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Association Between Food Affordability And Stunted Growth In Children Under Five Year

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ABSTRACT

Stunted growth is a major public health issue, particularly in low- and middle-income countries where nutritious food remains unaffordable for most households. In 2021, 42.2% of the global population could not afford a healthy diet, rising to 86.1% in low-income countries (FAO et al., 2023). Stunting, defined as a height-for-age more than two standard deviations below the WHO reference, Globally, stunting affects 149 million children under the age of five, with 55% of these children residing in Asia with

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38% of Pakistani children moderately stunted (PDHS, 2017–18). This study investigates the link between food affordability and stunting in Pakistan using national-level data from the Food System Dashboard. A mixed-methods approach combined quantitative indicators such as the cost of nutritious diets, affordability ratios, and food insecurity prevalence with qualitative evidence from existing literature. Results show that while caloric needs are generally met through cheap starchy staples, the high cost of nutrient-dense foods contributes to chronic malnutrition. Addressing stunting requires multi-sectoral strategies, including subsidies for diverse diets, improved market access, sanitation, and integrated nutrition programs. Future research should focus on regional disparities and policy effectiveness in reducing stunting. The causes of stunting are multifaceted, deeply rooted in socio-economic and political factors. Family resources, access to healthcare, and political stability all play crucial roles in determining whether a child has the opportunity to grow and develop properly. Despite global efforts to reduce stunting, progress has been uneven. Some countries, such as Brazil and China, have made rapid progress in reducing stunting rates, while others, including Pakistan, have seen stunting rates rise. If current trends continue, by 2030, the number of stunted children under five is projected to be 131 million, highlighting the urgent need for accelerated interventions to meet global health targets and ensure children everywhere have access to the nutrition they need for healthy development.

Keywords: Stunting, Stunted Growth, Availability, Affordability

INTRODUCTION

In 2021, the share of the global population who could not afford a healthy diet that is energy sufficient, nutritionally adequate and sourced from diverse foods was estimated at 42.2% (FAO et al., 2023). The corresponding share in low income and lower-middle-income countries was estimated at 86.1% and 70.2%, respectively (FAO et al., 2023). Nutritious foods are unaffordable to the majority of households in lower-income countries. Hence, starchy staples tend to be the main source of diets for men, women, and children, implying poor diet quality and deficiency in key nutrients that are crucial for child's physical growth and cognitive development (Raghunathan, Headey et al. 2021).

Worldwide, under-nutrition is still determining as silence emergency and policy concerns that arise as a result of alarming health problem especially in Southeast Asia (Black et al., 2003; WHO, 2019). When child's height is less than -2 standard deviations (SD) from the World Health Organization standard is called stunted (WHO, 2006). Stunted children have a threefold higher mortality compared to non-stunted children (McDonald et al., 2013; Victora et al., 2021). Children stunted in early life also are at higher risk of displaying cognitive impairments later in life and of experiencing metabolic disease (Prendergast & Humphrey, 2014). Complements of stunted growth are irreversible physical and cognitive damage from which children might be suffering severely. Stunting can affect for late a lifetime and even it has shocking effect on next generation (Kim, Deng et al. 2014). Stunted child growth is also influenced by socio-economic and political factors, including familial resources and configuration, access

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to health care, and the broader political economic conditions in which children and their families live (Victora, Christian et al. 2021). In 2018 globally, stunted growth continues with an estimated 149 million of children under the age of five. More than half (55%) of under five children live in Asia (UNICEF, 2018). The results of Pakistan demographic and health survey 2017-18 describes the 38 percent children of the total are moderately stunted (below -2 SD) and in Punjab children are moderately stunted (below -2 SD) 29.8 (PDHS, 2017-18).Globally, major efforts have been made to decrease stunting prevalence and nutrition-specific and nutrition-sensitive interventions are included in almost all national health plans (Victora, Christian et al. 2021).

1.1. Global targets, trends, and degrees of stunting:

It's easy to measure a child's height or length. In order to determine if the kid is stunted—defined as being less than two standard deviations below the median of the reference population—the height and age data can then be plotted on a growth chart developed from a well-nourished population.

1.1.1. Levels of stunting around the world

With rising per capita income, stunting rates decrease (see Figure 1.1.1), even though the elasticity in relation to per capita GDP is not as high as the elasticity in relation to poverty per capita GDP (Galasso, Wagstaff et al. 2016), for instance, there is a significant rate of stunting in a few major low- and middle-income nations, such as Nigeria, Pakistan, India, and Indonesia. Nonetheless, there is a great deal of heterogeneity along the regression line. (the correlation is around -0.55): Stunting rates are higher than expected in Guatemala, India, Indonesia, Nigeria, and South Africa, and lower than expected in China, the Dominican Republic, and Senegal (Mary 2018). Within-country disparities are also evident, with impoverished populations generally exhibiting two to three times greater rates of stunting (Jonah, Sambu et al. 2018).

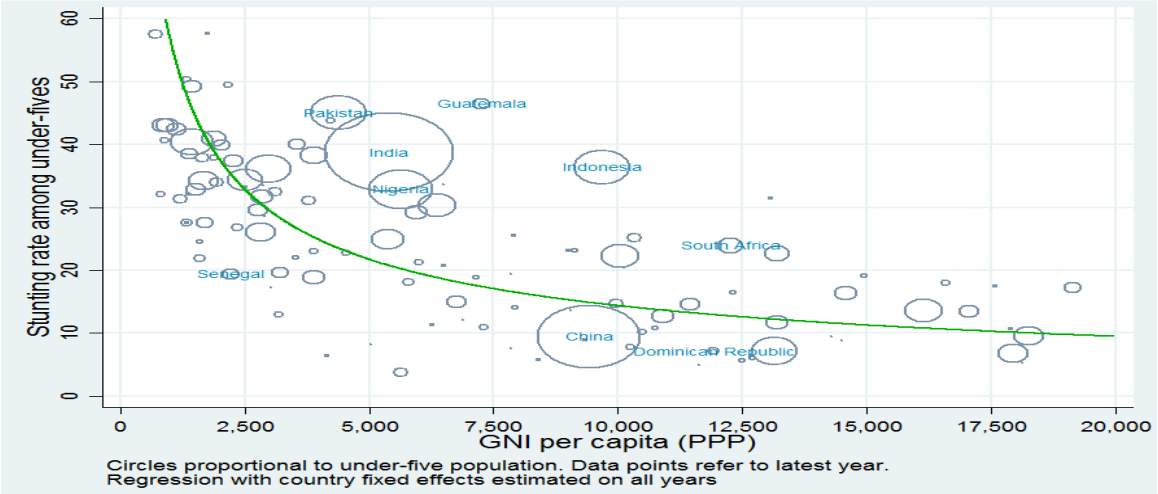

Figure 1.1.1: Stunting's long-term relationship with GNI per capita and its most recent values

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1.1.2. Trends in stunting and global targets

Reducing stunting has been more successful in some nations than in others. Stunting has decreased rather quickly in Argentina, as well as in Brazil, China, Iran, Senegal, Peru, and Vietnam; in contrast, stunting has increased in Eritrea, Pakistan, and PNG. Within-country disparities have demonstrated a significant level of durability. (Galasso, Wagstaff et al. 2016). According to current trends, there would be 131 million stunted children under the age of five in 2030, when malnutrition will have been "ended" by the present SDG recommendations. (Galasso, Wagstaff et al. 2016). The WHA has set a very lofty goal: a 40% decrease between 2010 and 2025. Based on present patterns, the decrease from 2010 to 2025 will only be 20%, not 40%. It would take more than twice as long to reduce stunting annually—from the present historical rate of 1.5% to 3.4%—in order to meet the 40% target. p.a.§§ (Galasso, Wagstaff et al. 2016).

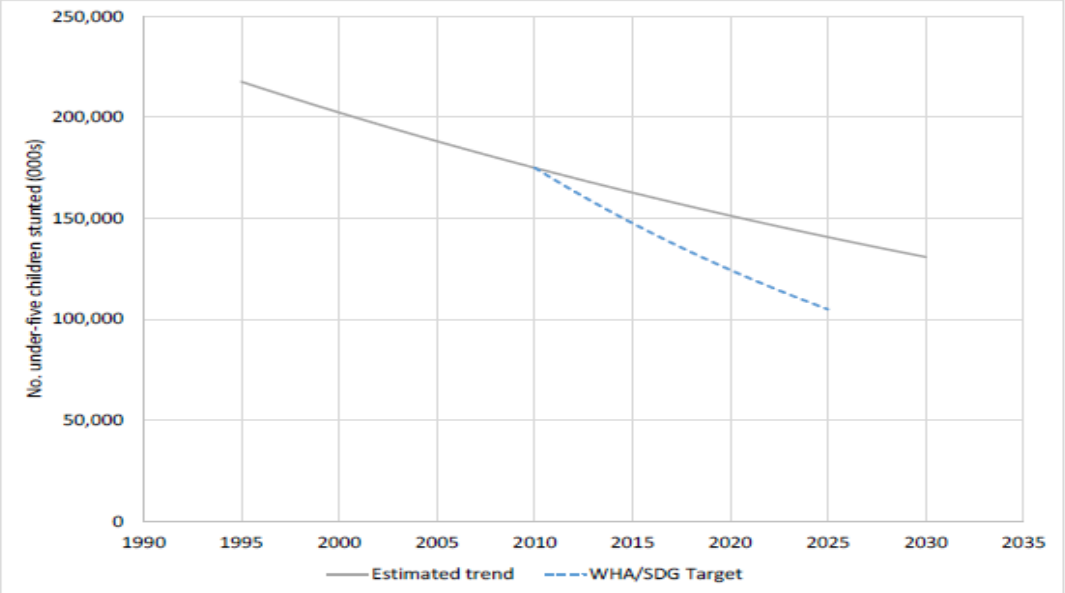

Figure 1.1.2: Trend in stunting and WHA/SDG target

[Source: Joint Child Malnutrition Estimates (JME) dataset, September 2015, as calculated by the authors]

1.2. The costs of stunting: Pathway:

A conceptual framework for considering the causes, effects, and correlates of stunting is shown in Figure 1.2. It facilitates comprehension of the expenses related to stunting as well as the potential for these expenses to be decreased.

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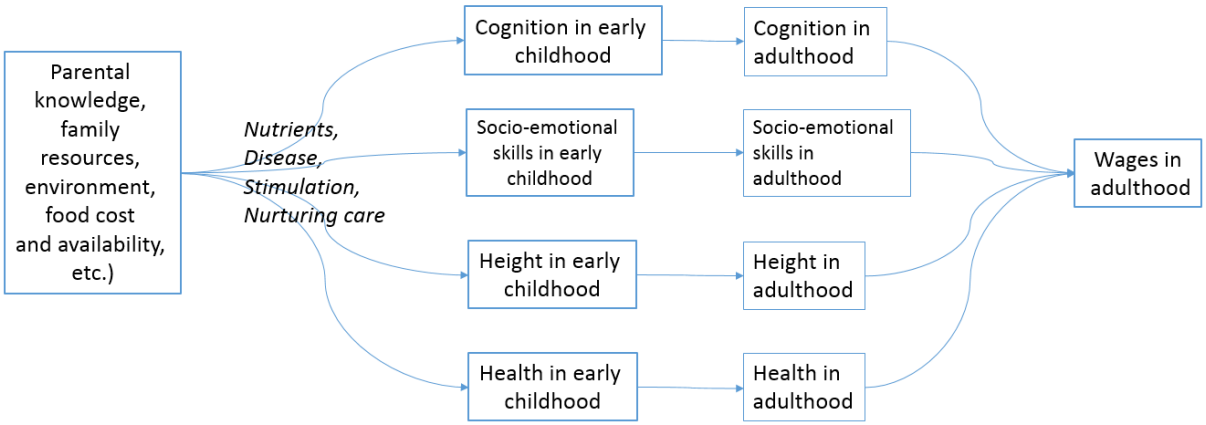

Figure 1.2: Conceptual framework for analyzing the causes and expenses of stunting

1.3. Estimates of the costs of stunting

In any year, the workforce comprises workers of different ages, typically with proportionally more young workers than old workers. Young workers are less likely to have been stunted in childhood than old workers – a worker aged 50, for example, has a probability of being stunted in childhood equal to the childhood stunting rate 50 almost years ago (Galasso and Wagstaff 2019). The mean percentage of childhood stunting in the labour force will correspond to the rates of childhood stunting from roughly fifty years ago to roughly fifteen years ago. The individuals in the workforce now would not have experienced stunting as children, would not have had to forgo their schooling, and would have reached a normal height if they had not experienced stunting as children. Given the adult height penalty to childhood stunting, the returns to height, the returns to education, and the education penalty associated with childhood stunting, their income today would have increased by a percentage. The per capita income penalty from stunting is estimated to be roughly 7% on average; if no one who is currently employed had experienced childhood stunting, per capita income in the developing countries would have increased by 7%. Greater fines apply to South Asia and Africa, ranging from 9 to 10% of GDP per person (Galasso, Wagstaff et al. 2016).

Table 1.3: Costs of childhood stunting among today's workforce

Region	No. of country	Mean
East Asia & Pacific	23	-7%
Central Asia and Europe	09	-5%
The Caribbean and Latin America	33	-5%
North Africa and the Middle East	19	-4%
North America	01	-2%

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Asia-Pacific	08	-10%
Sub-Saharan Africa	47	-9%
Total	**140**	**-7%**

2. LITERATURE REVIEW

Availability: In study on food insecurity, the terms "accessibility," "affordability," and "availability" are used and defined inconsistently. The ensuing literature is intricate and, more than anything else, shows that none of these factors adequately represents food insecurity. According to current studies, there is little to no correlation between food availability and food security. This means that simply while nutrient-dense food is readily available locally, it does not guarantee that people will buy and eat it. Rather, choices on what to buy are nuanced.

• There is insufficient data to establish a link between food insecurity, bad eating habits, and living in a food desert.

• Even in cases when consumers lack resources or access to transportation, they do not always shop at the store that is nearest to them. (Carson and Boege 2020).

Affordability: The degree to which food is "affordable" for consumers is determined by high food prices and non-food demands on household resources.

• Food insecurity is associated with higher food prices, particularly for low-income households. According to a study, a $10 rise in the cost of a typical "basket" of essential items would result in a roughly 2.5 percentage point increase in food insecurity among low-income households. (Gregory and Coleman-Jensen 2013).

Accessibility: A 2016 assessment concluded that "of all the factors that seemingly limit access to food, the most important is no money but second in importance is no car." Private transport is a meaningful indication of food access."(Tach and Amorim 2015). While food costs, food-specific budgets, and non-food household expenses aren't irrelevant to food affordability, there is clear and consistent evidence linking simple measures of total household income to food security. More generalized approaches that measure and bolster overall household resources may also be conducive to food security. (Carson and Boege 2020).

• Food availability might be supported by public transit, particularly for individuals without access to a vehicle; however, routes would need to be convenient and reach into neighborhoods that have supermarkets. (Carson and Boege 2020).

To assess the effects of dietary diversity, seasonal patterns of household food insecurity, and household characteristics on stunting and wasting in children living in drought-prone districts of Sidama, Ethiopia, throughout a one-year period of time. Cohort research design was used. Pre-harvest (March and June) and post-harvest (September and December) data for 2017 were gathered. In March, during the pre-harvest period of food scarcity, there was a larger percentage of severe food insecurity (69%), compared to 50% in September (P <.001). 43% (1,408) (95% CI: 40.8-44.2) of the 3,312 observations' kid population was stunted. With 36% (95% CI: 32.5-39.0) in March and 48% (95% CI: 45.0-51.8) in December, stunting displayed seasonal fluctuations. A larger percentage of wasted children (8%) occurred in March than in September (3%), with a 95% confidence interval (CI) of 4.8-6.3 (P <.001).

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Additionally, a household's food insecurity and dietary variety, as well as its education and work levels, were linked to later wasting or stunting (Belayneh, Loha et al. 2021). Stunting incidences in under-five-year-old Indonesian youngsters have grown to be national concerns. This is because, as compared to other southeast Asian nations, the frequency of stunting in Indonesian children has remained high, at about 31% nationwide. Stunting in children can have both short-term and long-term effects, such as higher morbidity and effects on the growth and development of the kid. There is proof that a few things are generally recognized as risk factors for childhood stunting. The included studies showed that low birth weight and premature delivery are among the child variables; maternal factors, such as parental education and short stature; and breastfeeding are among the key predictors of stunting in children. Stunting is linked to a wide number of contributing factors, to varied degrees, which highlights the significance of taking into account how those predictors interact with nutrition. To stop new stunted children from being born in Indonesia, health care providers, communities, and health cadres must work together to promote, prevent, and intervene in integrated health (Mediani 2020).

Even though Pakistan's sanitation situation has improved over the past ten years, a sizeable section of the population still uses subpar sanitation or doesn't have access to toilets at all. Although open defecation has declined over time, inadequate sanitation in rural areas has taken its place and may still result in undernourishment and disease. There is still little research on Pakistan's poor sanitation conditions, particularly when it comes to the sanitation ladder. Thus, the current study closes this research gap by utilizing the Pakistan Demographic and Health Survey (2017–18), a nationally representative micro survey, to evaluate the effects of various sanitation practices on the prevalence of stunting and underweight (both moderate and severe) among children under five in Pakistan. Open defecation, other improved and unimproved sanitation, flushing to a septic tank, flushing to a pit latrine, and piping to sewer (the highest level, base) make up the sanitation ladder.(Ponum, Khan et al. 2020). The logistic regressions are utilized in this research to determine the adjusted and unadjusted odds ratios of the determinants. We demonstrate that a sizable portion of Pakistan's rural population still engages in open defecation and that there are very few toilets linked to piped sewage networks in these locations. The results of the logistic regressions indicate that among children under five, flush to septic tanks and a piped sewage network are linked to the lowest probabilities of stunting and underweight, both adjusted and unadjusted. Pit latrines are linked to considerably higher adjusted chances of underweight and severe, moderate, and severe stunting in children under five in multivariate regressions. This suggests that low-quality pit latrines may bring the source of fecal contamination right to the doorstep of the homes. As a result, initiatives aimed at reducing open defecation ought to support high-quality restrooms in order to benefit child health over the long run.(Soofi, Khan et al. 2023)

OBIECTIVES

- Identify how common stunted growth is among children under five in different socioeconomic groups.

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- Examine the link between food affordability and the nutritional quality of children's diets.
- Examine how income levels and food prices affect families' ability to buy nutritious foods.
- Analyze children's diets and identify nutrient deficiencies linked to stunted growth, focusing on the role of food affordability.

3. METHODOLOGY

3.1. Research design

This study investigates the relationship between food affordability and stunted growth in children under five years old using a mixed-methods approach that integrates both quantitative and qualitative data. The mixed-methods design combines contextual insights with numerical data to enable a thorough knowledge of the problem.

3.2. Data collection

Data for this research will be collected primarily from the Food System Dashboard, which provides detailed indicators related to food supply chains, food environments, food affordability, and nutritional status. The Dashboard offers extensive quantitative data that can be used to analyze trends and patterns in between food affordability and stunted growth in children under five year and long-term effects on a child's health and development

3.3. Sampling techniques and sample size

The quantitative data from the Food System Dashboard will include national-level indicators, ensuring a comprehensive overview of the issue across Pakistan. The Food System Dashboard contains data in the form of tables and graphs representing various indicators across different countries, including Pakistan. The relevant indicators for this study include:

1. The price of an energy-dense diet
2. The price of a nutritious diet in comparison to the price of obtaining enough energy from starchy staples
3. The affordability of a nutritious diet; the cost to food spending ratio
4. Percentage of people who don't have enough money for a nutritious diet
5. Fruit and vegetable costs in relation to starchy staples in a healthy, least-expensive diet
6. Cost of seeds, nuts, and legumes in comparison to the starchy mainstays in the least expensive diet
7. POU: Undernourishment Prevalence
8. Percentage of people who are food insecure at a moderate or severe degree

Data will be extracted for these indicators for Pakistan and compared with data of the association between food affordability and stunted growth in children under five year. Data can also be compared from other countries to identify patterns and correlations between these indicators.

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3.4. Data analysis procedure

Data from the Food System Dashboard will be analyzed using statistical between food affordability and stunted growth in children under five years. Inferential statistics, like regression analysis, examine the type and strength of relationships, while descriptive statistics serve to summarize the data.

4. RESULTS

4.1. Stunting of Children under 5 years in Pakistan

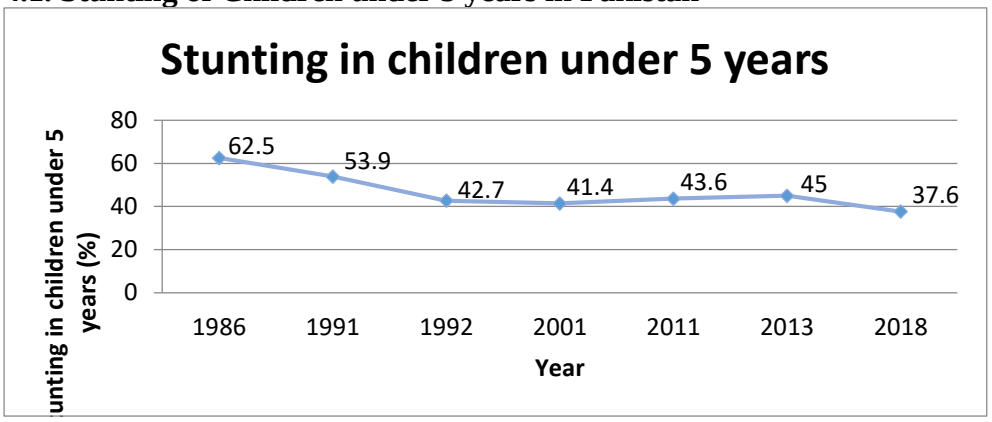

Figure 4.1: Stunting in children under 5 years in Pakistan

The graph displaying the percentage of stunting in children under 5 years from 1986 to 2018 reveals significant insights into the progress and challenges faced in reducing chronic malnutrition in Pakistan. In 1986, the stunting rate was alarmingly high at 62.5%, indicating widespread malnutrition among young children. However, a notable improvement was seen by 1991, with the rate decreasing to 53.9%, and further declining to 42.7% by 1992. This rapid reduction suggests that early interventions in nutrition and health were effective. Despite these gains, the period between 2001 and 2013 presented a mixed picture. The stunting rate showed a slight decrease to 41.4% in 2001 but then experienced a setback, rising to 43.6% in 2011 and reaching 45% in 2013. These fluctuations highlight challenges in sustaining progress, potentially due to economic downturns, policy changes, or implementation issues. The most recent data from 2018, however, shows a significant decline to 37.6%, indicating renewed and effective efforts to combat child malnutrition. Overall, the data underscores a positive trend over the decades, despite periods of stagnation and regression. This progress reflects successful public health interventions and on-going efforts to address the complexities of child malnutrition in Pakistan

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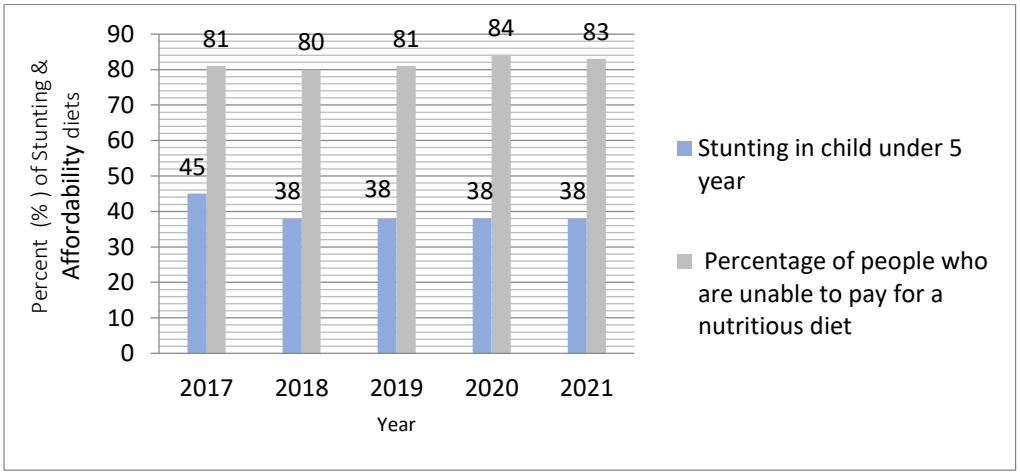

4.2. Percentage of people who are unable to pay for a nutritious diet:

The graph shows data from 2017 to 2021 on the percentage of people who cannot afford a healthy food and the percentage of children under 5 who are stunted. In 2017, 81% of people could not afford a healthy food, and 45% of children were stunted. By 2018, the stunting rate had significantly decreased to 38%, and it remained at this level through 2021. The population's inability to buy a nutritious food fell to 80% in 2018, after which it fluctuated slightly, reaching a peak of 84% in 2020 and then falling to 83% in 2021.

The stunting rate saw a notable improvement between 2017 and 2018, indicating effective interventions during that period, but it remained stable from 2018 to 2021. On the other hand, the cost of eating a healthy diet stayed very constant, with very little fluctuations, suggesting that the population's access to wholesome food is still being hampered by ongoing economic difficulties. This data underscores the ongoing issue of food affordability and highlights the need for continued efforts to reduce child malnutrition and improve overall access to healthy diets.

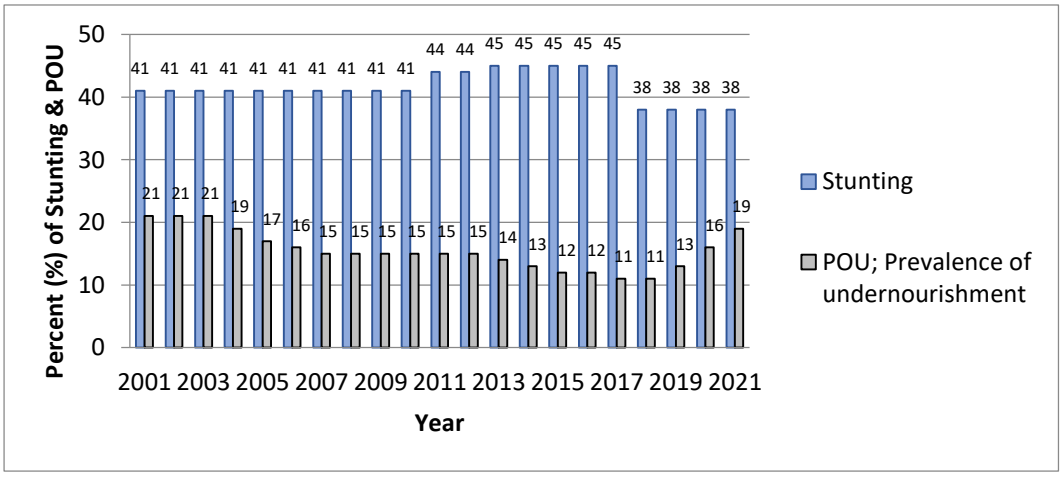

Figure 4.3: Percent (%) of Stunting & POU

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The graph presents data on the percentage of children under five years old experiencing stunting and the prevalence of undernourishment (POU) from 2001 to 2021. The stunting rate remained constant at 41% from 2001 to 2011, increased to 44% in 2012, and then to 45% from 2014 to 2016. In 2017, a significant reduction occurred, bringing the rate down to 38%, where it stabilized through 2021. The POU rate was 21% from 2001 to 2003, then decreased to 19% in 2004, continued to decline, reaching 17% in 2005, 16% in 2006, and 15% in 2007, maintaining this level until 2010. It further decreased to 14% in 2011, 13% in 2012, and 12% in 2013. From 2014 to 2019, the POU rate stabilized at 11%. However, it increased to 13% in 2020 and then to 16% in 2021, indicating a recent rise in undernourishment. These trends underscore the importance of sustained and adaptive public health and nutrition strategies to address both chronic malnutrition in children and broader food security challenges. POU rates have recently increased between 2020 and 2021; this increase could be related to worldwide events like the COVID-19 epidemic, which upset food supply systems and caused instability in the economy.

4.4. The relationship between the price of a healthy diet in relation to the price of starchy staples that provide enough energy, the affordability of a healthy diet, the ratio of cost to food expenditures, and the cost of an energy-sufficient diet Cost of fruit and vegetables in relation to starchy staples in a least-costly healthy diet and stunted growth in children under five years old, in 2005. Cost of legumes, nuts, and seeds in relation to the starchy staples in a least-costly healthy diet.

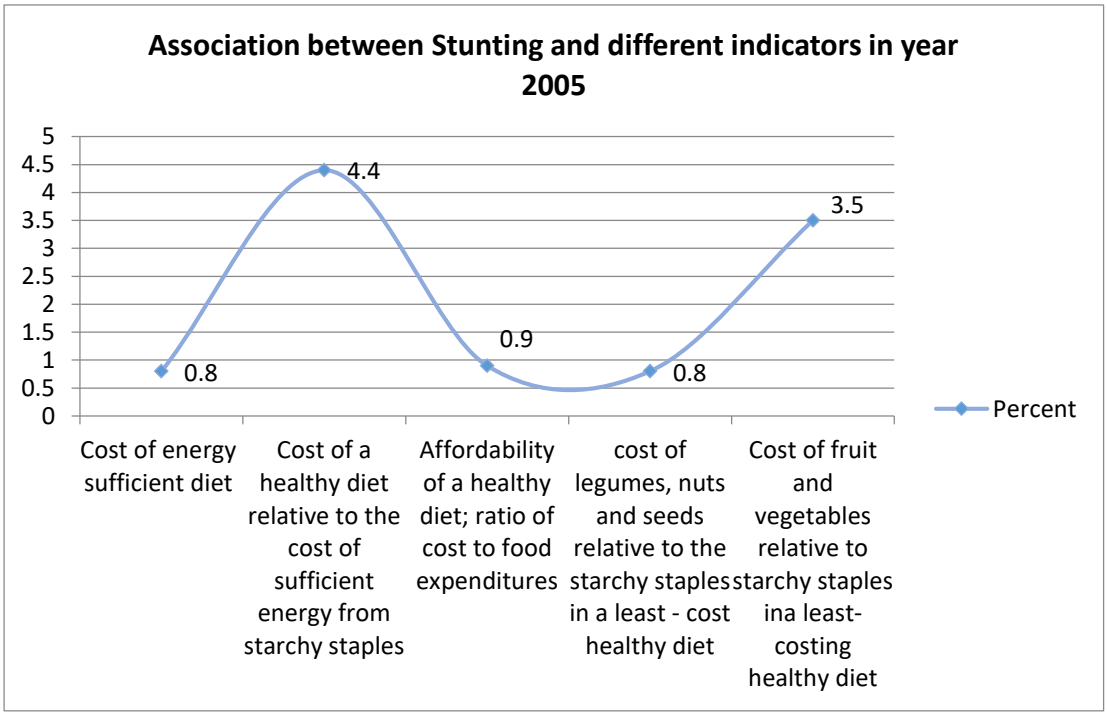

Figure 4.4 Data of 2005 Stunting among Indicators

The graph represents data from Pakistan in the year 2005, focusing on the cost-related

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aspects of maintaining different types of diets, with a stunting rate consistently at 45% across all indicators. The comparatively low cost of 0.8% for an energy-sufficient diet illustrates the minimal outlay needed for an adequate intake of energy from starchy staples. But at 4.4%, the cost of keeping a healthy diet is much higher, indicating the higher cost of making sure that a balanced meal satisfies all nutritional requirements. The percentage of food expenses required to get a healthy diet is reflected in the affordability ratio of a healthy diet, which sits at 0.9%. Legumes, nuts, and seeds add about 0.8% to the cost of a least-cost healthy diet, which is comparable to the cost of an energy-sufficient diet. On the other hand, adding fruits and vegetables comes at a much greater cost of 3.5%, highlighting the financial difficulties associated with having access to a wide variety of nutrient-dense foods. This data highlights the economic constraints faced by populations in maintaining a nutritious diet and emphasizes the need for strategies to make healthy food more affordable. The constant stunting rate of 45% underlines the persistent issue of child malnutrition despite varying diet costs, indicating the need for targeted nutritional interventions.

Discussion

The data reveals a significant relationship between food affordability and stunting rates in children under five years old in Pakistan. While energy-sufficient diets may be accessible, the high cost of maintaining a healthy, nutrient-rich diet poses a considerable barrier to addressing malnutrition. The consistent stunting rate of 45% across various cost indicators suggests that basic caloric needs might be met, but the lack of access to diverse, nutrient-dense foods remains a primary contributor to chronic malnutrition.

These findings are consistent with existing literature, which indicates that food availability alone is not an adequate measure of food security. For instance, Carson and Boege (2020) highlight that even when nutritious food is available, it may not be purchased or consumed due to the complex nature of food acquisition decisions. This complexity is evident in Pakistan, where the high costs of healthy diets relative to starchy staples hinder nutritional adequacy, despite the availability of cheaper, energy-sufficient options. Similarly, Gregory and Coleman-Jensen (2013) found that even a modest increase in food prices can significantly elevate food insecurity among low-income households. The persistent high rates of stunting and food insecurity in Pakistan underscore the critical role that economic constraints play in achieving nutritional security.

The relationship between stunting and food affordability must also be considered within the broader context of socioeconomic and environmental factors. Belayneh, Loha et al. (2021) demonstrated that seasonal variations in food insecurity in Ethiopia significantly impact child nutrition, and similar patterns may be observed in Pakistan. Fluctuations in stunting and undernourishment rates suggest that external factors, such as economic downturns or environmental challenges like droughts, may exacerbate food insecurity and malnutrition. Additionally, the research by Ponum, Khan et al. (2020) on sanitation

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in Pakistan highlights the interplay between environmental factors and nutritional outcomes. Poor sanitation and inadequate access to clean water contribute to the spread of diseases that can worsen malnutrition, complicating efforts to reduce stunting.

The findings from this study suggest that addressing stunting in Pakistan requires a multi-faceted approach that extends beyond improving food availability. Strategies should focus on enhancing the affordability of diverse, nutrient-dense foods, possibly through subsidies or other economic interventions aimed at low-income households. Improving public transportation and access to markets, as Carson and Boege (2020) suggest, could also help alleviate some barriers to accessing healthy diets. Integrated health and nutrition programs that address both economic and environmental factors are crucial. Efforts to improve sanitation, as well as targeted nutritional interventions for vulnerable populations, can play a significant role in reducing stunting rates.

Despite the valuable insights provided by this study, there are limitations that should be acknowledged. The reliance on national-level data may overlook regional variations in food affordability and nutritional outcomes. Additionally, using historical data from the Food System Dashboard limits the ability to capture more recent trends, especially those influenced by global events like the COVID-19 pandemic. Future research should consider longitudinal approaches to better understand the long-term effects of food affordability on stunting and other developmental outcomes in children. Research incorporating more localized data, as well as qualitative insights from affected communities, would provide a more comprehensive understanding of the factors contributing to child malnutrition in Pakistan. Moreover, exploring the impact of specific policy interventions aimed at improving food affordability and access, and their effectiveness in reducing stunting rates, would be a valuable addition to the literature.

Conclusion

Child stunting in Pakistan is deeply connected to the high cost of nutritious diets, despite the availability of basic food options. Economic barriers, along with environmental and social factors, significantly contribute to persistent malnutrition. Addressing this issue requires targeted policies that make healthy foods more affordable, improve access, and enhance public health infrastructure. A comprehensive approach that integrates economic and environmental interventions is essential for reducing stunting and improving child health outcomes in Pakistan.

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