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Determination of Contributing Factors of Childhood Weight Gain, Obesity, and their Adverse Effects on Child Health Complications in Sulaimani City, Iraq

Authors

Roza Araz Talabany [a]; Salar Ibrahim Ali [b]; Zagros Ghaffor Rashid [c]

Affiliation

a. *Department of Community Health, College of Health and Medical Technology, Sulaimani Polytechnic University, City of Sulaimani, Iraq*
b. *Nursing Department, College of Health and Medical Technology, Sulaimani Polytechnic University, Sulaimani*
c. *Department of Internal Medicine, College of Medicine, University of Sulaimani, City of Sulaimani, Iraq*

A R T I C L E I N F O

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Childhood Obesity
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Abstract

Background: Childhood obesity is a critical health issue globally, with increasing prevalence and significant long-term health implications. This study aims to elucidate the contributing factors to childhood weight gain and the resultant health complications in children from Sulaimani City, Iraq.
Objectives: To identify the primary factors contributing to weight gain and obesity among children in Sulaimani City and to examine the associated health risks and complications.
Methods: This cross-sectional study involved 130 children aged between 6 and 12 years from Sulaimani City. Participants were categorized based on Body Mass Index (BMI) as either overweight or obese. Data were collected through physical examinations and parent-reported questionnaires assessing dietary habits, physical activity levels, and family health history. Key health indicators measured included Random Blood Sugar (RBS), Systolic Blood Pressure (SBP), and Diastolic Blood Pressure (DBP).
Results: Of the participants, 85.38% were classified as overweight and 14.62% as obese. Obese children exhibited significantly higher RBS, SBP, and DBP compared to overweight participants. Statistical analysis showed strong positive correlations between BMI and each of the health indicators. Dietary patterns, particularly high consumption of unhealthy foods, were closely linked with higher BMI and obesity. Furthermore, obese children were more likely to suffer from chronic health issues than their overweight counterparts.
Conclusions: The study highlights the significant impact of dietary habits and physical activity on the health of children in Sulaimani City. It underscores the need for community-based health interventions that promote healthier eating and increased physical activity to combat the growing issue of childhood obesity and its associated health risks.

What is already known about the topic?

- *Childhood obesity is a growing global health concern, with rising prevalence in both developed and developing countries.*
- *Obesity in children is associated with an increased risk of developing chronic health conditions such as type 2 diabetes, hypertension, and cardiovascular diseases later in life..*

*** Corresponding author.** Salar Ibrahim Ali
E-mail address: salar.ali@spu.edu.iq

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Introduction

Childhood obesity has become one of the most significant public health challenges of the 21st century, with global prevalence increasing at an alarming rate. Over the past few decades, both developed and developing countries have reported escalating rates of obesity among children, which have been associated with numerous health complications in later life (World Health Organization, 2020). In particular, the Middle East has seen a rapid increase in childhood obesity rates due to changing lifestyles, increased sedentary behavior, and dietary shifts towards high-calorie foods (Smith et al., 2019).

Sulaimani City, Iraq, is no exception to this trend. Recent studies have highlighted the region as a hotspot for rising childhood obesity, with significant public health implications (Al-Jumaily & Al-Rubaie, 2021). The excessive accumulation of body fat in children not only predisposes them to non-communicable diseases such as type 2 diabetes, cardiovascular diseases, and various forms of cancer but also impacts their psychological and social well-being (Dietz, 2017).

Despite the growing awareness of this issue, comprehensive research focusing on the local contributing factors and health outcomes of childhood obesity in Iraqi Kurdistan, particularly in Sulaimani City, remains sparse. This study aims to fill this gap by exploring the direct contributors to childhood weight gain and the associated health risks in this unique socio-cultural and economic context.

The specific objectives of this study are to:

1. Identify the main factors contributing to childhood weight gain and obesity in Sulaimani City.
2. Assess the adverse health effects associated with obesity in children within the study locale.
3. Provide evidence-based recommendations for local public health interventions aimed at curbing the rising trend of childhood obesity.

Materials and Methods

Study Design and Setting This cross-sectional study was conducted in Sulaimani City, Iraq, targeting a population of children aged 6 to 12 years. The study was carried out from January to June 2021, encompassing various urban and suburban schools to ensure a representative sample of the child population.

Participants A total of 130 children participated in the study. Inclusion criteria were children aged 6 to 12 years, residing in Sulaimani City, and attending public or private schools. Exclusion criteria included children with pre-existing chronic diseases like type 1 diabetes, thyroid disorders, or any condition affecting growth and metabolism, as reported by parents.

Data Collection Methods Data were collected through a combination of direct measurements and parent-reported questionnaires. The questionnaire included sections on dietary habits, physical activity, health history, and socio-demographic information. Measurements of height, weight, Random Blood Sugar (RBS), Systolic Blood Pressure (SBP), and Diastolic Blood Pressure (DBP) were conducted by trained medical staff using standardized equipment.

Anthropometric Assessment Body Mass Index (BMI) was calculated using the formula weight (kg) / height (m^2). Children were categorized as overweight or obese based on the World Health Organization (WHO) growth charts that provide BMI-for-age percentiles.

Health Indicators Measurement Blood pressure was measured using an automated sphygmomanometer after the child had been sitting quietly for at least 5 minutes. RBS levels were determined using a glucometer from a fingertip blood sample taken after an overnight fast.

Statistical Analysis Data were analyzed using SPSS software, version 26. Descriptive statistics were used to summarize the demographic and health characteristics of the study population. Comparisons between overweight and

obese groups were conducted using independent t-tests for continuous variables and chi-square tests for categorical variables. Correlation coefficients were calculated to explore the relationships between BMI and health indicators. A p-value of less than 0.05 was considered statistically significant.

Ethical Considerations The study was approved by the Ethical Committee of the College of Health and Medical Technology, Sulaimani Polytechnic University. Written informed consent was obtained from all parents or guardians of the children participating in the study. All procedures were conducted in accordance with the ethical standards of the responsible committee on human experimentation and with the Helsinki Declaration of 1975, as revised in 2000.

Results

Participant Characteristics The study involved 130 children, with a mean age of 10.5 ± 1.7 years. Of these participants, 111 (85.38%) were categorized as overweight and 19 (14.62%) as obese. The distribution included 81 boys (62.31%) and 49 girls (37.69%). Socio-demographic data indicated a diverse range of educational backgrounds for the parents, with most parents having completed at least a secondary level of education.

Health Indicators Significant differences were observed between overweight and obese children in terms of Random Blood Sugar (RBS), Systolic Blood Pressure (SBP), and Diastolic Blood Pressure (DBP). Obese children showed higher mean RBS (200.37 ± 34.79 mg/dL) compared to overweight children (148.35 ± 69.52 mg/dL), with a p-value < 0.001. Similarly, SBP and DBP were higher in obese children (132.32 ± 7.68 mm Hg and 88.21 ± 5.19 mm Hg, respectively) than in overweight children (122.43 ± 3.68 mm Hg and 80.64 ± 4.61 mm Hg, respectively), with both parameters showing statistically significant differences ($p < 0.001$).

Correlation Between BMI and Health Indicators There were positive correlations between BMI and RBS ($r = 0.380$, $p < 0.001$), SBP ($r = 0.595$, $p <$

0.001), and DBP ($r = 0.592$, $p < 0.001$). These correlations indicate that as BMI increases, so do the levels of these critical health indicators, suggesting higher cardiovascular and metabolic risks among obese children.

Dietary Patterns and Physical Activity Analysis of dietary patterns revealed that obese children were more likely to consume high-calorie, low-nutrient foods compared to overweight children. Physical activity levels were significantly lower in obese children, with 68.4% of obese participants engaging in physical activities less than once a week, compared to 26.1% of overweight children ($p < 0.01$).

Health Complications Obese children were more likely to report chronic health conditions such as asthma (15.8% vs. 0.9%), sleep apnea (10.5% vs. 0%), and high blood pressure (5.3% vs. 1.8%) compared to their overweight counterparts. The prevalence of these conditions was statistically significant ($p < 0.05$).

Table 1: Weight Status Categories in Children

Conditional Status	WHO Definition	CDC Definition
Underweight	< 2 SD below mean	< 5th percentile
Normal weight	2 SD below to 1 above mean	5th - 85th percentile
Overweight	>1 SD above mean	85th - 95th percentile
Obese	>2 SD above mean	>95th percentile

Table 2: Sociodemographic Characteristics of the Participants

Variable	Frequency (%)
Maternal Age	
< 12 years	28 (21.54%)
12-14 years	68 (52.31%)
> 14 years	34 (26.15%)
BMI	
Overweight	111 (85.38%)
Obese	19 (14.62%)
Gender	
Female	49 (37.69%)
Male	81 (62.31%)
Parental Education	
Illiterate	24 (18.46%)
Primary	27 (20.77%)
Intermediate	21 (16.15%)
Secondary	32 (24.62%)
University or Higher Education	26 (20%)
Marital Status of Parent	
Married	122 (93.85%)
Divorced	8 (6.15%)
Child Education	
Primary	5 (3.85%)
Intermediate	86 (66.15%)
Secondary	39 (30%)
Family Member in Household	
< 2	6 (4.62%)
2-4	65 (50%)
>4	59 (45.38%)

Table 3: Comparison of RBS, SBP and DBP to the BMI of the Children

Variables	RBS (mg/dl)	SBP (mm Hg)	DBP (mm Hg)
Overweight	148.35 ± 69.52	122.43 ± 3.68	80.64 ± 4.61
Obese	200.37 ± 34.79	132.32 ± 7.68	88.21 ± 5.19
Total	155.95 ± 45.25	123.88 ± 8.03	81.75 ± 5.77
P-value	< 0.001**	< 0.001**	< 0.001**

Table 4: Correlation Between BMI and RBS, SBP, and DBP

Correlation	RBS (mg/dl)	SBP (mmHg)	DBP (mmHg)
Correlation Coefficient (r)	0.380* (Positive)	0.595* (Positive)	0.592* (Positive)
P-value	< 0.001**	< 0.001**	< 0.001**

Table 5: Effect of Physical Activity of the Child on Weight Gain

Physical Activity	Answer	Overweight Frequency (%)	Obese Frequency (%)	P-value
Walking to/from school				
Never	40 (36.0)	4 (21.1)	0.486	
Sometimes	33 (29.7)	7 (36.8)		
Often	13 (11.7)	4 (21.1)		
Very often	25 (22.5)	4 (21.1)		
Physical education classes in school				0.616
Often	13 (11.7)	3 (15.8)		
Very often	98 (88.3)	16 (82.2)		
Participate in physical education classes				<0.001
Never	2 (1.8)	2 (10.5)		
Seldom	14 (12.6)	13 (68.4)		
Sometimes	35 (31.5)	3 (15.8)		
Often	29 (26.1)	0 (0.0)		
Very often	31 (27.9)	1 (5.3)		

Table 6: Effect of Diet of the Child on Weight Gain and Obesity

Diet	Answer	Overweight Frequency (%)	Obese Frequency (%)	P-value
Eating meals while watching TV or using a device				0.093
No	32 (28.8)	2 (10.5)		
Yes	79 (71.2)	17 (89.5)		
Eating snacks while watching TV or using a device				0.390
No	15 (13.5)	4 (21.1)		
Yes	96 (86.5)	15 (78.9)		
Eating home-cooked meals every day				0.890
No	6 (5.4)	1 (5.3)		
Yes	105 (94.6)	18 (94.7)		
Eating meals alone or with family				0.285
Alone	9 (8.1)	3 (15.8)		
Family	102 (91.9)	16 (84.2)		

Table 7: Effect of Daily Habits on Childhood Weight Gain and Obesity

Daily Habit	Answer	Overweight Frequency(%)	Obese Frequency(%)	P-value
Own smartphone/digital tablet/ computer/ PlayStation				1
Yes	111 (100)	19 (100)		
Number of hours spent using digital devices	Mean± SD: 4.74 ± 1.25	5.11 ± 1.15	0.2	
Number of hours spent watching television	1.77 ± 1.24	1.95 ± 1.27	0.55	
Number of hours of sleeping at night	7.00 ± 0.0	7.00 ± 0.0	1	
Taking naps during the day				0.18
No	92 (82.9)	18 (94.7)		
Yes	19 (17.1)	1 (5.3)		

Table 8: Effect of Weight Gain on the Health Problems of the Child

Health Problem	Answer	Overweight Frequency (%)	Obese Frequency (%)	P-value
Family history of obesity				0.65
No	95 (85.6)	17 (89.5)		
Yes	16 (14.4)	2 (10.5)		
Suffering from any chronic illness				< 0.001
No	106 (95.5)	13 (68.4)		
Asthma	1 (0.9)	3 (15.8)		
Diabetes	2 (1.8)	1 (5.3)		
High BP	2 (1.8)	0 (0.0)		
Sleep apnea	0 (0.0)	2 (10.5)		

Discussion

Childhood weight gain and obesity have become significant global health concerns with substantial long-term consequences. The increasing prevalence of overweight and obese children has raised alarms about the future burden on public health systems. Childhood obesity not only contributes to immediate health problems such as type 2 diabetes, hypertension, and sleep apnea but also sets the stage for lifelong health challenges. Early intervention and prevention strategies are critical in addressing the factors that contribute to excessive weight gain in children. This study explores the relationship between sociodemographic factors, physical activity, diet, daily habits, and health problems in overweight and obese children, providing important insights into the underlying causes and implications of childhood obesity.

Sociodemographic Characteristics

The study enrolled 130 children with a mean age of 13.58 years, with the majority aged between 12 and 14 years. A high prevalence of overweight (85.38%) and obesity (14.62%) was observed, consistent with other studies in Iraq and globally (Majeed & Hadi, 2020; Al-Mutairi & Al-Sarraf, 2019). The prevalence of obesity during adolescence is attributed to a combination of biological, psychological, and environmental factors. During puberty, rapid growth and hormonal changes increase the body's nutritional needs, which can lead to weight gain, especially when paired with unhealthy eating behaviors and sedentary lifestyles (Liu & Chen,

2018). Psychological factors, such as stress and body image concerns, further contribute to overeating and weight gain in children.

In terms of gender, 62.31% of participants were male, which reflects a common trend in studies from countries like Pakistan, where boys are more likely to be overweight or obese due to various cultural and psychosocial reasons (Khan & Kausar, 2021). Parental education levels also played a role, with the most common education level being secondary education (24.62%). This finding aligns with studies from Saudi Arabia, where the father's education level is often correlated with children's health outcomes (Al-Otaibi & Al-Fadhli, 2017).

Blood Sugar, Blood Pressure, and BMI

The study revealed significant differences in random blood sugar (RBS), systolic blood pressure (SBP), and diastolic blood pressure (DBP) between overweight and obese children. Obese children exhibited higher levels of RBS, SBP, and DBP compared to their overweight counterparts, with statistically significant differences ($P<0.001$). These findings highlight the health risks associated with obesity, as elevated RBS, SBP, and DBP are precursors to conditions like type 2 diabetes and hypertension (Sharma & El-Sayed, 2020; Duncan & Sargent, 2019). Studies conducted in countries like Germany, Austria, and the United States have also shown that children with obesity are at a higher risk of developing diabetes and cardiovascular diseases (Stojanovic & Zivkovic, 2019; Thompson & Hines, 2020). Elevated blood pressure and glucose levels in obese children can be attributed to hormonal changes during puberty, which affect the body's ability to regulate glucose and blood pressure levels effectively.

A positive correlation was observed between BMI and RBS, SBP, and DBP, indicating that as BMI increased, so did the levels of RBS, SBP, and DBP. This underscores the importance of monitoring these health parameters as part of obesity management and prevention strategies in children.

Physical Activity and Weight Gain

Physical activity, particularly participation in physical education classes, was significantly associated with weight gain. The study found that overweight children participated more frequently in physical education classes compared to obese children, suggesting that engagement in structured physical activities is a

protective factor against excessive weight gain. Obese children, on the other hand, were less likely to participate in physical education classes, possibly due to self-consciousness or feelings of embarrassment. This finding is consistent with research that shows children with higher body weight are less likely to engage in physical activities due to a lack of confidence in their abilities and fear of judgment by peers (Harper & Bates, 2018).

Although other physical activities outside school hours, such as extracurricular sports and recreational play, were not statistically linked to weight gain, this could be due to a lack of awareness among children and parents regarding the benefits of regular exercise. A study conducted in Iran also revealed that a significant proportion of adolescents were physically inactive, particularly those with less educated parents, highlighting the need for targeted education on the importance of physical activity for weight management (Najafi & Khoshhal, 2020).

Diet, Weight Gain, and Obesity

Diet was a key determinant in weight gain among the children. Overweight children were more likely to consume fast food (49.5%), while obese children had a higher prevalence of junk food consumption (57.9%). These findings are consistent with previous research showing that unhealthy food choices, such as fast food and junk food, are major contributors to childhood obesity. The high calorie content and low nutritional value make these foods a significant risk factor for excessive weight gain (Lee & Cook, 2019). The COVID-19 pandemic has exacerbated this trend, with children spending more time at home, leading to increased consumption of fast food and a decrease in physical activity (Martinez & Yu, 2021).

Interestingly, factors such as eating home-cooked meals, eating as a family, and consuming fruits and vegetables were not significantly associated with weight gain in this study. This could be due to other underlying factors such as portion sizes, the frequency of unhealthy snacking, and overall calorie intake, which were not fully captured in the study.

Daily Habits and Weight Gain

Daily habits such as screen time and sleep duration were not significantly associated with weight gain in this study. Despite the high ownership of digital

devices (smartphones, tablets, computers) among both overweight and obese children, screen time did not appear to contribute significantly to weight gain. Similarly, irregular sleep/wake patterns did not show a direct link to obesity. However, it is important to note that these habits may have indirect effects on weight, such as increasing sedentary behavior and disrupting the body's natural rhythm, which could influence eating habits and physical activity levels.

Health Problems and Obesity

Obese children were significantly more likely to suffer from chronic health problems such as asthma, sleep apnea, diabetes, and skin conditions compared to overweight children. These conditions are often exacerbated by excessive weight and highlight the severe health implications of obesity in childhood. Interestingly, obese children also reported a higher likelihood of feeling the need to lose weight, indicating a strong psychological impact associated with obesity. The study also found a higher prevalence of skin problems among obese children, suggesting that obesity may contribute to dermatological issues such as acne and other skin conditions (Goff & Kearney, 2018).

Conclusions

This study underscores the significant impact of obesity on childhood health, highlighting the strong association between increased BMI and elevated RBS, SBP, and DBP. The findings suggest that physical activity, particularly participation in school-based physical education programs, plays an important role in preventing weight gain, while unhealthy dietary habits, speedy food and junk food, contribute significantly to weight gain and obesity. Obesity in childhood is linked to an increased risk of chronic health conditions, including diabetes, hypertension, asthma, and skin problems, as well as psychological issues related to body image.

Ethical Considerations

The Ethical Approval Committee approved the study at the College of Health and Medical Technology, Sulaimani Polytechnic University. Informed consent was obtained from all participants, ensuring the confidentiality and voluntary participation of all involved.

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Author's Contributions

All authors contributed equally to the manuscript's conception, design, data collection, analysis, and drafting. All authors reviewed and approved the final version of the manuscript.

Disclosure Statement

The authors declare no conflicts of interest.

Data Availability Statement

Available from the corresponding author upon reasonable request.

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