Journal of Sociology and Ethnology (2022)
Clausius Scientific Press, Canada

DOI: 10.23977/jsoce.2022.040413
ISSN 2616-2318 Vol. 4 Num. 4

Meta-analysis: risk factors for the obesity in Chinese children and adolescents

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Keywords: China, children and adolescents, obesity, risk factor, Meta-analysis

Abstract: To systematically evaluate the risk factors of the obesity in Chinese children and adolescents.Method: A search was done in electronic databases (PubMed, Web of Science, CBM, WanFang Data and CNK), Cohort or case-control studies of obesity risk factors in children and adolescents were collected from the database establishment to June 2021.Two reviewers independently screened literature, extracted data and assessed the risk of bias of included studies, then, meta-analysis was performed by using RevMan5.4 and Stata 15.0 software. Results: A total of 23 articles (19 case-control studies), involving 11,661 patients in the case group and 16,072 patients in the control group were included. The combined OR values (95% confidence interval) were: strong appetite 7.44(5.84,9.47), Both parents are overweight or obese 3.93(3.24,4.78), fast eating speed 2.97(2.34,3.76), overweight or obesity of father2.18(1.86,2.56), long video time 1.85(1.52,2.25), overweight or obesity of mother 1.84(1.66,2.04), big birth weight 1.54(1.36,1.75), eating fried food 1.14(1.05,1.23), meal time 0.33(0.23,0.46).Conclusion: It is Overweight or obesity of parents, birth weight, eating fried food, fast eating speed, strong appetite, long video time and other factors are the risk factors of childhood and adolescent obesity, among which the risk degree of strong appetite is the highest, followed by both overweight or obesity of parents. The duration of consumption is a protective factor for obesity in children and adolescents.

1. Introduction

Obesity in children and adolescents has become an increasingly serious public health problem in China [1]. The Report on Nutrition and Chronic Diseases of Chinese Residents (2020) shows that the overweight obesity rate of preschool children in China reaches 10%, and that of children aged 6-17 reaches 20%[2]. Obesity seriously affects the physical and mental health of children and adolescents, leading to sleep breathing disorder, asthma, affecting learning and memory functions, and easy to cause individual self-esteem, depression and other adverse psychological effects, and even bring children and adolescents with hypertension, diabetes and other diseases that originally only appear in adults[3]. The factors causing obesity in children and adolescents are complex, mainly related to genetic factors and environmental factors, including parental obesity, eating habits, sleep status, exercise factors, etc. [4-7]. Therefore, this study systematically evaluated the risk factors of obesity in Chinese children and adolescents, in order to provide evidence for the prevention and control of obesity in children and adolescents and the formulation of medical and health policies.

2. Data and Methods

(1) Inclusion and exclusion criteria: ① Inclusion criteria: Cohort study or case-control study; Children under the age of 18 in China; Outcome indicators can be extracted OR converted from the OR value (odds ratio) and 95%CI (confidence interval) of multivariate Logistic regression analysis. ② Exclusion criteria: Unable to obtain data literature; Poor quality, repeated publication, incomplete information, etc; The subjects had other diseases except overweight and obesity; Research content and research methods are inconsistent; Non-Chinese and English literature.

(2) Literature Retrieval

PubMed, Web of Science, CBM, WanFang Data and CNKI databases were searched by computer to collect cohort studies or case-control studies on obesity risk factors in children and adolescents. The retrieval period was from the establishment of the database to June 2021. Literature retrieval adopts the combination of subject words and free words. Chinese keywords include: children, adolescents, primary and secondary school students, obesity, overweight, risk factors, related factors, influencing factors, case control, cohort study; English search words include: China, Chinese, teen*, youth, child*, adolescents, dissimilarity, obesity, overweight, cohort, relative risk.

(3) Literature screening and data extraction

Two researchers independently screened literature, extracted data and cross-checked them. If there is any disagreement, it can be resolved through group discussion. Missing information should be supplemented by contacting the author by email. During literature screening, the titles and abstracts were first read to exclude the literature that obviously did not meet the requirements, and the full text was further read to determine whether the study was finally included. Data extraction included: first author, publication year, age of subjects, number of patients in case group, number of control group, OR value of multiple Logistic regression analysis and 95%CI data.

(4) Risk bias evaluation of included literature

By referring to NOS (Newcastle-Ottawa Scale), the two researchers evaluated the bias risk of the included studies, and extracted research data from the literatures that reached 6 stars.

(5) Statistical Analysis

RevMan5.4 software and Stata15.0 software were used for statistical analysis, and the OR value (95%CI) of obesity risk factors was the effect size. $\chi 2$ test was used to test heterogeneity. When $P > 0.1$ and $I2 < 50\%$, the heterogeneity among studies was small, and the fixed-effect model was used for meta-analysis. When $P < 0.1$ and $I2 > 50\%$, there was obvious heterogeneity among studies, and the random effect model was used for meta-analysis. Egger's test and Begg's test were used to evaluate publication bias. When $P > 0.05$, there was no publication bias. When $P < 0.05$, it indicates that there is publication bias, and then the shear and complement method is used to analyze and draw the funnel plot after the shear and complement.

3. Result

(1) Literature retrieval results

590 literatures were initially searched, and 18 literatures were included (19 case-control studies), including 16 literatures in Chinese [8-23] and two in English [24-25].

(2) Basic characteristics and bias risk assessment results of the included literature

The 19 included studies were all case-control studies, including 11,403 patients in the case group and 15,814 in the control group.

(3) Meta-analysis results

Meta-analysis of the impact of large birth weight on obesity in children and adolescents

A total of 8 studies were included, I^2=47%, P=0.07 < 0.1, with moderate heterogeneity. The fixed effect model was selected, and it was concluded that large birth weight was a risk factor for obesity in children and adolescents (Z=6.79, P < 0.00001). Therefore, The risk of obesity in children with high birth weight was 1.54 times higher than that in children with normal birth weight.

Then, publication bias analysis was conducted. Begg's test:P=0.009; Egger's test:P=0.035, all less than 0.05, there was obvious publication bias, and further analysis was made with the method of cutting and filling. After the inclusion of the corresponding 3 articles, the funnel plot could be symmetrical (FIG. 1) to eliminate publication bias. The combined OR value and 95%CI were 1.46 (1.30, 1.65), which had no significant impact on the original results.

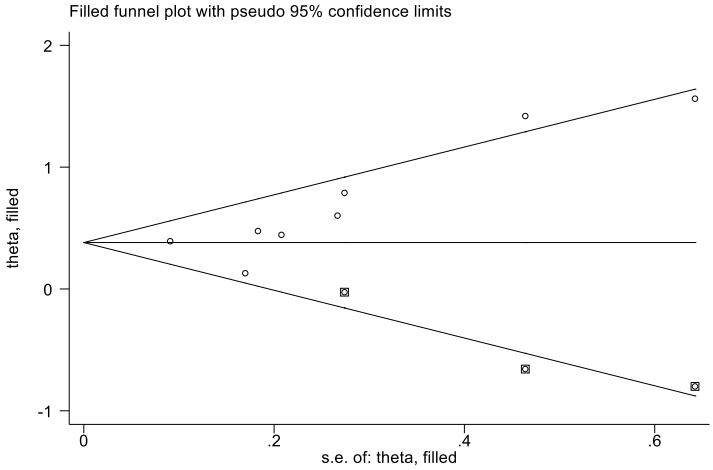

Fig.1 Funnel plot of large birth weight after trimming

Meta-analysis of the impact of risk factors on children and adolescents, Overweight or obese parents, large birth weight, love to eat fried food, eating fast, high appetite, long screen time and other factors are the risk factors of obesity in children and adolescents, among which the risk degree of high appetite is the highest, followed by both overweight or obese parents. Duration of intake was a protective factor (Table 1).

Table 1 Analysis results of risk factors for childhood and adolescent obesity

Risk factor	N	Heterogeneity test		Effect of the model	Combined effect size		Begg's test: P; Egger's test: P
		P-value	I^2（%）		OR（95%CI）	P-value	
The father is overweight or obese	6[8, 11, 19, 22, 24]	0.19	33%	Fixed	2.18（1.86, 2.56）	＜0.01	0.060; 0.106
The mother is overweight or obese	7[8, 11, 17, 20, 22, 24]	0.59	0%	Fixed	1.84（1.66, 2.04）	＜0.01	0.230; 0.297
Both parents are	3[17, 23, 25]	0.43	0%	Fixed	3.93（3.24, 4.78）	＜0.01	0.296; 0.487

overweight or obese							
High birth weight	8[10, 11, 13, 17-19, 23, 24]	0.07	47%	Fixed	1.54（1.36, 1.75）	＜0.01	0.009; 0.035
You like fried food	3[8, 18, 20]	0.36	3%	Fixed	1.14（1.05, 1.23）	＜0.01	0.296; 0.036
Eat fast	8[9, 11, 14, 16, 17, 21, 23, 24]	0.05	51%	Random	2.97（2.34, 3.76）	＜0.01	0.108; 0.283
Time spent eating	3[15, 24]	0.54	0%	Fixed	0.33（0.23, 0.46）	＜0.01	0.296; 0.384
A strong appetite	5[10, 19, 21, 24]	0.20	33%	Fixed	7.44（5.84, 9.47）	＜0.01	0.221; 0.203
Long video time	3[10, 24, 25]	0.41	0%	Fixed	1.85（1.52, 2.25）	＜0.01	0.296; 0.494

4. Discuss

Appetite, eating speed, food preference and other eating behaviors and habits are closely related. After eating, the gut signals its response to food to the central nervous system to produce a sense of satiety and stop eating. If eating too fast, it is easy to cause overeating before the above physiological adjustment process is completed. This study confirmed that eating duration is a protective factor for obesity in children and adolescents, further illustrating the risk of eating fast. Complex energy balance regulation pathways include appetite centers in the hypothalamus and brainstem as well as energy signals released around the intestine, etc. In obese individuals, this process is often unbalanced, resulting in the loss of satiety signals and increased food intake.Fried food as a kind of high calorie, high fat food, easy to stimulate the appetite of children and teenagers, increase food intake. Regular intake of such food is likely to cause excess energy, which leads to obesity. Therefore, we should pay attention to the cultivation of children and adolescents eating habits of eating slowly, limit the intake of high-fat, high-calorie food, a balanced diet.

The results of this study show that high parental weight is a risk factor for obesity in children, especially the risk of both parents being obese is much higher than that of one parent being obese. It has been reported that the probability of obesity in children and adolescents with a family history of obesity is significantly higher than that in adolescents without a family history of obesity, which may be related to genetic factors or the transmission of bad eating habits and unscientific lifestyle between parents and children. Long time watching TV, playing video games and other video behaviors are also risk factors for obesity in children and adolescents. A number of studies at home and abroad have shown that obesity has significant family aggregation, which proves that obesity is related to unhealthy family sharing environment. Therefore, as the main place for children (especially preschool children) to develop a good lifestyle and healthy eating habits, family plays an irreplaceable role in preventing and controlling the occurrence and development of obesity and promoting the health of children and adolescents.

With the continuous improvement of living standards, the number of giant babies (birth weight > 4000g) is increasing in China. The results of this study indicate that high birth weight is a significant risk factor for obesity in children and adolescents. Some foreign studies have already confirmed that the risk of obesity in the future of giant children is several times that of normal children. Late pregnancy is the first critical period for obesity in children and adolescents, during which the number and volume of fat cells increase the fastest in life, and fat cells will not disappear once formed. Excessive maternal weight gain during pregnancy not only leads to excessive growth of fetal fat cells, forming macrosomia, but also increases the difficulty of treating obesity in the future. Therefore, the prevention of obesity in children and adolescents should start from pregnancy, avoid pregnant women over nutrition, reduce the occurrence of macrosomia.

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