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Full Length Research Article

COMPREHENSIVE ANALYSIS OF CHILDHOOD OBESITY DETERMINANTS FOR THE DEVELOPMENT OF TARGETED HEALTH INTERVENTIONS IN NASARAWA STATE

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ABSTRACT
Childhood obesity is an emerging public health challenge in low- and middle-income countries, including Nigeria, where it coexists with persistent undernutrition, creating a double burden of malnutrition. This study assessed the prevalence and determinants of childhood obesity among school-aged children (6–14 years) in Nasarawa State to guide targeted health interventions. A cross-sectional descriptive design was employed, involving 261 participants selected through multistage sampling from urban and rural schools. Data were collected using structured questionnaires covering socio-demographic characteristics, dietary practices, physical activity, and obesity-related knowledge, alongside anthropometric measurements. Statistical analysis was conducted using SPSS version 25, with significance set at $p < 0.05$. Findings revealed that 26.4% of respondents had been informed they were overweight or obese. Significant associations were observed between obesity perception and frequency of fruit consumption ($p = 0.0031$), soft drink intake ($p = 0.0018$), engagement in structured physical activities ($p = 0.0027$), exercise duration ($p = 0.0007$), and emotional eating ($p = 0.0374$). Urban residence, female gender, and higher socioeconomic status were linked to increased obesity risk, whereas regular physical activity was protective. Despite high awareness (83.9%) of obesity-related health risks, a knowledge–behavior gap persisted, with many participants failing to adopt healthier lifestyles. This study concludes that childhood obesity in Nasarawa State is driven by a complex interplay of dietary, behavioral, psychological, and socio-environmental factors. Addressing this issue requires multi-sectoral strategies integrating nutrition education, promotion of physical activity, restriction of sugar-sweetened beverages, and psychosocial support. Interventions should be culturally appropriate, school-centered, and reinforced through community engagement to achieve sustainable impact.

Keywords: Childhood obesity; Adolescents; Dietary behavior; Physical activity; Emotional eating; Family influence; Nigeria.

INTRODUCTION

Childhood obesity is a multi-factorial condition characterized by excessive fat accumulation in children, leading to significant health risks such as type 2 diabetes, hypertension, and cardiovascular diseases (WHO, 2021). Childhood obesity has become a significant public health challenge globally, contributing to increased risk for chronic diseases and poor quality of life (Clark *et al*., 2020). Although under-nutrition remains a critical concern in many low- and middle-income countries, recent trends indicate a rising prevalence of overweight and obesity among children, often coexisting with malnutrition in the same communities, creating a double burden of malnutrition (WHO, 2017; UNICEF, 2020). This shift poses new challenges for health systems, especially in regions like Nasarawa State, Nigeria, where socioeconomic and nutritional transitions are rapidly occurring.

Studies have shown that childhood obesity is influenced by multiple determinants including socioeconomic status, dietary patterns, physical inactivity, and environmental factors (Khanam & Haque, 2021; Joseph *et al*., 2023). For instance, children from low-income households often face food insecurity and poor nutrition which can paradoxically increase obesity risk due to high-calorie, nutrient-poor diets (Francis *et al.*, 2020; Charles, 2021). Additionally, limited access to safe play areas and urbanization-related lifestyle changes contribute to decreased physical activity among children (Musenge *et al*., 2019; Menalu *et al.,* 2021).
In Nasarawa State, recent assessments have highlighted nutritional challenges among children under five, ranging from under-nutrition to emerging cases of overweight, emphasizing the need for comprehensive research on obesity determinants in this population (Francis *et al*., 2020; Charles, 2021). Furthermore, parental socioeconomic status and household food security remain key factors affecting children's nutritional outcomes (Joseph *et al.,* 2023).
Understanding these determinants in the specific context of Nasarawa State is essential for developing targeted health interventions that address both prevention and management of childhood obesity.
This study aimed to determine the prevalence and key determinants of childhood obesity among children aged 11 to 19 years in Nasarawa State, with the goal of informing targeted health interventions.

MATERIALS AND METHODS

Study Design

This mixed-methods (quantitative and qualitative) study was conducted in four distinct phases to achieve the general objectives of evaluating the knowledge, attitudes, and behaviours related to

physical activity and nutrition, assessing contributing factors, and identifying barriers and enablers to promoting healthy behaviours in Nasarawa State.

Description of Study Area

This study was conducted in three selected primary school in Nasarawa State, Nigeria. Nasarawa State, located in the North-Central region of Nigeria, has a population of approximately 2.5 million people, according to the 2006 census. The state is known for its diverse ethnic composition and varying socioeconomic conditions, making it an ideal location for this study on obesity among school-aged children. The state capital is Lafia, comprising 13 local government areas(Adeoye & Etuk, 2023). The healthcare infrastructure includes several general hospitals and primary healthcare centers across the state. However, access to healthcare varies significantly between urban and rural areas (Adeoye & Etuk, 2023).

Study Populations and Selection Criteria

The consist of male and female students aged 11 to 19 years enrolled in public secondary schools in Nasarawa State during the 2023/2024 academic session. This age range is selected as it represents a critical developmental period where lifestyle habits related to physical activity, nutrition, and health behaviors are formed. These habits can have a significant impact on the prevalence of childhood obesity, making this group ideal for investigating the determinants of obesity. The insights gained from this population will contribute to understanding the socio-demographic, behavioral, and environmental factors that influence obesity and overweight in school-aged children, which directly aligns with the study's objectives.

Research Design

The cross-sectional survey research design was adopted in this study

Inclusion Criteria:

1. Students aged 11 to 19 years attending public secondary schools in Nasarawa State during the 2023/2024 academic session. This age group is critical for studying lifestyle habits that influence childhood obesity.
2. Both male and female students were being included to ensure a comprehensive understanding of gender differences in obesity determinants.
3. Students who have been enrolled in the school for at least one academic year, to ensure familiarity with school routines and behaviours.
4. Participants whose parents or guardians have provided consent for participation, in line with ethical standards for research involving minors

Exclusion Criteria:

i. Students outside the age range of 11 to 19 years, as this group is beyond the focus of childhood and adolescent obesity.
ii. Students not attending public secondary schools in Nasarawa State, to maintain consistency with the study's geographic focus.
iii. Students with obvious physical disabilities that may significantly limit their physical activity levels, as these conditions could confound the relationship between lifestyle factors and obesity outcomes.
iv. Students with diagnosed metabolic or genetic conditions that could independently predispose them to obesity, such as Prader-Willi syndrome, which might skew the analysis of lifestyle-related determinants.

Sample Size Calculation

The sample size was calculated using the formula by Lemeshow *et al*. (1998) based on the highest available prevalence of overweight and obesity (23.1%) Yahaya *et al*. (2021) reported in similar populations.

The formula for sample size calculation is:

Sample size (n) = $\underline{Z1^2\text{-}\alpha/2\ Pq}\ /d^2$

= $\underline{Z1^2\text{-}\alpha/2\ P(1\text{-}P)}\ /d^2$ (El Mouzan *et al.*, 2010).

Where, Z1-α/2 = standard error when α = 0.05 (95% Confidence Interval) = 1.96

q = 1-P

P = prevalence of the attribute = (23.1%)

d = Acceptable difference using 5% (0.05)

N = number of sample size

By substituting the values using the above formula, we can have the calculation sequence as follows:

$N = (1.96)^2 \times 0.231(1\text{-}0.231)/(0.05)^2$

$= (3.8416 \times 0.231 \times 0.769)/0.0025$

$= (0.682417982)/0.0025$

= 273. (El Mouzan *et al.*, 2010).

Method of Data Collection

Primary data was used in this study. The primary data was collected using structured questionnaire which was administered personally by the researcher to reduce the risk of failure to respond and also ensure that relevant and accurate information are obtained from the respondents.

Instrument for Data Collection

The instrument for data collection used in this study is the structured questionnaire. The structured questionnaire was divided into six sections (A, B, C, D, E, & F). The section A covered social demographic information of the respondents, Section B covered routine dietary practices, section C covered exercise and daily life activity, section D covered health care and body condition awareness, section E, covered Psychosocial and environmental factors and section F Covered Family and medical history.

Ethical Considerations

Ethical approval for the study was obtained from the Health Research Ethics Committee of the Nasarawa State Ministry of Health. Written informed consent was obtained from parents or guardians of the participants. All information collected was treated with strict confidentiality and used solely for academic purposes.

Data Analysis

Collected data were entered and analyzed using SPSS software (version 25.0). Descriptive statistics such as means, frequencies, and percentages were used to summarize variables. Chi-square tests were applied to assess associations between categorical variables such as gender, physical activity, dietary patterns, and obesity status. A p-value of less than 0.05 was considered statistically significant.

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RESULTS

Socio demographic Characteristics of the Study Participants

Age Group and Gender Distribution

Age Group and Gender Distribution of respondent are presented in Figure1A and B respectively. The majority of respondents (73.9%) were between 15–20 years old, reflecting largely late adolescence. Females gender represented 54.8% of respondents, slightly higher than males that are 45.2% of the respondents,

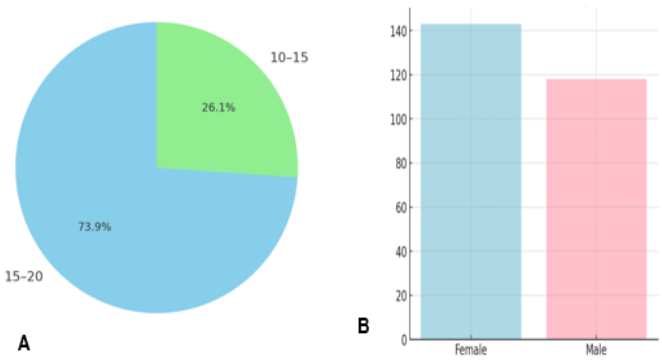

Figure 1A and B: Age Group Gender Distribution of the Respondents

Residential and Local Government Areas Distribution

The Residential and Local Government Areas Distribution of the respondents is presented in figure 2A and B respectively. Most respondents up-to 82.4% were urban residents, emphasizing urbanization as a key determinant. While Lafia LGA alone constitute 76.6%,of the respondents which mostly highlight urban concentration of the respondents.

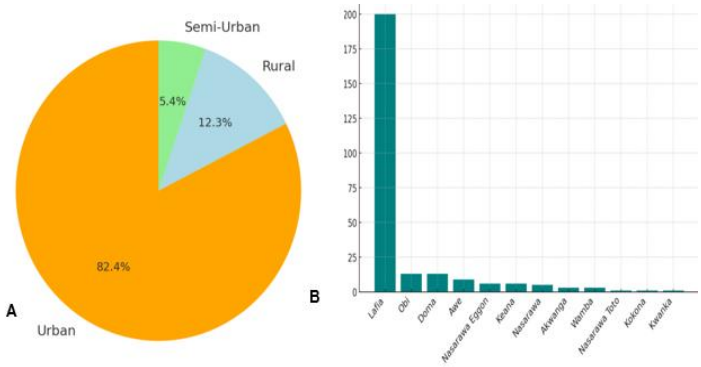

Figure 2A and B: The Residential and Local Government Areas Distribution of the respondents

The Prevalence of Perceived Overweight and Obesity Among Respondents (Based on what they being told of their overweight or obese)

The Prevalence of Perceived Overweight and Obesity Among Respondents is presented in Figure 3 the Perceived Overweight/Obesity (A) and Awareness of Obesity (B) by the Respondents. this is as a result of what individual respondent been aware or are been informed as overweight or obese . It indicated that 26.4% of respondents reported being told they were overweight/obese, while 73.6% had not been told. While as much as 74.3% had heard information of obesity, but a quarter of respondents remained uninformed.

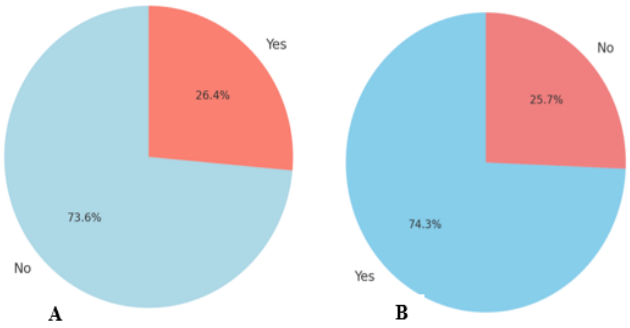

Figure 3A and B: The Perceived Overweight/Obesity and Awareness of Obesity by Respondents

The Dietary Pattern of Respondents in Relation to Obesity (frequency of meals, fruits, vegetables, soft drinks, and fast food)

Daily and Weekly Meal Frequency and Consumption Trends of the Respondents

The daily meal frequency of the respondents and the weekly consumption trend are presented in figure 4 and 5. The daily meal frequency result indicated that larger number of the respondents as much as 75.9% ate 3 meals daily; while only, 10% ate ≥4 meals, indicating possible excess intake (Figure 4). The weekly food consumption trends for Fruit Vegetable, Soft Drink, and Fast Food is presented by the line graph compares the weekly consumption of fruits, vegetables, soft drinks, and fast foods. The fruit intake was low, with only 8.8% consuming ≥4 times weekly, below WHO recommendations While vegetable consumption is relatively higher, with 35.6% consuming ≥4 times weekly, though inconsistency persisted and the frequent intake of soft drinks with 20.7% consuming ≥4 times and fast foods was notably higher, with 43% eating ≥2 times weekly both remained consistently high and demonstrates clear obesogenic dietary patterns (Figure 5).

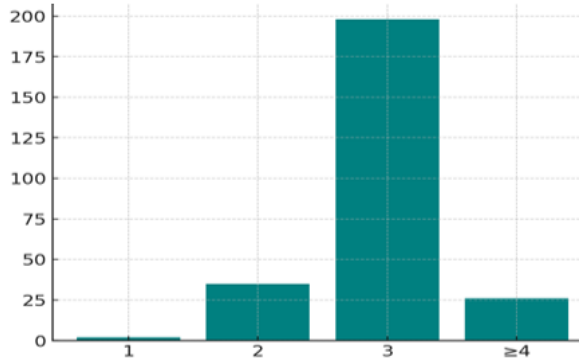

Figure 4: Daily Meal Frequency of the respondents

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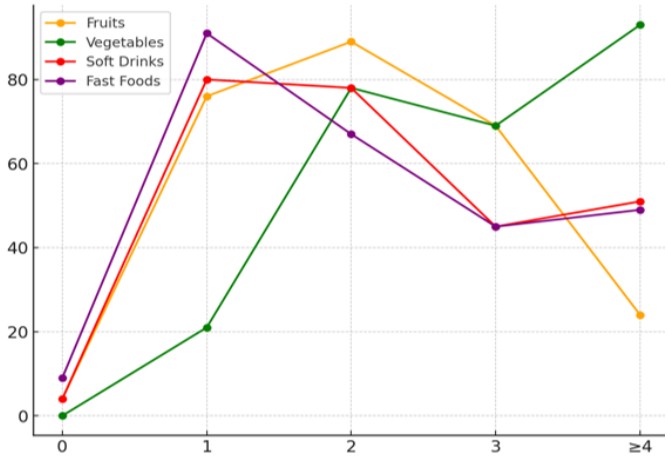

Figure 5: Weekly Food Consumption Trends for Fruit Vegetable, Soft Drink and Fast Food

Cross-tabulations of Dietary Habits and Perceived Obesity (Daily meal, fruits, vegetables, soft drinks, and fast food vs. perceived obesity)

The figure 6 and 7 represent the Dietary Habits and Perceived Obesity cross comparison, relative to the daily meal and weekly fruit, vegetable, soft drink and fast food consumption vis-a-vis perceived obesity.. It shows that frequent intake of soft drinks and fast foods is strongly associated with perceived obesity. Interestingly, higher vegetable and fruit intake was also reported among some obese respondents, suggesting overall higher energy consumption (Figure 6). The perceived obesity by dietary Habits by heat-map highlights clusters of perceived obesity across dietary practices. High associations are visible in categories involving ≥3 fruit/vegetable intake and frequent soft drink/fast food consumption, highly reflecting obesogenic behaviors (Figure 7)..

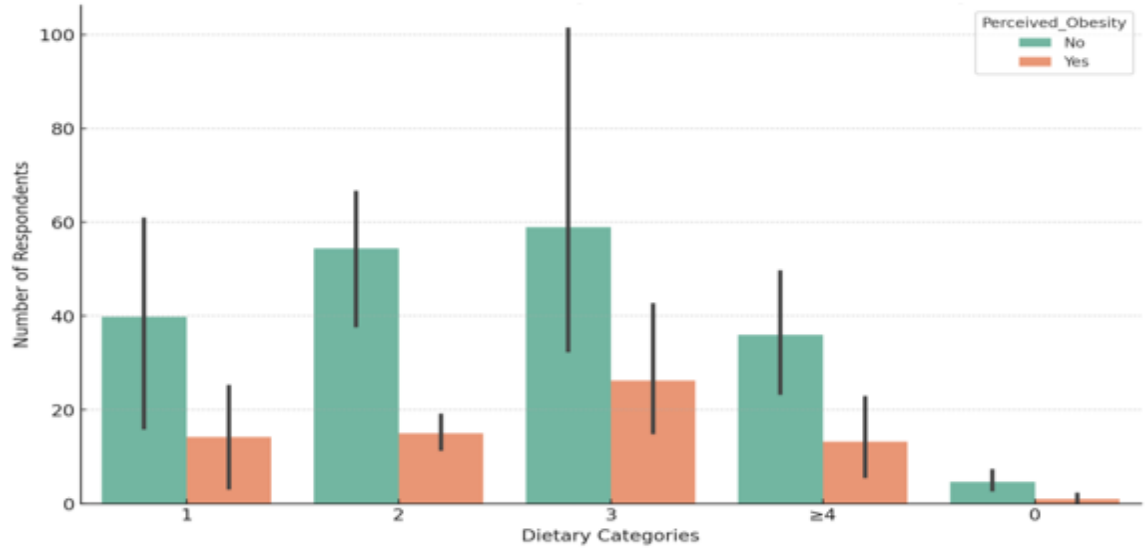

Figure 6: Cross-tabulation of Dietary Habits and Perceived Obesity

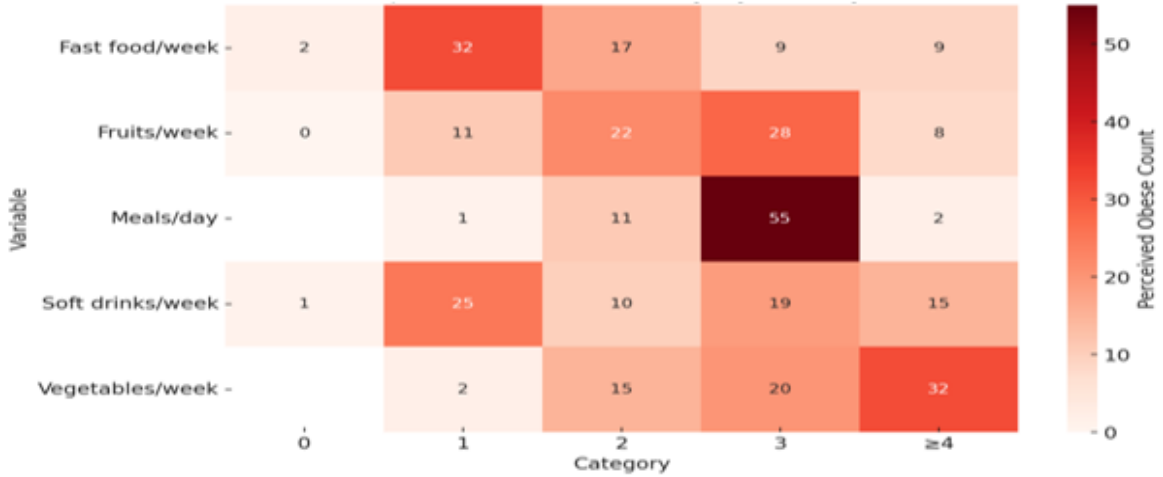

Figure 7: Heat-map of Perceived Obesity by Dietary Habits

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Physical Activity and Nutritional Behavior of Respondents

Table 1: Chi-square Test Results for Dietary Patterns in Relation to Perceived Obesity

Dietary Variable	χ^2 (Chi-Square)	df	p-value	Significance
Meals per Day	5.90	3	0.1166	✗ Not Significant
Fruits per Week	34.20	8	0.0031	✓ Significant
Vegetables per Week	12.17	7	0.0950	✗ Not Significant
Soft Drinks per Week	26.30	9	0.0018	✓ Significant
Fast Foods per Week	13.65	8	0.0913	✗ Not Significant

Bold values for significant chi-square results and p-values
Added symbols (✓ / ✗) for easy visual interpretation of significance.
Streamlined text: avoids repetitive "Not Significant" phrases.
Improved alignment: χ^2, df, p-values neatly presented for quick scanning.

Chi-square Test Results for Dietary Patterns

The table 1.represent the Chi-square Test Results for Dietary Patterns in Relation to Perceived Obesity. Form the table it is clear that Fruit intake (χ^2=34.20, p=0.0031) and soft drink intake (χ^2=26.30, p=0.0018) were significantly associated with obesity perception. Meal frequency, vegetable intake, and fast food consumption were not significantly associated, though they may contribute indirectly.

Physical Activity and Nutritional Behavior of Respondents

The Physical Activity of the Respondents and their Nutritional Behavior is presented as a clustered bar chart and Heat-map in Figure 8 and 9 respectively. In Figure 8 the chart demonstrated that the respondent distributions across behaviors. Emotional eating and reduced exercise duration show strong links to obesity risk, while parental encouragement appears to be less impactful. The heat-map in figure 9 reveals clear clustering of sedentary behaviors, especially low exercise duration and emotional eating, with stronger frequencies compared to protective activities such as football or rope skipping.

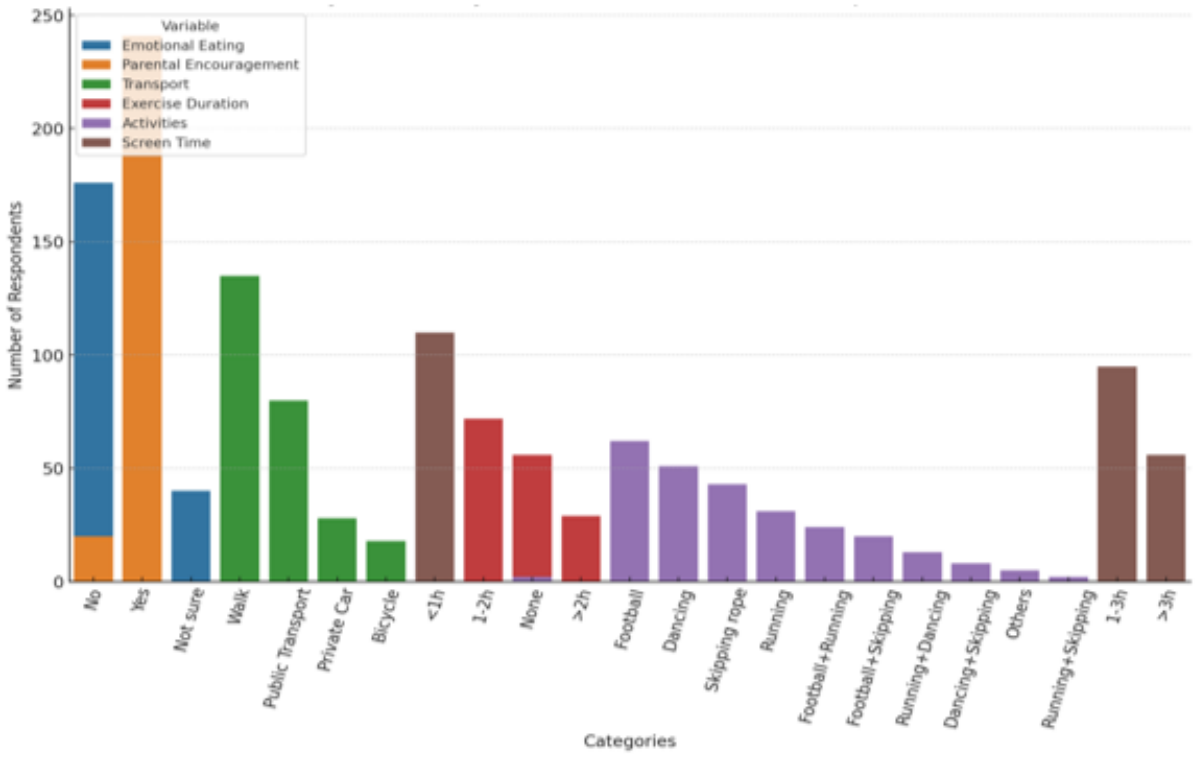

Figure 8: Physical Activity and Nutritional Behavior of Respondents

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Physical Activity and Nutritional Behavior of Respondents

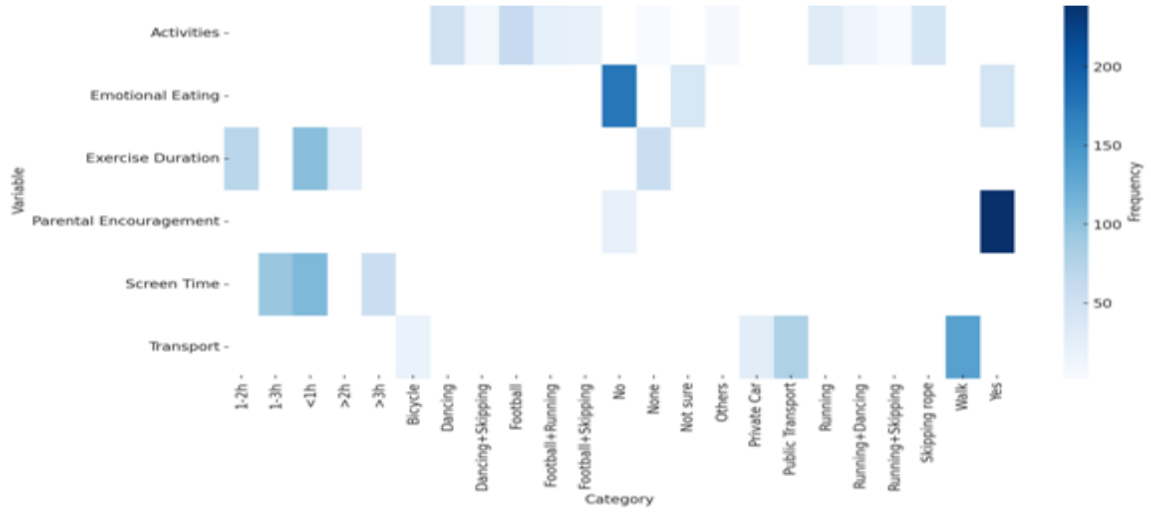

Figure 9: Heat-map of Physical Activity and Nutritional Behaviors

Knowledge and Attitudes of the respondent Towards Obesity

The Chi-square Results for Associations presented in Table 2, Significant associations were observed in emotional eating, low exercise duration, and physical activity type as significant predictors of obesity indicating their strong influence on obesity perception, whereas parental encouragement, mode of transport, and screen time were not statistically significant, suggesting limited direct influence in this cohort. Table 3 showed the Knowledge and Attitudes of the respondent Towards Obesity. The majority of respondents had heard of obesity (74.3%) and recognized its health risks (83.9%). However, a striking 75.5% considered their body weight "just right", while only 5% admitted being "too high." This disconnect between awareness and accurate self-perception highlights a barrier to effective obesity prevention, as knowledge is not translating into self-recognition or behavioral change.

Health and Environmental Factors

The Health and Environmental Factors of the respondent were presented in Table 4, Few respondents had medical diagnoses (4.2%), but 41% reported overweight/obese family members, indicating intergenerational influence. Stress was common, with 75.9% feeling stressed 'sometimes' and 14.2% 'many times,' suggesting psychosocial stress contributes to obesity-related behaviors suggesting environmental and genetic influence. Stress and anxiety were widespread, with 75.9% experiencing stress "sometimes" and 14.2% "many times." These findings emphasize that psychosocial stress and family environments play important roles in shaping obesity-related behaviors.

Table 2: Chi-square Test Results for the Association Between Physical Activity, Nutrition, and Perceived Obesity

Variable	χ^2 (Chi-Square)	df	p-value	Significance
Eat more when stressed, sad, tired, or bored	6.57	2	0.0374	✓ Significant
Encouraged by parents/guardians to eat healthy	0.89	1	0.3456	✗ Not Significant
Mode of transport to school	6.04	3	0.1095	✗ Not Significant
Daily exercise/sports duration	16.94	3	0.0007	✓ Significant
Types of activities performed	67.40	10	0.0027	✓ Significant
Daily screen time (TV/cellphone)	1.21	2	0.5469	✗ Not Significant

Table 3: Knowledge and Attitudes Towards Obesity Among Respondents

Variable	Category	Frequency (n)	Percentage (%)
Heard of the word "obesity"	Yes	194	74.3
	No	67	25.7
Knowledge that obesity can cause diabetes/heart disease	Yes	219	83.9
	No	42	16.1
Self-perception of body weight	Just right	197	75.5
	I don't know	34	13.0
	Too low	17	6.5
	Too high	13	5.0

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Table 4: Health and Environmental Factors Related to Obesity

Variable	Category	Frequency (n)	Percentage (%)
Medical diagnosis history	No	250	95.8
	Yes	11	4.2
Family members overweight/obese	No	118	45.2
	Yes	107	41.0
	Not sure	36	13.8
Frequency of stress/anxiety	Sometimes	198	75.9
	Many times	37	14.2
	Rarely	25	9.6
	Always	1	0.4

DISCUSSION

This study highlights the multifaceted nature of adolescent obesity in Nasarawa State, shaped by dietary behaviors, psychosocial stress, physical activity, family environment, and body weight perception. While awareness of obesity and its health risks was relatively high, mis-perception of body weight was prevalent, with most respondents considering themselves 'just right.' This perception gap reflects broader national and global patterns where cultural norms normalize excess weight (Musa *et al.,* 2020; WHO, 2023). Sociocultural and environmental influences in urban settings—such as increased access to calorie-dense foods, sedentary lifestyles, and media-driven body ideals—appear to reinforce this trend. Adeomi *et al.* (2024) demonstrated that higher household wealth, concentrated in urban areas, significantly predicted adolescent overweight, while Ojofeitimi *et al*. (2011) found elevated obesity rates among private schoolgirls in Osun State despite their high nutrition knowledge. Together, these findings underscore that knowledge alone does not translate into healthier practices when obesogenic pressures are pervasive. Dietary findings revealed clear obesogenic patterns. High consumption of sugar-sweetened beverages (SSBs) and fast foods was strongly and significantly linked to perceived obesity, echoing global evidence on the role of SSBs in the obesity epidemic (Ng *et al.,* 2014; Popkin *et al.,* 2020). Local studies support these trends: Gbadebo *et al*. (2024) reported SSB consumption rates of 85–96% among adolescents in Ogun State, while Oladoyinbo *et al*. (2024) confirmed a significant relationship between carbonated drink intake and BMI-for-age. These behaviors reflect environmental and behavioral influences, including peer pressure, taste preferences, aggressive marketing, and limited parental supervision. Although fruits and vegetables are protective, frequent consumers were still represented among obese respondents, likely due to overall high caloric intake, low nutrient density of complementary foods, or preparation methods. This reflects the double burden of malnutrition typical of urbanizing societies (Adeboye *et al.,* 2012). Engagement in structured physical activities such as football, dancing, running, and skipping was significantly associated with healthier weight perception, consistent with findings from Ogun *et al.* (2010). in Abeokuta, where physically active adolescents exhibited healthier BMI profiles. Physical activity not only regulates energy balance but also promotes psychological well-being, self-esteem, and academic performance, indirectly shaping healthier body image. Conversely, inactivity accelerates fat accumulation and increases risks of both metabolic and psychological complications.

One of the most novel findings in this study was the significant association between emotional eating and perceived obesity. Emotional eating—defined as consuming food in response to negative emotions such as stress, anxiety, sadness, or boredom—represents a psychological pathway to unhealthy weight gain that is often overlooked in Nigerian adolescent research. With most respondents reporting stress 'sometimes,' this suggests that psychosocial states may play a critical role in eating behavior, particularly in urban and school environments where stressors are common. This aligns with international research linking stress to poor dietary choices and excess weight gain (Mikolajczyk *et al.,* 2009).

Finally, family influences emerged as important. Over 40% of respondents reported overweight or obese family members, underscoring inter-generational risk patterns. While parental encouragement to eat healthy was not statistically significant, the broader household environment—including food availability, cultural dietary practices, and lifestyle norms—likely exerts substantial influence.

Conclusion

The findings of this study illustrate the complex and dynamic nature of adolescent obesity in Nasarawa State. Urbanization, poor dietary patterns, psychosocial stress, family influences, and body weight misperceptions all contribute to the rising trend. Combating this issue requires a coordinated, multi-layered response that goes beyond awareness creation. Effective interventions must include behavior-focused education, family and school engagement, accessible physical activity opportunities, and policy measures that promote healthier food environments. Urban centers such as Lafia, where risks are concentrated, should be prioritized for intervention. These strategies align with global recommendations for integrated, context-specific action to address adolescent obesity (Popkin *et al*., 2020; WHO, 2023).

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