate sugar and dairy intake. Overall, girls have a more diverse diet, with a slightly higher intake of vegetables, fruits, and protein sources. In comparison, boys consume more oily and miscellaneous foods but have a lower intake of proteins and dairy.

Gender Differences in Dietary Diversity

There were notable gender disparities in dietary diversity. Girls had a higher dietary diversity (51.9%) than boys (38.8%). Chi-square tests showed a significant association between gender and dietary diversity ($p < 0.05$), suggesting that girls were more likely to consume diverse foods.

Parental education and income levels were positively correlated with dietary diversity. Students from families with higher education levels and incomes had a significantly higher DDS.

Years spent in ashram school also influenced dietary diversity. Students who had spent more than three years in ashram schools reported lower DDS than those with shorter durations.

School Meal Satisfaction and Dietary Intake

The usual diet served to students consisted of wheat roti, dal, and vegetables with gravy, with rice provided daily. On festival days, a greater variety of meals was offered. Due to financial constraints, students rarely purchased food outside.

Ashram school authorities reported efforts to ensure nutritious meals, including celebrating Nutrition Week and regular inspections of stored food. However, students often expressed dissatisfaction, citing a lack of variety. Someday scholars supplemented school meals with home-cooked food, perceiving school meals as monotonous or subpar. An incident highlighted students' preference for familiar foods when they rejected dhokla on Republic Day, reinforcing the need for culturally appropriate meal planning.

Discussion

Research indicates that adolescents from higher socio-economic backgrounds tend to have more diverse diets and greater access to various nutrient-rich foods (Islam et al., 2020). In contrast, students from economically disadvantaged families often rely on staple grains such as rice and millet, resulting in lower dietary diversity and an

increased risk of micronutrient deficiencies (Raghunathan et al., 2021). Traditional dietary practices in tribal communities emphasize locally available and seasonal foods, which, while culturally significant, can limit the intake of a broad spectrum of essential nutrients, contributing to dietary monotony (Ghosh et al., 2023).

In addition to economic constraints, logistical barriers such as limited access to markets and transportation challenges further restrict the availability of nutrient-dense foods, including fresh fruits and vegetables (Jin et al., 2022). Nutritional education plays a crucial role in improving dietary diversity. Evidence suggests that adolescents who have participated in school-based nutrition programs demonstrate greater awareness of healthy eating practices and make more informed food choices (Hamulka et al., 2018).

Gender disparities in food access and consumption patterns are also evident within these communities. Adolescent girls often encounter greater challenges in obtaining adequate nutrition due to socio-cultural norms that influence food distribution within households, often prioritizing male family members (Belachew et al., 2011). Addressing such inequalities requires targeted interventions considering cultural sensitivities and gender dynamics in food allocation.

The findings of this study underscore the need for comprehensive, multi-dimensional approaches to improving dietary diversity among tribal adolescents. These include strengthening food security, integrating culturally appropriate nutrition education, and addressing gender-based disparities in food access. However, the study is limited by its cross-sectional design, which captures dietary patterns at a single point in time. Future research should incorporate longitudinal studies and qualitative methods to gain deeper insights into the cultural and socio-economic determinants influencing food choices in tribal communities.

Overall, this study highlights several critical factors—socio-economic conditions, traditional food practices, food availability, and nutrition education—that collectively shape dietary diversity in these communities. Addressing these issues through holistic and context-specific strategies can help improve the nutritional well-being of tribal adolescents.

Socio-Economic Status and Dietary Diversity

One of the most significant factors influencing dietary diversity among tribal adolescents was the socio-economic status of their families. Students from households with higher income levels and greater access to diverse food sources

demonstrated better dietary diversity scores. This aligns with the observations of Smith et al. (2013), who emphasized that financial stability enables families to afford a broader variety of foods, thereby improving the nutritional intake and overall health of adolescents. On the other hand, those from economically disadvantaged backgrounds—especially in remote tribal areas—often depended on a restricted selection of staple foods such as rice, millets, and pulses, limiting dietary diversity (Kumari & Singh, 2020). This lack of variety in daily meals increases the risk of micronutrient deficiencies, which can have long-term consequences on adolescent growth and development (Kumar et al., 2022).

Cultural and Traditional Practices

Cultural traditions and food preferences also played a critical role in shaping dietary habits. Many families followed longstanding dietary practices that emphasized the consumption of locally grown, seasonal foods, reinforcing a deep-rooted connection to indigenous food systems. While these traditional diets offer some nutritional benefits, they often exclude a diverse range of food groups essential for balanced nutrition. Similar findings have been reported by Kapoor et al. (2022), who noted that rural tribal diets primarily consist of staple foods, with limited inclusion of fruits, vegetables, and animal-based products. Additionally, some adolescents expressed reluctance toward consuming unfamiliar, non-traditional foods, perceiving them as unsuitable for their cultural norms. This resistance to dietary change can pose challenges to nutrition-focused interventions, even when diverse food options are accessible in local markets (Agedew et al., 2022).

Food Availability and Accessibility

The availability of food emerged as another crucial factor affecting dietary diversity. Many tribal communities residing in geographically isolated regions faced significant barriers in accessing fresh produce, dairy, and protein-rich foods. Limited market infrastructure, transportation difficulties, and financial constraints often restricted their ability to obtain nutrient-rich foods, particularly during off-seasons when local food production declined. As a result, families frequently relied on preserved or less nutritious food options to sustain themselves. These findings are consistent with the work of Waswa et al. (2021), who highlighted that food scarcity during certain seasons exacerbates nutritional insecurity in tribal populations. Similar research by Kumar & Reddy (2021) further supports the idea that restricted access to diverse

foods in rural tribal areas contributes to poor dietary diversity, reinforcing food insecurity concerns (Ghosh-Jerath et al., 2016).

Educational and Awareness Programs

Nutritional education emerged as a pivotal factor influencing dietary diversity among adolescent students. Those who had access to school-based nutrition programs or received guidance from health professionals demonstrated a better understanding of the importance of consuming a well-balanced diet. This highlights the potential of targeted educational interventions in promoting the inclusion of a diverse range of food groups in daily meals (Nair et al., 2016). In contrast, students with minimal exposure to nutrition education exhibited lower dietary diversity, largely due to limited awareness of the health benefits associated with different food types (Murimi et al., 2018). Furthermore, structured nutrition education initiatives in tribal schools have proven effective in fostering improved dietary habits and food choices, reinforcing the significance of integrating such programs into school curricula.

Gender Disparities in Dietary Patterns

Gender-based differences also played a crucial role in shaping dietary diversity. Female adolescents, in particular, encountered greater barriers in accessing and consuming adequate food, often eating smaller portions and prioritizing the nutritional needs of other family members. This observation aligns with the research of Mitra and Rao (2017), which highlights how entrenched gender norms in rural and tribal communities frequently result in nutritional disparities, with girls being at a disadvantage when it comes to food allocation within households. Notably, disparities were evident in the intake of essential nutrients such as energy, iron, thiamin, riboflavin, and niacin, with a considerable proportion of boys consuming less than 70% of the recommended daily intake (RDI). Addressing these gender inequities requires a more inclusive, gender-sensitive approach to nutrition policies and interventions, ensuring that both male and female adolescents have equal access to adequate nutrition.

Policy Implications and Intervention Strategies

The findings of this study underscore the need for comprehensive policies and intervention strategies that address the diverse factors affecting dietary diversity

among tribal adolescents. Initiatives aimed at enhancing food security, expanding access to a variety of nutrient-rich foods in remote areas, and incorporating culturally relevant nutrition education could significantly contribute to improving the overall health and well-being of these students. Additionally, fostering collaboration between local communities, public health agencies, and educational institutions can enhance the sustainability and impact of these programs. This perspective aligns with the recommendations of Rao et al. (2019), who emphasized the importance of adopting multi-sectoral approaches to improving nutritional outcomes in tribal populations. By integrating these measures into policy frameworks, long-term improvements in dietary diversity and adolescent nutrition can be effectively achieved.

Limitations and Directions for Future Research

While this study offers critical insights into the dietary diversity of tribal adolescents, it is essential to acknowledge certain limitations. The cross-sectional design limits the ability to establish direct causal links between various determinants and dietary diversity. To gain a more comprehensive understanding, future studies should employ longitudinal approaches to track dietary changes over time and assess the long-term impact of specific interventions. Additionally, qualitative research exploring the underlying cultural and socio-economic influences on food choices would provide a deeper, context-specific understanding of the barriers to dietary diversity in these communities.

Another notable limitation lies in the data collection methodology. Dietary intake was assessed using a Food Frequency Questionnaire (FFQ), which relies on self-reported data. This approach is inherently subject to recall bias, where participants may unintentionally misreport or misremember their actual food consumption, particularly when documenting habitual dietary patterns. To enhance the accuracy of dietary assessments, future research should integrate objective methods such as direct food weighing or biochemical markers, which offer more precise measures of nutrient intake.

Conclusion

The study identified distinct dietary patterns among adolescent boys and girls. Girls generally consumed a more balanced diet with greater dietary diversity, whereas boys demonstrated a higher intake of oily foods and a lower variety of protein sources. These dietary tendencies could have long-term implications for the overall nutritional status and health outcomes of both groups.

Through an in-depth exploration of dietary diversity and its determinants among tribal adolescent students in Pune district, Maharashtra, this study highlights the significant role of socio-economic status, cultural traditions, food accessibility, and nutrition education in shaping dietary behaviors. Adolescents from families with higher economic stability exhibited a more diverse diet, whereas those from economically disadvantaged backgrounds—especially in remote tribal regions—relied heavily on staple foods, resulting in lower nutritional diversity. Cultural traditions also played a crucial role, as deeply rooted food preferences and local dietary customs often restricted exposure to a broader range of nutrients.

Moreover, economic and geographic constraints emerged as key barriers to accessing diverse and nutrient-rich foods. However, nutrition education programs demonstrated a positive influence on dietary awareness and healthier food choices. Gender disparities in food access and consumption were also evident, with female adolescents facing more significant challenges due to household food distribution norms. These findings underscore the urgent need for interventions that address both socio-economic and cultural barriers to dietary diversity.

To improve the nutritional well-being of tribal adolescents, multi-faceted strategies must be adopted. This includes strengthening food security measures, implementing culturally sensitive nutrition education programs, and addressing gender-based disparities in food distribution and consumption. Future research should explore the long-term effectiveness of dietary interventions and expand its focus to other tribal regions to develop a broader, evidence-based framework for improving dietary diversity across India's indigenous communities.

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