OBESITY IN THE RURAL AREA: RELATIONSHIP WITH MATERNAL ELEMENTS

ABSTRACT

Objective: to evaluate the association and similarity between nutritional status and dietary intake of children and their mothers in rural areas. Method: this is a bibliographic descriptive study, type integrative, carried out using the PECO strategy, in the LILACS, MEDLINE and COCHRANE databases, with articles published between 2007 and 2016. Results: 16 articles were included. It was noticed that there is great variability of the instruments and references used for the evaluation of nutritional status and eating habits in the evaluated manuscripts. The comparison between the maternal BMI and the BMI of the child was carried out in ten studies, and all found a positive relation. In eight studies, food consumption between mother and child was evaluated and compared, and all found significant relationships. It is noteworthy that most of the articles are international, with only two in Brazil. In addition, most of them were carried out in an urban area, with only one investigation covering urban and rural areas. Conclusion: it is revealed that the results of this review do not show that nutritional status and maternal eating habits can determine the overweight of rural children.

Descriptors: Child; Obesity; Nutritional status; Food behavior; Mother-child relationships; Maternal nutrition.

RESUMO

Objetivo: avaliar a associação e a similaridade entre o estado nutricional e a ingestão dietética de crianças e suas mães na zona rural. Método: trata-se de um estudo bibliográfico, descritivo, tipo revisão integrativa, realizado por meio da estratégia PECO, nas bases de dados LILACS, MEDLINE e COCHRANE, com artigos publicados entre 2007 e 2016. Resultados: incluíram-se 16 artigos. Percebeu-se que há grande variabilidade dos instrumentos e referências utilizados para a avaliação do estado nutricional e dos hábitos alimentares nos manuscritos avaliados. Realizou-se, em dez estudos, uma comparação entre o IMC materno e o IMC da criança, e todos encontraram relação positiva. Avaliou-se e comparou-se, em oito estudos, o consumo alimentar entre mãe e filho, e todos encontraram relações significativas. Destaca-se que a maioria dos artigos é internacional, sendo apenas dois realizados no Brasil. Realizou-se, além disso, a maior parte deles em zona urbana, sendo que apenas uma investigação abrangeu áreas urbana e rural. Conclusão: revela-se que os resultados desta revisão não permitem evidenciar que o estado nutricional e os hábitos alimentares maternos podem determinar o excesso de peso de crianças da zona rural. Descriptors: Criança; Obesidade; Estado nutricional; Comportamento alimentar; Relações mãe-filho; Nutrição materna.

RESUMEN

Objetivo: evaluar la asociación y la similaridad entre el estado nutricional y la ingestión dietética de niños y sus madres en la zona rural. Método: se trata de un estudio bibliográfico, descritivo, tipo revisión integrativa, realizado por medio de la estrategia PECO, en las bases de datos LILACS, MEDLINE y COCHRANE, con artículos publicados entre 2007 y 2016. Resultados: se incluyeron 16 artículos. Se percibió que hay gran variabilidad de los instrumentos y referencias utilizados para la evaluación del estado nutricional y de los hábitos alimenticios en los manuscritos evaluados. Se realizó, en diez estudios, la comparación entre el IMC materno y el IMC del niño, y todos encontraron relación positiva. Se evaluó y se comparó, en ocho estudios, el consumo alimentario entre madre e hijo, y todos encontraron relaciones significativas. Se destaca que la mayoría de los artículos son internacionales, siendo apenas dos realizados en Brasil. Se realizó, además, la mayor parte de ellos en zona urbana, siendo que sólo una investigación abarcó áreas urbanas y rurales. Conclusión: se revela que los resultados de esta revisión no permiten evidenciar que el estado nutricional y los hábitos alimenticios maternos pueden determinar el exceso de peso de los niños de la zona rural. Descriptors: Niño; Obesidad; Estado nutricional; Conducta Alimentaria; Relaciones Madre-Hijo; Nutrición Materna.
INTRODUCTION

It is known that obesity is a multifactorial disease characterized by an excessive increase of body fat, having a detrimental effect on the health of the individual, with a significant loss in quantity and quality of life. It is noticed that some cases of obesity are of endogenous origin, associated with hormonal, genetic or syndromic disorders such as hypothyroidism, Cushing's syndrome, growth hormone deficiency, defective leptin signaling, mutations at the melanocortin 4 receptor, and the Prader-Willi and Bardet-Biedl syndromes; however, most cases are of exogenous origin, due to the positive energy balance. 

Childhood obesity is a serious public health problem of contemporary times. It is estimated by the World Health Organization that 41 million children under five and more than 340 million children and adolescents aged five to 19 years were overweight or obese in 2016. Recent research by the Centers for Disease Control and Prevention (CDC) conducted in the United States showed that 12.1% of children between two and five years of age and 18.0% between six and eleven were obese. It is inferred that in Brazil, according to the Family Budget Survey (FBS) (2008-2009), one in three children aged five to nine years were overweight, with 51.4% of the boys and 43.8% of the girls, and, of Brazilian children aged five to ten years, accompanied by SISVAN, 28.4% are overweight.

It is believed that overweight or obese children, who remain in this condition throughout development, tend to become adults with neurometabolic and endocrine complications, as well as predisposition to the metabolic syndrome, cardiovascular diseases such as dyslipidemia, hyperinsulinemia, increased blood pressure and autonomic dysfunction. These children are often presented with socialization difficulties and they face suffering due to the stigmatization of obesity, reflecting in low self-esteem and behavioral disorder, characterizing bullying.

In addition to the genetic factor, it contributes to weight gain and body fat, which also predispose the environmental factors to obesity, and among them the sedentary lifestyle and inadequate eating habits, such as excessive exposure to ultraprocessed foods and with low nutritional value.

Children of different socioeconomic levels and places of housing have been reached today, either in urban or rural areas. It is observed that, although in the countryside, the family's work practices involve planting and the harvest, favoring physical exercise and access to in natura food, an increase in the consumption of processed products and sedentary practices among children and their families.

It is also believed that children acquire their eating habits and lifestyle in the family, especially with the mother, thus, maternal nutritional status and eating habits may constitute risk factors for childhood obesity. In fact, investigations have been carried out in urban areas in order to verify this relationship showing that maternal overweight and their habits of life can be associated with higher levels of BMI of the children.

One can certainly contribute to this increase in the prevalence of overweight among children also in rural settings and, considering the implications of obesity on children’s health, it is pertinent to deepen the knowledge about the subject and seek evidence about this causal relationship. In this research, we sought to answer the question: “Can nutritional status and maternal eating habits determine the overweight of rural children?”

Through the findings of this study, a better understanding of factors that may affect the dietary intake patterns and the nutritional status of the children will be possible and may produce useful information for the development of effective intervention programs to promote healthy eating in childhood, especially in the family environment.

OBJECTIVE

• To evaluate the association and similarity between nutritional status and dietary intake of children and their mothers in rural areas.

METHOD

An integrative literature review was carried out, consisting of a scientific investigation with the objective of gathering, critically evaluating and conducting a synthesis of the results of several primary studies, generating evidence. An integrative literature review was carried out, consisting of a scientific investigation with the objective of gathering, critically evaluating and conducting a synthesis of the results of several primary studies, generating evidence. The research question was defined through the strategy PECO on research and search for evidence (People - children from five to ten years old - Exposure - nutritional status and eating habits

English/Portuguese

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The research was carried out in the electronic databases MEDLINE (Medical Literature Analysis and Retrieval System Online), LILACS (Latin American and Caribbean Health Sciences Literature) and Cochrane Central (Register of Controlled Trials), merging the following terms from the list of Descriptors in Health Sciences (DeCs) and Medical Subject Headings (MeSH), in English: child, obesity, nutritional status, feeding behavior, mother-child relationship, maternal nutrition; and in English: child, obesity, nutritional status, feeding behavior, mother-child relations, maternal nutrition. The following inclusion criteria were considered: all types of studies published in the last ten years, published between January 2007 and December 2016, with a population between five and ten years of age. The chronological period for the inclusion of the studies in order to investigate the most up-to-date data on the subject was defined. The age group is justified because it is a phase with an accelerated ascendency of excess weight; in addition, this group has peculiar characteristics in the pattern of growth and diagnostic criteria.² The data was collected from March to November 2017. The studies were selected by two reviewers, independently. The studies were, at first, tested by the reading of titles and abstracts and, in the event of disagreement between them, it was decided in plenary for the moment to read the whole article and then it was defined on the inclusion of the manuscript. The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) protocol²¹ was followed for the identification, selection, eligibility and inclusion of studies.

In the next phase, the selected studies were read in full and, simultaneously, a standardized and structured instrument was used to collect data from each article, in order to systematize the relevant information, as well as to classify the level of scientific evidence, according to the categorization of the Agency for Healthcare Research and Quality (AHRQ).²² A total of 29 articles were selected for reading in full. After reading, 13 articles were excluded because they did not respond to the research question or because the age group was in disagreement with that defined in the inclusion criteria (Figure 1).
RESULTS

Included in this review were 16 articles that answered the question of the study, of which 12 are of cross-sectional design; three, cohort and one, systematic review. It should be emphasized that there is great variability of the instruments and references used to evaluate the nutritional status and eating habits in the evaluated manuscripts. It was also found that the type of analysis of the relationship between study variables is heterogeneous (Figure 2).

<table>
<thead>
<tr>
<th>Study (Author/year)</th>
<th>Study population</th>
<th>Drawing</th>
<th>Location</th>
<th>Anthropometric measurements</th>
<th>Instrument(s) to evaluate eating habits</th>
<th>Variable(s) compared between mother and child</th>
<th>Scientific Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Francis et al, 2007</td>
<td>197 five-year-old girls and their parents.</td>
<td>Longitudinal</td>
<td>Pennsylvania, United States of America</td>
<td>Percentile of BMI / Age (children); BMI (parents) at baseline</td>
<td>Food disinhibition subscale (country)</td>
<td>Maternal BMI and BMI Child: Positive relationship when father and mother were overweight (p &lt;0.01) and when only the mother was overweight (p &lt;0.05))</td>
<td>Level 3</td>
</tr>
<tr>
<td>López Alvarenga et al, 2007</td>
<td>552 children between eight and 12 years of age</td>
<td>Cross-sectional</td>
<td>Mexico</td>
<td>Means and Standard Deviation of BMI, weight and height (children and</td>
<td>Questionnaire containing: 43 questions about parents' habits, 34 about</td>
<td>Maternal food preference and child's food preference:</td>
<td>Level 4</td>
</tr>
<tr>
<td>Study</td>
<td>Participants</td>
<td>Design</td>
<td>Country</td>
<td>Measures</td>
<td>Results</td>
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<tr>
<td>Zeller et al, 2007</td>
<td>78 obese and 71 non-obese children and adolescents, ages eight to 16, and their parents</td>
<td>Cross-sectional</td>
<td>USA</td>
<td>BMI Z score / age (child), BMI (parents)</td>
<td>Did not evaluate eating habits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mazur et al, 2008</td>
<td>2182 girls and 2066 boys, with a mean age of 10.4 and 10.5 years, respectively</td>
<td>Cross-sectional</td>
<td>Poland</td>
<td>BMI Z score / age (child), BMI (parents)</td>
<td>Did not evaluate eating habits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beydoun et al, Wang, 2009</td>
<td>1370 boys, 1322 girls (from two to 18 years old), 1081 fathers and 1230 mothers</td>
<td>Cross-sectional</td>
<td>USA</td>
<td>Means and Standard Deviation of BMI (children and parents)</td>
<td>Two 24-hour food reminders</td>
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<tr>
<td>Rosenkranz et al, 2010</td>
<td>76 girls from nine to 13 years old and their mothers</td>
<td>Cross-sectional</td>
<td>USA</td>
<td>Percentile and Z score of BMI / age (child), BMI (parents)</td>
<td>Questionnaire on the consumption of fruit, vegetables and sugary drinks</td>
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</tbody>
</table>

Maternal BMI and Child BMI: positive relation (OR: 2.8, p <0.0001). Maternal food intake and infant food intake: positive correlation for total intake of cholesterol, calcium and dairy products, fruits and vegetables (p <0.05). Maternal food intake and dietary intake of the child: direct relationship between fruit consumption (p <0.01), vegetable intake (p = ...
Wang et al., 2011. 29 studies with children, adolescents and their parents Systematic review USA Did not evaluate anthropometric data 24-hour food recall, Food Frequency Questionnaire (FFQ) Obesity in the rural area: relationship 0.01

Bernaldo et al., 2012. 30 1,223 children, seven to ten years old and their parents Cross-sectional Florianópolis, SC, Brazil BMI Z score / age (child), (parents) Previous Day Food Questionnaire (QUADA), version 3 Maternal BMI and child BMI: positive relation (OR: 1.58; p = 0.001).

Laster et al., 2013. 31 177 children two to five years old and their mothers Cross-sectional North Carolina, United States Percentile of BMI / age (child), BMI (parents) Two 24-hour food reminders Maternal food intake and infant food intake: positive correlation between the quality of the diet of the mother and child (r = 0.44, p <0.0001)

Park et al., 2015. 32 1350 six-year-olds and their mothers Cross-sectional USA BMI Z score / age (child), (mother) Four adapted questions from the Child Feeding Questionnaire Maternal food pattern and infant food consumption: significant relation (p <0.05).

Robinson et al., 2014. 33 66 families with children aged eight to 12 years Cross-sectional Hunter and Forster (New South Wales, Australia) BMI Z score / age (child), (parents) Australian Eating Survey (AES)- adults Australian Child and Adolescent Eating Survey (ACAES)- Children Maternal food intake and infant food intake: positive correlation for the intake of plant variety (p <0.01) and meat intake (p <0.001).

Tschan et al., 2015. 34 322 Mexican-American children, ages eight to ten, and their parents Longitudinal, California (cohort two years) Ratio of Waist / Height, percentile of BMI / age (child), (parents) at baseline Parental Feeding Practices (PFP) Questionaire Maternal and child BMI: positive relation (p <0.001).

Faith 302 girls Longitudinal USA BMI Z Not Maternal

| Wang et al., 2011. | 29 studies with children, adolescents and their parents | Systematic review | USA | Did not evaluate anthropometric data | 24-hour food recall, Food Frequency Questionnaire (FFQ) | Obesity in the rural area: relationship 0.01 |
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| Faith | 302 girls | Longitudinal | USA | BMI Z | Not | Maternal |
Lagares EB, Resende KA, Romano MCC.  

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In all the studies included in this review, except for the systematic review study, BMI as an anthropometric indicator of the nutritional status of children and their mothers, and as a child evaluation parameter, the studies used: BMI / Age in Z score;25,26,30,31,37 percentile;23,31,2,36 Z score and percentile;28,35 Z score and waist / height ratio;24,38 mean and standard deviation of BMI.24,27 It is mentioned that two articles did not classify BMI as children;24,27 other two34,5 did not refer to the criteria used; five investigations 22,25,28,31,24 adopted the criteria proposed by the Centers for Disease Control and Prevention (CDC) in 2000;29 three other studies26,33,38 used the proposal of the International Obesity Task Force (IOTF) of 2000 and 200240-1 and the last three studies30,36,7 used the criteria of the World Health Organization (WHO) in 2006 and 2007.42,3

Among these studies, ten of them compared the maternal BMI with the BMI of the child, and all found a positive relation (p <0.05).23 OR: 2.8 [95%: 1.8-4.35] p<0.0001;25 OR: 14.28 [CI 95%: 10.31-19.79] p<0.001; OR: 16.75 [95%: 11.78-23.82] p<0.0001 for girls and boys respectively;26 p<0.05;28 PR: 1.58 [95%: 1.26-1.98];30 r= 0.36; p<0.001;34 OR: varied 2.48-8.63 e 2.72-4.03 [CI 95%] for girls and boys respectively;35 OR: 22.5 [95%: 2.5-203.2];36 OR 15.5 [CI 95%: 1.8-132];37 OR: 2.33 [95%: 1.80-3.01]28.

The prevalence of overweight in the majority of the original studies was evaluated,

<table>
<thead>
<tr>
<th>Study</th>
<th>Year</th>
<th>Methodology</th>
<th>Sample Size</th>
<th>Data Collection</th>
<th>BMI Measurement</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mende et al, 2015</td>
<td>2015</td>
<td>Cross-sectional</td>
<td>60 children aged 6-10</td>
<td>Questionnaire</td>
<td>BMI / Age Percentile</td>
<td>OR 14.28 [CI 95%: 10.31-19.79] p&lt;0.001; OR: 16.75 [95%: 11.78-23.82] p&lt;0.0001 for girls and boys respectively;26 p&lt;0.05;28 PR: 1.58 [95%: 1.26-1.98];30 r= 0.36; p&lt;0.001;34 OR: varied 2.48-8.63 e 2.72-4.03 [CI 95%] for girls and boys respectively;35 OR: 22.5 [95%: 2.5-203.2];36 OR 15.5 [CI 95%: 1.8-132];37 OR: 2.33 [95%: 1.80-3.01]28.</td>
</tr>
<tr>
<td>Mirenda-Rios et al, 2015</td>
<td>2015</td>
<td>Cross-sectional</td>
<td>174 Schoolchildren aged 12</td>
<td>Questionnaire</td>
<td>BMI / Age Percentile</td>
<td>OR 14.28 [CI 95%: 10.31-19.79] p&lt;0.001; OR: 16.75 [95%: 11.78-23.82] p&lt;0.0001 for girls and boys respectively;26 p&lt;0.05;28 PR: 1.58 [95%: 1.26-1.98];30 r= 0.36; p&lt;0.001;34 OR: varied 2.48-8.63 e 2.72-4.03 [CI 95%] for girls and boys respectively;35 OR: 22.5 [95%: 2.5-203.2];36 OR 15.5 [CI 95%: 1.8-132];37 OR: 2.33 [95%: 1.80-3.01]28.</td>
</tr>
<tr>
<td>Parrino et al, 2016</td>
<td>2016</td>
<td>Cross-sectional</td>
<td>2025 Children aged 9-14</td>
<td>Questionnaire</td>
<td>BMI / Age Percentile</td>
<td>OR 14.28 [CI 95%: 10.31-19.79] p&lt;0.001; OR: 16.75 [95%: 11.78-23.82] p&lt;0.0001 for girls and boys respectively;26 p&lt;0.05;28 PR: 1.58 [95%: 1.26-1.98];30 r= 0.36; p&lt;0.001;34 OR: varied 2.48-8.63 e 2.72-4.03 [CI 95%] for girls and boys respectively;35 OR: 22.5 [95%: 2.5-203.2];36 OR 15.5 [CI 95%: 1.8-132];37 OR: 2.33 [95%: 1.80-3.01]28.</td>
</tr>
</tbody>
</table>

Figure 2. Description of study articles, according to selected variables, published in the period from 2007 to 2016. BMI: Body Mass Index; MG, Minas Gerais; OR, Odds Ratio; SC, Santa Catarina.
varying from 11.6% to 84% among mothers and from 21.6% to 51% among the children. It is mentioned that three studies did not present the prevalence of overweight / obesity of the children evaluated. In one, the mean Z score for BMI / age was 0.42 ± 1.19 for girls and 0.73 ± 1.18 for boys. It was shown, in two other studies, that the average BMI was 20.2 ± 0.1, and another 19.2 ± 4.1 for public school children and 19.1 ± 3.2 for private school children. Data on the dietary intake of children in eleven studies were evaluated, but only eight of them evaluated parental feeding and compared the consumption of mother-infant dyads and also father-son.

The questionnaires used to collect data between the studies were different. It is noticed that some authors used QUADA, version 3, which consists of an illustrated questionnaire referring to the food consumption of the previous day in a qualitative way; others used four questions extracted from the Infant Feeding Questionnaire and focused on maternal behavior regarding the child's diet, and two questions regarding the frequency with which the child had ingested non-alcoholic sugary drinks in the last month; Some authors have used validated semiquantitative food frequency questionnaires (FFQs), Australian Eating Survey (AES) for adults and Australian Child and Adolescent Eating Survey (AACES) for children; others used the 24-hour food recall, as well as some authors who used a structured questionnaire with questions about the eating habits of children and parents; another group of authors used a questionnaire on the consumption of fruit, vegetables and sugary drinks, and the studies included in the review used FFQs and 24-hour food recall.

It is exposed, from the studies found in this review, that only two simultaneously evaluated the relationship of BMI between mother and child contemplating data on the food consumption of both in urban environment. A total of 76 girls aged nine to 13 years and their mothers were evaluated. The higher the connectivity score in the relationship between mother and daughter, the greater the similarity between their BMI (p <0.05); there was a significant similarity in the consumption of fruits and vegetables by children and their mothers (p = 0.01 and p <0.01, respectively). The child's eating habit was also directly associated with this habit (p <0.001), but there was no similarity relation between the intake of sugary beverages by the children and their mothers (p > 0.05). In a study of 172 Mexican children aged five to 12 years and their mothers, it was found that obese mothers had a significantly higher proportion of obese children compared to normal or overweight mothers [OR 15.5 (IC 95 % 1.8-132), p = 0.003]. However, the state of overweight and maternal obesity in a single group was compared to the overweight and obesity status of the children, but no statistical association was found. The risk of excessive energy consumption by their daughters (p = 0.04) increased by 11 times the mothers' excessive energy consumption. The maternal lipid intake was associated with the lipid intake of their sons and daughters (p <0.001 and p = 0.005, respectively), and the mothers' carbohydrate intake was associated with their children's consumption (p = 0.004). Increased sugar consumption by mothers increased the risk of excessive sugar consumption in their sons and daughters by four to five times.

In a study carried out in Brazil, specifically in a city in the center-west of Minas Gerais, the factors associated with infant BMI in 60 children between six and ten years old were measured, and the mother's obesity was found as an independent variable associated with excess (p = 0.004). Of the children whose mothers were obese, 71.4% were overweight versus 15.1% of those whose mothers were not obese. In this study, the average daily intake of breads (p = 0.03) and the lowest average daily intake of yogurt (p = 0.007) were statistically significant, with statistically significant associations with the highest BMI of the child. The average daily intake of “chip” snacks (p = 0.08) was also directly associated with the highest infant BMI, and the highest average daily intake of ice creams (p = 0.09) was indirectly associated with higher child BMI, without statistical significance. Other variables such as father's obesity, birth weight, breastfeeding and number of children were evaluated, however, they were not associated with the BMI of the child.

A follow-up study of 197 girls, five years of age, was performed at the baseline until the age of 13, and the prevalence of overweight of the girls over time was evaluated. It should be noted that BMI change patterns were higher than expected for normal growth among daughters of overweight parents compared with girls whose parents were not overweight [mean weight gain 40.8 ± 13.3 kg, 29.1 ± 6.2 kg, respectively] p <0.001]. It was observed that girls from families in which only mothers were overweight showed a faster rate of increase in BMI over time compared to

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25 characteristics of parents associated with obesity in children and adolescents were examined in a study to better understand the obesogenic family environment. It was found that mothers and fathers of obese youngsters had significantly higher BMIs compared to mothers and fathers of overweight children [(Mothers: 35.2 ± 9.6 kg/m² vs. 27.6 ± 6.9 kg/m²; Parents: 33.3 ± 8.4 kg/m² vs. 28.2 ± 4.7 kg/m²), of youngsters with and without overweight, respectively] p < 0.001]. Maternal obesity increased by 2.8 times the chance of the child being obese until [p < 0.0001; 95% CI: 1.80-4.35] and, as expected, the socioeconomic level did not differ significantly among the participants, since it is a convenience sample whose sociodemographic characteristics of families tend to be similar.

In one study, 26 risk factors for the development of obesity in children in the south-eastern region of Poland were assessed. It was found that maternal obesity was highly associated with the presence of obesity in children, with a differential impact between the sexes [OR: 14.28 (95% CI: 10.31-19.79), p < 0.001] in girls and [OR: 16.75 (95% CI: 11.78-23.82), p < 0.0001] in boys. Children's obesity was also significantly associated with paternal obesity (p < 0.001), however, this relation is higher with the mother. It was found that family income, parental education level and maternal occupation were not associated with the presence of obesity in children, and the lower number of children living in the same household was significantly associated with childhood obesity (p < 0.05).

The early risk factors for obesity related to the parents of 2025 Sicilian children aged nine to 14 years living in urban and rural areas were estimated.38 Obese mothers had a significantly higher prevalence of obese children (32.9 vs. 9.6% in normal weight mothers, p < 0.005). The BMI of both fathers and mothers was significantly correlated with the BMI-z score (r = 0.27 and r = 0.25, respectively, p < 0.0001), waist circumference (r = 0.25 (r = 0.27 and p = 0.23, respectively, p < 0.0001), also adjusted for age and sex (p < 0.05). There was also a significant relationship between the level of parental schooling and the child's weight status. It was inferred that when the mother or father had a low level of schooling, the prevalence of childhood obesity was significantly higher than when the parents had a high educational level (p < 0.05); in addition, overweight and obese children had a significantly higher prevalence of high birth weight (PN ≥ 4 kg) compared to lean or normal-weight children (6.1 vs. 3.1%, p < 0.05). It was found that the prevalence of high birth weight was significantly higher among overweight and obese females (8.0 vs. 3.7%, p < 0.05), but no significant differences were found between areas urban and rural areas for BMI, z scores for BMI and waist-to-height ratio, however, children living in urban areas had a significantly higher WC (74.8 ± 11.4 vs. 73.3 ± 11.9; < 0.05) than children in rural areas.

A total of 1223 schoolchildren aged seven to ten years, 49.2% boys and 50.8% girls, were found, and a significant relationship was found between the nutritional status of the children and the nutritional status of their mothers.20 It was observed that the prevalence of overweight or obesity was 1.58 times higher among children of mothers who were overweight (p = 0.001), with no significant difference between genders, revealing that approximately 84.9% of the children had habits healthy diet, but in this investigation there was no significant association between family income and overweight.

In a longitudinal study, 35 302 girls and 316 boys, mean age of 4.5 years, at baseline, were observed during a ten-year follow-up. Measurements of anthropometric measurements were made at five moments during the study, and maternal obesity was a predictor of the increase in overweight/obesity in girls (OR ranged from 2.48 to 8.63, p < 0.0001) and (OR ranged from 2.27 to 4.03, p < 0.0006) in boys at all time points.

In another longitudinal study, 34 32-year-old Mexican American children aged eight to ten years were followed for two years of follow-up regarding the influence of parental feeding practices on the child's weight and, positive correlation between BMI, waist/height ratio of children and parental BMI, both maternal BMI and paternal BMI (p < 0.001). The socioeconomic level of the families was associated with lower BMI and lower waist-to-height ratio (r = -0.12, p < 0.05).

The influence of maternal food preferences on children's food preferences was measured.24 This study was carried out in a public school and a private school, comparing, therefore, two groups from different social strata. It was observed that the mothers of the public school students had a higher BMI when compared to the mothers of the private school (p < 0.0001). The preferences of the children were more strongly associated with maternal food preferences compared to the paternal preferences for the following foods: vegetables (r_mom = 0.92, r_dad = 0.58, r_child =...
0.94), fruits (\(f_{\text{mom}} = 0.77, f_{\text{dad}} = 0.47, f_{\text{child}} = 0.82\)), diet refrigerant (\(f_{\text{mom}} = 0.97; f_{\text{dad}} = 0.60; f_{\text{child}} = 0.86\)) and fish (\(f_{\text{mom}} = 0.76; f_{\text{dad}} = 0.63; f_{\text{child}} = 0.78\)). The results showed that mothers influenced their children's food preferences by 30%, and this association was stronger for students in public schools; both parents influenced their children in regular consumption of common refrigerator \(f_{\text{mom}} = 0.84, f_{\text{dad}} = 0.81, f_{\text{child}} = 0.98\).

The association between ingestion and dietary pattern between parents and children in a representative sample of the United States was studied and it was found that the adjusted correlations were significantly stronger between mother-child dyads than between parent-child dyads, and, when comparing food intake among children and their mothers, a correlation was observed between cholesterol intake (\(r_{\text{mom}}=0.47; r_{\text{father}}=0.31; p<0.05\)), calcium and dairy products \(r_{\text{mom}}=0.30; r_{\text{father}}=0.30; p<0.05\), fruits and vegetables \(r_{\text{mom}}=0.31; r_{\text{father}}=0.37; p<0.05\). It is generally suggested from the findings of this study that the similarity in dietary intake between parents and children is relatively weak (correlations ranged from 0.20 to 0.33 for total energy intake and diet). It was increased in parents who ate healthy food three times, the likelihood of children also having a healthy diet, and the age of the child significantly modified this relationship, which was higher for children aged between two and ten years \([OR : 4.05 (95\% CI 2.45-6.68), p<0.05]\) compared to those over the age of 10 \([OR : 1.55 (95\% CI 1.01-2.36), p<0.05]\). When the socioeconomic level was considered, it was only an interaction for the consumption of diet soda, with a significant correlation between parents and children of better social class \(r = 0.31, p<0.05\).

The quality of the diet of preschool children and their mothers with overweight was determined in a study, assessing the correlation between the quality of the maternal diet and the child's diet. The maternal-infant scores of the diet quality index were correlated with each other \(r = 0.44, p <0.0001\), and more than half of the children met the recommendations of total grains, milk and oils, however, only 6% of the children met the recommendation of total vegetables compared to 18% of the mothers. Children and mothers were significantly different in the percentage of adequacy to recommendations for fruits, vegetables, whole grains, milk and meat and beans. It should be noted that the quality of the infant diet was better among those children with longer breastfeeding, children of white mothers, married and non-smokers, however, BMI-Z score and BMI category were not associated with quality of the child's diet.

The comparison between the dietary intake of the children and their respective parents was found, and there were moderate positive correlations between the father-child dyads in relation to the percentages of energy intake from fats, saturated fats and carbohydrates \(r = 0.40-0.46 \ p<0.05\), while the mother-infant dyads presented moderate to moderate positive correlations for all percentages of intake, such as plant variety \(r = 0.40, p<0.01\), meat intake \(r = 0.46, p<0.001\) except for carbohydrates \(r = 0.27, p<0.05\); besides strong correlations for the general quality of the diet \(r = 0.50 - 0.59\).

The influence of maternal dietary practices on the ingestion of non-alcoholic sugary drinks in a sample of 1350 six-year-old children was evaluated and 23% of children were found to be overweight and consume these beverages once a day, and that regardless of the nutritional status of the child, children of mothers who limited their consumption of sweets and unhealthy foods were significantly less likely to consume non-alcoholic sweetened beverages \(p<0.05\).

In a systematic review with meta-analysis, the similarity in food intake of children and their parents was found. 24 studies published in the period from 1980 to 2011 were identified, of which 15 were included in the meta-regression analysis. Significantly, the results of the studies were varied and, generally speaking, weak to moderate correlations were suggested for nutrient intake between parents and children, with a mean correlation coefficient of 0.20 \(95\% CI: 0.13-0.28\) and 0.21 \(95\% CI: 0.18-0.24\) for total fat and energy, respectively. It is further noted by the authors that associations for these dietary items have become weaker over the years. It should be noted that food frequency questionnaires (FFQs) produced a lower correlation than the 24-hour records or reminders, and the better methodological quality of the studies showed a stronger correlation in fat intake. It is emphasized that the majority of the studies that composed this review was based on small non-representative samples and about half of them were carried out in the United States, being scarce the work done in underdeveloped countries.

DISCUSSION

It is understood that the results of this research do not show that nutritional status and maternal eating habits can determine the overweight of rural children. It is added that,
although the sample of the study population varies between 60 and 4,248 children, totaling 13,858 participants, only one study was carried out with rural children, showing the lack of research on the subject with the mentioned public.

The prevalence of overweight and childhood obesity found in the studies in this review varied between 21.6% and 51%. It is reported that a systematic review study, worldwide, identified a substantial increase in childhood obesity, with 23.8% of boys and 22.6% of girls in developed countries being overweight or obese. In developing countries, prevalence of overweight and obesity increased from 8.1% to 12.9% in 2013 for boys and from 8.4% to 13.4% in girls.

The methodology for collecting the anthropometric data was used to calculate the BMI between the studies. The weight and height measures of the children were obtained by a majority of them (n = 13) through an evaluation carried out by a trained researcher. In one of the selected studies, these measures were measured by the respective mothers. However, it was noticed that the anthropometric measurements of the mothers were self-reported in more than half of the studies (n = 9). Self-reported measures may include outdated data errors, lack of knowledge or underreporting of overweight.

It was verified that the instruments used for the evaluation of food consumption were heterogeneous, which makes it difficult to compare the results found. It is noteworthy that only three studies evaluated the consumption of non-alcoholic sugary drinks. It is relevant to evaluate this aspect in the dietary pattern, since studies have discussed the possible association between the consumption of sugary drinks and the BMI. It was pointed out in the literature review that the overall index of non-alcoholic sugary beverages consumption is high in the child and adolescent population, and that additional studies, especially follow-up studies, should be implemented to elucidate its effect on BMI and health in general.

It was verified that the majority of the articles of this revision is international, being only two realized in Brazil. In addition, most urban area surveys were carried out, with only one study covering urban and rural areas, and did not find significant differences in the prevalence of overweight between the two areas, demonstrating that the nutritional transition also affects children. As a result, the hypothesis is that rural inhabitants have more access to healthy foods, such as fruits and vegetables, as well as having adequate physical space for planting and growing gardens and leisure activities in the air free, so they would be less likely to become obese. It is necessary, in this sense, to carry out further investigations with this public for a better understanding about the prevalence of obesity and associated factors in children residing in this area.

The relationship in BMI and the dietary pattern between mother and child in this review was observed, especially in urban children. These findings may support genetic causation, but environmental and family components should be considered, since parents and the family environment are the primary influences of life habits that children tend to follow. It is understood that family practices such as food consumption, absence of physical activity, hours in front of the television or computer are examples that directly influence the choices and conditioning of the individual in relation to habits of life.

Among the studies analyzed in this review, nine of them evaluated the socioeconomic status of the participants and, from these, one found a significant association between the higher socioeconomic level and the lower child BMI. Evidence suggests that socioeconomic status is an important element associated with obesity, although the existing literature is not consensual. There was a direct association between higher family income and obesity in schoolchildren, justifying that greater access to consumer goods stimulates sedentariness, such as excessive use of the computer. In addition, due to the higher purchasing power, access to an inadequate nutritional standard, such as the use of sugary drinks, delicacies and industrialized foods of high energy value.

It was found that more than half of the studies, 75% (n = 12), are of the transverse type, characterized as level 4 of scientific evidence, 19% (n = 3) are descriptive cohort studies characterized as level 3 of evidence, and 6% (n = 1) are of systematic review, characterized as level 1 of evidence, however, because they are not randomized controlled clinical trials, we can not extract causal inferences.

It was found, with regard to the representativeness of the samples, that 43.8% (n = 7) of the selected studies had sampling for convenience. It becomes impracticable to state that the data from the studies analyzed with non-randomized sampling represent a population, and representative and random samples are essential from the point of view of internal and external validity to ensure that
the information collected is extended to the population.50

The lack of studies evaluating the relationship between nutritional status and food consumption among children from five to ten years old and their mothers, especially in rural environments, shows that only two of the articles evaluated in this review presented it clearly. It is known that the family directly influences the health promotion practices or the illness of its members, since it plays a fundamental role in the formation of values, beliefs, knowledge and habits of life.51

Therefore, it is necessary, in relation to the factors associated with overweight in children, of longitudinal rural surveys that assess the highest possible volume of variables of the mother and child, such as the consumption of sugary drinks non-alcoholic, socioeconomic status, BMI, level of physical activity, favoring the analysis of the determinants of this phenomenon of global magnitude.

CONCLUSION

It is concluded that the results of this review do not show that nutritional status and maternal eating habits can determine the overweight of rural children, considering that, in this research, only one study was conducted in rural areas and, nevertheless, it is an international study that did not compare maternal and child food consumption. It is therefore recommended to implement more studies in the rural area, mainly in Brazil, on this subject.

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