Original Article

The Effects of Children's Eating Behaviors on Obesity: A Meta-Analysis Study

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Abstract

Objectives: This study was conducted to analyze the effects of children's eating behaviors on obesity.
Methods: The study was aimed to reach the current studies from January 2008 to May 2018 by literature review. Full-text researches published on the subject to be analyzed were used in the data collection phase. In order to collect data, a total of seven electronic databases were searched, consisting of Pubmed, EBSCO Host, Ovid, ScienceDirect, BioMed Central, Embase/Elsevier, and Google Scholar databases. While searching, keywords of "child", "obesity", "childhood obesity", "eating behaviors" and "children's eating behaviors" were used. Children and adolescents between the ages of 5-18 were the sample. A total of eight studies were included in the meta-analysis study. The Comprehensive Meta-Analysis Software was used for meta-analysis.
Results: The total sample size of eight studies included in the meta-analysis was 5142 children. Heterogeneity test showed that the sub-dimension of children's eating behavior has heterogeneous characteristics. Average effect sizes in the 95% confidence interval according to the random effects model were determined to be: 1,019 for food responsiveness, 0,194 for enjoyment of food, 0.367 for emotional over-eating, 0.170 for desire to drink, -0.384 for satiety responsiveness, -0.168 for emotional under-eating, -0.005 for food fussiness, and 0.307 for slowness in eating.
Conclusion: In this meta-analysis, it has been determined that children's eating behaviors affect incidence frequency of obesity in children.

Keywords: Child, obesity, childhood obesity, eating behaviors, children's eating behaviors, meta-analysis

Introduction

Eating behaviors play an important role in the treatment and prevention of chronic diseases related to inadequate and unbalanced nutrition (Rossi, Moreira, & Rauen, 2008; Scaglioni et al., 2018). Differences in eating behavior lead to the progression of the weight problem of children and adults. Individual differences in eating behavior affect both weakness and obesity (Wardle, Guthrie, Sanderson, & Rapoport, 2001). Obesity is an important nutritional problem in both developed and developing countries (Bhurosy & Jeewon, 2014). Childhood obesity has a growing prevalence throughout the world (Bhurosy & Jeewon, 2014; Sahoo et al., 2015). One in ten children in the 5-17 age group in the world is overweight and 30-45 millions of them have severe obesity problem (Ogden et al., 2014).

Nutritional habits, genetic/environmental factors, decrease in physical activity, socioeconomic status of the family and psychological factors are observed to have effects in obesity (Birch & Ventura, 2009; Sahoo et al., 2015). It has been shown that eating habits of children constitute an important place in obesity formation (Viana,

Sinde, & Saxton, 2008; Birch & Ventura, 2009; Webber et al., 2009; Santos et al., 2011). Eating habits and tendencies are acquired in the early days of childhood, which represent behavioral characteristics that can change over time according to personal experiences (Carnell & Wardle, 2008; Sahoo et al., 2015). Children's food preferences and eating behaviors occur in the first two years of life. This was reported to be associated with the development of obesity in later times (Wardle et al., 2001; Rossi et al., 2008; Viana et al., 2008; Webber et al., 2009). Also, the importance of family and social environment in food intake, eating behaviors and childhood obesity was emphasized (Carnell & Wardle, 2008; Sahoo et al., 2015). In addition, changes in behaviors at later ages may be more difficult to achieve. This case highlights the importance of researching eating behaviors at an early age, and demonstrates that actions aimed at improving healthy eating behavior should focus on children with greater emphasis (Rossi et al., 2008; Passos et al., 2015; Scaglioni et al., 2018).

Among the overweight and non-overweight children, eating behaviors were found to be different in various sizes (Santos et al., 2011; Ozer et al., 2014; Passos et al., 2015; Demir & Bektas, 2017). In comparison to children with healthy weight, overweight children are determined to be more sensitive to external stimuli (smell, taste, appearance, etc. of the food), less responsiveness to satiety (fullness), eating faster and more, less picky, enjoying very much while eating, interested in food, consuming sweetened drinks more frequently during the day, increasingly eating more in different emotional situations such as worry and stress (Wardle et al., 2001; Webber et al., 2009; Ozer et al., 2014). On the other hand, weak children were determined to be more selective about eating, eating more slowly, responding to satiety more quickly, and consuming small amounts of food (Wardle et al., 2001; Webber et al., 2009).

In line with these studies, it is important to identify eating behaviors of children who are weak, overweight and obese (Wardle et al., 2001; Viana et al., 2008; Ozer et al., 2014). A number of psychometric tools have been used to prevent weight-related problems and the risk of eating disorders, and to assess eating behaviors in children and adults (Wardle et al., 2001; Santos et al., 2011). These psychometric tools show a strong and gradual relationship between eating behavior scores and childhood obesity (Webber et al., 2009). Children's Eating Behaviors Questionnaire is often considered to be one of the most comprehensive measurement tools used to evaluate children's eating behaviors and it includes different eating styles (Sleddens, Kremers, & Thijs, 2008; Viana et al., 2008). In addition, the validity and reliability of this questionnaire were conducted (Wardle et al., 2001; Ozer et al., 2014). Considering Children's Eating Behaviors Questionnaire sub-dimensions; food responsiveness, enjoyment of food, emotional over-eating, emotional under-eating, desire to drink, satiety responsiveness, slowness in eating and food fussiness are included (Wardle et al., 2001).

When examining studies on effects of children's eating behaviors on obesity, while some studies put forward that there is a relation between obesity and children with sub-dimensions of food responsiveness, enjoyment of food, emotional over-eating, emotional under-eating, desire to drink, satiety responsiveness, food fussiness, slowness in eating (Sleddens et al., 2008; Webber et al., 2009; Santos et al., 2011; Loh, Moy, Zaharan, & Mohamed, 2013; Ozer et al., 2014; Cantoral et al., 2015; Passos et al., 2015; Sánchez et al., 2016; Tay et al., 2016; Demir & Bektas, 2017; Behar et al., 2018) in some studies, it was found that there was no relationship between obesity and eating behaviors of children with these sub-dimensions (Sleddens et al., 2008; Webber et al., 2009; Santos et al. 2011; Passos et al., 2015; Tay et al., 2016; Demir & Bektas, 2017). This diversity in the results of studies makes it difficult to make a clear judgment on the issue. This situation revealed the need to examine the subject with advanced statistical methods. Meta-analysis is one of these statistical methods (Bakioglu & Ozcan, 2016; Cooper, 2016). Meta-analysis is an analysis method in which similar studies on a given topic are grouped under certain criteria, quantitative findings of these studies are discussed in a combination, existence and magnitude of an impact is revealed, inconsistencies and causes of the results of the studies are examined, possible new relationships are discovered and new approaches to future studies are brought forward (Bakioglu & Ozcan, 2016; Cooper, 2016; Bashir & Conlon, 2017; Lee, 2018).

However, the researchers could not find any meta-analysis studies investigating the effect of children's eating behavior on obesity in none of the reviewed databases (Cole et al., 2017; Moss

et al., 2018). This situation was the main starting point for the planning of the study. The study is aimed to synthesize the research results which examined the effects of children's eating behaviors on obesity using meta-analysis method. It is thought that, with the results of the study, it will contribute to understanding healthy eating behaviors of children and to policymakers and managers in order to develop strategies to maintain healthy weight. It is also expected to provide a new perspective to researchers for future studies. The aim of this study is to analyze effects of children's eating behaviors on obesity.

Research Questions

a. What is the effect size on obesity of food responsiveness among children's eating behaviors?
b. What is the effect size on obesity of enjoyment of food among children's eating behaviors?
c. What is the effect size on obesity of emotional over-eating among children's eating behaviors?
d. What is the effect size on obesity of emotional under-eating among children's eating behaviors?
e. What is the effect size on obesity of desire to drink among children's eating behaviors?
f. What is the effect size on obesity of satiety responsiveness among children's eating behaviors?
g. What is the effect size on obesity of slowness in eating among children's eating behaviors?
h. What is the effect size on obesity of food fussiness among children's eating behaviors?

Methods

Literature Review

Quantitative studies about effects of children's eating behaviors on obesity were reviewed in order to determine effects of children's eating behaviors on obesity. Although meta-analysis studies were conducted for children's eating behaviors in the world before, no meta-analysis studies have been found describing effects of children's eating behaviors on obesity (Cole et al., 2017; Moss et al., 2018). With the literature review, it was aimed to find existing studies from January 2008 to May 2018. Full text research papers published on the subject to be analyzed were used in the data collection phase. A total of seven electronic databases were scanned for collecting data, including Pubmed, EBSCO Host, Ovid, ScienceDirect, BioMed Central, Embase/Elsevier, and Google Scholar databases. In this way, accessible publications were scanned, and the congress statements were not scanned. The keywords "child", "obesity", "childhood obesity", "eating behaviors" and "children's eating behaviors" were used in Turkish and English while conducting the literature review.

Inclusion Criteria of Studies

The criteria that were used while inclusion of studies found in literature review into the Meta-analysis were: (a) The sampling of children and adolescents between 5-12, 12-18 years of age, (b) having quantitative analysis data, (c) examining the BMI variable, (d) having sufficient statistical data to calculate the effect size (e) use of Children's Eating Behaviors Questionnaire as a tool of measurement (f) examining all sub-dimensions of children's eating behaviors. In addition, the reason for addressing only the studies that used the Children's Eating Behaviors Questionnaire in the study is that other measurement tools address different sub-dimensions and topics, but this questionnaire includes more comprehensive sub-dimensions.

The flow diagram summarizing the process of inclusion of the studies in Meta-analysis is presented in Figure 1. In the screening, a total of 36 887 studies were reached, 310 were discarded due to duplication, 36 577 studies were examined and 36 553 were eliminated based on study titles. Abstracts of the remaining 24 studies were evaluated by two researchers according to inclusion and exclusion criteria, and full text analysis was performed when necessary, and the studies not meeting the inclusion criteria were eliminated. A total of 8 studies were included in the analysis. But when studying the sub-dimensions children's eating behaviors, 8 studies for food responsiveness and slowness in eating, 7 studies for enjoyment of food, emotional over-eating, food fussiness, satiety responsiveness; 6 studies for desire to drink and emotional under-eating were found to comply with the inclusion criteria.

The reasons for elimination include not containing the BMI variable, difference of the study population and the absence of Children's Eating Behaviors Questionnaire. The selection of

the studies for Meta-analysis was carried out separately by two researchers. In the comparison afterwards, it was determined that there was a 100% agreement on the inclusion criteria. The studies included in the analysis have been prepared in accordance with "PRISMA Flow Diagram Directive" and are given in Figure 1. (Moher et al., 2009).

Coding of studies: Data coding form was used to collect study data. The data encoding form was developed by the researchers using the literature (Bakioglu & Ozcan, 2016; Cooper, 2016; Bashir & Conlon, 2017; Lee, 2018). The data encoding form was used to obtain the statistical data and study characteristics (method, sample, measurement tool, type of study, etc.) required to calculate the effect size from each individual study. For each study the title of the study, the author, the year of publication, the type of study, design, the size of the sampling, the measurement tool used to measure the children's eating behaviors, the findings and the result, Cohen's (d) domain size were encoded. The reliability of the coded data was obtained by comparing the coding of the first and second researchers. Positive effect size value indicates that food responsiveness, enjoyment of food, emotional over-eating and desire to drink among children's eating behaviors effect childhood obesity positively and its being negative indicates that satiety responsiveness, emotional under-eating, food fussiness and slowness in eating among children's eating behaviors effect childhood obesity positively. In other words, as food responsiveness, enjoyment of food, emotional over-eating and desire to drink scores increase, the status of being obese increases, and being obese becomes also more frequent as satiety responsiveness, emotional under-eating, food fussiness and slowness in eating scores decrease. If the effect size is zero (0) or close to zero, it is concluded that children's eating behaviors do not affect obesity.

Data Analysis: Group difference method, which is one of the group Meta-analysis types, was used in this meta-analysis. The comparisons of the effect sizes of each study and the groups were calculated using the CMA (The Comprehensive Meta-Analysis software) statistical program pack for Meta-analysis. "Hedge's g" was used to calculate the effect size due to differences in sampling and measurement tools (Bakioglu & Ozcan, 2016; Cooper, 2016). Hedge's g is calculated by dividing the difference between operations by the combined standard deviation of the two groups (Cooper, 2016). Cohen (1988) It says that it can be defined as weak if the effect size is smaller than 0.20, and strong effect size if it is greater than 0.80 (Cohen, 1988). According to this classification, $d \leq 0{,}20$ is considered to be weak, $0{,}20 < d < 0{,}80$ is medium and $d \geq 0{,}80$ is considered as strong effect size. Meta-analysis studies use fixed effects or random effects model according to heterogeneity (Bakioglu & Ozcan, 2016; Bashir & Conlon, 2017; Lee, 2018). If the universe effect sizes of the studies in Meta-analysis do not change, the fixed effect model is used, and random effect model is used if the universe effect sizes vary from research to research. In the meta-analysis, random effect model was used because of the heterogeneity of the studies as a result of homogeneity tests (Bakioglu & Ozcan, 2016). To test the heterogeneity of the effect sizes, Cochran's Q statistics, p value and I^2 tests were used. It is recommended that the limit value for p value should be taken as 0.10 at the stage of significance of Q test. In the heterogeneity assessment, the heterogeneity ratio (I^2) is none if it is below 25%, 25-50% is low; 51-75% is considered as medium and above 75% is high (Bakioglu & Ozcan, 2016; Cooper, 2016; Bashir & Conlon, 2017; Lee, 2018). The Rosenthal and Orwin fail-safe N, Funnel plot graph, Duval and Tweedie's method, rank correlation, egger regression, Begg and Mazunder correlations were used to test publication bias (Bakioglu & Ozcan, 2016). The significance level of the statistical analyses was determined to be 0.05 in the study since the significance levels in the included studies ranged from 0.01 to 0.05.

Ethical Considerations: Before starting the study, it was approved by Ethical Committee for Non-Invasive Researches with approval number 2018/21-12, dated 09.08.2018 and 4221-GOA protocol numbered.

Results

All 8 studies included in the meta-analysis are research articles. Thesis were not included in the study. The sample of the study consisted of 5-12, 12-18 years old children and adolescents. The studies included in the meta-analysis were conducted between 2008-2018 (Table 1).

Figure 1. Flow chart for selection of studies (Flow Diagram).

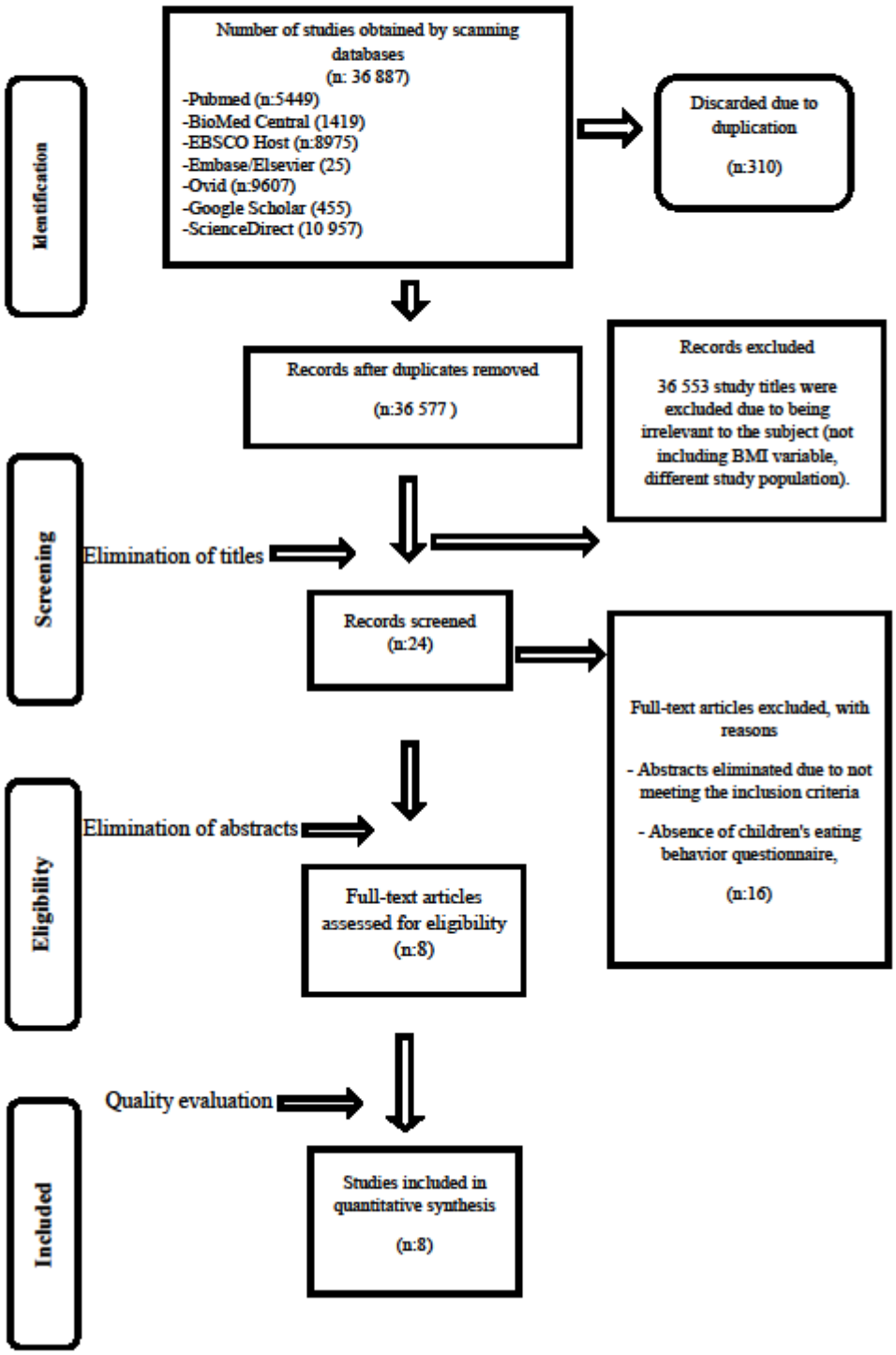

Table 1. Studies on the effect of eating behavior of children on obesity

Author (year) Location Design	Participants	Measured
Sleddens et al. (2008) Netherland-Maastricht Descriptivedesign	Age range: 6-7 years n =135	Child's Eating Behaviour Questionnaire (CEBQ) Antropometric measurements
Webber et al. (2009) UK-London Cross-sectionaldesign	Age range:7-9; 9-12 years n=406	Child's Eating Behaviour Questionnaire (CEBQ) Antropometric measurements
Loh et al.(2013) Malaysia-Kuala Lumpur Cross-sectionaldesign	Age range: 13 years n=646	Child's Eating Behaviour Questionnaire (CEBQ) Antropometric measurements
Ozer et al. (2014) Turkey- Tokat Descriptivedesigndesign	Age range: 8-17 years n=366	Child's Eating Behaviour Questionnaire (CEBQ) Antropometric measurements
Passos et al. (2015) Brazil-São Paulo Cross-sectionaldesign	Age range: 6-10 years n=335	Child's Eating Behaviour Questionnaire (CEBQ) Antropometric measurements
Tay et al. (2016) Malaysia Cross-sectionaldesign	Age range: 7-12 years n=1782	Child's Eating Behaviour Questionnaire (CEBQ) Antropometric measurements
Demir et al. (2017) Turkey-İzmir Cross-sectionaldesign	Age range: 6-10 years n=1201	Child's Eating Behaviour Questionnaire (CEBQ) Antropometric measurements
Behar et al. (2018) US- California-San Diego Cross-sectionaldesign	Age range: 5-11 years n=295	Child's Eating Behaviour Questionnaire (CEBQ) Antropometric measurements

Table 2. Homogeneity test results

Children's Eating Behaviors	Q	df	Table X^2 Value	p	I^2
Food responsiveness	525.960	7	14.067	0.000	98.669
Enjoyment of food	391.641	6	12.592	0.000	98.468
Emotional over-eating	1033.459	6	12.592	0.000	99.419
Desire to drink	156.624	6	12.592	0.000	96.808
Satiety responsiveness	54.585	6	12.592	0.000	89.008
Emotional under-eating	26.916	5	11.070	0.000	81.424
Food fussiness	62.722	6	12.592	0.000	90.434
Slowness in eating	81.947	7	12.592	0.000	91.458

Q:Homogeneity test value; df: Degree of free; I^2: The study level measure of effect

Table 2 shows the homogeneity test results of the studies included in the meta-analysis. The Q value was calculated to be 525.960 for food responsiveness, 391.641 for enjoyment of food, 1033.459 for emotional over-eating, 156.624 for desire to drink, 54.585 for satiety responsiveness, 26.916 for emotional under-eating, 62.722 for food fussiness, and 81.947 for slowness in eating. The I^2 value was calculated to be 98.669 for food responsiveness, 98.468 for enjoyment of food, 99.419 for emotional over-eating, 96.808 for desire to drink, 89.008 for satiety responsiveness, 81.424 for emotional under-eating, 90.434 for food fussiness, and 91.458 for slowness in eating.

Table 3. Average effect sizes and related values by random effects model

Children's Eating Behaviors	k	n	Average Effect size	SE	95% CI		Z	p
					Lower	Upper		
Food responsiveness	8	5142	1.019	0.284	0.463	1.576	3.592	0.000
Enjoyment of food	7	4847	0.194	0.030	0.135	0.252	6.507	0.000
Emotional over-eating	7	4847	0.367	0.030	0.308	0,426	12.127	0.000
Desire to drink	6	4732	0.170	0.030	0.113	0.228	5.772	0.000
Satiety responsiveness	7	4496	-0.384	0.031	-0.444	-0.324	-12.561	0.000
Emotional under-eating	6	4441	-0,168	0.030	-0.228	-0.109	-5.557	0.000
Food fussiness	7	4847	-0.005	0.029	-0.062	0.052	-0.173	0.863
Slowness in eating	8	5142	-0.307	0.028	-0.363	-0.251	-10.773	0.000

k: Number of studies included in the meta-analysis; n: Number of children included in the study; SE: Standart error; Z: Standard normal distribution value

Table 3 shows the effect size of studies on the effects on obesity of food responsiveness, enjoyment of food, emotional over-eating, desire to drink, satiety responsiveness, emotional under-eating, food fussiness and slowness in eating, which are among children's eating behaviors. The average effect sizes at 95% significance level were calculated to be 1.019 for food responsiveness, 0.194 for enjoyment of food, 0.367 for emotional over-eating, 0.170 for desire to drink, -0.384 for satiety responsiveness, -0.168 for emotional under-eating, -0.005 for food fussiness, and -0.307 for slowness in eating. As a result; it has been determined that food responsiveness has a strong effect size on obesity in positive direction, enjoyment of food and desire to drink have weak effect sizes on obesity in positive direction, emotional over-eating has a

medium effect size on obesity in positive direction, satiety responsiveness and slowness in eating have medium effect sizes on obesity in negative direction, emotional under-eating and food fussiness have weak effect sizes on obesity in negative direction.

In order to test the publication bias, Rosenthal and Orwin fail-safe N, Funnel plot chart, Duval and Tweedie plots method, rank correlation, egger regression, Begg and Mazunder correlations were used. When the Rosenthal fail-safe N is examined by children's eating behaviors, it is determined that the effect size of the study is between 0 and 1075 for 0, and between 1 and 3 when Orwin fail-safe N is considered, it is determined that between 0 and 3 is needed when the Duval and Tweedie's method is considered. It was determined that there is no publication bias according to Begg and Mazunder, Funnel plot graph, and Egger regression analysis (p> 0.05).

Discussion

Today, children's eating behaviors, which is one of the factors affecting obesity with the increase of obesity in children, is a concept that has been on the agenda in recent years. In particular, the early acquisition of eating behaviors has attracted attention on this issue and has revealed the need to understand the effect of eating behaviors on obesity. The purpose of this meta-analysis study is to determine effects of children's eating behaviors on obesity.

The total sample size of eight studies included in the meta-analysis was 5142 children. Total number of studies addressed in the sub-dimension of food responsiveness and slowness in eating was 8, the total sample size was 5142 children, the total number of studies addressed in the sub-dimensions of enjoyment of food, emotional over-eating, food fussiness was 7, the total sample size was 4847 children, the total number of studies addressed in the sub-dimension of desire to drink was 6, the total sample size was 4732 children, total number of studies addressed in the sub-dimension of satiety responsiveness was 7, the total sample sample size was 4496 children and total number of studies addressed in the sub-dimension of emotional under-eating was 6, the total sample size was 4441children.

Q, p and I^2 values were used in the heterogeneity test for the studies included in the meta-analysis. Q values were found to range between 26.916 and 1033.459, and I^2 values ranged between 81.424 and 99.419. While 0.10 value of the limit value for p value is considered statistically significant at the stage of Q test significance in the heterogeneity evaluation in literature, the heterogeneity ratio (I^2) is considered none if it is less than 25%, 25-50% is considered low, 51-75% is considered medium and higher than 75% is considered high (Bakioglu & Ozcan, 2016; Cooper, 2016; Bashir & Conlon, 2017; Lee, 2018). The effect of children's eating behaviors on obesity was heterogeneous (Q = 26.916-1033.459, I2= 81.424-99.419, p = 0.000) according to heterogeneity test in this meta-analysis. In line with this result, it was decided that the studies showed heterogeneous characteristics and the average effect sizes were calculated according to the random effects model.

It was determined that food responsiveness has a strong positive effect size on obesity according to the meta-analysis results. A significant positive correlation was also found between food responsiveness and obesity in the literature (Sleddens et al., 2008; Webber et al., 2009; Santos et al., 2011; Passos et al., 2015; Demir & Bektas, 2017). Both in this meta-analysis study and in the above literature studies, it is observed that as food responsiveness increases, obesity increases as well. Children's consuming more food than they normally eat by being impressed by external stimuli (food's taste, smell, appearance, etc.) and eating tips lead to obesity (Sleddens et al., 2008; Ozer et al., 2015). Particularly, while in individuals with normal weight, desire to eat is generated by hunger internal sensations, obese individuals are more likely to eat by external eating tips (Rossi et al., 2008). Obese individuals have been found to be more sensitive to taste tips than normal weight and weak individuals (Wardle et al., 2001). In other words, obese individuals show a low sensitivity to internal saturation tips, and they show extreme sensitivity to external nutrient tips such as taste and odor, thus they over-eat against stimulation and eat too fast, and they miss out the saturation during the meal (Wardle et al., 2001). In addition, children are often affected by the food offered in their environment and are preferred by the family to create their own eating attitudes (Wardle et al., 2001; Ozer et al., 2014). Therefore, nutritional habits of children's society

or their parents' eating style and habits may be associated with obesity.

It was determined that enjoyment of food has a weak positive effect on obesity in the meta-analysis (0.194). In the literature, a significant positive correlation was also found between enjoyment of food and obesity (Sleddens et al., 2008; Webber et al., 2009; Santos et al., 2011; Passos et al., 2015; Demir & Bektas, 2017). Both in this Meta-analysis study and in the above literature studies, it is observed that as enjoyment of food increases, obesity increases as well. The child's words, "I often feel hungry, I need to eat something", interest in all foods increase the tendency to obesity as a result of more calorie intake (Wardle et al., 2001).

It was determined that desire to drink has a weak positive effect size on obesity in this work (0.170). In the literature, a significant positive correlation was also found between desire to drink and obesity (Sleddens et al., 2008; Cantoral et al., 2015; Passos et al., 2015). Both in this meta-analysis study and in the above literature studies, it is observed that as desire to drink increases, obesity increases as well. In other studies, it was found that desire to drink did not significantly affect the obesity of the child (Santos et al., 2011; Jansen et al., 2012; Demir & Bektas, 2017). Excessive consumption of sweetened drinks significantly affects the development of obesity (Sleddens et al., 2008). The increase in children's desire for sugary drinks especially causes obesity by causing children to take more calories (Wardle et al., 2001; Sleddens et al., 2008). Again, nutritional habits of children's society or their parents' eating style and habits may be associated with obesity.

It was determined that emotional over-eating has a medium positive effect size on obesity in this meta-analysis (0.367). In the literature, a significant positive correlation was also found between emotional over-eating and obesity (Sleddens et al., 2008; Webber et al., 2009; Santos et al., 2011; Passos et al., 2015; Demir & Bektas, 2017). Both in this meta-analysis study and in the above literature studies, it is observed that as emotional over-eating increases, obesity increases as well. In other studies, it was found that emotional over-eating did not significantly affect the obesity of the child (Jansen et al., 2012). In response to negative feelings such as anger and anxiety, children are responding by eating more increase susceptibility to obesity by causing calorie intake (Sleddens et al., 2008). It is thought that low self-esteem, feelings of inadequacy, eating disorders, insufficient coping with stress and feeding styles of parents (constraints, rewards, etc.) may be related to emotional over-eating in obese children. Parents may give food as a reward or for children to calm down and relax when they are angry, anxious and upset (Wardle et al., 2001). This can lead to obesity, resulting in over-eating.

It was determined that satiety responsiveness has a medium negative effect size on obesity in this research (-0.384). In the literature, a significant negative correlation was also found between satiety responsiveness and obesity (Webber et al., 2009; Santos et al., 2011; Jansen et al., 2012; Passos et al., 2015; Demir & Bektas, 2017). Both in this meta-analysis study and in the above literature studies, it is observed that as emotional over-eating decreases, obesity increases. In one study, it was found that satiety responsiveness did not significantly affect the obesity of the child (Loh et al., 2013). Children regulate food intake according to internal satiety symptoms, children who do not notice or are not sufficiently aware of their internal satiety symptoms can over-eat, which may cause the child to become obese (Sleddens et al., 2008). In addition, some parents can prevent their children from learning to eat, these children can eat more without realizing that they are satisfied, which can increase the risk of obesity by increasing energy intake (Sahoo et al., 2015; Scaglioni et al., 2018).

The slowness in eating was determined to have a medium negative effect size on obesity by the results (-0.307). In the literature, a negative correlation was also found between slowness in eating and obesity (Webber et al., 2009; Passos et al., 2015; Tay et al., 2016; Behar et al., 2018). Both in this meta-analysis study and in the above literature studies, it is observed that as slowness in eating decreases, obesity increases. However, in one study, it was found that slowness in eating did not significantly affect the obesity of the child (Demir & Bektas, 2017). In children with fast and over-eating behaviors, the sensation of satiety is delayed, which leads to over-eating and causes more caloric intake than is needed, as a result, susceptibility to obesity may be observed (Wardle et al., 2001). The emotional under-eating was determined to have a weak negative effect on obesity in the study (-0.168). In the literature, a negative correlation was also found between emotional under-eating and obesity

(Sleddens et al., 2008; Jansen et al., 2012). Both in this meta-analysis study and in the above literature studies, it is observed that as emotional under-eating decreases, obesity increases. In other studies, however, it was found that emotional under-eating did not significantly affect the obesity of the child (Webber et al., 2009; Passos et al., 2015; Demir & Bektas, 2017). In the case of emotional under-eating, there is a decrease in food intake and intestinal activity due to emotional stress in children and therefore less calorie intake than body requirement is observed (Wardle et al., 2001). The food fussiness was determined to have a weak negative effect on obesity in this work (-0.005). In other studies, a negative correlation was also found between food fussiness and obesity (Sleddens et al., 2008; Webber et al., 2009; Jansen et al., 2012; Demir & Bektas, 2017). Both in this meta-analysis study and in the above literature studies, it is observed that as food fussiness decreases, obesity increases. In other studies, however, it was found that food fussiness did not significantly affect the obesity of the child (Santos et al., 2011; Passos et al., 2015). Particularly the fact that children who are not picky about food like to taste new foods and enjoy a wide variety of foods are interested in trying tastes that they did not know or taste before can lead to excessive calories and increase the susceptibility to obesity (Wardle et al., 2001). Again, Parents' eating style and habits may be associated with obesity. In particular, parental restriction of children's eating some foods or allowing excessive consumption of certain foods may lead to more energy intake than needed, or vice versa, due to limited diet, can lead children to have lower calories than necessary and cause weight problems to occur. In this meta-analysis, Rosenthal and Orwin fail-safe N, Funnel plot graph, Duval and Tweedie's method, rank correlation, egger regression, Begg and Mazunder correlations were used to test publication bias. These analyzes calculate the number of studies that may be missing in a meta-analysis (Bakioglu & Ozcan, 2016; Cooper, 2016). It is recommended not to use only one method for the identification of Publication bias and to review other methods. According to Rosenthal fail-safe N, which is one of the technical methods, the required number of studies which can bring the magnitude of the effect to zero was shown to be big, which indicates that this publication is not biased. However, when other methods were examined in the meta-analysis, it was observed that in the majority of methods, study could involve publication bias. It is recommended to consider this when analyzing the results of this Meta-analysis study.

Conclusion

This meta-analysis study provides important information to determine the effect of children's eating behaviors on obesity. According to findings of the study, food responsiveness has a positive effect on obesity with weak effect size, enjoyment of food and desire to drink have positive effects on obesity with weak effect sizes, emotional over-eating has a positive effect on obesity with medium effect size, satiety responsiveness and slowness in eating have negative effects on obesity with medium effect sizes, emotional under-eating and food fussiness have negative effects on obesity with weak effect sizes. In conclusion, children's eating behaviors were determined to affect obesity in children. Due to the possibility of publication bias because of the fact that in this meta-analysis study, the number of studies included in the study was low, number of studies was low, in order to clarify results, there is a need for new studies with high levels of evidence that will reveal effects of children's eating behaviors on obesity. It is recommended to plan randomized controlled experimental studies and to give effect sizes and power analysis in studies. In this Meta-analysis study, studies with the same scale have been used in order to ensure objectivity and prevent bias in results, it is recommended to include studies with other measurement tools in future meta-analysis studies.

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