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SYSTEMATIC REVIEW AND META-ANALYSIS OF CHILDHOOD NUTRITION AND OBESITY IN PAKISTAN

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ABSTRACT

The metabolic risks related to obesity are more in South Asian populations as compare to white or other ethnic groups. Similarly, levels of obesity in childhood of South Asians are known to track into adulthood. Childhood obesity is becoming an equally challenging in developing countries including Pakistan. Children and teenagers are effecting badly with an estimated 10% of the world's children being overweight and one quarter of these being obese. The purpose of this study is to assess occurrence and socioeconomic correlates of overweight and obesity, and trend in prevalence statistics, among Pakistani childhood. A Systematic Review and Meta-Analysis of Childhood Nutrition and Obesity analysis is carried out to estimate the results. In conclusion, addressing childhood obesity and nutrition issues in Pakistan requires a comprehensive approach involving education, policy changes, community engagement, and healthcare interventions. By implementing these strategies, we can work towards a healthier future for Pakistani children, reducing obesity rates and improving overall nutrition outcomes.

1. Introduction

Obesity is a major health issue for children and adults across the world. The Global Nutrition Report 2019 shows that about 40.1 million children globally are overweight and, at the same time overweight and obesity is increasing rapidly in almost every country in the world, with no signs of any decline in numbers. It is estimated that in 2015, approximately 10% of children and adults globally were obese. In reports of non-communicable disease risk factor collaboration, a remarkable increase is observed from 0.7% in 1975 to 5.6% in 2016 of global prevalence of obesity in boys while in girls this increase is from 0.9% to 7.8% during the same bracket of time. Data from the National Health and Nutrition Examination Survey (NHANES) shows that in United States, obesity in boys aged 2–5 years had a steep incline from 1999–2016, whereas an increase in overweight girls aged 16–19 years also observed. Comparable trends are noted in the data gathered from United Kingdom, where the obesity epidemic is increasing continually in teen-age population. Low middle income countries

(LMICs) are afflicted with the “double burden of disease” epidemic. Popkin et al demonstrated a significant increase in body mass index (BMI) and waist circumference in individuals from LMICs including Asia and Africa. The occurrence of overweight and obesity in teenagers in LMICs is 15% and 6% respectively. This is particularly noted in Asian regions. Childhood obesity is yet under-recognized problem in developing countries including Pakistan. Childhood obesity and nutrition issues are significant concerns in Pakistan. Several factors contribute to this problem, including poor dietary habits, limited access to nutritious food, inadequate education about healthy eating, and a sedentary lifestyle. The prevalence of childhood obesity in Pakistan has been increasing rapidly over the years. According to a study published in the Journal of the Pakistan Medical Association in 2020, approximately 15% of children in Pakistan are overweight or obese. Poor dietary habits play a major role in childhood obesity. Children in Pakistan often consume a diet that is high in processed foods, sugar, and unhealthy fats, while lacking essential nutrients like fruits, vegetables, and whole grains. Fast food consumption has also risen, contributing to the problem.

Many families in Pakistan face challenges in accessing nutritious and affordable food. The availability of fresh fruits, vegetables, and whole grains is often limited, especially in rural areas. In urban areas, the reliance on convenient, processed foods is more common due to time constraints and lack of awareness about healthier options. There is a lack of awareness and education about proper nutrition and healthy eating habits among parents, children, and even healthcare professionals. Nutritional education is not adequately integrated into school curricula, and many parents may not understand the long-term health consequences of poor nutrition. Socioeconomic factors also contribute to childhood obesity and nutrition issues in Pakistan. Low-income families may have limited resources to purchase healthy food and may rely more on inexpensive, calorie-dense options. In contrast, higher-income families may have greater access to processed and unhealthy foods.

1.1 Childhood

In Pakistan, childhood is a complex and diverse experience shaped by a variety of social, economic, and cultural elements. While some Pakistani children may have a carefree and pleasant upbringing, others may endure tremendous hardships and obstacles.

Poverty is one of the most serious issues confronting children in Pakistan. According to UNICEF, approximately 40% of Pakistani children are poor, which has a significant influence on their health, education, and overall well-being. Low-income children are more likely to suffer from hunger, have restricted access to healthcare, and have fewer possibilities for education and social mobility. Child labor is another major issue affecting Pakistani children. Despite laws forbidding child labor, many children in Pakistan are compelled to work in dangerous and exploitative situations, frequently in agriculture, brick-making, and carpet weaving. This can harm their physical and emotional health, as well as their ability to attend school and pursue their aspirations. Children in Pakistan are similarly concerned about violence and abuse. Physical and emotional abuse, as well as sexual exploitation, are all too widespread in Pakistan, and many children may lack the assistance and safety they require to recover from these traumas. Despite these difficulties, there are numerous pleasant aspects of childhood in Pakistan. Family is fundamental to Pakistani culture, and many children grow up in loving and supportive houses. Pakistani children are also noted for their perseverance, ingenuity, inventiveness, and artistic abilities. Childhood in Pakistan is molded by a variety of social, economic, and cultural elements, and it varies widely depending on a child's origin and circumstances. While Pakistani children face numerous problems, there is also hope for a brighter future with increasing access to education, healthcare, and social services.

1.2 Obesity

Obesity is a major public health issue in Pakistan, afflicting both adults and children. According to the Pakistan Demographic and Health Survey (2017-18), the prevalence of overweight and obesity was 37.9% among women and 18.1% among males. Overweight and obesity were present in 10.9% of children under the age of five. Obesity is on the rise in Pakistan due to a number of factors, including changes in food patterns and a sedentary lifestyle. Traditional Pakistani diets were rich in whole grains, vegetables, and fruits, but the introduction of processed and high-calorie meals has resulted in an unhealthier diet. Fast food, fried foods, candies, and sugary drinks are increasingly popular in Pakistan, contributing to the growth in obesity. Furthermore, due to the increased use of technology, less physical activity, and less time spent outside, many people in Pakistan lead sedentary lifestyles. Obesity and weight growth can result from a lack of physical activity. Socioeconomic variables are also contributing to the growth of obesity in Pakistan. People with lesser incomes may have limited access to healthful eating options and may rely on high-calorie items. Furthermore, a lack of knowledge and awareness about appropriate eating choices and physical activity may exacerbate the situation. Obesity can have serious and long-term implications. Obese people are more likely to develop a variety of health problems, including type 2 diabetes, heart disease, stroke, and some types of cancer. Obesity can also have a significant impact on one's mental health, self-esteem, and overall quality of life. In Pakistan, efforts are being undertaken to combat the obesity problem, including public awareness programmes promoting healthy food and physical activity. However, more has to be done to guarantee that everyone in Pakistan has access to nutritious diets and physical activity opportunities. This includes both teaching about healthy diet and lifestyle choices, as well as infrastructural investments such as parks and playgrounds. The government may play an important role in combating obesity by enacting regulations that encourage healthy diet and physical activity. This can involve food labelling and marketing rules, as well as incentives for businesses to promote healthier food options. Furthermore, investments in healthcare infrastructure and physical activity promotion can aid in the prevention and treatment of obesity.

Obesity is an increasing concern in Pakistan, with serious health consequences for individuals and the society as a whole. Addressing the underlying causes of obesity necessitates a diverse approach that involves education, policy changes, and infrastructural investment. We can help Pakistan achieve a healthier and more successful future by working together to address this issue.

1.3 Nutrition

Nutrition challenges in Pakistan are complicated and multidimensional, owing to a variety of social, economic, and environmental factors. According to the Pakistan Demographic and Health Survey (2017-18), 36.9% of children under the age of five have stunted growth, which indicates chronic malnutrition, while 18.7% have wasting, which indicates acute malnutrition. Micronutrient deficiencies, such as iron, iodine, vitamin A, and zinc, are also widespread in both children and adults in Pakistan. Poverty is a major source of malnutrition in Pakistan. Poverty and food insecurity make it difficult for people to obtain the food they require to stay healthy. Furthermore, a lack of knowledge about good nutrition and feeding practices might contribute to malnutrition. Malnutrition can also be caused by poor sanitation and hygiene practices, which increase the risk of infections and diarrheal disorders.

Traditional diets in Pakistan consisted of nutritious grains, vegetables, and fruits, but the advent of processed and high-calorie meals has resulted in a move towards an unhealthier diet. Fast food, fried foods, candies, and sugary drinks have become more popular in Pakistan, contributing to an increase in obesity and related health problems. In addition to hunger, the incidence of micronutrient deficiencies in Pakistan is a major concern. Micronutrients such as iron, vitamin A, iodine, and zinc are necessary for optimum health, yet many people in

Pakistan do not get enough of these. Micronutrient deficiencies can cause a variety of health issues, including anemia, blindness, decreased cognitive development, and compromised immune systems. In Pakistan, efforts are being made to address nutrition challenges, such as nutrition education programmes, vitamin supplementation, and the provision of fortified foods. However, more work must be done to ensure that all Pakistanis have access to nutritional foods and supplements. By enacting regulations that promote healthy eating and access to nutritious foods, the government may play a vital role in addressing nutrition challenges. This can involve food labelling and marketing rules, as well as incentives for businesses to promote healthier food options. Furthermore, investments in healthcare infrastructure and physical activity promotion can aid in the prevention and treatment of malnutrition. Overall, nutrition concerns are a major concern in Pakistan, with a variety of social, economic, and environmental variables contributing to the problem. To address the core causes of malnutrition and micronutrient deficiencies, a multimodal approach that involves education, policy changes, and infrastructure investment is required. By working together to address these concerns, we can help Pakistan achieve a healthier and more successful future.

1.4 Childhood Obesity and Nutrition Indicators

There are numerous indicators to determine an individual's level of obesity, and we use data from the Body Mass Index (BMI) in this study. BMI is computed by dividing a person's weight in kilograms by their height in meters squared. Body Mass Index (BMI) was developed in the mid-nineteenth century and became the global standard in the 1980s. The National Institutes of Health issued the most recent BMI standards in June 1998. If your BMI is less than 18.5, you are considered underweight. Your BMI ranges from 18.5 to 25, which is considered a healthy weight range. If your BMI is between 25.0 and 30, you are considered overweight. Obesity is defined as a BMI of 30 or higher. Hip and waist circumferences are important measurements for determining total body fat in the center of the body, which may suggest an unhealthy lifestyle. The average waist and hip circumferences for men were 92.0 and 98.7 cm, respectively, while the norms for women were 78.7cm and 98.2cm.

Meta-analysis is a statistical technique that involves combining and analyzing data from multiple independent studies to obtain a more comprehensive and robust understanding of a specific research question or topic. It provides a systematic and objective approach to synthesizing the findings from various studies, enabling researchers to draw more reliable conclusions than what individual studies may offer. The process begins with formulating a clear research question and conducting an extensive literature search to identify relevant studies. The selected studies are then carefully evaluated and their data extracted. Statistical analysis is performed to calculate effect sizes and associated measures of uncertainty for each study. These effect sizes are then combined using appropriate statistical methods to generate an overall summary effect size, taking into account sample sizes and variability across studies. Heterogeneity, or variation in effect sizes, is assessed to determine the appropriateness of combining the studies. Additionally, publication bias, which refers to the selective publication of studies with significant or positive findings, is assessed to mitigate potential distortions in the overall results. The findings of the meta-analysis are interpreted in the context of the research question and the limitations of the included studies. Overall, meta-analysis is a valuable tool in evidence-based research, allowing researchers to synthesize and evaluate the available evidence to make informed decisions and draw more reliable conclusions.

2. Literature Review

According to a WHO estimate from 2022, there are more than 1 billion obese individuals in the world, including 650 million adults, 340 million teenagers, and 39 million children. In

2020, it was anticipated that 22.0% (UI 21.3 to 22.7) of all children under five worldwide (149.2 million [UI 144.4 to 154.2 million]) were stunted (that is, too short for their age). In 2020, it was anticipated that 45.4 million (UI 37.0 to 53.7 million) children under the age of five were badly wasted, with 13.6 million (UI 10.6 to 16.7 million) being abnormally thin for their height. In contrast, the number of children under the age of five who were overweight (too fat for their height) was expected to have increased from 33.3 million to 38.9 million (UI 35.6 to 42.4 million) in 2020 [global health statistics 2022].

In comparison to other developing nations, Pakistan is said to have one of the highest rates of child and female malnutrition (Waghmare, 2022). Malnutrition is characterized by inadequate or excessive nutrient intake, an unbalanced intake of vital nutrients, or poor nutrient use. Children's nutritional health directly impacts their cognitive ability (Marwat, 2019) . Malnutrition carries a dual cost of undernutrition as well as overweight and obesity. Children are the most adversely impacted by the global epidemic of obesity, with an estimated 11% of them being classified as overweight or obese (Mushtaq M. U., 2011) . An epidemic of childhood obesity is currently sweeping through developing nations, including Pakistan (Mushtaq M. , 2011), particularly among the wealthy metropolitan population. According to State Bank of Pakistan (SBP), 2019: In Pakistan, one in ten youngsters engaged in wasting, and nearly half of children under the age of five are stunted.

Pakistan is ranked 154th on the Children's Right Index (global survey of 181 countries in October 2020). It has been found that there are large disparities in stunting and thinness among the lowest sections of society, including those who live in rural and urban areas, are the least educated, originate from low-income neighborhoods, and have congested housing. Stunting and thinness prevalence showed an upward trend with age (Mushtaq, 2011).

Pakistan has much more young children that are stunted than other countries with comparable income levels (Pu, 2020). Stunting had a greater impact on children living in rural areas than on those in urban areas (Ponum, 2020). The results of the study revealed that the nutritional health of the children was significantly influenced by the parent's or caregiver's literacy [30]. Numerous domestic child labourers are malnourished, and physical violence against them is common (Zainab, 2016) . While stunting and underweight did not appear to be related, children who were not breastfed had a higher risk of wasting (Tariq, 2018)

Biswas et.al (2016) findings shows that prevalence rates of overweight and obesity among children and adolescents varied widely from 1.0% to 20.6% and 0.3% to 25.6%, respectively. The pooled prevalence rates of overweight and obesity were 7.0% (95% confidence interval [CI] 5.0 10.0) and 6.0% (95% CI 4.0- 8.0), respectively. The pooled prevalence rate of overweight increased substantially over the years, from 3.6% during 1998-2003 (95% CI 0.3-29.2) to 5.7% during 2004-2009 (95% CI 0.8-30.2) and 7.9% by 2010-2015 (95% CI 5.1-12.1). However, the pooled prevalence rate of obesity registered a sharp decline between 1998-2003 and 2004-2009 from 9.7% (95% CI 5.7-16.2) to 2.0% (95% CI 0.3-11.1) and subsequently increased significantly to 9.0% by 2010-2015 (95% CI 5.3-14.6). This review identified increasing trends in the prevalence of overweight and need to promote healthy lifestyles among children and adolescents with a view to effectively address the increasing problem of overweight and obesity. This would also help to prevent the development of chronic non-communicable diseases in adulthood obesity among children and adolescents in Pakistan. Mazidi et.al (2018) conducted a systematic review and meta-analysis to estimate the prevalence of overweight and obesity in children (aged 5–12 years) and adolescents (aged 12–19 years) in Asian countries. Brown et al. (2015) studied Twenty-nine studies included, seven children, 21 adult and one mixed age. No studies in children under six were identified. Sixteen studies were conducted in South Asia, ten in Europe and three in USA. Effective or promising trials include physical activity interventions in South Asian men in Norway and South Asian school-children in the UK. A home-based, family-orientated diet and physical

activity intervention improved obesity outcomes in South Asian adults in the UK, when adjusted for baseline differences. Meta-analyses of interventions in children showed no significant difference between intervention and control for body mass index or waist circumference. Meta-analyses of adult interventions showed significant improvement in weight in data from two trials adjusted for baseline differences (mean difference −1.82 kgs, 95% confidence interval −2.48 to −1.16) and in unadjusted data from three trials following sensitivity analysis (mean difference −1.20 kgs, 95% confidence interval −2.23 to −0.17). Meta-analyses showed no significant differences in body mass index and waist circumference for adults. Twenty of 24 intervention groups showed improvements in adult body mass index from baseline to follow-up; average change in high quality studies (*n* = 7) ranged from 0.31 to −0.8 kg/m2. There was no evidence that interventions were more or less effective according to whether the intervention was set in South Asia or not, or by socioeconomic status.
Mansori et al. (2019) Six articles were ultimately included in the meta-analysis to estimate the pooled prevalence, based on which the prevalence of obesity and overweight were estimated to be 8% (95% confidence interval [CI], 6%–10%) and 9% (95% CI, 7%–11%), respectively. The results of the subgroup analysis showed that the prevalence of obesity in boys and girls was 9% (95% CI, 6%–13%) and 7% (95% CI, 4–10%), respectively, and the prevalence of overweight in boys and girls was 10% (95% CI, 5%–15%) and 9% (95% CI, 5%–13%), respectively.

Salam et al. (2020) examined the evidence for the prevention of obesity among children and adolescents that suggests a combination of diet and exercise might reduce the BMI z-score (MD: -0.12; 95% CI: -0.18 to -0.06; 32 studies; 33,039 participants; 93%; low quality evidence), body mass index (BMI) by 0.41 kg/m2 (MD: -0.41 kg/m2; 95% CI: -0.60 to -0.21; 35 studies; 47,499 participants; I2 98%; low quality evidence), and body weight (MD: -1.59; 95% CI: -2.95 to -0.23; 17 studies; 35,023 participants; 100%; low quality evidence). Behavioral therapy alone (MD: -0.07; 95% CI: -0.14 to -0.00; 19 studies; 8569 participants; I2 76%; low quality evidence) and a combination of exercise and behavioral therapy (MD: -0.08; 95% CI: -0.16 to -0.00; 9 studies; 7334 participants; I2 74%; low quality evidence) and diet in combination with exercise and behavioral therapy (MD:-0.13; 95% CI: -0.25 to -0.01; 5 studies; 1806 participants; I2 62%; low quality evidence) might reduce BMI z-score when compared to the control group. Evidence for obesity management suggests that exercise only interventions probably reduce BMI z-score (MD: -0.13; 95% CI: -0.20 to -0.06; 12 studies; 1084 participants; I2 0%; moderate quality evidence, and might reduce BMI (MD: -0.88; 95% CI: -1.265 to -0.50; 34 studies; 3846 participants and body weight (MD: -3.01; 95% CI: -5.56 to -0.47; 16 studies; 1701 participants; I2 78%; low quality evidence) when compared to the control group. and the exercise along with behavioral therapy interventions (MD: -0.08; 95% CI:-0.16 to -0.00; 8 studies; 466 participants; I2 49%; moderate quality evidence), diet along with Nutrients 2020, 12, 2208; behavioral therapy interventions (MD: -0.16; 95% CI: -0.26 to -0.07; 4 studies; 329 participants; I2 0%; moderate quality evidence), and combination of diet, exercise and behavioral therapy (MD: -0.09; 95% CI: -0.14 to -0.05; 13 studies; 2995 participants; 12%; moderate quality evidence) also probably decreases BMI z-score when compared to the control group. The existing evidence is most favorable for a combination of interventions, such as diet along with exercise and exercise along with behavioral therapy for obesity prevention and exercise alone, diet along with exercise, diet along with behavioral therapy, and a combination of diet, exercise, and behavioral therapy for obesity management. Despite the growing obesity epidemic in LMICs, there is a significant dearth of obesity prevention and management studies from these regions. Mushtaq et.al (2011) analyzed Seventeen percent (95% CI 15.4-18.8) children were overweight and 7.5% (95% CI

6.5-8.7) were obese. Higher prevalence of obesity was observed among boys than girls (P = 0.028), however, there was no gender disparity in overweight prevalence. Prevalence of overweight showed a significantly increasing trend with grade (P < 0.001). Children living in the urban area with high socioeconomic status (SES) were significantly at risk for being overweight and obese (both P < 0.001) as compared to children living in the urban area with lower SES and rural children. Being in higher grade (aOR 2.39, 95% CI 1.17-4.90) and living in the urban area with higher SES (aOR 18.10, 95% CI 10.24-32.00) independently predicted the risk of being overweight. There is no correlation between increased food availability at home and a reduced incidence of childhood obesity (LeCroy, 2020). A study demonstrates that the nutritional status of children is significantly influenced by household circumstances. Children who live in lower-poverty households are less likely to be underweight, obese, or suffer from other forms of malnutrition (Shahid, 2022). Compared to poor countries, developed countries have a higher rate of obesity. But in order to completely eradicate this disease from developing nations, awareness programs are required (Haq, 2010). High obesity risks among school-aged children are a blatant sign that social assistance programs and parental education are required to address the obesity problem (Gupta, 2012).

Meat consumption, fast food consumption, and a lack of physical activity are all factors that have been linked to obesity [(Haider Javed Warraich, 2009), (Muhammad Umar Hayyat, 2019)]. Food frequency has an impact on health. School kids have a propensity of skipping breakfast. When compared to public school students, private school students enjoy a more nutritious diet and are more physically active. Private school parents have a higher socioeconomic standing and desire high-quality food (Parvesz, 2016). Micronutrient levels were evaluated in healthy children and found to be deficient in iron, copper, and zinc (Mohammad Shoaib Khan, 2015). Undernutrition can be remedied through birth spacing, mother education, and financial assistance (Lubna Naza, 2020). Children born to illiterate moms are more likely to be stunted (Muhammad Umar Farooq, 2019).

When compared to other factors such as media and food influence, the decline in physical education in private schools clearly shows a high frequency of childhood obesity (Anwar, 2010). To avoid stunting in toddlers, improved supplementary feeding practices should be implemented in infancy (Krebs, 2011). At the primary level, it is recommended to have a basic grasp of nutrition, food, and exercise (Pairzo Achakzai, 2016). Children's undernutrition has been connected to high family sizes, early marriages, inadequate breast-feeding practices, and poverty (Waqar Ali, 2015).

In primary school students, poor health appears to be connected with low socioeconomic position, a low reading rate, and a big family size. Much more work is needed on the political, educational, economic, and media fronts to enhance the nutritional status of Pakistan's future generations (SAIMA BATOOL, 2012)

Nutrient-rich diets and cleanliness practises should be prioritised to address malnutrition in children under the age of five (Gul Nawaz Khan, 2016). Girls experience malnutrition at a higher rate than boys (Zulfiqar Ali Laghari, 2015). Parents in rural Pakistan pay greater attention to their sons, feed them more, and prioritise boys (Syed M Shah, 2003). A plan to address the underlying causes of childhood malnutrition is required (Shafaq Mahmood, 2016). The majority of children under two years old have nutritional anaemia and low nutritional status (Yasir Bin Nisar, 2013). Malnutrition affects both male and female children equally due to a lack of education, pregnancy, vaccination, and family size (H Ullah, 2014) A considerable difference was discovered between children measured and perceived weights by their parents (Hiba Ashraf, 2017). Diabetes is a major risk factor for children in the future. Preventive measures should be put in place to help future generations avoid diabetes (Hydrie, 2004). Proactive nutrition education and sugar-sweetened beverage limitations in schools are required to halt the beginning of the obesity pandemic (Azra Rizwan, 2011).

3. Materials and Method

Meta-analysis is a statistical technique used to combine and analyze data from multiple independent studies on a specific research question or topic. It involves systematically reviewing and extracting data from individual studies, analyzing the collected data using statistical methods, and drawing conclusions based on the overall findings.

The main objective of a meta-analysis is to provide a more precise estimate of the effect size or outcome of interest by pooling data from multiple studies. It allows researchers to examine the overall pattern of results, identify consistencies or inconsistencies across studies, explore sources of variation, and increase the statistical power to detect small or moderate effects that may not be evident in individual studies.

The process of conducting a meta-analysis typically involves the following steps:

- Formulating the research question: Clearly defining the research question or objective to determine the scope of the meta-analysis.
- Conducting a comprehensive and systematic search of relevant studies, including published and unpublished sources, to identify all potentially eligible studies.
- Applying predefined inclusion and exclusion criteria to select studies that meet the eligibility criteria for the meta-analysis.
- Extracting relevant information from each selected study, such as sample size, study design, methodology, outcomes, and effect sizes or other relevant statistics.
- Calculating the effect size or outcome measure for each study, which could be a standardized mean difference, odds ratio, risk ratio, correlation coefficient, or other appropriate statistical measures.
- Performing statistical analysis to combine the effect sizes across studies, typically using weighted averages based on the sample size or precision of each study. This analysis can involve fixed-effects models, which assume that the true effect size is the same across studies, or random-effects models, which take into account the variability among studies.
- Assessing the degree of heterogeneity or variation in effect sizes across studies using statistical tests and graphical representations. High heterogeneity may indicate differences in study design, populations, or other factors that need to be explored.
- Conducting subgroup analyses or sensitivity analyses to explore potential sources of heterogeneity or evaluate the robustness of the findings based on different study characteristics or methodological factors.
- Assessing the potential for publication bias, which occurs when studies with significant results are more likely to be published than those with nonsignificant results. This can be done through statistical tests or graphical methods, such as funnel plots.
- Interpreting the combined results of the meta-analysis, including the overall effect size estimate, its precision, the degree of heterogeneity, and the implications for the research question or topic under investigation.

For our research, we employ meta-analysis. A meta-analysis is a statistical method that analyses and combines the findings of multiple related investigations. Although the term "similar" is not defined in this case, it is critical to ensure that when selecting a topic for a meta-analysis, the numerous studies provide data that can be compared.

Up until March 2022, the databases Science Direct, Web of Science, Springer, Scopus, JSTOR, Pakistan Medical Journal, and Google Scholar were used for a thorough computerised literature search. The terms "child," "adolescent," "overweight," "obesity," and "body mass index" were used as key words during the search. A snowball method involving manual reference checking of articles found was employed to achieve thorough gathering. Additional studies uncovered while reading was also gathered for evaluation.

Studied were included if they were:

- Occur in any state of Pakistan.
- If the sampled are below 18 years.
- were released in a peer-reviewed journal in English.

Both primary and secondary outcomes on our related variables are considered.

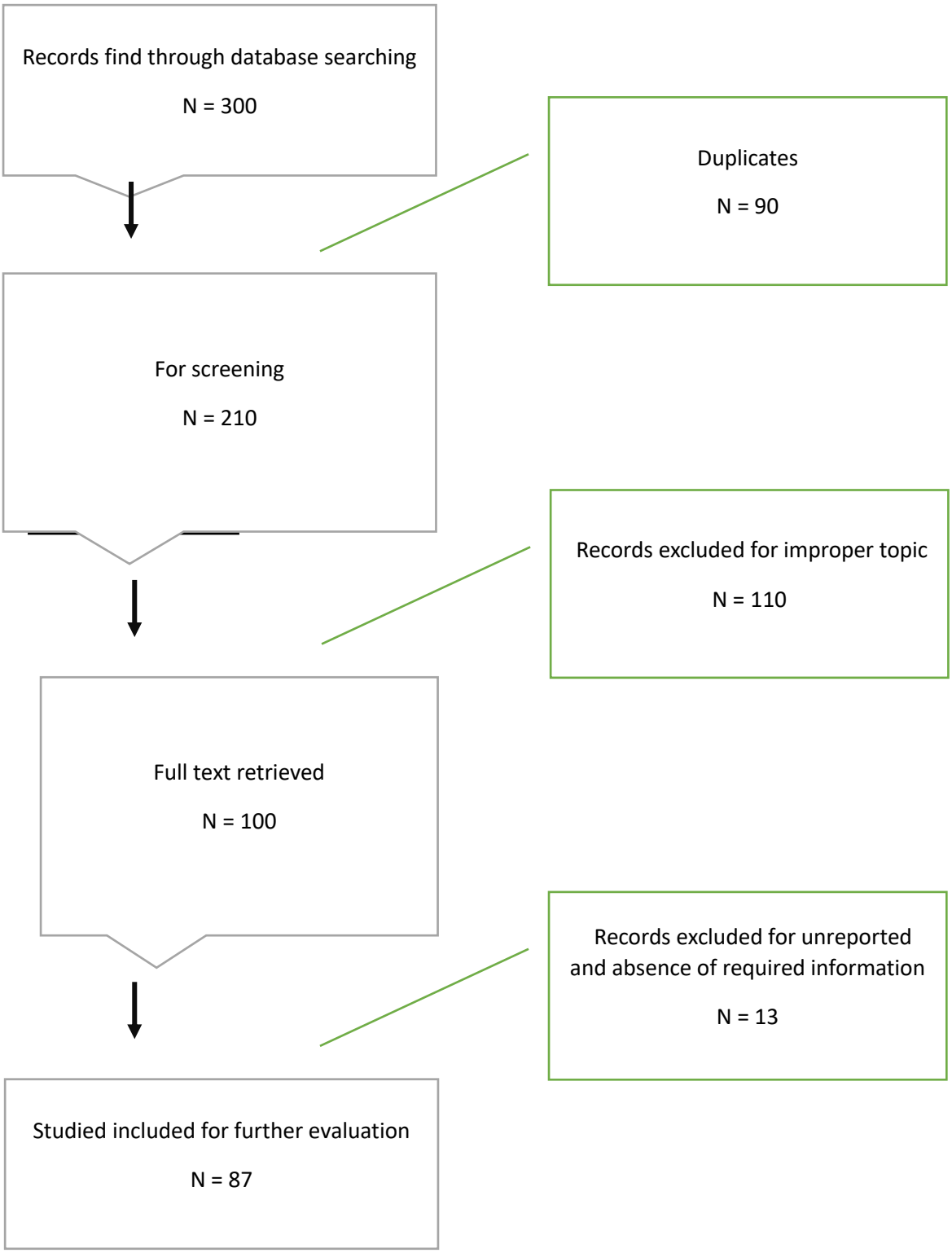

Figure 1. PRISMA Flow-chart

4. Results and Discussion

The Results and Discussion section is a crucial part of a research paper or study report. It presents the findings of the study and provides an interpretation and discussion of the results.

This section aims to communicate the key outcomes of the research and their implications, as well as compare them to existing knowledge and theories in the field.

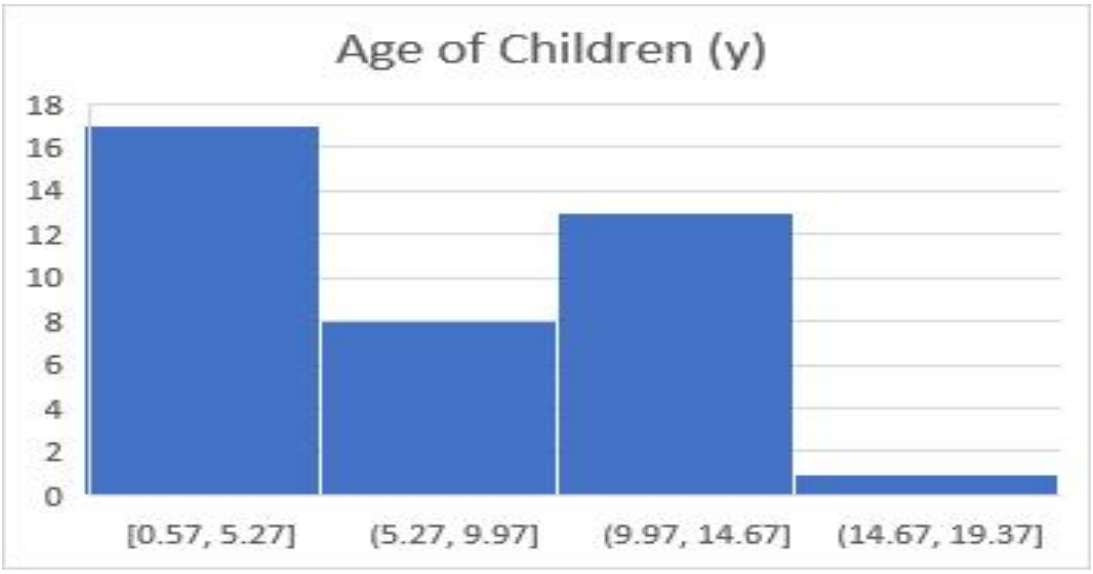

Figure 2. Histogram of Child's Age.
Figure 2 is a histogram showing children's ages. This demonstrates that the majority of our adolescents are between the ages of 0 and 5.

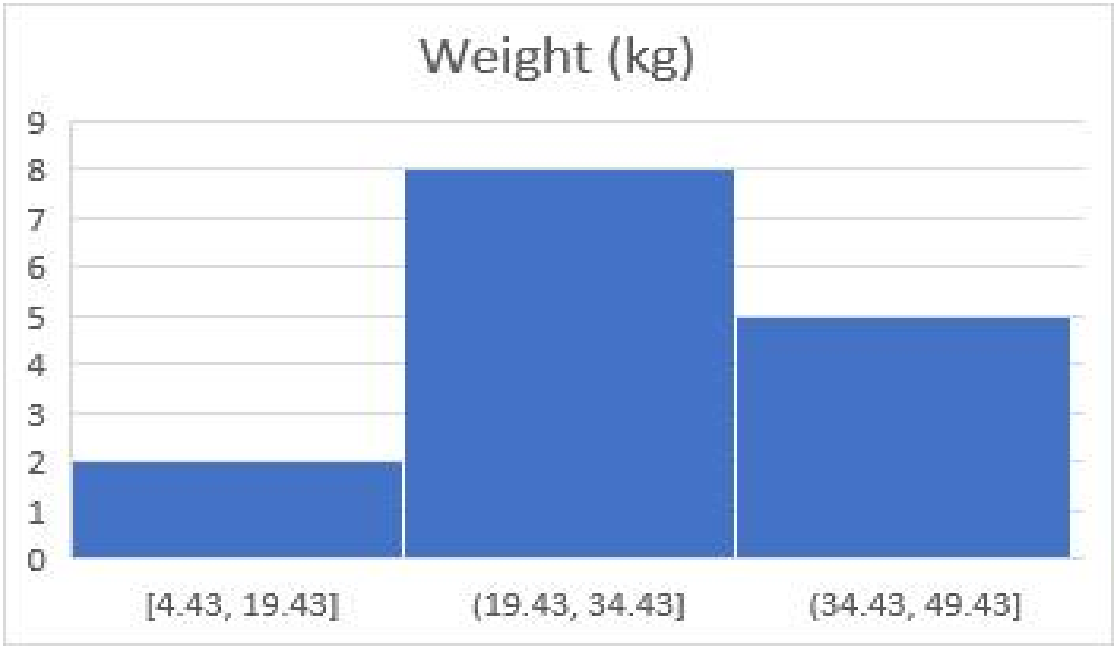

Figure 3. Histogram of Child's Weight
Figure 3 depicted the bulk of the children weigh between 19kg and 34kg. This is far too much weight for their age.

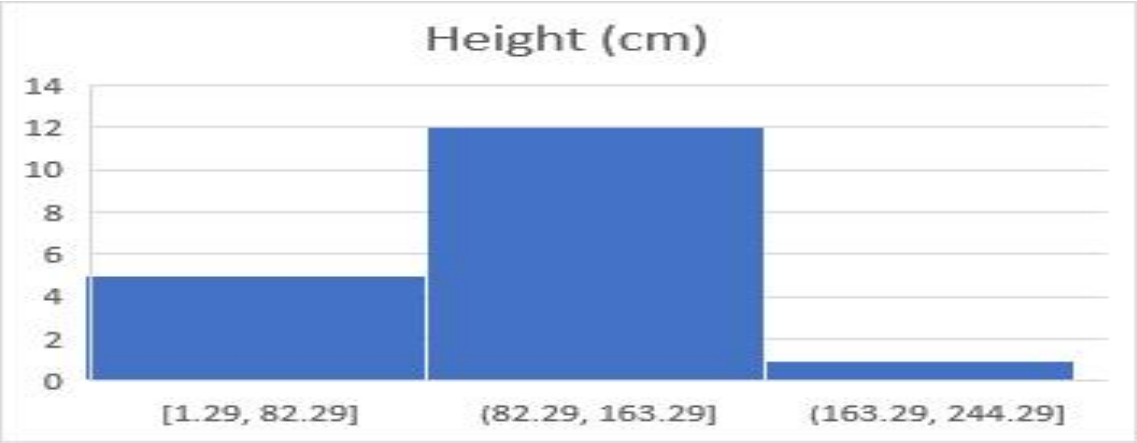

Figure 4. Histogram of Child's Height.
The graph demonstrates that overweight children range in height from 82cm to 163.29cm. According to the WHO, the typical height of a child aged 5 to 10 years is between 107cm and 138cm. And it appears that the average height of children is above the standard.

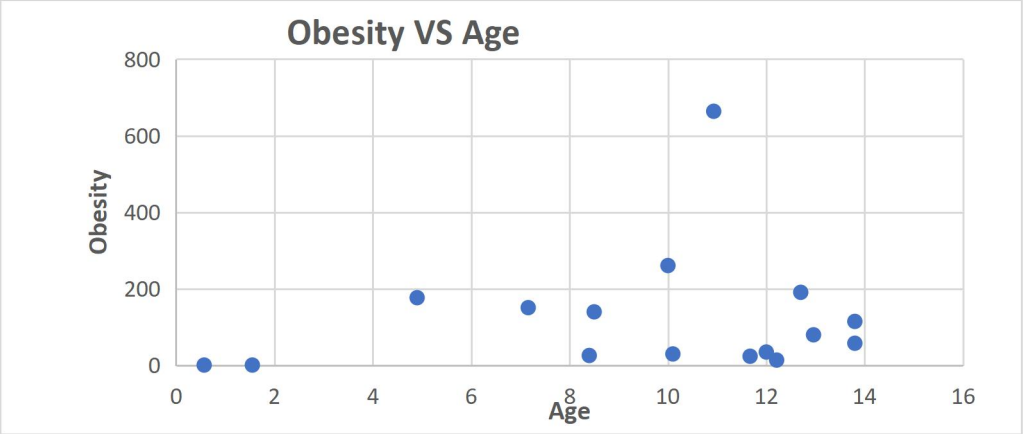

Figure 5. Scatter plot of Child's age and Obesity.
Figure 5 is a scatter plot of Obesity vs Age. According to this graph, the majority of obese children are between the ages of 5 and 15.

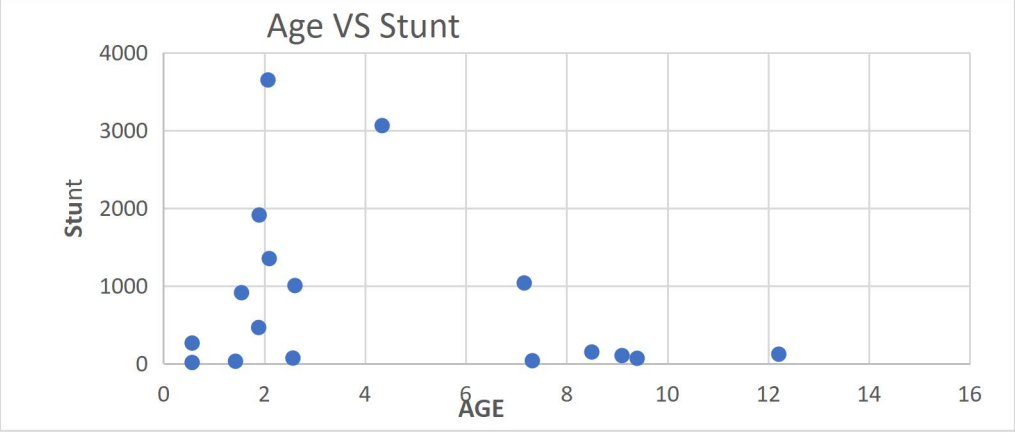

Figure 6. Scatter plot of Child's Age and Stunt.
Figure 6 is a scatter plot of the variables Age and Stunt. This demonstrates that more stunt children are present in our data from 0 to 5 years of age.

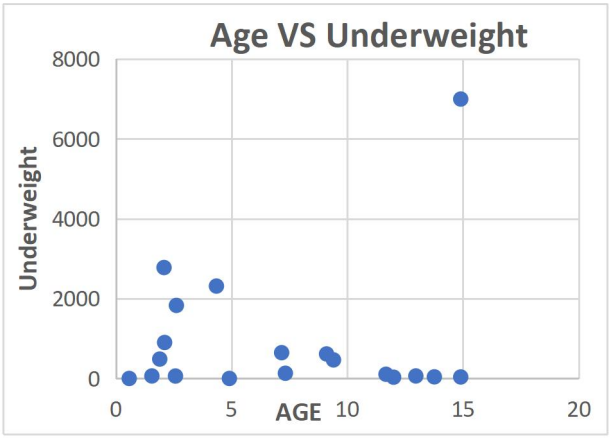

Figure 7. Scatter plot of Child's Age and Underweight.
The figure 7 is a scatter plot of age versus underweight. This demonstrates that underweight is present at practically every age, but slightly more so in children aged 0 to 5.

In this study, we use meta-analysis research technique. For this purpose, we collect data from 86 different published papers on Childhood Obesity and Nutrition Issues and its analysis related topics is shown in TABLE 1. The goal is to assess the nutritional status of children in Pakistan. We conducted a meta-analysis and collected data from research around the country to gain insight into child obesity measurements. In our study, the sample size was 3296 children ranging in age from newborn to 15 years, with a mean age of 7.16 $\pm$ 2.16 years. In this age group, the average height is 106.4 cm, with a standard variation of 9.78 cm in a sample size of 4483. Height ranges from 1.29 cm (newborn) to 196.7 cm. While weight might have an impact on a person's physical health, it is also recorded in studies. In a sample of 2398, the average weight is 29.87 kg, with a standard deviation of 10.47 kg and a range of 4.43 kg to 43.1 kg. Body mass index, or BMI, is a measurement of body fat based on a person's height and weight. It is frequently used to establish whether or not a person's weight is within a healthy range for their height. The mean BMI in this study's sample of 5397 is 22.17 kg/m^2 indicating a healthy weight level.

Table 1. Pooled Estimates of the Studied Variables

VARIABLES	Sample Size		Mean	SD
AGE (years)	3296		7.16	2.16
		Min	0.57	0.08
		Max	14.9	5.25
HEIGHT (cm)	4483		106.4	9.78
		Min	1.29	0.31
		Max	196.7	19.61
WEIGHT (kg)	2398		29.87	10.47
		Min	4.43	1.78
		Max	43.1	24.99
BMI [kg/m(sq)]	5397		22.17	4.26
		Min	5.7	0.28
		Max	58	31.2
WEIGHT CIRCUMFERENCE (cm)	7431		107.49	

		Min	58.4	
		Max	182.7	
HIP Circumference (cm)	2918		106.12	
		Min	66.79	
		Max	171.27	

The next variable is waist circumference, which is used to identify individuals who may be at increased risk for various health issues due to excess abdominal fat. Our results show that the average weight circumference in a sample of 7431 people is 107.49 cm, which is close to the normal value. Hip circumference is the distance measured around the broadest section of a person's hips and buttocks. The average hip circumference in our sample of 2918 cm is 106.12 cm, which falls within the range of 80 cm to 140 cm. This means that the hip circumference of the youngsters under observation is normal. The results presented in TABLE 2 shows the number of children in our study who were underweight, overweight, normal weight, obese, wasting, or stunted. 648 children are underweight, according to the data from the sample of 41557. 1005 of the 1613 children in the normal weight sample are normal weight. From a total sample of 39663, 262 children are overweight. Obesity is detected in 151 adults from a sample size of 1866. In our study, there are 560 wasting children out of 3519. Our sample size is 3242, and the number of stunted children is 1037.

Table 2. Mean Count of Respondents for the studied Variables.

VARIABLES	Sample Size		Mean
UNDER WEIGHT	41557		648
		Min	3
		Max	6996
NORMAL WEIGHT	1613		1005
			58
			6924
OVERWEIGHT	39663		262
		Min	1
		Max	2300
OBESE	1866		151
		Min	1
		Max	1530
WASTING	3519		560
		Min	7
		Max	4285
STUNTING	3242		1037
		Min	14
		Max	9732

5. Discussion

The provided information pertains to a sample of children, particularly those aged 0-5 years. Obesity: 8% of the children in the sample are detected as obese. This means that approximately 8% of the children have a body mass index (BMI) that falls within the range classified as obese. Obesity is a condition characterized by excess body fat and is often associated with various health risks. Wasted Children: 16% of the observed children are classified as wasted. Wasting refers to a condition where a child has low weight for their height, indicating acute malnutrition. It suggests that 16% of the children in the sample

exhibit signs of inadequate nutrition or recent weight loss. Stunted Children: The data indicates that 32% of the children in the sample are stunted. Stunting refers to a condition where a child's height is significantly below the average height for their age, reflecting chronic malnutrition and impaired growth. Weight Categories: The weight distribution among the studied children is divided as follows: 2% are classified as underweight, 63% as normal weight, and 1% as overweight. These percentages represent the proportions of children falling into each weight category based on certain criteria or standard references. Waist and Hip Circumference: The average waist circumference of the studied children is reported to be 107.49 cm, while the average hip circumference is 106.12 cm. Waist circumference and hip circumference measurements provide insights into body composition and can be used to assess factors like abdominal obesity and body fat distribution.

Overall, the provided information highlights various aspects related to the nutritional status, weight distribution, and body composition of the sampled children. It suggests the prevalence of obesity, wasting, stunting, and different weight categories among the studied population, along with average measurements of waist and hip circumferences. These indicators can be valuable for understanding the health and nutritional challenges faced by the children in the sample and informing appropriate interventions or policies.

6. Conclusion

In conclusion, childhood obesity and nutrition issues in Pakistan are significant challenges that require immediate attention and concerted efforts from various stakeholders. The prevalence of childhood obesity is on the rise, driven by poor dietary habits, limited access to nutritious food, inadequate education about healthy eating, and sedentary lifestyles. Addressing these issues requires a multi-faceted approach. The major portion of the studied sample was of 0-5 years children. 8% are detected obese. 16% are observed wasted children. Stunted children are 32%. The weightage of underweight, normal weight and overweight are 2%, 63% and 1%. Our studied children have an average waist circumference of 107.49 cm and average hip circumference is 106.12 cm. It is crucial for the government, healthcare professionals, educators, parents, and the food industry to work together and prioritize the health and well-being of children. By implementing comprehensive strategies that encompass nutrition education, food availability, physical activity promotion, and parental involvement, we can make a positive impact on childhood obesity and nutrition issues in Pakistan. It is through these collective efforts that we can ensure a healthier future for the children of Pakistan.

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