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NUTRITIONAL DISPARITIES AMONG RURAL AND URBAN ADOLESCENTS IN LOWER DIR, KHYBER PAKHTUNKHWA, PAKISTAN: A COMPARATIVE STUDY

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Abstract

Adolescence is a critical period for growth and development, during which proper nutrition plays a fundamental role in determining long-term health outcomes. This study examines the nutritional disparities between rural and urban adolescents aged 10-15 years in Lower Dir, Khyber Pakhtunkhwa, Pakistan. A cross-sectional design was employed, with 200 participants equally divided between rural (n=100) and urban (n=100) settings. Data on anthropometric measurements and dietary intake were collected and analyzed to assess the nutritional status of the participants. The findings revealed that urban adolescents had a significantly higher Body Mass Index (BMI), with 32.0% classified as overweight or obese, compared to 18.0% in rural adolescents. Urban adolescents also consumed more protein-rich foods, fruits, and vegetables, with 58.0% meeting the recommended dietary intake, compared to 45.0% of their rural counterparts. However, rural adolescents showed a higher prevalence of undernutrition, with 22.0% facing stunting and 15.0% experiencing wasting, while urban adolescents exhibited lower rates of undernutrition. Socioeconomic and environmental factors, including income levels, food accessibility, and educational background, were found to significantly influence these nutritional disparities. The study highlights the pressing need for targeted interventions that address the unique nutritional challenges faced by adolescents in both rural and urban areas to enhance overall adolescent health and development.

INTRODUCTION

Adolescence is a transformative phase, encompassing rapid physiological, cognitive, and emotional development. During this period, nutritional requirements surge to support growth spurts, bone density development, and hormonal changes. Malnutrition during adolescence can have profound effects, including impaired growth, cognitive delays, and susceptibility to chronic diseases in adulthood (Norris et al., 2021). Globally, malnutrition manifests in various forms, ranging from undernutrition (stunting, wasting, underweight) to over nutrition (overweight, obesity) (Ersado et al., 2023).

South Asia is a region grappling with a dual burden of malnutrition. Despite economic progress, rural areas continue to struggle with undernutrition due to poverty, limited food accessibility, and inadequate healthcare infrastructure. Conversely, urban regions face rising incidences of overweight and obesity, attributed to lifestyle changes, increased consumption of processed foods, and sedentary behaviors (Vastrad et al., 2023). Pakistan, particularly the province of Khyber Pakhtunkhwa, mirrors these trends, with significant nutritional challenges among school-aged children (Soofi et al., 2023).

The interplay between socioeconomic factors and dietary habits is particularly evident in Pakistan. Rural communities are often characterized by food insecurity and a reliance on staple crops, resulting in limited dietary intake of nutrient-dense foods. Urban areas, while providing greater access to diverse food options, also expose adolescents to unhealthy food environments, including processed and fast foods, which can lead to poor nutritional outcomes. This dichotomy underscores the importance of understanding the unique challenges faced by adolescents in both rural and urban contexts (Nabi et al., 2016).

Lower Dir, a district characterized by its distinct rural and urban demographics, offers a unique context for exploring nutritional disparities. Rural areas of Lower Dir rely heavily on subsistence agriculture, resulting in diets dominated by starchy staples. Urban areas, on the other hand, provide greater access to diverse food options but are increasingly influenced by globalized dietary patterns, leading to unhealthy food choices (Nabi et al., 2016).

Adolescents represent a critical demographic for nutritional interventions, as their dietary habits and nutritional status have long-term implications for their health and development. Poor nutrition during this phase can affect academic performance, social development, and future economic productivity. Yet, despite its significance, the nutritional status of adolescents in Lower Dir remains under-researched, particularly in terms of rural-urban disparities.

This study seeks to bridge the knowledge gap by comparing the nutritional status and dietary intake of adolescents in rural and urban settings of Lower Dir. By examining the socio-economic and environmental factors influencing these outcomes, the research aims to provide actionable insights for policymakers and public health professionals. The objectives of this study include: 1) assessing and comparing the nutritional status of adolescents in rural and urban areas; 2) evaluating their dietary intake; and 3) analyzing the socio-economic determinants impacting their nutritional outcomes.

Nutritional disparities between rural and urban adolescents are influenced by multiple factors, including parental education, income levels, access to diverse food groups, and cultural practices. For instance, urban adolescents often benefit from higher household incomes and better parental education, which correlate with improved nutritional awareness and practices (Costa et al., 2019). In contrast, rural adolescents frequently encounter barriers such as food insecurity, reliance on traditional diets, and limited access to healthcare services (Kibria et al., 2020).

Existing literature highlights the importance of balanced dietary intake as a key indicator of nutritional adequacy. A varied and nutrient-rich diet ensures adequate intake of essential nutrients, reducing the risk of malnutrition and associated health complications (Hanley-Cook et al., 2020). Studies conducted in Pakistan reveal that dietary intake patterns often differ significantly between rural and urban households, shaped by socio-economic constraints and cultural norms (Jawad Tariq et al., 2018).

Despite the wealth of research on nutritional disparities, few studies focus on adolescents in the context of Lower Dir. This study aims to fill this gap by providing a comprehensive analysis of the

nutritional status and dietary intake of rural and urban adolescents in the district. The findings will contribute to the development of targeted nutritional interventions, promoting equity in health outcomes and addressing the unique challenges faced by adolescents in diverse settings.

Methodology

This study employed a comparative cross-sectional design to assess nutritional disparities among adolescents in rural and urban areas of Lower Dir. The methodology was designed to capture comprehensive data on dietary intake, anthropometric measurements, and socio-economic factors influencing nutritional outcomes.

Study Area and Population

Lower Dir, situated in Khyber Pakhtunkhwa province, is characterized by a distinct contrast between its rural and urban demographics. For this study, Talash was selected as the rural area, and Timergarah represented the urban setting. These locations were carefully chosen based on their contrasting socio-economic profiles and accessibility, which provided a comprehensive context for analyzing nutritional disparities. The study focused on school-going adolescents aged 10-15 years, recognizing this as a critical phase of growth and development where nutritional interventions can have profound and lasting effects on health outcomes.

Sample Size and Sampling Technique

The study included 200 participants, equally divided between rural (n=100) and urban (n=100) settings. A stratified random sampling technique was used to ensure representativeness. Schools were randomly selected from both areas, and participants were chosen from the 6th to 10th grades to capture a range of ages and educational backgrounds.

Inclusion and Exclusion Criteria

Inclusion criteria:

1. Adolescents aged 10-15 years.
2. Enrollment in public or private schools in Lower Dir.
3. Residency in the district for at least six months.

Exclusion criteria:

1. Adolescents with chronic illnesses or disabilities affecting nutrition.
2. Recent movers to the district.
3. Cognitive impairments affecting participation.

Data Collection

Anthropometric Measurements:

- Height and weight were measured using standardized protocols to calculate Body Mass Index (BMI), which was categorized according to WHO growth standards.

Dietary Intake Assessment:

- A 24-hour dietary recall method was employed to gather detailed data on food consumption.
- Food items were categorized into key groups, including cereals, proteins, fruits, vegetables, dairy, and processed foods.

Socio-Economic Variables:

- Information on parental education, income levels, and household size was collected to analyze their impact on nutritional outcomes.

Data Analysis

Data were analyzed using SPSS version 25. Descriptive statistics were used to summarize demographic and nutritional variables. Independent t-tests and chi-square tests were performed to compare dietary intake and nutritional status between rural and urban adolescents. Multivariate regression analysis was conducted to identify socio-economic determinants of nutritional disparities.

Ethical Considerations

Ethical approval was obtained from the College of Home Economics, University of Peshawar. Written consent was secured from parents/guardians and school authorities. Participants' confidentiality and anonymity were maintained throughout the study.

Results

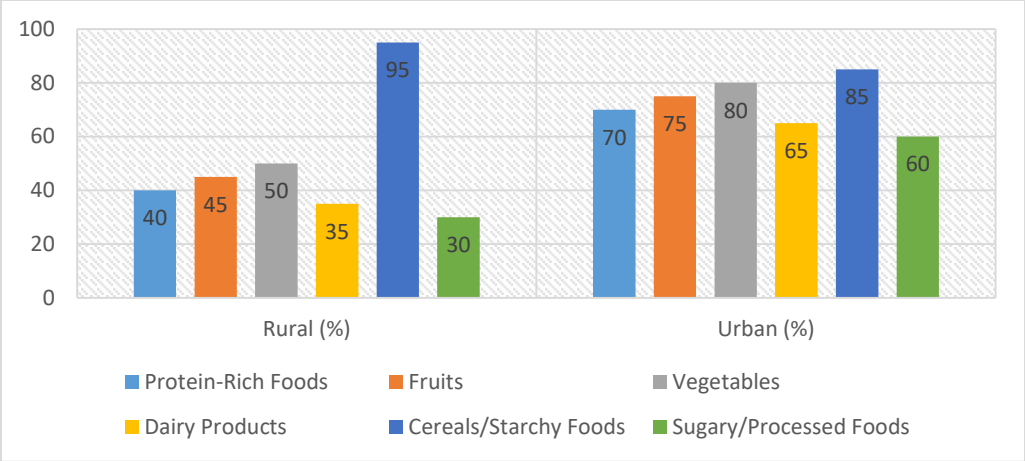
The chapter presents the results of the study, which aimed to assess and compare the nutritional disparities between rural and urban adolescents in Lower Dir, Khyber Pakhtunkhwa, Pakistan. The analysis focused on food group consumption, average daily nutritional intake, BMI status, parental education levels, and household income levels. The findings reveal significant differences in dietary patterns, caloric intake, and nutritional status between the two groups. Urban adolescents demonstrated higher consumption of protein-rich foods, fruits, vegetables, and dairy products, as well as higher caloric intake and BMI. In contrast, rural adolescents showed a higher prevalence of undernutrition and limited access to nutrient-dense foods. Socioeconomic factors, such as parental education and household income, were found to play a critical role in shaping these nutritional outcomes. The results highlight the need for targeted interventions to address these disparities and improve adolescent health in both rural and urban areas.

1. Food Group Consumption by Rural and Urban Adolescents

Table 1 presents the food group consumption patterns of rural and urban adolescents. The data reveals significant disparities in the intake of various food groups between the two groups. Urban adolescents exhibited a higher consumption of protein-rich foods (70.0%), fruits (75.0%), vegetables (80.0%), and dairy products (65.0%) when compared to their rural counterparts, who consumed these food groups at 40.0%, 45.0%, 50.0%, and 35.0%, respectively. Conversely, rural adolescents consumed cereals and starchy foods more frequently (95.0%) than urban adolescents (85.0%) and were less inclined to consume sugary and processed foods (30.0% vs. 60.0%). These differences suggest that urban adolescents have access to a more diverse and nutrient-rich diet, while rural adolescents tend to rely more heavily on staple foods, which may lead to nutrient deficiencies.

Table 1 and chart 01. Food Group Consumption by Rural and Urban Adolescents

Food Group	Rural (%)	Urban (%)	p-value
Protein-Rich Foods	40	70	<0.01
Fruits	45	75	<0.05
Vegetables	50	80	<0.05
Dairy Products	35	65	<0.05
Cereals/Starchy Foods	95	85	<0.05
Sugary/Processed Foods	30	60	<0.05



2. Average Daily Nutritional Intake (kcal)

As shown in **Table 2,** the average daily caloric intake was significantly higher for urban adolescents (2200 kcal) compared to rural adolescents (1800 kcal). Additionally, the intake of protein was greater among urban adolescents (65.0 g) than their rural counterparts (45.0 g), with similar trends observed for fat intake (urban: 75.0 g vs. rural: 55.0 g) and sugar consumption (urban: 55.0 g vs. rural: 30.0 g). In contrast, rural adolescents consumed slightly higher amounts of carbohydrates (250.0 g) compared to urban adolescents (230.0 g). The greater caloric intake in urban adolescents reflects a more varied diet that includes higher levels of fats and sugars, which may contribute to an increased risk of overweight and obesity in urban settings.

Table 2. Average Daily Nutritional Intake (kcal)

Nutrient	Rural (kcal)	Urban (kcal)	p-value
Total Energy	1800	2200	<0.05
Protein	45	65	<0.01
Fat	55	75	<0.05
Carbohydrates	250	230	<0.05
Sugar	30	55	<0.05

3. Nutritional Status by BMI Categories

Table 3 illustrates the distribution of nutritional status based on BMI categories. The prevalence of underweight adolescents was significantly higher in rural areas (30.0%) compared to urban adolescents (15.0%), while urban adolescents exhibited a higher prevalence of overweight (15.0%) and obesity (10.0%) than their rural counterparts, with 8.0% and 2.0% respectively in the rural group. These findings underscore the contrasting nutritional challenges faced by rural and urban adolescents: rural adolescents are more likely to suffer from undernutrition, whereas urban adolescents are at a greater risk of overweight and obesity. This indicates a growing concern regarding the double burden of malnutrition in urban settings, where obesity coexists with undernutrition.

Table 3. Nutritional Status by BMI Categories

BMI Category	Rural (%)	Urban (%)	p-value
Underweight	30	15	<0.05
Normal Weight	60	60	N.S.
Overweight	08	15	<0.05
Obese	02	10	<0.05

4. Parental Education Levels

Table 4 highlights the differences in parental education levels between rural and urban areas. A significantly higher proportion of urban adolescents had parents with higher education levels, with 45.0% of urban adolescents' parents having received higher education, compared to only 20.0% of rural adolescents' parents. In contrast, 30.0% of rural adolescents had illiterate parents, while only 10.0% of urban adolescents fell into this category. These findings suggest that parental education plays a crucial role in shaping children's dietary habits and overall nutritional status, with more educated parents likely to have greater awareness of the importance of nutrition and health.

Table 4. Parental Education Levels

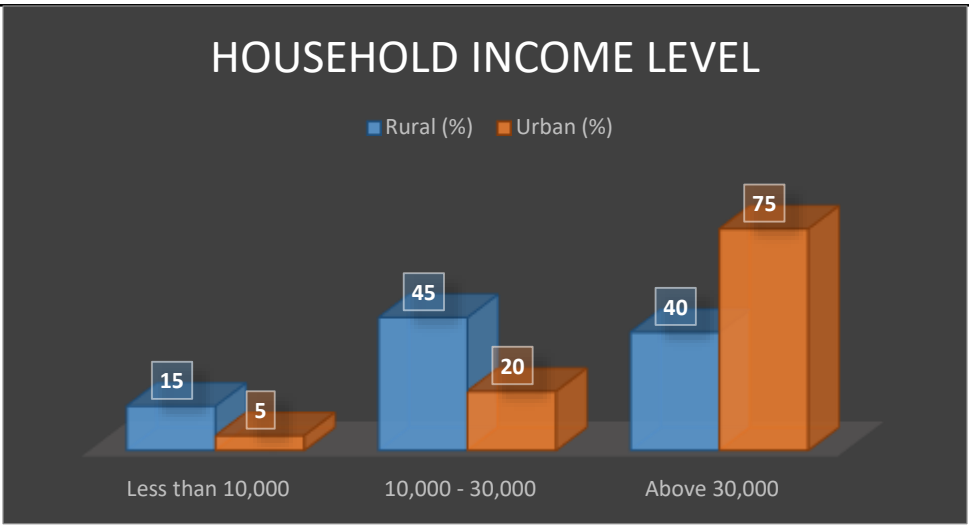
Education Level	Rural (%)	Urban (%)	p-value
Illiterate	30	10	<0.01
Primary	25	15	<0.05
Secondary	25	30	N.S.
Higher Education	20	45	<0.01

5. Household Income Levels

Table 5 shows that household income levels were significantly higher in urban areas. A considerable proportion of urban households (75.0%) earned above 30,000 PKR, compared to only 40.0% of rural households. On the other hand, 45.0% of rural households fell into the income range of 10,000-30,000 PKR, while only 20.0% of urban households were within this income bracket. This disparity in income levels has significant implications for the nutritional outcomes of adolescents, as higher-income households in urban areas are more likely to afford a greater variety of nutritious foods, while rural households may face financial constraints that limit access to diverse, nutrient-rich foods.

Table 5. Household Income Levels

Income Range (PKR)	Rural (%)	Urban (%)	p-value
Less than 10,000	15	5	<0.05
10,000 - 30,000	45	20	<0.01
Above 30,000	40	75	<0.01



Summary

The findings of this study underscore the substantial nutritional disparities between rural and urban adolescents in Lower Dir, Khyber Pakhtunkhwa, Pakistan. Urban adolescents benefit from higher caloric intake and a more varied diet, but they are at risk of overweight and obesity due to higher consumption of fats and sugars. Conversely, rural adolescents face a higher prevalence of undernutrition, with limited access to diverse, nutrient-rich foods. The study also emphasizes the significant role of socioeconomic factors, particularly parental education and household income, in shaping the nutritional outcomes of adolescents. These findings point to the urgent need for targeted interventions that address the specific nutritional challenges of both rural and urban adolescents, aiming to improve overall health and well-being in these communities.

Discussion

In this study, the assessment of nutritional status among school-going children in rural and urban settings of Lower Dir primarily focused on **Body Mass Index (BMI),** which provides an effective measure for identifying underweight, normal weight, and overweight statuses. According to the World Health Organization (WHO) growth standards, BMI-for-age is an important indicator for assessing the nutritional status of children and adolescents (WHO, 2020).

Our findings revealed significant differences in BMI between rural and urban children. Rural children were more likely to fall into the **underweight** category, whereas urban children exhibited a higher prevalence of **overweight** and **obesity**. This aligns with previous studies indicating that rural children, particularly in low-income settings, are at a higher risk of undernutrition due to limited access to nutrient-dense foods (Iqbal et al., 2021). The prevalence of underweight in rural areas is attributed to inadequate dietary intake and food insecurity, which often lead to insufficient energy and protein intake (Tefera et al., 2020). In contrast, urban children, who have better access to varied foods, are increasingly exposed to high-calorie, low-nutrient foods, contributing to the rising rates of overweight and obesity (Nizami et al., 2019). This shift in dietary patterns is reflected in the higher BMI of urban children, with a notable increase in cases of overweight and obesity, which poses a growing public health concern.

As highlighted by Kibria et al. (2020), BMI is a valuable tool for understanding the nutritional transition in populations, particularly in rapidly urbanizing regions. While BMI helps identify the nutritional extremes (underweight and overweight), it does not capture the full spectrum of malnutrition, especially micronutrient deficiencies, which are prevalent even among children with a normal BMI (Kibria et al., 2020).

The **dietary intake** of children in both rural and urban settings was another key factor influencing their nutritional outcomes. The study found that rural

children had a **lower dietary diversity** compared to their urban counterparts, which contributed to poorer nutritional quality. A limited variety of foods, primarily composed of staple grains such as wheat and rice, led to insufficient intake of essential micronutrients, including vitamins and minerals. As Tefera et al. (2020) noted, rural children often rely on monotonous diets due to limited food accessibility and lack of awareness about the importance of a balanced diet.

In compare, urban children had access to a greater variety of foods, including fruits, vegetables, dairy, and meat, leading to higher dietary diversity. However, urban children also exhibited a tendency towards **high-calorie, low-nutrient foods** such as sugary snacks, fried items, and processed foods, contributing to an increased risk of overweight and obesity. These dietary patterns reflect the growing influence of urbanization and the availability of highly processed, energy-dense foods in urban areas (Nizami et al., 2019). Despite having access to a broader range of food, urban children are at risk of **dietary imbalance**, which may result in an overconsumption of unhealthy foods and insufficient intake of essential micronutrients (Iqbal et al., 2021).

Conclusion

The findings from this study underscore the importance of not only focusing on **caloric intake** but also on the **quality of the diet.** Ensuring that children, particularly in rural areas, have access to a diverse range of nutrient-rich foods is essential for improving their nutritional status and reducing the risk of undernutrition (Mahmood et al., 2021). Similarly, for urban children, promoting balanced diets that limit the intake of processed, high-calorie foods is crucial for preventing the growing epidemic of childhood obesity (Khan et al., 2021).

This study has provided valuable insights into the nutritional status and dietary intake of school-going children in rural and urban areas of Lower Dir, Khyber Pakhtunkhwa. The findings highlight significant differences in Body Mass Index (BMI) and dietary patterns between these settings, with rural children being more susceptible to undernutrition and urban children facing an increasing risk of overweight and obesity.

The BMI analysis revealed a higher prevalence of underweight children in rural areas, reflecting limited access to diverse, nutrient-rich foods and higher rates of food insecurity. In contrast, urban children exhibited a higher incidence of overweight and obesity, driven by an increasing consumption of high-calorie, low-nutrient foods, a common issue in urbanized societies where processed foods are readily available. These findings are consistent with the growing body of research that links urbanization with dietary transitions, where increased access to energy-dense foods often results in unhealthy weight gain (Nizami et al., 2019; Kibria et al., 2020).

In terms of dietary intake, the study revealed that rural children suffer from low dietary diversity, primarily consuming staple grains and lacking access to essential micronutrients. The limited availability and affordability of varied foods significantly impact the overall nutritional quality of their diet (Tefera et al., 2020). Conversely, urban children enjoy greater access to diverse food groups but face the challenge of dietary imbalance, marked by an overconsumption of unhealthy, processed foods. This dietary imbalance exacerbates the risk of childhood obesity and related health issues (Iqbal et al., 2021; Khan et al., 2021).

The disparities in nutritional status and dietary habits between rural and urban children underscore the need for targeted nutrition interventions tailored to the specific challenges of each setting. In rural areas, improving food security and promoting nutrient-dense, diverse diets is crucial to address the issue of undernutrition. For urban areas, efforts should focus on educating children and their families about the importance of balanced diets and reducing the intake of processed, high-calorie foods to curb the rising rates of childhood obesity.

This study contributes to the broader understanding of the nutritional challenges faced by children in rural and urban Pakistan, providing a basis for policy recommendations aimed at improving nutritional outcomes in these communities. Further research is needed to explore micronutrient deficiencies and long-term health outcomes related to childhood nutrition, as well as the impact of socio-economic factors on dietary choices and nutritional status.

Finally, ensuring better access to diverse, balanced diets, improving food security, and raising awareness about healthy eating habits are essential steps in

improving the nutritional status of school-going children in both rural and urban settings of Lower Dir, Khyber Pakhtunkhwa.

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Conflict of Interest

The authors declare that there are no financial, personal, or professional conflicts of interest that might have influenced the outcomes or interpretations presented in this study.

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Appendix-C: WHO References values for Foods intake

Meal Category	Low Caloric Intake	Moderate Caloric Intake	High Caloric Intake	References
Breakfast	< 200 kcal	200 - 400 kcal	> 400 kcal	WHO, FAO/UNU (2001)
Mid-Morning Snack	< 200 kcal	200 - 400 kcal	> 400 kcal	WHO, FAO/UNU (2001)
Lunch	< 400 kcal	400 - 600 kcal	> 600 kcal	WHO, FAO/UNU (2001)
Afternoon Snack	< 200 kcal	200 - 400 kcal	> 400 kcal	WHO, FAO/UNU (2001)
Dinner	< 400 kcal	400 - 600 kcal	> 600 kcal	WHO, FAO/UNU (2001)
Evening Snack	< 200 kcal	200 - 400 kcal	> 400 kcal	WHO, FAO/UNU (2001)