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GENDER DIFFERENCES IN BODY MASS INDEX AND BREAKFAST SKIPPING AMONG SCHOOL CHILDREN. META-ANALYSIS

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ABSTRACT

Breakfast skipping and obesity are common among children, and co-existing might have deleterious consequences. Investigating gender-related differences is important for an effective intervention. Therefore, this meta-analysis aimed to assess gender differences in body mass index and breakfast skipping among Saudi children. PubMed, MEDLINE, EBSCO, and the first 100 articles from Google Scholar were searched from inception up to November 2023. The keywords used were breakfast skipping, breakfast intake, body mass index, obesity, overweight, screening time, sleep duration, and Saudi Arabia. An Excel sheet including the study type, region of publication, year of publication, breakfast consumption among males and females, the number of participants, and body mass index was used for data extraction. Five studies included 4922 schoolchildren from different regions of Saudi Arabia. There were no differences between males and females regarding breakfast intake, either when breakfast was percentages or mean± SD. Odd ratio: 0.09, 95% CI: -0.06-0.25, P-value for overall effect: 0.25, and odd ratio: 1.10, 95% CI: 0.80-1.53, P-value for overall effect: 0.56. Body mass index was higher among males and compared to their female counterparts, but did not amount to statistical significance. P-value, 0.09; Odd ratio, -1.28.09; 95% CI, -2.78–0.22. No differences were evident between males and females regarding breakfast intake and body mass index among Saudi schoolchildren; further studies investigating sleep patterns, texting, and their relationship to obesity are recommended.

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Introduction

Childhood obesity has become a pressing global health concern in recent decades, with a profound increase since the 1980s. A great affliction is being on children, where the risk of having this condition extends into adulthood along with associated health complications. Data showed that children and adolescents who are obese might continue to be at risk of obesity, diabetes, cardiovascular diseases, and dyslipidemia when they reach adulthood [1, 2].

A well-known valuable tool in assessing the nutritional status and health of schoolchildren is the Body Mass Index (BMI), which is calculated by dividing a person's weight in kilograms by the square of their height in meters (BMI = weight (kg) / height (m^2) [3]. Growth charts are commonly used to display BMI-for-age percentiles that typically range from the fifth to the 95th percentile. A below-5th percentile suggests that the child is underweight for their age and gender; the 5th to 85th percentile is considered within the normal weight range; the 85th to 95th percentile suggests the child is at risk of being overweight; and an above-95th percentile indicates that the child is overweight or obese. Therefore, BMI percentiles are useful for screening and monitoring children's growth [4]. Interestingly, looking at the gender disparity, there are many potential implications for understanding growth patterns, health disparities, and tailored healthcare interventions [5]. There has been a growing interest in examining gender differences in BMI among children. In adults, the impact of BMI on health-related quality of life (HRQOL) is not the same when looking at gender variables. Men with a higher BMI were reported to have a higher HRQOL compared to women. Additionally, there is a relationship between obesity and lower HRQOL for women but not for men [6]. Breakfast is often referred to as the "most important meal of the day," and its significance, especially among schoolchildren, cannot be overstated. The breakfast habits of children play a pivotal role in their overall health, academic performance, and overall well-being [7]. Exploring such habits is essential for addressing nutritional concerns, promoting healthy lifestyles, and optimizing educational outcomes. Recently, a shift in breakfast habits among schoolchildren was driven

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by changes in lifestyles, schedules, and dietary preferences. The modern era has seen the rise of fast food, irregular eating patterns, and the tendency to skip breakfast [8]. A common practice of breakfast skipping has attracted significant attention, particularly in the context of childhood health and well-being [9]. Its potential impact on the Body Mass Index (BMI), a widely used indicator of nutritional status and obesity risk, has made it a subject of extensive research and public health interest. Understanding the relationship between breakfast skipping and BMI in children is of paramount importance for addressing the growing concern of childhood obesity and its associated health consequences [10].

This review will encompass an extensive analysis of the existing literature related to breakfast skipping and its impact on BMI in schoolchildren with gender differences. It explores the factors influencing breakfast-skipping behaviors, the potential consequences for obesity and related health issues, and strategies for addressing this dietary habit.

Materials and Methods

Eligibility Criteria According to PICOS

This meta-analysis was conducted to assess gender differences regarding breakfast intake and body mass index among schoolchildren in Saudi Arabia. The study was conducted in November 2023, and the period was from inception up to November 2023 **(Figure 1)**.

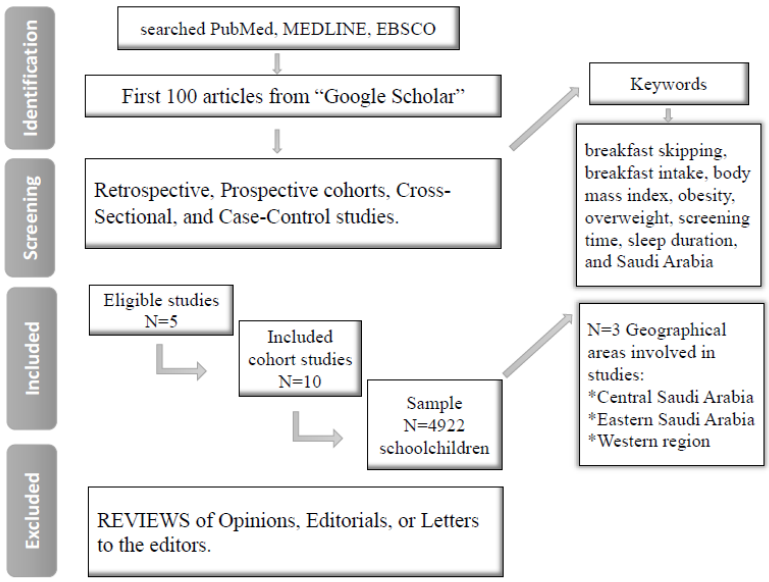

Figure 1. Selection flow chart

Inclusion Criteria

We include retrospective, prospective cohorts, cross-sectional, and case-control studies.

Exclusion Criteria

Studies were excluded if they were opinions, editorials, or letters to the editors.

The Searching Strategy

The author systematically searched PubMed, MEDLINE, EBSCO, and the first 100 articles from Google Scholar from inception up to November 2023. The keywords used were breakfast skipping, breakfast intake, body mass index, obesity, overweight, screening time, sleep duration, and Saudi Arabia.

Outcome Measures

The outcome measures were:

- Gender differences regarding breakfast skipping among Saudi schoolchildren **(Table 1)**.
- Gender differences regarding body mass index among Saudi schoolchildren **(Table 2)**.

Table 1. Breakfast skipping among schoolchildren, Saudi Arabia.

Author	Country	Females	Total number	Males	Total number
		Brekfast skipping ()No%			
Abalkhail *et al.* 2002 [11]	Jeddah	354	424	327	376

Al-Hazzaa *et al*. 2020 [12]	Riyadh	117	528	101	523
Said and Ibrahim, 2022 [13]	Al-ahsa	161	240	440	741
Breakfast skipping (mean± SD)					
Al-Hazzaa *et al*. 2020 [12]	Riyadh	3.58 ± 2.3	528	3.44 ± 2.3	523
Al-Hazzaa *et al*. 2020 [9]	Riyadh	3.76 ± 2.2	626	3.75 ± 2.3	523
Al-Hazzaa *et al*. 2019 [14]	Riyadh	3.58 ± 2.3	528	3.44 ± 2.3	523

Table 2. Body mass index among schoolchildren, Saudi Arabia (mean± SD)

Author	Country	Females	Number	Males	Number
Al-Hazzaa *et al*. 2020 [12]	Riyadh	18.1 ± 4.4	528	20.8 ± 9.6	523
Al-Hazzaa *et al*. 2020 [9]	Riyadh	18.3 ± 3.9	626	17.8 ± 4.0	523
Al-Hazzaa *et al*. 2019 [14]	Riyadh	18.2 ± 4.4	528	20.8 ± 9.6	523
Said and Ibrahim, 2022 [13]	Alahsa	18.97 ± 3.33	240	19.37 ± 4.68	741

Data Extraction

All the data were entered into an Excel sheet detailing the study type, region of publication, year of publication, breakfast consumption among males and females, the number of participants, and body mass index.

Risk of Bias Assessment

The standard of the included studies was assessed by Newcastle Ottawa Scale risk of bias. All the studies were of good quality [15] **(Table 3)**.

Table 3. Newcastle Ottawa scale risk of bias of the included studies

Author	Country	Selection bias	Comparability bias	Outcome	Total score
Al-Hazzaa *et al*. 2020 [12]	Riyadh	4	2	3	9
Al-Hazzaa *et al*. 2020 [9]	Riyadh	4	2	3	9
Al-Hazzaa *et al*. 2019 [14]	Riyadh	4	2	3	9
Abalkhail *et al*. 2002 [11]	Jeddah	4	1	3	8
Said and Ibrahim, 2022 [13]	Alahsa	4	1	3	8

Statistical Analysis

The most recent version of the RevMan system assessed the data and we pooled 10 cohorts from five cross-sectional studies to assess gender differences regarding breakfast skipping and body mass index among Saudi schoolchildren. The dichotomous and continuous data were entered manually, and the fixed or random effects were applied depending on heterogeneity. A P-value of 0.05 was considered significant.

Results and Discussion

Characteristics of the Included Studies

In the present meta-analysis, we included ten cohorts from five studies [9, 11-14]. The studies included 4922 students; three studies were conducted in Central Saudi Arabia **(Table 1)**, one from Eastern Saudi Arabia, and one was published in the Western region. All the studies were cross-sectional, and the ages of the participants ranged from 9 to 21 years.

Findings

There were no differences between males and females regarding breakfast intake (breakfast represented as mean± SD), Odd ratio, 0.09, 95% CI, -0.06-0.25, P-value for overall effect, 0.25, and Chi-square = 0.61. No significant heterogeneity was found (I2 = 0%), and the P-value for heterogeneity was 0.74 **(Figure 2)**.

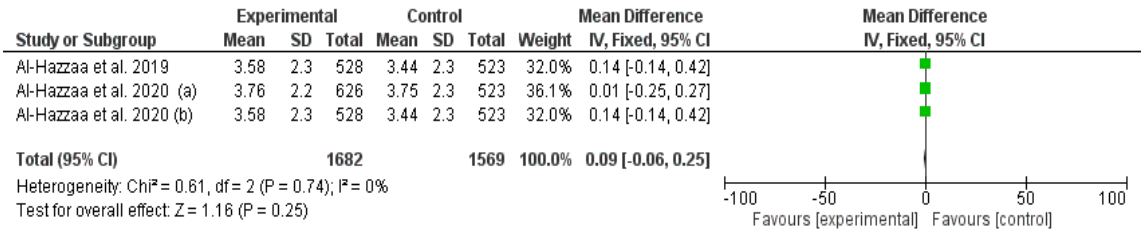

Figure 2. Breakfast intake (continuous) among schoolchildren, in Saudi Arabia

No significant difference was evident when breakfast was represented as a percentage, odd ratio, 1.10, 95% CI, 0.80-1.53, P-value for overall effect, 0.56, and Chi-square = 5.84. However, significant heterogeneity was observed (I2 = 66%), and the P-value for heterogeneity was 0.05 **(Figure 3)**.

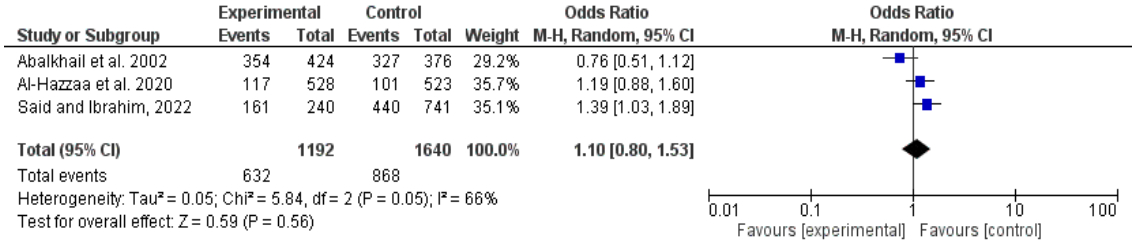

Figure 3. Breakfast intake (percentage) among schoolchildren, in Saudi Arabia

Body mass index was higher among males and compared to their female counterparts, but did not amount to statistical significance (P-value, 0.09, Odd ratio, -1.28.09, 95% CI, -2.78-0.22, and Chi-square = 63.80). A remarkable heterogeneity was found, I2 = 95%, and the P-value for heterogeneity was <0.001 **(Figure 4)**.

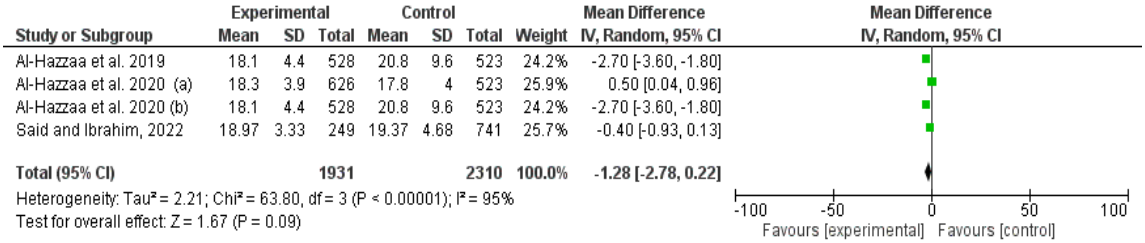

Figure 4. Body mass index among schoolchildren, Saudi Arabia

Previous studies showed that skipping breakfast, lunch, and dinner was associated with obesity and overweight [16, 17]. However, few studies have assessed gender differences regarding body weight and breakfast skipping among the young age group.

In the present meta-analysis, no differences were evident between males and females regarding breakfast intake and body mass index (odd ratio, 1.10, 95% *CI, 0.80–153, and odd ratio, -1.28, CI, -2.7–0.22*, respectively). An exploratory community-based study by Longo-Silva *et al*. (2022) [17] found a positive correlation between breakfast skipping and late lunch intake and body mass index. The authors concluded that their findings were not related to age or sex and were in line with the current findings. Yaguchi-Tanaka and colleagues [18] conducted a study in the year 2021 and found a temporal relationship between breakfast skipping and overweight/obesity. The authors found that skipping breakfast at an earlier age of 2.5 years is associated with obesity at 7-9 years old but not at 2.5-4.5 years. The association of breakfast skipping with obesity was significant among boys aged 13 years; no association was evident among girls. A plausible explanation might be that junior females usually overestimate their body weight and want to be thinner than their male counterparts [19]. A study published in China [20] reported contradicting results and found that females who skipped breakfast are more susceptible to obesity. The authors explained their findings by stating that female children are less likely to participate in outdoor walks than boys. Sociodemographic characteristics, including diet, exercise, income, and sleep duration, explain the discrepancy between the studies [21]. Previous studies published in Asia found that proximity to fast food consumption, breakfast skipping, and parent education are strong determinants of obesity and breakfast skipping among adolescents [22, 23]. A recent study conducted among young adults in Poland [24] showed that young females are more adherent to low-calorie, high-fiber diets than males; high fruit and vegetable consumption; and frequent meals were more common among girls. Therefore, breakfast skipping was less common. A study published in Tunisia [25] found no gender differences in breakfast skipping, in agreement with the current observation. An interesting observation from a study published in Spain is that moderate or severe activity ameliorates the effects of breakfast skipping on body weight [26]. Therefore, it is important to increase awareness about physical activity among schoolchildren. Another important factor associated with breakfast skipping and obesity is screen time. Tambalis *et al*. [27] conducted a study among schoolchildren in Greece and found a strong association between breakfast skipping, the length of screen time, and a high body mass index. The minimal number of included studies and the significant heterogeneity limited this meta-analysis.

Conclusion

Breakfast skipping was common among Saudi schoolchildren. There was no significant difference between males and females regarding breakfast intake and body mass index among Saudi schoolchildren; further studies investigating sleep patterns, texting, and their relationship to obesity are recommended.

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