

**A Study on Risk Factors and Awareness Level of Type 2 Diabetes
Mellitus among Chinese Adolescents**

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Abstract

Objective: To understand the cognitive level of Chinese adolescents on type 2 diabetes, and to formulate targeted health education strategies and intervention measures for the effective prevention and control of type 2 diabetes.

Patients and methods: The method of stratified cluster random sampling is adopted in this study. A questionnaire survey was conducted among 624 students from different schools in Chengde, China. Samples were collected from five different schools between April 2022 and October 2022. The target population was adolescent students of different ages and educational levels (including primary and junior high school students, senior high school student, college students and postgraduates).

Results: At present, Chinese adolescents' cognition level of type 2 diabetes is generally low, which is mainly manifested in three aspects: 1) there is insufficient awareness of the serious risks of type 2 diabetes. 2)

Adolescents lack a comprehensive understanding of certain risk factors that lead to type 2 diabetes. 3) Adolescents have insufficient knowledge of prevention and control of type 2 diabetes.

Conclusions: The basic reason for the low level of cognition of type 2 diabetes among Chinese adolescents lies in the serious neglect of health education of type 2 diabetes among Chinese adolescents over the years. In view of the serious threat to the life and health of adolescents caused by the trend of type 2 diabetes at a younger age, it is imperative to strengthen the health education of adolescents, especially the health education of Type 2 diabetes.

Keywords: Type 2 diabetes; Chinese adolescents; Awareness level; Countermeasures and suggestions

Introduction

Type 2 Diabetes Mellitus (T2DM) is a chronic metabolic condition characterized by hyperglycemia [1]. About 500 million people worldwide are affected by diabetes, which is expected to become the seventh leading cause of death worldwide by 2030 [2,3]. As a complex chronic disease, type 2 diabetes continues to be prevalent all over the world and has become a global public health problem. The consensus of the World Health Organization, the American Diabetes Association, the World Diabetes Foundation and other authoritative organizations on curbing the epidemic of type 2 diabetes is that only prevention and intervention can slow down and fundamentally curb the occurrence and development of type 2 diabetes [4]. In 2006, the United Nations designated 14 November as World Diabetes Day to raise public awareness of diabetes, an epidemic killer, and draw public attention to this chronic disease [5]. In recent years, domestic and foreign data show that the prevalence of type 2 diabetes presents a trend of younger people [6-8], which has posed a serious threat to the healthy growth of adolescents. Now a day, with the increase of obesity, the prevalence rate of type 2 diabetes among adolescents around the world has increased significantly, and the prevalence rate of type 2 diabetes among Chinese adolescents has also increased to 4.2% [9]. In view of the severe situation of the prevention and control of type 2 diabetes in China, many domestic experts and scholars have investigated and studied the effective prevention and control of type 2 diabetes. For example, Han Yu et al. [10] proposed the idea that "health education is the leader to prevent and control diabetes in children and adolescents". Rongli Qian et al. [5] pointed out the urgency of health prevention and education for children and adolescents in view of the trend of type 2 diabetes at a younger age. Chuye Wang (2017) [11], a senior high school student, believed that health education was one of the effective measures to prevent diabetes, and advocated that primary and middle school students should voluntarily publicize diabetes knowledge from themselves. Yige He et al. [12] believe that it is

an effective way to effectively prevent and control diabetes to comprehensively carry out accurate health science popularization education. The Guidelines for the Prevention and Treatment of Type 2 Diabetes in China (2020 Edition) clearly put forward the implementation of tertiary prevention of type 2 diabetes, among which the primary prevention strategy is to carry out health education for specific groups and improve public awareness and participation in the prevention and treatment of diabetes [13]. Based on the serious harm of type 2 diabetes and the prevalence of young people, it is of great significance to investigate the cognitive level of type 2 diabetes among adolescents. In this study, students of different educational levels were selected as the research objects, and relevant studies were carried out on adolescents' risk awareness and prevention and control knowledge level of type 2 diabetes. Simultaneously, this paper analyzes the factors that lead to teenagers' lack of knowledge of diabetes prevention and treatment, and puts forward the corresponding countermeasures.

Methods

Survey object

The study subjects were students from primary school to graduate school in Chengde, China. Data for the study was collected from five randomly selected schools in Chengde, China, between April 2022 and December 2022. The target population is aged 10-25 years old.

Questionnaire Preparation

Based on previous research and guidelines, a standard questionnaire was developed following a comprehensive literature review. The questionnaire is divided into two parts: the first part is the survey of teenagers' cognition level of the serious harm of type 2 diabetes. The second part of the questionnaire is to investigate the adolescents' knowledge of prevention and control of type 2 diabetes.

Data Collection

Questionnaires are distributed on site and collected on site. The study excluded participants whose questionnaires were broken and unclear. After unified training, all investigators collected participants' data, and the third investigator verified the collected results, excluded invalid questionnaires, completed data sorting by using the double-entry method, and comprehensively reviewed the data logic.

Statistical Analysis

All statistical processing was performed on SPSS22.0 statistical software. Statistical data were represented by n (%) and compared with χ^2 test or Fisher exact test. $P < 0.05$ was considered statistically significant.

Results

A total of 689 participants agreed to participate in the study; Sixty-five participants had incomplete data and were excluded. Data from the remaining 624 participants were analyzed. The results were shown in **Table 1**: 382 (61.2%) were male, 242 (38.8%) were female, 186 (29.8%) were aged 6-15 years old, 438 (70.2%) were aged 16-25 years old, 186 (29.8%) were primary and junior high school students, 96 (15.4%) were senior high school student, 273 (43.8%) were college students and 69 (11.0%) were graduate students. Non-smoking students make up the majority (n=517, 82.9%). The percentage of people who have never heard of diabetes is small (n=87, 13.9%). In terms of exercise status, most participants chose to exercise irregularly (n=265, 42.4%). Normal weight is 253 (40.5%), 186 (29.8%) were overweight and 73 (11.7%) were obese. 54 (8.6%) students had a family history of diabetes.

Table 1: Demographic information of participants (n=624).

Item	Categories	N (%)
Gender	Male	382 (61.2%)
	Female	242 (38.8%)
Age	6-15	186(29.8%)
	16-25	438 (70.2%)
Education level	Elementary and junior high school	186 (29.8%)
	Senior high school	96 (15.4%)
	College	273 (43.8%)
	Graduate	69 (11.0%)
Smoker	Yes	107 (17.1%)
	No	517 (82.9%)
Heard about DM	Yes	537 (86.1%)
	No	87 (13.9%)
Physically active	Yes	104 (16.7%)
	No	155 (24.8%)
	irregularly	365 (58.5%)

BMI	Underweight	112 (17.9%)
	Normal	253 (40.5%)
	Overweight	186 (29.8%)
	Obese	73 (11.7%)
Family history of diabetes	Yes	54 (8.6%)
	No	570 (91.3)

In order to understand the cognitive level of Chinese adolescents on the harm of type 2 diabetes, we conducted a questionnaire survey with the title of "How much do you know about Type 2 diabetes". The survey results are shown in **Table 2**. Most participants (537, 86.1%) thought diabetes was a common disease. But very few people (38, 6.1%) knew much about the risks of diabetes. More than half of the participants did not know how many types of diabetes there were, and only 21.1% participants knew that type 2 diabetes accounts for more than 90% of all diabetics. It follows that most people do not know enough about the type 2 diabetes epidemic. Most participants (502, 80.4%) did not understand that diabetes cannot be cured. This shows that most adolescents do not know enough about the serious dangers of diabetes. In addition, 48.9% of the participants did not know that diabetes can be inherited, which once again confirmed the lack of sufficient awareness of the serious harm of diabetes among Chinese adolescents. With regard to the treatment cycle of type 2 diabetes, most people (540, 86.5%) believed that long-term treatment was required. This showed that most participants had some awareness of the serious dangers of diabetes. When it comes to complications from type 2 diabetes, most people (562, 90.1%) chose cardiovascular disease and 497 (79.6%) respondent chose uremia. But only 281 (45.0%) and 235 (37.7%) chose blindness and amputation, respectively. This again indicates that the respondents have a certain awareness of the serious harm of type 2 diabetes, but the awareness level is limited. When it comes to bad habits that can lead to diabetes, most participants chose lack of exercise (576, 92.3%), eating a lot of candy (536, 85.9%), and eating junk food (496, 79.5%). However, less than 60% of participants chose the other bad habits on the list, such as consuming more bakery items (306, 49%), drinking a lot of soft drinks (262, 42%) and smoking and drinking (249, 39.9%). This suggests that many of the bad habits that can lead to type 2 diabetes are still unknown to teenagers.

Table 2: Cognition level of type 2 diabetes among Chinese adolescents.

Item	Categories	N (%)
Diabetes is a common disease	Yes	537 (86.1%)
	No	87 (13.9%)
What do you know about the risks of diabetes	Much	38 (6.1%)
	General	530 (84.9%)
Do you know what types of diabetes there are? (Multiple choice)	Little	56 (9.0%)
	Type 1 diabetes	342 (54.8%)
	Type 2 diabetes	347 (55.6%)
	Gestational diabetes	156 (25.0%)
	All of the above	262 (42.0%)
	Unclear	103 (16.5%)
Do you know the proportion of type 2 diabetes in all diabetes	No understanding	413 (66.2%)
	20%	51 (8.2%)
	50%	28 (4.5%)
	More than 90%	132 (21.1%)
Are you aware that diabetes cannot be cured	Yes	122 (19.6%)
	No	502 (80.4%)
Did you know that diabetes can be inherited	Yes	319 (51.1%)
	No	305 (48.9%)
What do you think is the duration of treatment for type 2 diabetes	Long-term continuous therapy	540 (86.5%)
	Short-term treatment Obese	14 (2.2%)
	Unclear	70 (11.2%)
Do you know which of the following complications type 2 diabetes can cause (Multiple choice)	Cardiovascular diseases	562 (90.1%)
	Uremia	497(79.6%)
	Binocular blindness	281 (45.0%)
	Amputation	235 (37.7%)
Which of the following bad behaviors do you	Lack of exercise	576 (92.3%)

think can cause diabetes (Multiple choice)	Smoking and drinking	249 (39.9%)
	Drinking lots of soft drinks	262 (42%)
	Consuming lots of animal products	349 (55.9%)
	Eating lots of candy	536 (85.9%)
	Eating lots of junk food	496 (79.5%)
	Consuming more bakery items	306 (49%)
Did you know that type 2 diabetes is asymptomatic for a period of time	Yes	212 (34%)
	No	412 (66%)
Did you know that lifestyle changes are one of the three stages of treating type 2 diabetes	Yes	349 (55.9%)
	No	275 (44.1%)
Whether you are willing to receive health education about type 2 diabetes	Yes	558 (89.4%)
	No	66 (11.8%)
Whether the school has conducted health education on diabetes	Yes	188 (30.1%)
	No	436 (69.9%)
Which of the following sources have you learned about type 2 diabetes	Lecture	299 (47.9%)
	Brochure	249 (39.9%)
	Internet	370 (59.3%)
	Public service advertisement	263 (42.1%)
	Medical staff	244 (39.1%)
	Diabetic	300 (48.1%)
	Television and radio	178 (28.5%)
	Others	210 (33.7%)
How often do you measure your blood sugar	A week	4 (0.6%)
	One semester	74 (11.8%)
	More than one year	224 (35.9%)
	never	319 (51.1%)

Conclusion and Countermeasure Suggestion

Cognition level of type 2 diabetes among Chinese adolescents

Based on the previous investigation, it is found that Chinese adolescents' cognition level of type 2 diabetes is generally low at present, which is mainly manifested in three aspects:

- Insufficient awareness of the serious harm of type 2 diabetes among Chinese adolescents. For example, nearly 80% of respondents did not know that type 2 diabetes accounts for more than 90% of all diabetics; 80.4 % of the respondents did not know that type 2 diabetes cannot be cured and requires lifelong treatment. Most respondents were poorly informed about the serious complications of type 2 diabetes, which can lead to blindness, gangrene of the lower extremities and even amputation.
- Chinese adolescents lack a comprehensive understanding of some risk factors leading to type 2 diabetes. The survey found that adolescents currently have a certain understanding of risk factors for type 2 diabetes, but lack comprehensive understanding. For example, most respondents know that lack of exercise, obesity, poor diet and other factors can lead to type 2 diabetes, but they lack awareness of risk factors such as smoking and drinking, drinking lots of soft drinks and consuming more bakery items.
- Insufficient knowledge of prevention and control of type 2 diabetes among Chinese adolescents. For example, 412 (66%) respondents (**Table 2**) do not know that type 2 diabetes is asymptomatic for a period of time, that is, patients do not have any symptoms in the early stage of diabetes, but will continue to be quietly obese, and can only be found through physical examination that the blood sugar is consistently higher than the normal value. 275 (44.1%) respondents (**Table 2**) did not know that lifestyle changes are one of the three stages of treating type 2 diabetes.

Problems in health education of adolescents with type 2 diabetes

The basic reason for the low cognitive level of type 2 diabetes among Chinese adolescents lies in various problems in health education. Specific performance in the following aspects:

- Schools do not pay enough attention to health education

In the 1990s, China promulgated the "Regulations on School Health Work", which clearly stipulates that schools should organize health education activities, hold health lectures, distribute health education materials and other forms to enable children and adolescents and their parents to master the knowledge of disease prevention and

health. However, nearly 70% of the respondents said that the school had not carried out health education about diabetes. The survey also found that adolescents' knowledge of type 2 diabetes came mainly from the Internet, rather than from school health education or public lectures. In addition, through the survey of some primary and secondary school teachers, it is found that schools rarely or never hold health lectures. These fully reflect the serious neglect of health education in schools.

- The overall education level of parents is low, and the lack of health knowledge

School and family are the main ways for children and adolescents to acquire knowledge. Studies show that the knowledge level of children and adolescents with type 2 diabetes is proportional to the educational level of parents. According to the seventh national census in 2020, the illiteracy rate dropped from 4.08% to 2.67% compared to the sixth census in 2010. Although with the popularization of compulsory education, the cultural degree of our country gradually increased, but at present our average culture is still on the low level, the knowledge level of health aspect is correspondingly low. The low education level of parents and the lack of health knowledge make most children and adolescents lack of health education from their families.

- The health administration department does not supervise the school health work and does not implement health education in place

"Regulations on School Health Work" clearly stipulates that health administrative departments at or above the county level shall exercise the power of supervision over school health work. The administrative departments of health at various levels shall organize medical treatment and professional prevention and control institutions to conduct health examination, prevention and control of infectious diseases and correction of common diseases of students, and receive referral for treatment. However, the survey on the time interval of blood sugar measurement showed that 51.1% of participants never measured their blood sugar, while 35.9% chose more than one year. This shows that the health administration does not regularly urge and organize medical examinations for students. In addition, there is insufficient investment in the construction of primary and secondary school health care institutions. In order to supplement funds and ensure the smooth development of the work, the staff has to focus on the health technology services for students, and then earn funds. The final result is that primary and secondary health care institutions are unable to implement health education on prevention knowledge of common diseases and infectious diseases.

Countermeasures to further strengthen adolescent health education for type 2 diabetes mellitus

- Strengthen the emphasis on health education in schools, and do a good job in health education of type 2 diabetes.

The serious neglect of health education in schools leads to poor implementation of health education and further leads to the lack of correct understanding of the serious harm of chronic diseases such as type 2 diabetes among adolescents. The so-called "fearless of the ignorant", it is the young people's fear of type 2 diabetes, which makes them relaxed about the daily bad lifestyle habits (such as lack of exercise, love of snacks, high calorie diet, smoking, drinking, etc.), but they do not know that type 2 diabetes is a bad lifestyle disease in a sense. Therefore, we must strengthen the emphasis on health education in schools and do a good job in health education of type 2 diabetes. Specific implementation measures are as follows:

On the one hand, schools can regularly carry out health education activities on chronic diseases and common diseases, and the best time is during the parents' meeting, so that not only students can carry out health education, but also parents can popularize health knowledge. This measure is especially suitable for students in the lower grades, because students in the lower grades have relatively low understanding and may be difficult to understand some health knowledge, but parents will surely re-educate their children after having the relevant health knowledge, which can make up for the lack of school health education. On the other hand, schools can use physical education to popularize the knowledge of type 2 diabetes. If physical education teachers can spend 1-2 minutes before each physical education class to emphasize the serious harm of type 2 diabetes and the important role of exercise in preventing type 2 diabetes to students, then the cognitive level of type 2 diabetes in children and adolescents will be generally improved in a short time.

- Encourage medical college students to go to the countryside to carry out health education and practice activities for type 2 diabetes.

The lack of universal health knowledge is an important factor leading to the lack of health education for adolescents with type 2 diabetes. To solve this problem, it is necessary to strengthen the popularization of diabetes health knowledge, but it is far from enough to rely on medical staff to popularize diabetes health knowledge. Health education cannot be implemented due to the shortage of medical staff, especially the heavy task of primary medical care and the shortage of medical staff. Therefore, medical college students can be encouraged to carry out health education activities in rural areas to make up for the lack of health education popularization of type 2 diabetes at grassroots level. At the same time, it is also conducive to improving the practical ability and quality education of college students.

- Strengthen the supervisory role of health administration departments, and increase the capital input of school health technology services.

The fact that students do not receive regular health check-ups is a major failure of school health education, and

the fact that the health administration department, as the supervision department of school health work, fails to urge schools to make corrections in time is a strong proof of its inadequate supervision. In order to effectively prevent the occurrence of juvenile type 2 diabetes, it is necessary to give full play to the role of health administration departments, provide technical guidance for school health examination, and make students accept health examination regularly. In addition, inadequate funding for school health technology services makes it difficult to improve school health technology equipment and technology updating conditions, and further leads to inadequate health service capacity. School health technicians have no energy to carry out students' health education because of the lack of funds. They pay more attention to how to earn funds. Therefore, increasing the financial allocation of local governments to school health technology services is helpful to improve the status quo of school health education, which is conducive to the prevention and control of type 2 diabetes.

In conclusion, by investigating the knowledge level of adolescents with type 2 diabetes, this study found that the cognition level of Chinese adolescents with type 2 diabetes is generally low, and the fundamental reason lies in the serious neglect of health education for adolescents with type 2 diabetes over the years. Therefore, in view of the current lack of type 2 diabetes education, this study further proposed relevant intervention measures and optimization strategies. In view of the serious threat to the life and health of adolescents caused by the trend of type 2 diabetes at a younger age, it is imperative to strengthen the health education of adolescents, especially the health education of Type 2 diabetes. Young people are the future of the motherland and the hope of the nation. Paying attention to their healthy growth shows the foresight of a nation. Let us work together to popularize health education, popularize the knowledge of type 2 diabetes, and escort the healthy growth of young people.

Conflict of Interest

The Authors declare that they have no conflict of interests.

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Authors' Contribution

Conception or design: Zhiwei Yan. Data acquisition, analysis or interpretation: Ting Zhang, Sumei Xu, Yifan Zhao. Drafting the work or revising: Zhiwei Yan and Ting Zhang.

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