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Original/*Obesidad*

Prevalence of obesity among secondary school students from 2009 to 2014 in China: A Meta-analysis

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Abstract

Background: **In recent years, obesity was a major public health problem in many countries. It was estimated that 8% of their children are obese. However, little is known about the overall prevalence of obesity among secondary students in China, the aim of this study was to evaluate the overall obesity prevalence of student from Chinese secondary school.**

Methods: **Publications from 2009 to 2014 on the obesity prevalence among secondary school students in China were retrieved from PubMed, online Chinese periodical full-text databases of VIP, CNKI and Wan fang. Meta Analyst was used analyze the total rates of obesity for Chinese secondary school.**

Results: **After evaluation of the quality of the articles, 32 papers were finally included in our study, and the total sample sizes on the obesity investigation were 218317 (107631 male and 110686 female), in which 27455(14865 male and 12590 female) were obesity. Meta-analyst findings showed that the pooled prevalence of obesity in secondary school students are 8.4 %(95% CI: 6.2%-11.3%) and 4.8 %(95% CI: 3.2%-7.2%) for boy and girl respectively.**

Conclusion: **Our results suggest that school and government related department should pay more attention to the obesity among secondary school students in China, and take some properly measures should to curve the trend growth of obesity.**

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Key words: *Secondary school students. Obesity. Prevalence. Meta-analysis.*

LA PREVALENCIA DE LA OBESIDAD ENTRE LOS ALUMNOS DE SECUNDARIA A PARTIR DE 2009 A 2014 EN CHINA: UN META-ANALISIS

Resumen

Antecedentes: **En los últimos años, la obesidad es un importante problema de salud pública en muchos países. Se calcula que el 8% de los niños son obesos.Sin embargo, poco se sabe acerca de la prevalencia de la obesidad entre los alumnos de secundaria en China, el objetivo de este estudio fue evaluar la prevalencia de la obesidad en general chino, estudiante de la escuela secundaria.**

Métodos: **Publicaciones de 2009 a 2014 en la prevalencia de obesidad entre los estudiantes de la escuela secundaria en China fueron recuperados de PubMed, Online Chinese periódico de bases de datos de texto completo de VIP, CNKI y Wan Fang.Analista del meta fue utilizado analizar el total de las tasas de obesidad para chinos de la escuela secundaria.**

Resultados: **Después de la evaluación de la calidad de los artículos, 33 papeles fueron finalmente incluidos en nuestro estudio, y el total de los tamaños de muestra sobre la obesidad investigación fueron 218317 (107631 macho y 110686 hembra), en la que 27455 (14863 macho y 12590 mujeres) fueron la obesidad.Los resultados mostraron que el analista del meta la prevalencia de la obesidad en estudiantes de secundaria son 8,4% (IC del 95%: 6,2% - 11,3%) y 4,8% (IC del 95%: 3,2% - 7,2%) para chico y chica, respectivamente.**

Conclusión: **Nuestros resultados sugieren que la escuela y Gobierno related Departamento debería prestar más atención a la obesidad entre los estudiantes de la escuela secundaria en China, y tomar algunas medidas adecuadamente a la curva de la tendencia de crecimiento de la obesidad.**

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Palabras clave: *Estudiantes de secundaria. La obesidad. Prevalence. Meta-analysis.*

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Introduction

With the development of national economy and the improvement of people's living standard, there is rising prevalence of overweight and obesity in both developing countries and developed countries[1]. The rate of obesity has tripled in developing countries over the past 20 years as they rapidly become more urbanized, with increased consumption of high calorie foods and adoption of a more sedentary lifestyle[2].

Some studies reported that obesity is associated with breast cancer[3], asthma[4,5],diabetes mellitus[6,7], hypertension, coronary artery disease[8], and dental caries[9-11]. In addition, the obese suffer from social bias, prejudice and discrimination[12]. It is known that the prevalence of obesity in Chinese children and adolescents was considered to be still relatively low[13]. However, there is a paucity of data on prevalence of overweight and obesity in Chinese secondary school student.

Thus, we performed the meta-analysis to assess the prevalence of obesity for secondary school students in recently, so as to provide a basis for intervention to children obesity.

Materials and methods

Literature retrieval

Related publications on obesity released from 2009 to 2014 were retrieved online from the PubMed. Chinese periodical full-text databases of VIP, Wan fang and CNKI in compliance with the key words "Obesity, students, children, adolescents and China" in Chinese for Chinese database and in English for Pub Med. Full-texts were eligible to retrieve manually from the previous data.

Criteria

The entry criteria for the literature was consisted of:1)The papers on the obesity among college or university students in China published between January 2009 and June 2014; 2)Articles aimed at the discussion of the prevalence of obesity in the secondary school students of China. Exclusion criteria included: 1) The indicators described in the article were with fewer association or data being incomplete; 2) Repeated articles.

Literature screening and Quality assessment in process

Each study was assessed by two investigators independently, and the disagreements were resolved by expert assessment. Blind method was used to ensure quality. The related literatures were retrieved on the basis of the key words described previously, and initially selected through the title appraisal and scanning the abstracts. Full-text appreciation was carried out for the secondary selections. Data extraction was performed in papers verified eligibly. Evaluation of the article quality was made as meta-analysis of observational studies in epidemiology proposed Stroup DF, et al[14].

Statistical analysis

Meta Analyst for Windows[15] was used for performing meta-analysis. By heterogeneity test, the random-effect model was applied to merging sets of data and data analysis. The final data were subdivided into several groups for statistical analysis and chart description.

Results

Basic information and quality assessment of the articles

A total of 127 articles were retrieved from online Chinese periodical full-text databases of VIP , Wan fang database and CNKI well as Pub Med . Quality assessment was made by Meta-analysis of observatio-

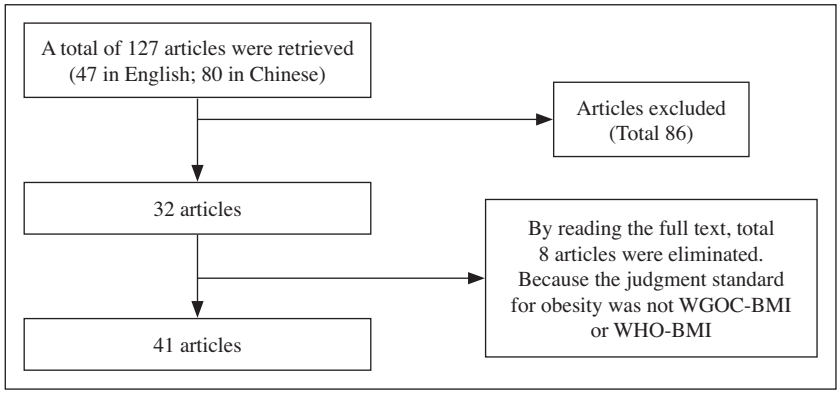

Fig. 1.—Flow Chart for the Literature Screening.

Table I
Main Characteristic of the Studies and the Detection Rate of Obesity among Secondary School Students in China

Author, year	*Obesity*			*Sample size (n)*			*Age*	*Geographical distribution*	*Criterion*
	Boys	*Girls*	*Total*	*Boys*	*Girls*	*Total*			
Xiaorong Hu, 2009[16]	248	189	437	5081	4898	9979	Junior high school	Jiangsu	WGOC-BMI
	155	54	209	5098	4878	9976	High school		
Juan Jin, 2009[17]	31	24	55	1656	1612	3268	Junior high school to university	Guangdong	WGOC-BMI
Xiaomin Zhang, 2010[18]	31	8	39	213	246	459	15~18	Shanghai	WGOC-BMI
Zhijie Xue, 2010[19]	49	35	84	584	513	1097	16~18	Neimenggu	WGOC-BMI
Weifeng Huang, 2010[20]	62	90	152	92	101	193	15~20	Beijing	WGOC-BMI
Ying Yang, 2010[21]	163	84	247	2151	2847	4998	13~18	Jilin	WGOC-BMI
Qiuming Sheng, 2010[22]	167	64	231	1737	1658	3395	13~15	Shanghai	WGOC-BMI
Yinghuan Xiong, 2010[23]	18	12	30	771	887	1658	High school	Jilin	WGOC-BMI
Qing Tang, 2011[24]	148	75	223	1459	1477	2936	13~18	Guangxi	WGOC-BMI
Xianghong Cao, 2011[25]	67	32	99	1810	1709	3519	13~18	Gansu	WGOC-BMI
Shizhong Jia, 2011[26]	23	10	33	747	653	1400	11~20	Gansu	WGOC-BMI
Yue Pan, 2011[27]	258	105	363	454	187	641	12~15	Beijing	WGOC-BMI
Yinhua Jin, 2011[28]	18	12	30	771	887	1658	17~19	Jilin	WGOC-BMI
Xia Peng, 2012[29]	127	133	260	2630	3151	5781	13~18	Yunnan	WGOC-BMI
Bin Hong, 2012[30]	125	66	191	1992	2183	4175	11~17	Shanghai	WGOC-BMI
Chunxia Hui, 2012[31]	275	205	480	1656	1792	3448	13~18	Neimenggu	WGOC-BMI
Jun Cui, 2012[32]	17	3	20	617	611	1228	13~17	Zhejiang	WGOC-BMI
Dan Zhang, 2012[33]	158	163	321	2657	2636	5293	13~17	Shanghai	WGOC-BMI
Yang Yang, 2012[34]	186	83	269	3511	3416	6927	13~18	Shanghai	WGOC-BMI
Xiaojing Liu, 2012[35]	54	16	70	600	600	1200	13~18	Xinjiang	WGOC-BMI
Ming Chang, 2012[36]	152	148	300	3692	3778	7470	13~18	Shanxi	WGOC-BMI
Yi Song , 2012[37]	10086	9809	19895	45511	47550	93061	12~18	China	WGOC-BMI WHO-BMI
Zhaocheng Zhang, 2012[38]	490	215	705	2993	2737	5730	High school	Jiangsu	WGOC-BMI
Ping Li , 2012[39]	31	8	39	1088	1019	2107	13~15	Sichuan	WHO-BMI (2007)
Meng Jia , 2012[40]	73	39	112	322	380	702	12~15	Beijing	WGOC-BMI
Meilin Dong, 2013[41]	108	46	154	199	186	385	13~16	Shanghai	WGOC-BMI
Xueliang Zhang, 2013[42]	33	31	64	407	408	815	14~18	Guangdong	WGOC-BMI
Xiaomei Lin, 2013[43]	71	15	86	885	431	1316	13~18	Fujian	WGOC-BMI
Jing Sun, 2013[44]	167	88	255	936	943	1879	12~13, 15~16	Beijing	WGOC-BMI
Ping Shi, 2013[45]	48	51	99	583	649	1232	13~17	Beijing	WGOC-BMI
Jun Qiu, 2013[46]	578	260	838	8149	8694	16843	12~18	Hunan	WHO-BMI
Shenglin Xia, 2014[47]	42	33	75	916	926	1842	12~18	Guangdong	WGOC-BMI

nal studies in epidemiology[14]. Of the 32 articles, the total sample sizes on the obesity investigation were 27455(14865 male and 12590 female). Figure 1 shows the process of literature screening and the basic information on the final articles are showed in table I.

Meta-analysis of the obesity prevalence among secondary school students in China

Heterogeneity test was carried out on the obesity detection rate, with a result of I^2=0.499, Q=1.00, suggesting that the research results in the 34 article were heterogeneous. Random-effect model was used to meta-analysis. As is shown by the forest plots (Fig. 2), the results suggested that pooled prevalence of boy obesity in secondary school students is 8.4% (95% CI: 6.2%-11.3%).

Heterogeneity test was carried out on the obesity detection rate, with a result of I^2=0.499,Q=1.00, suggesting that the research results in the 34 article were heterogeneous. Random-effect model was used for meta-analysis. As is shown by the forest plots (Fig. 3), the results suggested that pooled prevalence of girl

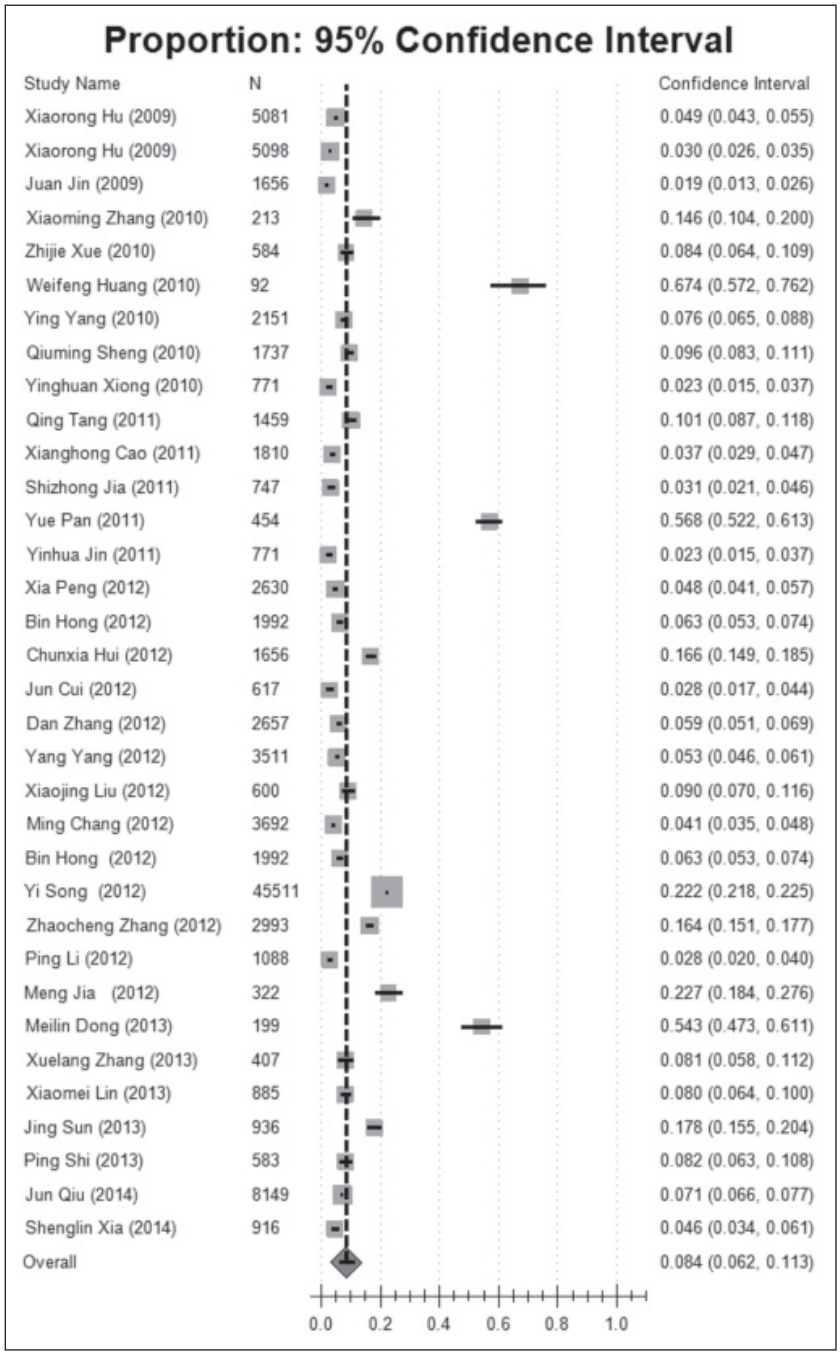

Fig. 2.—Forest plot of obesity rate for secondary students in boy.

obesity in secondary school students is 4.8 %(95% CI: 3.2%-7.2%).

Publication bias

Publication bias is a tendency on average to produce results that appear statistical significance on the part of investigator to submit, or the reviewers and editors, to accept manuscripts. Even though a potential threat in meta-analysis, it may be verified with funnel plots, which was applied to modifying the possible bias in our literature selection. Verification by funnel plot (Figs. 4-5) shows that the literatures included were in better symmetry, suggesting less possibility of publication bias on the detection rate of obesity in China secondary school students.

Discussion

The results of presents Mata-analysis were based on 32 articles, which indicated that the obesity prevalence in China was still troublesome, the pooled prevalence

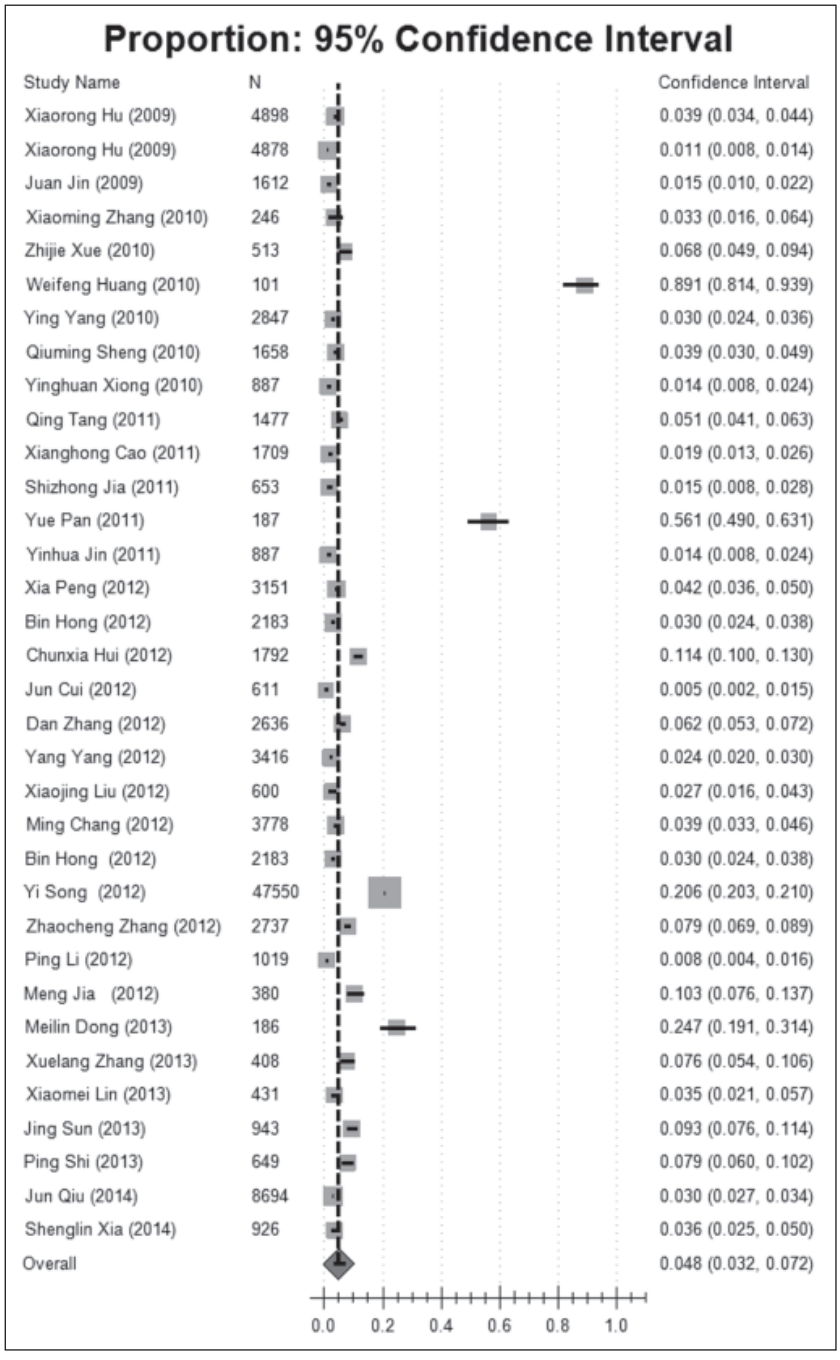

Fig. 3.—Forest plot of obesity rate for secondary school students in girl

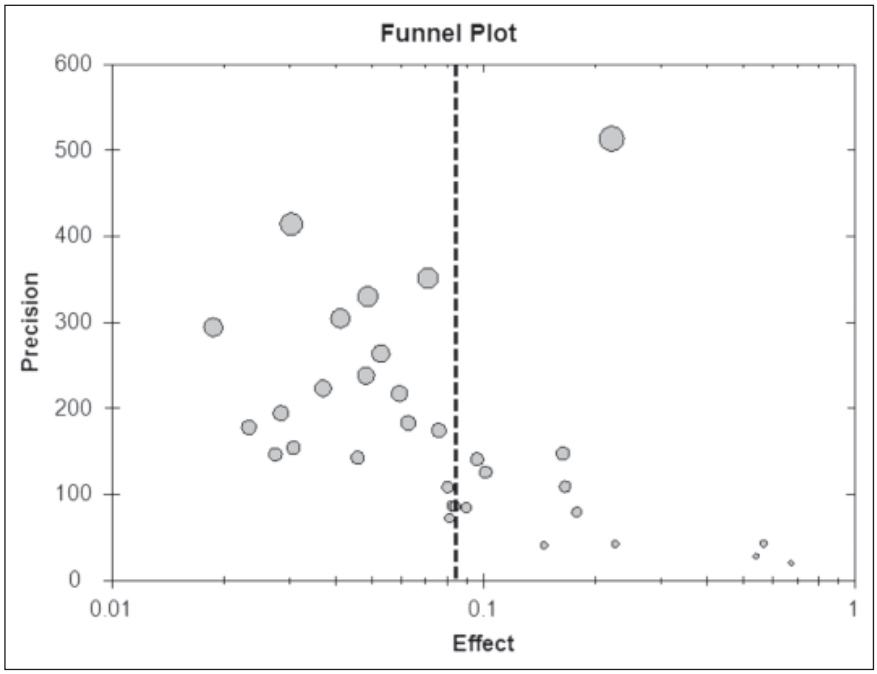

Fig. 4.—Funnel plot of obesity rate for secondary school students in boy.

of obesity in secondary school students is 8.4 %(95% CI: 6.2%-11.3%) and 4.8 %(95% CI: 3.2%-7.2%) for boy and girl respectively.boy obesity is twice times close to the rate of obese girls. The possible explanation maybe that boy is more important than girl in traditional Chinese thoughts, and parents pay more attention to health of boy. Lacking of knowledge for healthy lifestyle and healthy behavior, it is maybe another possible reason. Additionally, numerous modern vehicles were used in our daily life , which lead to reduce daily physical activities and a decrease in daily energy expenditure, and increase the prevalence of children obesity.

Although the figure by our study doesn't seem as high as previous reports in western nations, the prevalence of obesity in Mainland China is still arouse our attention. Obesity not only brings serious health problems but also huge financial burden to whole country. Our educational departments and health authorities should jointly take effective and practical measures,

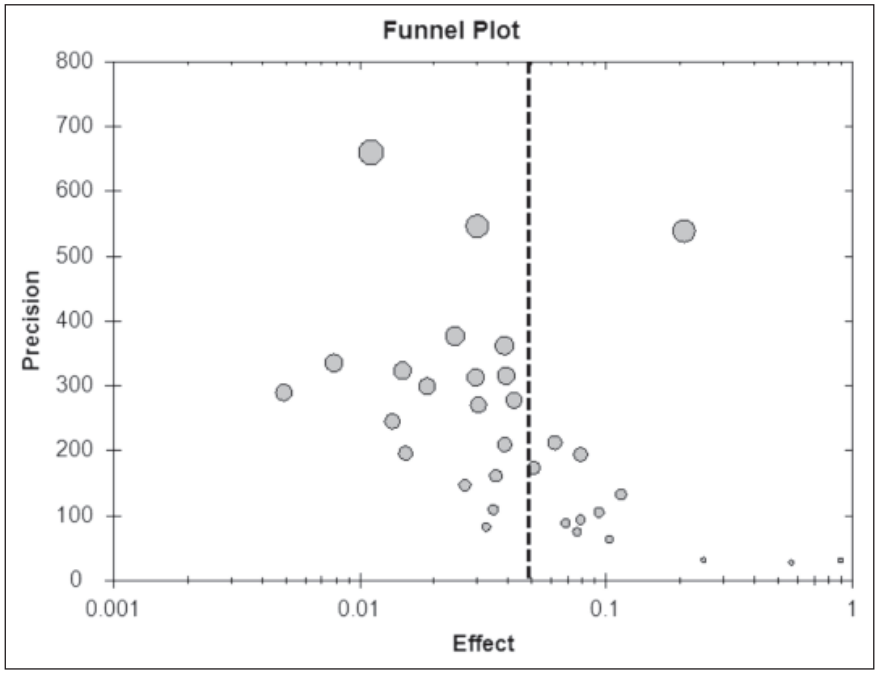

Fig. 5.—Funnel plot of obesity rate for secondary school students in girl.

such as health education and regular physical examination, to put it under control. Besides, parents should lead a healthy eating habit to the students, while students are encouraged to take more exercise and shape good living habits.

Limitations

This study provides a general situation of childhood obesity from 2009 to 2014 in China. The following limitations cannot be ignored: for example, we selected the article based on age range from 12 to 18 years, only published data are included, publication bias remains possible, relatively smaller sized samples from tends to weaken the validity of the results; and failure to exclude the genetic susceptibility as an important risk factor for childhood obesity in China. Therefore, more reliable obesity prevalence in secondary school students in China still needs further investigation.

Conclusion

Our results indicated that the obesity prevalence status in China was still troublesome, for the situation will be worse if we currently fail to take effective and practical measures.

Conflict of interest

None declared

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Disclosure of conflict of interest

The authors have no conflicts of interest to disclose.

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Original/*Pediatría*

Levels of eicosapentaenoic acid in obese schoolchildren with and without insulin resistance

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Abstract

Background: **Obesity in children is now an increasing health risk worldwide in which the insulin-resistance can be present. Studies have linked a diet rich in n-3 fatty acids with a lower prevalence of insulin-resistance.**

Objective: **To compare the levels of eicosapentaenoic acid among obese children with and without insulin-resistance.**

Materials and Methods: **In 56 randomly school-age children with obesity, insulin-resistance was determined by the homeostasis model assessment for insulin-resistance index and the serum levels of eicosapentaenoic acid were determined by gas chromatography. Insulin-resistance was established when the index was >6.0, non- insulin-resistance when that index was <1.4 and as an intermediate group when the index was within the range of 1.4-5.9. The serum levels of eicosapentaenoic acid were compared with the Kruskal-Wallis and Mann-Whitney U tests, as needed.**

Results: **No differences in age or sex were identified among the groups studied. The anthropometric parameters were significantly higher in the group of children with insulin-resistance than in the other two groups. The children with insulin- resistance had significantly lower levels of eicosapentaenoic acid than the non- insulin-resistance group [12.4% area under the curve vs. 37.4%, p = 0.031], respectively.**

Conclusion: **Obese primary school-aged children with insulin-resistance had lower plasma levels of eicosapentaenoic acid.**

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Key words: *Eicosapentaenoic acid. Insulin resistance. Obesity. Polyunsaturated fat. Schoolchildren.*

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NIVELES DE ÁCIDO EICOSAPENTAENOICO EN ESCOLARES OBESOS CON Y SIN RESISTENCIA A LA INSULINA

Resumen

Introducción: **La obesidad en los niños es un problema de salud pública en todo el mundo y la resistencia a la insulina puede estar presente. Existen estudios publicados que han relacionado una dieta rica en n-3 ácidos grasos con una menor prevalencia de resistencia a la insulina en sujetos obesos.**

Objetivo: **Comparar los niveles de ácido eicosapentaenoico en niños escolares obesos con y sin resistencia a la insulina.**

Métodos: **Se eligieron al azar 56 niños en edad escolar con obesidad, a los cuales se les determinó resistencia a la insulina mediante la evaluación del modelo de homeostasis para el índice de resistencia a la insulina y se determinaron los niveles séricos de ácido eicosapentaenoico por cromatografía de gases. La resistencia a la insulina se estableció cuando el índice fue> 6,0, no resistencia a la insulina cuando ese índice fue <1,4 y como un grupo intermedio cuando el índice estaba dentro del rango de 1.4 a 5.9. Los niveles séricos de ácido eicosapentaenoico se compararon entre los grupos estudiados con las pruebas de Kruskal-Wallis y Mann-Whitney U, según fue necesario.**

Resultados: **No hubo diferencias en la edad o el sexo entre los grupos estudiados. Los parámetros antropométricos fueron significativamente mayores en el grupo de niños con resistencia a la insulina que en los otros dos grupos. Los niños con resistencia a la insulina tenían niveles significativamente más bajos de ácido eicosapentaenoico que el grupo que no tenía resistencia a la insulina [área 12,4% bajo la curva frente a 37,4%, p = 0,031], respectivamente.**

Conclusión: **los niños en edad escolar obesos con resistencia a la insulina presentaron niveles plasmáticos más bajos de ácido eicosapentaenoico que los niños escolares obesos sin resistencia a la insulina.**

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Palabras clave: *Acido eicosapentaenoico. Resistencia a insulina. Obesidad. Grasas poliinsaturados. Escolares.*