

Research Article

The Impact of Different Regions and Dietary Structures on Blood Glucose and Lipid Levels

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Abstract

Objective: To explore the effects of different regions and dietary structures on the blood glucose and lipid levels of residents. **Method:** 1220 examinees from Fenyang City, Shanxi Province were selected as the research subjects and included in the study group. In addition, 1225 examinees from Xinjiang Communist Youth League Farm were selected as the control group 1, and 1200 examinees from Wujiaqu City, Xinjiang Uygur Autonomous Region (limited to regular physical labor and light diet) were selected as the control group 2. Collect general information such as the regional situation and dietary structure of personnel in each group, and use a fully automated biochemical analyzer to detect blood glucose (GLU) and lipid indicators (including total cholesterol (TC) and triglycerides (TG)). Compare the levels of the above indicators and the differences in the abnormal detection rates of each indicator in each group. **The results:** The levels of GLU, TC, and TG in the study group were significantly higher than those in control group 1 and control group 2 [GLU (mmol/L): 5.30 ± 1.45 compared to 5.03 ± 1.50 , 4.18 ± 0.39 ; TC (mmol/L): 1.67 ± 1.20 compared to 1.58 ± 1.01 , 0.69 ± 0.36 ; TG (mmol/L): 5.02 ± 1.71 compared to 4.72 ± 1.17 , 3.19 ± 0.89], and the differences were statistically significant (all $P < 0.01$). The abnormal detection rates of GLU, TC, and TG in the study group were significantly higher than those in the control group 1 and control group 2 (GLU: 18.43% compared to 13.64% and 2.00%, TC: 35.43% compared to 28.42% and 0.00%, TG: 14.05% compared to 5.63% and 0.00%), and the differences were statistically significant (all $P < 0.01$). **Conclusion:** Regional differences and dietary structures are important factors affecting the blood sugar and lipid levels of residents. Balanced diet is beneficial for the stability of blood indicators and physical health of residents.

Keywords

Investigation and Analysis, Blood Sugar, Blood Lipids

1. Introduction

At present, due to the continuous improvement of people's living standards, the increasingly accelerated pace of work, the imbalance of residents' diet structure and excess nutrition, the increased intake of high calorie food and animal fat, as

well as environmental factors, people's blood sugar and lipid levels have increased, leading to the gradual (GLU) increase in the number of patients with diabetes and dyslipidemia. Due to the insufficient attention paid to this phenomenon, it

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has affected people's quality of life and physical health. In recent 10 years, the incidence rate of diabetes among Chinese residents has been rising, and the incidence rate of the disease in developing countries is far higher than that in developed countries. At present, there are many studies related to blood sugar and blood lipids, but there are still few studies that cross different regions and control individuals who strictly limit their daily physical labor and have a light diet. This study detected the blood glucose and lipid levels of residents undergoing physical examinations in Fenyang City, and compared them with those who underwent physical examinations at the Xinjiang Communist Youth League Farm and those in Wujiaqu City, Xinjiang Uygur Autonomous Region (who were limited to regular physical labor and light diet on a daily basis). The survey analyzed the current status of blood glucose and lipid abnormalities and related risk factors among residents in Fenyang City. The results are reported as follows.

2. Materials and Methods

2.1. Research Object Method

A retrospective study was conducted, collecting 1220 examinees from Fenyang City, Shanxi Province in August 2017 as the research group. 1225 examinees from Xinjiang Communist Youth League Farm during the same period were selected as the control group 1, and 1200 examinees from Wujiaqu City, Xinjiang Uygur Autonomous Region (who were limited to regular physical labor and light diet) were selected as the control group 2.

2.1.1. Inclusion Criteria

(1) Daily physical examination population in Fenyang City in August 2017, random physical examination population in Xinjiang Communist Youth League Farm, and Wujiaqu physical examination population in Xinjiang (limited to those who engage in regular physical labor and light diet on a daily basis); (2) Age range from 20 to 60 years old.

2.1.2. Exclusion Criteria

(1) Individuals who have previously been diagnosed with cardiovascular and cerebrovascular diseases and have taken medication; (2) Patients who take medication that affects blood sugar and lipid metabolism on a regular basis.

2.1.3. Ethics

This study meets the standards of medical ethics and has been approved by the Ethics Committee of our hospital (approval number: 20221118). All tests have been conducted with the informed consent of the subjects.

2.2. Diagnostic Criteria Diabetes Is Diagnosed According to International Standards [1, 2]

There are typical symptoms, that is, there are obvious "three more or less" (more food, more drink, more urine, body weight reduction), fasting blood glucose >7.0 mmol/L, or oral glucose tolerance test (OGTT) 2h blood glucose >11.1 mmol/L, or blood glucose in random detection >11.1 mmol/L, as long as one of the criteria can be diagnosed as diabetes; For individuals without typical symptoms, if occasionally tested for high blood sugar levels, such as fasting blood sugar >7.0 mmol/L, or random blood glucose >11.1 mmol/L, then diabetes cannot be diagnosed, and blood glucose needs to be retested. If the average blood glucose level is abnormal for more than two times, diabetes can also be diagnosed. The standard for abnormal blood lipid levels refers to the 2007 Chinese Guidelines for the Prevention and Treatment of Adult Blood Lipid Disorders [3]: Total cholesterol (TC) ≥ 6.19 mmol/L; Triacylglycerol (TG) ≥ 2.27 mmol/L.

2.3. Survey Content and Testing Methods

Collect information on the location of three groups of personnel (including environment, climate, customs, culture, etc.), as well as the dietary structure of the population. After fasting for 8-12 hours for all subjects, fasting venous blood was collected in the morning and centrifuged at 3000 r/min (with a centrifugation radius of 10 cm) for 10 minutes. The upper layer of serum was collected and stored in a refrigerator at 2-8 °C. Blood glucose and lipid levels were measured using a Toshiba TBA 2000 fully automatic biochemical analyzer within 48 hours. Glucose oxidase method is used to detect blood glucose levels, and enzyme method is used to detect the level of blood lipid formula indicators.

2.4. Observation Indicators

(1) Compare the blood glucose and lipid levels of three groups of physical examination population; (2) Compare the abnormal detection rates of hyperglycemia and hyperlipidemia among three groups of physical examination population.

2.5. Statistical Methods Were Used to Analyze the Data Using SPSS 22.0 Software

Normally distributed econometric data were expressed as mean \pm standard deviation ($\bar{x} \pm s$), and analysis of variance was used for inter group comparisons; The count data is expressed as a percentage, and the comparison between groups is performed using the chi square test. $P < 0.05$ indicates a statistically significant difference.

3. Results

3.1. General Information

There was no statistically significant difference in general information such as gender, age, and body mass index among different groups (all $P>0.05$).

3.2. Comparison of Blood Glucose and Lipid Levels in Each Group

The GLU, TC, and TG levels in the study group were sig-

nificantly higher than those in the control group 1 and control group 2, and the differences were statistically significant (all $P<0.01$). See Table 1.

3.3. Comparison of Abnormal Detection Rates of Blood Glucose and Lipid Indicators in Each Group

The abnormal detection rates of GLU, TC, and TG in the study group were significantly higher than those in the control group 1 and control group 2, and the differences were statistically significant (all $P<0.01$). See Table 2.

Table 1. Comparison of blood glucose and lipid test results among three groups of population ($x\pm s$) mmol/L.

Regional	examples	GLU (mmol/L)	TG (mmol/L)	TC (mmol/L)
Research group	1220	5.30 ± 1.45	1.67 ± 1.20	5.02 ± 1.71
Control group 1	1225	5.03 ± 1.50^a	1.58 ± 1.01^a	4.72 ± 1.17^a
Control group 2	1200	4.18 ± 0.39^{bc}	0.69 ± 0.36^{bc}	3.19 ± 0.89^{bc}

Note: a represents statistical significance between control group 1 and study group, b represents statistical significance between control group 2 and study group, and c represents statistical significance between control group 2 and control group 1.

Table 2. Detection rates of hyperglycemia and dyslipidemia in three groups of population (%).

Regional	examples	GLU	TG	TC
Research group	1220	18.43 (225)	35.43 (432)	14.05 (171)
Control group 1	1225	13.64 (167) ^a	28.42 (348) ^a	5.63 (69) ^a
Control group 2	1200	2.0 (24) ^{bc}	0 (0) ^{bc}	0 (0) ^{bc}

Note: a represents statistical significance between control group 1 and study group, b represents statistical significance between control group 2 and study group, and c represents statistical significance between control group 2 and control group 1.

4. Discussion

According to statistics, at present, the number of diabetes patients in China is close to 50 million, and the number of dyslipidemia has reached nearly 200 million. Human health is seriously threatened by diabetes and dyslipidemia. Diabetes is one of the three killers endangering human health [4, 5]. Hyperlipidemia plays an important role in the occurrence and development of atherosclerosis, which leads to serious cardiovascular and cerebrovascular events with high disability and mortality. In recent years, great changes have taken place in the lifestyle and diet structure of Chinese residents, both in urban and rural areas, resulting in the rising incidence rate of diabetes. At present, diabetes is also a common disease, and

the number of people with diabetes is growing rapidly [6]. The incidence rate of diabetes in China is as high as 10%, which has become a serious public health problem. Diabetes is characterized by great harm and long course of disease, and patients' own health behavior directly affects the development of the disease [7]. Dyslipidemia is one of the risk factors for the increased incidence of cardiovascular and cerebrovascular complications in diabetes patients, because the incidence of dyslipidemia in diabetes patients is significantly higher than that in non diabetes patients, [8]. The main causes of coronary atherosclerosis are abnormal lipid metabolism and glucose metabolism. In the prevention and treatment of cardiovascular disease, we should pay attention to the influence of multiple factors, of which the most common initiating factor is insulin resistance.

The results of this study showed that the blood glucose and

blood lipid test results (including the average level of indicators and the detection rate of abnormal indicators) of residents in Fenyang City were higher than those of residents in Xinjiang Communist Youth League Farm and those in Wujiaqu City, Xinjiang Uygur Autonomous Region (limited to regular physical labor and light diet), and the differences were statistically significant. The detection rate of abnormal blood lipid indicators in physical examination patients in Wujiaqu City is even 0, and the test results of all indicators are below the lower limit of the normal reference value range. There may be several possible reasons for the analysis.

4.1. Regional Differences Diabetes and Hyperlipidemia Have a Great Relationship with People's Living Areas

The residents of Xinjiang Communist Youth League Farm are located in a basin, with long summer sunshine, hot weather, and cold winter. The examinees in this group are mainly engaged in agriculture, with a heavier physical labor load than the urban population in Fenyang City. In addition, the rural population has a slower work pace and a lighter psychological burden than the urban population. Such an environment may have an impact on blood sugar and lipid indicators. There is research confirming that summer blood sugar levels are significantly lower than winter blood sugar levels, with significant seasonal changes. At the same time, blood sugar levels are negatively correlated with monthly temperature [9]. This study collected specimens during the hot summer season, with an average temperature in Xinjiang higher than that in Fenyang City. Glycosylated hemoglobin (Hb1Ac) shows a seasonal variation pattern. Higgins et al. [10] conducted a comparative analysis between equatorial countries and the northern and southern hemispheres, and the results showed that during cold weather, glycated hemoglobin is higher, and the seasons in both hemispheres affect glycated hemoglobin. Hb1Ac levels in Singaporean residents with small temperature differences throughout the year did not show significant changes throughout the four seasons. The urban population of Fenyang City is located in a temperate continental monsoon climate with distinct four seasons. Most residents are office workers, resulting in high work pressure, fast pace of life, and frequent occurrence of psychological diseases. In addition, office workers sit for long periods of time, exercise less, and engage in mental labor more than physical labor. For the reasons why the blood sugar and blood lipid levels of the examinees in Wujiaqu City are relatively low, considering that they engage in more physical labor, do not smoke or drink alcohol, which all lead to a lower abnormal rate of blood sugar and blood lipid indicators. The Xinjiang Communist Youth League Farm is located in a basin, and the blood sugar and lipid levels of this group of people are lower than those of Fenyang City, which is located in the plain. It is considered to be related to this.

4.2. Dietary Structure

Abnormal blood glucose and lipid indicators are closely related to the dietary habits of the population. Currently, with the improvement of people's living standards, the proportion of people who consume meat and poultry eggs has significantly increased. Especially, the staff of Xinjiang Communist Youth League Farm often consume a large amount of animal meat. The change in dietary structure has led to an increase in the intake of high sugar, high calorie, and high animal fat foods, resulting in an increase in the level of blood glucose and lipid indicators in the population. But they eat a lot of onions in their diet because onions have natural hypoglycemic and lipid-lowering effects. Therefore, it is considered that the blood sugar and lipid levels are lower than those of residents in Fenyang City, which may be related to it. Fenyang City, Shanxi Province is located in the north, and its residents consume pork, eggs, noodles, and other foods year-round, with relatively less intake of vegetables and fruits. In recent years, the rise of takeout has led to an increase in high sugar and high calorie diets among young people. The onset age of hyperlipidemia and diabetes is gradually younger, and the incidence rate is increasing year by year. The working population does not have time for gatherings during the day, and most of their eating time is concentrated in the evening. Overeating during dinner, coupled with increased frequency of smoking and drinking during gatherings, can lead to abnormal blood sugar and lipid levels over time. The diet of the examiners in Wujiaqu City mainly consists of low calorie and low-fat foods such as cabbage, potatoes, onions, and cabbage, with fewer dairy and meat and eggs. As for the relationship between diabetes and high sugar diet, studies have shown that 1376 subjects choose different sugar diets and analyze the relationship between diet and type 2 diabetes (T2DM). The results show that low or medium sugar diet is better than high sugar diet in controlling blood sugar in T2DM patients. The control of blood sugar level of patients is related to the degree of self diet sugar control, and low sugar diet can significantly reduce the incidence rate of T2DM [11, 12]. In addition, high-fat diet is another important factor leading to the occurrence of diabetes. Some studies have shown that 18527 subjects eating red meat will lead to an increased risk of diabetes, because red meat may cause a decrease in insulin sensitivity [13, 14]. In addition, in red meat processing, we do not recommend barbecue, which is the most unhealthy, and its harm is very great [15]. LI et al. [16] research results show that meat intake is one of the important factors in the increase of incidence rate of diabetes. Compared to 30 years ago, the intake of meat and edible oil by Chinese residents has significantly increased. According to the survey, among various risk factors inducing diabetes, obesity is an independent risk factor [17]. The summer in Xinjiang is hot, and the appetite of residents decreases. The body's metabolism is vigorous in the summer, resulting in a decrease in blood sugar levels. On the contrary, studies have shown that due to various climatic conditions,

dietary characteristics, lifestyle habits, and other comprehensive factors in different regions, blood sugar levels will be higher in summer than in winter [18]. It can be seen that a good diet structure will reduce the incidence rate of hyperglycemia and hyperlipidemia. Vegetarian diet can affect the prevention of T2DM and the control of patients' blood sugar levels, as well as reduce the incidence of cardiovascular complications in diabetes patients [19]. Meta analysis shows that vegetarianism can reduce the risk of diabetes [20]. The results of this study show that regional differences and different dietary structures are important influencing factors for abnormal blood glucose and lipid indicators, suggesting the importance of balanced diet in different regions. It further reveals the related risk factors of high blood glucose and lipid.

In summary, it is necessary to strengthen health promotion for the population, recommend moderate exercise, weight control, low-fat and low sugar diet, quit smoking and limit alcohol consumption. For those who are still unable to effectively control blood lipids and blood sugar, rational medication and scientific treatment should be selected. It is necessary to promote a healthy lifestyle and dietary structure, pay attention to good living habits, and do a good job in health care. Through intervention, achieve blood lipid standards, reduce the occurrence of obesity and hyperglycemia, and do a good job in prevention.

Abbreviations

OGTT	Oral Glucose Tolerance Test
GLU	Glucose
TC	Total Cholesterol
TG	Triacylglycerol

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Conflicts of Interest

The author declares that there is no conflict of interest.

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