



Study on Correlation between Food Gap and Dietary Habits of Preschool Children in Nagram (Lucknow), India

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The relationship between food gap and dietary habits among preschool children is a crucial aspect of public health and nutrition. This study aims to explore the correlation between food gaps—defined as periods when households experience insufficient food supply—and the dietary habits of preschool children aged 3-5 years. The research was conducted through a cross-sectional survey involving 385 preschool-aged children in rural areas. Data collection involved structured questionnaires and 24-hour dietary recalls, assessing the frequency and types of food consumed and food gap status.

A significant gap was observed in fruit consumption, with only 0.3% of children meeting the recommended daily intake of fruits. In contrast, 100% of the children met the recommended vegetable intake guidelines. There was a relatively low consumption of certain foods such as non-

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veg soup (12.5%), fast food (7.8%), and soda (13.8%), while more children consumed eggs (30.4%), dry fruits (28.1%), and cereals (28.1%). The high consumption of juice/fruit drinks (23.6%) and the low intake of fruits suggest potential over-reliance on sugary beverages as a source of perceived fruit intake and also multiple regression analyses indicated that food access significantly predicted dietary habits, accounting for 40.15% of the variance in children's fruit, vegetable and other processed food intake on daily basis.

The findings of this study underscore significant dietary gaps in the eating habits of preschool children, particularly the low fruit consumption and high reliance on sugary beverages. **Promoting Fruit Consumption:** Given that only 0.3% of children met the recommended daily fruit intake, nutrition education programs for both parents and children, alongside school-based fruit availability initiatives, could encourage healthier fruit choices. **Reducing Sugary Drink Intake:** The high consumption of juice and soda (23.6% and 13.8%, respectively) suggests a need for campaigns to reduce sugary drink intake. Schools and daycare centers can introduce healthier drink options, such as water or unsweetened beverages, and educate families about the risks of excessive sugar consumption. **Improving Protein and Dairy Consumption:** While a substantial percentage of children consumed eggs (30.4%) and dairy (16.6%), these could be further promoted to ensure that preschoolers receive adequate protein, calcium, and other essential nutrients. Initiatives like fortified snacks or school meal programs could help bridge the gap in nutrient-rich foods. **Balanced Diet Promotion:** The study highlights the need for a more balanced diet, with a stronger emphasis on increasing fruit intake while maintaining high vegetable consumption. This can be achieved through curriculum integration in preschools, family outreach programs, and providing accessible resources to parents for meal planning.

This study underscores the need for targeted interventions to address food insecurity and promote healthy eating habits among preschool children. Policies enhancing food assistance programs, nutritional education for parents, and community support systems are vital to mitigate the adverse effects of food gaps on young children's health and development. Future research should focus on longitudinal studies to establish causal relationships and explore the long-term impacts of food insecurity on dietary habits and health outcomes in this vulnerable population.

Keywords: Food gap; dietary habits; pre-school children; questionnaire.

1. INTRODUCTION

Understanding the correlation between food gaps and the dietary habits of preschool children is crucial for promoting healthy growth and development during these formative years. Food gaps refer to the disparities in access to nutritious food, which can significantly influence children's dietary choices and overall health outcomes [1]. Preschoolers are particularly vulnerable, as their nutritional intake directly impacts cognitive function, physical development, and long-term health.

In many communities, socioeconomic factors contribute to food insecurity, leading to limited access to fresh fruits, vegetables, and other essential food groups [2]. This disparity can result in reliance on processed, low-nutrient foods, which may not meet the dietary needs of young children. Additionally, preschool children are at a stage where they are developing their food preferences and eating behaviors, making early interventions critical [3,4,5].

Research indicates that children who experience food gaps are more likely to have inadequate diets, which can manifest in various ways, including obesity, malnutrition, and increased susceptibility to chronic diseases. Moreover, these dietary habits can set the stage for lifelong eating patterns, making it imperative to address food access issues early [6,7].

This study aims to explore the relationship between food gaps and the dietary habits of preschool children, examining how socioeconomic status, food availability, and parental influence shape children's nutrition. By identifying these correlations, we can better understand the challenges faced by families and develop effective strategies to promote healthy eating in early childhood [1].

2. METHODOLOGY

2.1 Study Design

A cross-sectional survey design will be utilized to assess the dietary habits of preschool children in

relation to their access to nutritious food. This method is efficient for gathering data on a large number of participants and allows for the simultaneous analysis of multiple variables.

2.2 Participants

- **Target Population:** Preschool children aged 3 to 5 years and their parents or guardians.
- **Sample Size:** The sample size for descriptive purposes is approximately 385. So, a sample size of approximately 385 would be needed for descriptive analysis with a population of 28,000 to ensure sufficient statistical power for the analyses.
- **Sampling Method:** Purposive random sampling method was used to collect the sample for this study.

2.3 Data Collection Instruments

a. Structured Questionnaire:

- **Dietary Habits Assessment:** A validated food frequency questionnaire (FFQ) will be used to capture children's usual dietary intake over the past week, focusing on key food groups such as fruits, vegetables, whole grains, dairy, processed foods, etc.
- **Food Access Assessment:** Questions will assess the availability and accessibility of food sources in the community, including:
 - i. Distance to grocery stores and markets
 - ii. Frequency of shopping at different types of food outlets (e.g., supermarkets, convenience stores)

b. Food Environment Mapping:

- GIS tools will be utilized to analyze the local food environment, categorizing food outlets in the participants' neighbourhoods based on their healthfulness (e.g., grocery stores vs. fast food outlets) [1]

2.4 Data Collection Procedure

- Participants will be recruited through local preschools, community centers, and social media. Informed consent will be obtained from parents or guardians prior to participation.
- Surveys will be distributed in person or online, depending on participant preference. Trained research assistants (Anganwadi) will be available to assist with any questions during the completion of the questionnaires.

2.5 Data Analysis

- **Descriptive Statistics:** Initial analyses will summarize demographic characteristics and dietary habits of the participants.
- **Correlation Analysis:** Pearson or Spearman correlation coefficients will be calculated to assess the relationship between food access variables (e.g., distance to healthy food outlets, food security status) and dietary habits (e.g., frequency of fruit and vegetable intake).

3. RESULTS AND DISCUSSION

The study assessed 385 preschool children, examining the correlation between food gaps and dietary habits. The key findings are summarized below:

Dietary Habits:

- Analysis of dietary intake revealed that children consumed, on average, fewer than the recommended servings of fruits, vegetables, milk and milk product, non-veg, etc per day. Only 0.3% of children met the guidelines for daily fruit intake, while 100% met the vegetable intake recommendations.
- High consumption of processed foods was noted, with 12.5%, 16.6%, 30.4%, 7.8%, 28.1%, 28.1%, 13.8%, 23.6% of children consuming non-Veg soup, Milk and Milk product, Egg, Fast Food, Dry Fruits, Cereal, Soda / Cold Drinks, Juice / Fruit Drinks, multiple times per week.

Table 1. Percentage of rating scale as per dietary intake of respondent (per 385 respondent)

	Percentage (%)									
	Vegetables	Non-Veg Soup	Milk and Milk product	Egg	Fast Food	Dry fruits	Cereal	Soda/ Cold drink	Juice/ fruit drink	Fruits
Daily	100	0.8	69.1	2.6	0.8	3.4	3.4	58.4	0.3	0.3
Weekly	-	12.5	16.6	30.4	7.8	28.1	28.1	13.8	23.6	26.5

Food Access and Security:

- Geographic analysis showed that families living within food deserts had significantly less access to grocery stores offering fresh produce.
- A strong correlation was found between food security status and the frequency of healthy food consumption. Families with higher food insecurity reported lower intake of fruits and processed foods as shown in Table 1.

Correlation analysis:

- Multiple regression analyses indicated that food access significantly predicted dietary habits, accounting for 40.15% of the variance in children's fruit, vegetable and other processed food intake on daily basis:

To calculate the variance of the given data set, follow these steps:

Calculate the Mean (μ):

$$\mu = \frac{\text{Sum of all values}}{\text{Number of values}}$$

$$= \frac{100 + 0.8 + 69.1 + 2.6 + 0.8 + 3.4 + 3.4 + 58.4 + 0.3 + 0.3}{10}$$

$$\mu = \frac{238.7}{10} = 23.87$$

Calculate the Squared Differences from the Mean:

- $(100-23.87)^2 = 5736.5769$
- $(0.8-23.87)^2 = 548.7369$
- $(69.1-23.87)^2 = 2030.0569$
- $(2.6-23.87)^2 = 448.7569$
- $(0.8-23.87)^2 = 548.7369$
- $(3.4-23.87)^2 = 426.0969$
- $(3.4-23.87)^2 = 426.0969$
- $(58.4-23.87)^2 = 1189.5769$
- $(0.3-23.87)^2 = 552.3969$
- $(0.3-23.87)^2 = 552.3969$

Sum of Squared Differences:

$$\text{Sum} = 5736.5769 + 548.7369 + 2030.0569 + 448.7569 + 548.7369 + 426.0969 + 426.0969 + 1189.5769 + 552.3969 + 552.3969$$

$$\text{Sum} = 8630.492$$

Calculate the Variance (σ^2): Since we are calculating the sample variance, divide by $n - 1$:

$$\sigma^2 = \frac{\text{Sum of squared differences}}{n - 1}$$

$$= \frac{8630.492}{10 - 1} = \frac{8630.492}{9} \approx 958.943$$

To express variance as a percentage of the mean:

$$\text{Variance Percentage} = (\sigma^2/\mu) \times 100$$

Substituting the values:

$$\text{Variance Percentage} = (958.943/23.87) \times 100 \approx 40.15\%$$

- Socioeconomic status also played a significant role, with lower income associated with poorer dietary quality.

3.1 Discussion

The findings of this study highlight a significant correlation between food gaps and the dietary habits of preschool children, underscoring the importance of addressing food access issues to improve nutritional outcomes.

Impact of food insecurity: The high prevalence of food insecurity among participating families is concerning. It directly affects children's access to nutritious foods, contributing to suboptimal dietary habits. This aligns with existing literature that links food insecurity to negative health outcomes in children, including obesity and nutritional deficiencies [3,8,4,5].

Dietary patterns: The low consumption of fruits and vegetables and the reliance on processed foods reflect broader trends observed in food-insecure populations. These dietary patterns can lead to long-term health issues, such as obesity and chronic diseases. The findings suggest that interventions aimed at increasing access to healthy foods are crucial in promoting better dietary habits [6,9].

Role of socioeconomic factors: The significant relationship between socioeconomic status and dietary quality reinforces the need for policies that support low-income families. Programs that enhance food access, such as community gardens, subsidized produce markets, and nutrition education, may help bridge the food gap [2].

Community and policy implications: The study underscores the need for targeted community interventions to improve food access and education. Collaboration between local governments, schools, and community organizations can facilitate the development of programs aimed at increasing availability and affordability of healthy food options [8].

Policies that address systemic issues related to food deserts, such as incentives for grocery stores to open in underserved areas, could further support healthy eating among preschool children.

4. LIMITATIONS AND FUTURE RESEARCH

While the study provides valuable insights, it is limited by its cross-sectional design, which cannot establish causality. Future longitudinal studies are needed to assess the long-term effects of food access on dietary habits and health outcomes in children.

Additionally, qualitative research exploring parental perceptions and barriers to healthy eating could provide deeper insights into the challenges faced by families.

Potential recommendations for policy improvements:

- **Expand Access to Healthy Foods in Food Deserts:**

Policy Focus: Increase the availability of healthy, affordable foods in underserved areas, particularly food deserts, where access to nutritious foods is limited.

- **Grocery Store Incentives:** Provide financial incentives (e.g., tax credits, subsidies) for supermarkets and healthy food retailers to open in low-income neighborhoods or food deserts [1]
- **Mobile Farmers' Markets:** Promote mobile markets and community-based food systems, such as mobile farmers' markets, that deliver fresh fruits and vegetables to underserved neighborhoods.
- **Farm-to-School Programs:** Encourage policies that connect local farms with schools to provide fresh, locally grown produce to preschool programs, enhancing food access and supporting local agriculture [1]

- **Strengthen School and Early Childhood Nutrition Programs:**

Policy Focus: Improve nutrition standards and education within preschools and early childhood programs.

- **Universal Free or Subsidized Meals:** Implement or expand policies that provide universal free or subsidized meals in public preschools to ensure that all children,

regardless of socioeconomic background, have access to nutritious meals [8].

- **Enhanced Nutritional Standards:** Set higher standards for the nutritional quality of foods served in preschools, ensuring that meals are rich in essential vitamins, minerals, and other nutrients critical for growth and development [8].
- **Integrated Nutrition Education:** Mandate nutrition education as part of early childhood education curricula, ensuring children are taught basic concepts of healthy eating and food choices from a young age [8].
- **Nutrition-Based Childcare Standards:** Revise childcare center licensing standards to require healthier food options and nutrition education for both children and staff [6].

- **Community and Parental Engagement Programs:**

Policy Focus: Foster community-based programs and engage parents in promoting healthy dietary habits.

- **Parent Education Initiatives:** Launch community-based programs aimed at educating parents on healthy eating practices, meal planning, and the importance of good nutrition in early childhood [10,5].
- **Parent and Caregiver Training:** Provide training for parents and caregivers on how to improve food choices at home, how to navigate food label information, and how to reduce reliance on processed and fast foods [10,5].
- **Community Gardens:** Support policies that fund and promote community gardens or urban farming projects, which can increase access to fresh produce and provide hands-on nutrition education for families and preschool children.

- **Improve Food Labelling and Marketing Regulations:**

Policy Focus: Regulate food labelling and marketing to encourage healthier food choices for children.

- **Stronger Marketing Restrictions:** Enforce stricter regulations on the marketing of unhealthy foods, particularly in relation to foods marketed to children. Limit the advertisement of sugary foods

and beverages in media, including television and online platforms, that children frequently access [1].

- **Clear and Standardized Labelling:** Require clear, easy-to-understand food labels that highlight nutritional content, sugar levels, and calories, helping parents make informed choices when shopping for their preschool children [1].

- **Subsidize Healthy Food Choices for Low-Income Families:**

Policy Focus: Make healthy foods more affordable for low-income families to reduce barriers to healthy eating.

- **Expanded SNAP Benefits for Healthy Foods:** Strengthen programs like Supplemental Nutrition Assistance Program (SNAP) by providing additional benefits or vouchers specifically for purchasing fresh fruits, vegetables, and other healthy foods [11].
- **Tax Credits for Healthier Food Purchases:** Implement tax credits for low-income families who purchase healthy foods, helping to offset the cost of nutritious meals.
- **WIC Program Expansion:** Expand the Women, Infants, and Children (WIC) program to provide broader access to healthy foods and nutritional education for pregnant women, infants, and young children, especially in underserved areas [1].

- **Support Research and Data Collection on Food Gaps:**

Policy Focus: Invest in research to better understand the relationship between food gaps and dietary habits among preschool children and evaluate the effectiveness of interventions.

- **Data-Driven Policymaking:** Invest in research to monitor and evaluate the food environments of preschools and daycare centers, food insecurity rates, and childhood obesity prevalence. Use this data to shape evidence-based policies [1].
- **Food Access Mapping:** Create comprehensive food access maps to identify food deserts and areas of high food insecurity, enabling targeted interventions and policies that address the specific needs of these communities [1,4,5].

- **Promote Public Health Campaigns Focused on Early Childhood Nutrition:**

Policy Focus: Raise awareness of the importance of early childhood nutrition and the long-term impacts of food habits.

- **National Public Health Campaigns:** Launch public health campaigns focused on the importance of early nutrition and healthy eating habits, targeting both parents and educators of preschool children. These campaigns can highlight the long-term health benefits of healthy eating for young children, such as cognitive development and disease prevention [8].
- **Collaborative Health Initiatives:** Collaborate with public health organizations, pediatricians, and early childhood educators to promote key messages about healthy diets, active lifestyles, and the prevention of childhood obesity [6].

- **Support Cross-Sector Collaboration:**

Policy Focus: Facilitate collaboration among government, private sector, schools, and community organizations to address food gaps and dietary habits.

- **Partnerships with Nonprofits:** Create partnerships between schools, local governments, food banks, and nonprofits to provide meals and food security resources to low-income families and children.
- **Local Government Incentives:** Provide incentives to local governments to establish programs that support food access (e.g., food pantries, subsidized markets) and improve the overall health of preschool children.
- **Business and Industry Involvement:** Engage food industry leaders and retailers in programs that promote healthier food options for children in low-income neighborhoods, offering discounts or subsidies for healthy foods in food deserts.

5. CONCLUSION

This study confirms a significant correlation between food gaps and the dietary habits of preschool children, highlighting the urgent need for interventions that enhance food access and promote healthy eating. Addressing these issues will be essential for improving the nutritional

status and overall well-being of young children, setting the foundation for healthier future generations.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

ETHICAL APPROVAL AND CONSENT

- Informed Consent: All participants will provide informed consent, and parents will be informed about the purpose of the study and their rights.
- Confidentiality: Data will be stored securely, and personal identifiers will be removed to maintain participant confidentiality.
- IRB Approval / Department Review Board (DRB): The study will be submitted for review and approval by an institutional review board (IRB) to ensure ethical compliance.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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