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Prevalence and factors associated with Overweight and Obesity among adolescents aged 12-15 years in Longnan City, Gansu province, China

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ABSTRACT

Background: Body mass index of adolescents and children has risen rapidly so that the overweight and obesity rate has been significantly increased in social life, and it is now widely regarded as a serious global public health problem.

Objectives：This present study aimed to identify prevalence of factors associated with overweight and obesity among 12–15-year-old adolescents and children in Longnan City, Gansu Province.

Methods：A total 620 of students from Nine schools in Longnan City were selected and questionnaire survey was done in each school. Participants were selected as students from each school to investigate the influencing factors associated with overweight and obesity among them. Multiple logistic regression model considering backward elimination has been used for analysis.

Results: A total of 620 adolescents and children were investigated in this study. Multiple logistic regression model results demonstrated that the risk of obesity was higher in males (AOR=3.47, 95% CI:2.27-5.31) than in females. Statistically, eating fast food (AOR=1.65, 95% CI:1.05-2.58), chocolate (AOR=2.07, 95% CI:1.31–3.27) , not participating in weekly exercise (AOR=1.58, 95% CI:1.05–2.39), lack of weekly exercise time (AOR=2.75, 95% CI:1.20–6.31), and not eating fruit (AOR=1.53, 95% CI:1.01–2.32) were significantly associated with childhood obesity. Children living in cities (AOR=1.80, 95% CI:1.20–2.70) were more likely to be obese than those living in rural areas, and that children with a family genetic history of obesity (AOR=2.20, 95% CI:1.36–3.56) were also at risk of developing obesity.

Conclusion：In Longnan City, boys are more prone to be obese than girls. Eating behavior, number of exercises, length of exercise, area of residence and family genetic history are the main influencing factors for overweight and obesity in adolescents and children. Raising awareness, promoting healthy eating habits, and implementing policies are crucial to prevent and reduce overweight and obesity among adolescents and children.

Keywords: Adolescent, Overweight, Childhood, Obesity

1. Introduction

In recent decades, the prevalence of overweight and obesity has risen rapidly around the world, becoming a major public health concern in various fields internationally [1].

The rapid development of the economy and lifestyle resulted in a rapid increase in overweight and obesity rates among children and adolescents [1]. The prevalence of overweight and obesity among children and adolescents has widely increased worldwide, making it one of the most common chronic disorders in this age group and in adulthood [2]. It is of great importance to understand the prevalence of adolescent obesity and find out the factors related to obesity to improve adolescent health. This study aimed to understand the status quo of obesity among 12 -15-year-old in Longnan City, Gansu Province, China, and to identify factors associated with overweight and obesity. This study provided reliable basis and advice for preventing overweight and obesity in adolescents.

2. Methods

2.1 Study area

The research was conducted among 12–15-year-old adolescents and children in Longnan City, Gansu Province. All the subjects signed informed consent and the statement of the researcher/consenter, excluding 10 subjects who could not participate in the survey, a total of 620 subjects were included.

2.2 Study design

The data was used from the project "Epidemic Status and Influencing Factors of Overweight and Obesity among 12–15-year-old adolescents in Longnan City of Gansu Province". A multi-stage stratification cluster random sampling method determined the nine regional survey sites (such as Wu Du District, Cheng Zhou, Wen Xian County, Tan Chang County, Kang Xian County, Xi He County, Li Xian County, Hui Xian County and Liang Dang County) in Long Nan City of Gansu Province, China. A middle school was randomly selected from each county (district) survey site, and the researchers in charge of the project conducted physical survey and questionnaire survey.

BMI was calculated by dividing weight in kilograms by height in meters squared (kg/m^2). Children's overweight and obesity were defined by using the Working Group of Obesity in China (WGOC) criteria [3,4].

2.3 Data Collection

Online questionnaire survey (the respondents assisted by their guardians) were collected.

1. Data collection and distribution: Trained staff used the uniform data collection protocols and procedures to be distributed uniformly to participating schools;
2. Unified physical examination equipment: Trained staff unified medical examination equipment to be distributed uniformly to participating schools;

3. Adopt unified assessment standards and systems: the study established unified training and assessment standards and systems for data acquisition personnel, established unified assessment procedures, and issue entry certificates to qualified data acquisition personnel.

2.4 Standard of measurement

According to the standard measuring procedure, the height of primary and secondary school students was measured using a standing height meter. The accuracy was closest to 0.1 cm when respondents took off their shoes and socks. Weight was measured using a physical examination scale with a maximum weight of 120 kg. The closest accuracy was 0.1g, with respondents wearing only ultra-thin clothes and no shoes or socks.

According to the BMI Screening and Classification Criteria for Overweight and Obesity in school-age children and adolescents in China formulated by Chinese Obesity Working Group (WGOC), body mass index (BMI) method (body mass index method, weight/height 2 (kg /m^2) was used [3].

$$BMI = \frac{weight\ (kg)}{[height(m)]^2}$$

2.5 Statistical analysis

Data were collated and analyzed using STATA version 13 Texas USA 2007 (copyright Khon Kaen University). Crude odds ratio (OR) and 95% confidence interval (CI) for each variable was obtained from simple logistic regression (bivariate analysis) to evaluate the independence of the observed associations, the variables with a value $p<0.25$ were simultaneously entered in a multiple logistic regression analysis. The backward elimination method was applied to consider fitting model. Statistical significance was deemed to be present when the p-value was less than 0.05.

2.6 Ethical Approval

The study obtained ethical approval from Ethical Review committee Khon Kaen University Centre for Research Ethics in

Humans under ethical exemption (HE-652262).

3. Results

3.1. Socio-demographic characteristics of sample.

The results showed that the proportion of male students (51.94%) was slightly higher than that of female students (48.06%). The average age was 12 years, 13 years, 14 years and 15 years, accounting for (25.16%), (26.29%), (22.74%) and (25.81%) respectively. The students mainly studied in the second grade and the third grade of junior middle school, accounting for 34.03% and 39.84% respectively; The height was concentrated in 150cm-170cm, accounting for 48.06% and 47.09%, respectively. The average height was 160.66 cm, with little difference in height. Most of the weekly pocket money is more than 300RMB (80.48%), and the annual income of the family is mainly distributed in 7000RMB -120000RMB and 190000RMB-250000RMB, accounting for 35.00% and 37.74%, respectively. The lowest income is 75600RMB. The highest income was 242,490 RMB, the average income was 157,635 RMB, and the variance was 48,195 RMB, indicating that the income of each family varied greatly. We also found that the times of eating fast food, chocolate and fruit etc. were roughly evenly distributed among 0 ~, 1 ~ 2, 3 ~ 4, accounting for (33.87%), (32.74%), (33.39%) (35.32%), (30.00%), (34.68%), (31.94%), respectively. (34.03%) and (34.03%) etc.; The number of weekly exercise participation and weekly exercise time was roughly evenly distributed between 0 ~, 1 ~ 2, 3 ~ 4, accounting for (35.00%), (31.29%), (33.71%), (5.00%), (8.71%) and (14.84%), respectively. However, the proportion of people who exercised more than 4 hours per week was 71.45%; The proportion in urban areas (48.71%) was slightly lower than that in rural areas (51.29%), and the proportion without family genetic history (81.13%) was higher than that with family genetic history (18.87%), and most families had no family genetic history of obesity (Table 1).

Table 1: Socio-demographic characteristics of sample (n = 620)

Characteristics	Number (n)	Percentage (%)
Gender		
Male	322	51.94
Female	298	48.06
Age group)year(		
12	156	25.16
13	163	26.29

Characteristics	Number (n)	Percentage (%)
14	141	22.74
15	160	25.81
Grade		
Grade one of junior high school	93	15.00
Grade two of junior high school	211	34.03
Grade three of junior high school	247	39.84
Freshman year of high school	69	11.13
Height (cm)		
150 – 160	298	48.06
161 – 170	297	47.91
171 – 175	25	4.03
Mean ± S.D.,	160.66 ± 5.32	
Median Min: Max =	(150: 175)	
Yearly income (RMB)		
70,000 – 120,000	217	35.00
130,000 – 180,000	169	27.26
190,000 – 250,000	234	37.74
Mean ± S.D. =	157,635 ± 48,195	
Median (Min: Max)	75,600: 242,490	
Weekly allowance (RMB)		
200 – 250	69	11.13
251 – 300	52	8.39
More than 300	499	80.48
Soft drink (week)		
0	211	34.03
1 – 2	199	32.10
3 – 4	210	33.87
Eat fast food (time a week)		
0	210	33.87
1 – 2	203	32.74
3 – 4	207	33.39
Eat puffed food (time a week)		
0	195	31.45
1 – 2	216	34.84
3 – 4	209	33.71
Eat chocolate (time a week)		
0	219	35.32
1 – 2	186	30.00
3 – 4	215	34.68
Eat chicken / fish / beef (time a week)		
0	197	31.77
1 – 2	209	33.71
3 – 4	214	34.52
Eat vegetables (time a week)		
0	199	32.10
1 – 2	209	33.71
3 – 4	212	34.19
Eat fruit		
0	198	31.94
1 – 2	211	34.03
3 – 4	211	34.03
Exercise times to week		
0	217	35.00
1 – 2	194	31.29

Characteristics	Number (n)	Percentage (%)
3 – 4	209	33.71
Exercise per week (Hour)		
0	31	5.00
1 – 2	54	8.71
3 – 4	92	14.84
More and more	443	71.45
Place of resident		
City	302	48.71
Rural	318	51.29
Family history of overweight / obesity		
No	503	81.13
Yes	117	18.87

3.2 Bivariate analysis of Adolescent obesity

Simple logistic regression was used to determine the correlation between each variable and obesity. The results showed that the boys (OR = 3.12, 95% CI: 2.09 - 4.68, p<0.001), and eat fast food (OR = 1.08, 95% CI: 1.19-2.73, p = 0.004), chocolate (OR = 2.24, 95% CI: 1.47 - 3.43,p<0.001), no fruit (OR=1.71, 95% CI: 1.17 - 2.50,p=0.006), no weekly exercise (OR=1.76, 95% CI: 1.21 - 2.56, p = 0.003), no movement time (hours) every week (OR = 2.72, 95% CI: 1.31-5.65, p = 0.009), live in the city (OR = 1.77, 95% CI: 1.22 - 2.58, p = 0.003) and family history of obesity (OR = 2.61, 95% CI: 1.69 - 4.01, p <0.001) and adolescent obesity (P<0.25) (Table 2).

Table 2: Bivariable analysis of factors associated with obesity (n=620)

Factor	Number	Obesity (%)	Crude OR	95% CI	P-value
Gender					< 0.001
Female	298	13.85	1		
Male	322	33.44	3.12	2.09 – 4.68	
Eat fast food					0.004
Did not eat	210	17.62	1		
Eat fast food	410	27.80	1.80	1.19 – 2.73	
Eat chocolate					<0.001
Did not eat	219	15.53	1		
Eat chocolate	401	29.18	2.24	1.47 – 3.43	
Eat fruit					0.006
Eat fruit	422	21.09	1		
Did not eat	198	31.31	1.71	1.17 - 2.50	
Exercise times to week					0.003
Exercise	403	20.60	1		
Did not exercise	217	31.34	1.76	1.21 - 2.56	
Exercise per week (Hours)					0.009
Exercise	589	23.26	1		
Did not exercise	14	45.16	2.72	1.31-5.65	
Place of resident					0.003

Factor	Number	Obesity (%)	Crude OR	95% CI	P-value
Rural	318	18.99	1		
City	302	29.33	1.77	1.22 - 2.58	
Family history of overweight / obesity					< 0.001
No	503	20.36	1		
Yes	117	40.00	2.61	1.69 - 4.01	

3.3 Multivariate analysis of adolescent obesity

The results showed that males (AOR=3.47, 95%CI: 2.27 - 5.31, p< 0.001) more likely to be obese than women; Eat fast food (AOR =1.65, 95%CI: 1.05 - 2.58, p=0.028), eat chocolate (AOR =2.07, 95%CI: 1.31 - 3.27, p=0.002), don't eat fruit (AOR =1.53, 95%CI: 1.301 - 2.32, p=0.044), no weekly exercise (AOR =1.58, 95%CI: 1.05 - 2.39, p=0.028) and no weekly exercise time (AOR =2.75, 95%CI: 1.20 - 6.31, p=0.017) were statistically significantly correlated with adolescent obesity. Children living in cities (AOR =1.80, 95%CI: 1.20 - 2.70, p=0.004) were more likely to be associated with obesity than children living in rural areas, and children with a family history of obesity (AOR =2.20, 95%CI: 1.36 - 3.56, p=0.001) were also at risk of becoming obese. (p<0.05 was statistically significant) (Table 3).

Table 3: Multivariable analysis of factors associated with obesity (n=620)

Factor	Number	Obesity (%)	Crude OR	Adjust OR	95% CI	P-value
Gender						< 0.001
Female	298	13.85	1	1		
Male	322	33.44	3.12	3.47	2.27 – 5.31	
Eat fast food						0.028
Did not eat	210	17.62	1	1		
Eat fast food	410	27.80	1.80	1.65	1.05 – 2.58	
Eat chocolate						0.002
Did not eat	219	15.53	1	1		
Eat chocolate	401	29.18	2.24	2.07	1.31 – 3.27	
Eat fruit						0.044
Eat fruit	422	21.09	1	1		
Did not eat	198	31.31	1.71	1.53	1.01 – 2.32	
Exercise times to week						0.028
Exercise	403	20.60	1	1		
Did not exercise	217	31.34	1.76	1.58	1.05 – 2.39	
Exercise per week (Hours)						0.017
Exercise	589	23.26	1	1		
Did not exercise	14	45.16	2.72	2.75	1.20 – 6.31	
Place of resident						0.044
Rural	318	18.99	1	1		
City	302	29.33	1.77	1.80	1.20 – 2.70	
Family history of overweight / obesity						0.001
No	503	20.36	1	1		

Factor	Number	Obesity (%)	Crude OR	Adjust OR	95% CI	P-value
Yes	117	40.00	2.61	2.20	1.36 – 3.56	

4. Discussion

In our present study, it is further verified that overweight and obesity of adolescents in Longnan City, Gansu Province are strongly associated with gender, eating fast food, eating chocolate, eating fruit, weekly exercise time, weekly exercise time (hours), living area and family history of obesity. Moreover, the results showed a strong association between gender and weight, with boys having a much higher obesity rate than girls. as most boys' food intake is much higher than that of girls, and boys have more of a preference for meat and potato food, which is related to overweight and obesity [1].

Affluence and abundance of food are also accelerators of obesity. Teens in our study who ate fast food or chocolate had a higher risk of being overweight and obese. Because high-fat, high-cholesterol foods are more likely to cause fat accumulation [1]. These foods are the main cause of weight gain. On the contrary, fruit is generally considered a high fiber, low-calorie, low-fat food, regular consumption can increase intestinal motility ability, promote intestinal digestion, rid the body of excess fat. A survey showed that the detection rate of obesity in children and adolescents with western diet pattern (17.1%) was significantly higher than that with traditional diet pattern (9.2%)[5]. Eat more vegetables, Nuts, fruits and high-fiber foods are the main protective factors for overweight and obesity in children and adolescents [5].

Moreover, the results of this study showed that adolescents who did not participate in exercise and did not devote time to exercise had a significantly higher obesity rate than those who actively participated in exercise and those who could devote time to exercise, and the obesity rate between them was almost double. One study from China described that exercise is considered as one of the most effective external ways to lose weight and control obesity and especially, aerobic exercise is considered the best exercise weight loss program [6]. This is because the levels of glucagon, thyrotropin and adrenocorticotropin rise during exercise. It activates enzymes in the cell membrane of fat. Thus, promoting adipose tissue mobilization, decomposition and oxidation for energy, reducing fat synthesis [6]. However, the combined effects of insufficient physical activity and sedentary time have led to an

increasing incidence of overweight and obesity in children and adolescents [5].

The results illustrated that the overweight and obesity rate of urban children is higher than that of rural children. This may be because the higher the urbanization is, the easier it is to meet the food requirements of children. The weekly intake of fish, meat, soy products, dairy products, fruits, vegetables, etc. is significantly higher in urban areas than in rural areas, which leads to far more overweight and obese children in cities than in rural areas [1]. Family genetic history is also an important factor affecting overweight and obesity in children. The results demonstrated that having two overweight and obese parents is a risk factor for developing overweight and obesity in adolescents, and the risk of developing overweight and obesity in adolescents with both overweight and obese parents is 3.95 times higher than that of adolescents with neither overweight or obese parents. Clearly, family genetic history has a significant effect on children and adolescents [7].

This study has many limitations. We used the secondary data from “Epidemic Status and Influencing Factors of Overweight and Obesity among 12–15-year-old adolescents in Longnan City of Gansu Province”. Therefore, some cofounding factors and covariates cannot be added or removed in the study. There might be some recall bias on the eating history and exercise history. Moreover, interviewer bias and measurement bias can be detected in the study. However, this is first study to identify the prevalence of obesity and pinpoint the causes of overweight and obesity in youth aged 12 to 15 in Longnan City, Gansu Province, China. It will assist the program planner in creating a strategic plan to deal with the circumstances already outlined.

5. Conclusions

Therefore, the phenomenon of overweight and obesity among teenagers in Longnan City of Gansu Province cannot be ignored. In addition to human attributes, dietary behavior, exercise behavior and genetic factors are also important factors affecting adolescent overweight and obesity. Therefore, the prevention and control of adolescent overweight and obesity is an urgent task for the whole society. The government should ensure the compliance of high-calorie foods on the market, increase and promote the number of low-calorie, low-fat and zero-added compliant foods on the market, but should not prohibit the circulation of these foods in the market. Schools should increase the time of physical exercise by means of video broadcast, school radio publicity and

increasing the arrangement of PE class. Families should remind adolescents of the risks brought by excessive consumption of high-calorie food, improve their awareness of unhealthy diet, and recommend adolescents to eat more high-fiber, low-fat, low-calorie food in daily life. By adopting the above suggestions and measures, the whole society will play a positive and effective role in the process of preventing and reducing overweight and obesity among adolescents and children.

Although this study adopted real data and correlation analysis of influencing factors to understand the prevalence of overweight and obesity among children and adolescents aged 12 to 15 years in Longnan City, Gansu Province, China, and found out related influencing factors, there are still some limitations. Since this study only takes 12-15-year-old adolescents as part of the variables for analysis, it cannot effectively reflect the overall situation. Therefore, such research can consider more aspects of data collection and analyze more variables for research.

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Conflict of Interest

The authors declare that they have no competing interests

Reference

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