Journal of Clinical and Nursing Research, 2025, Volume 9, Issue 4
http://ojs.bbwpublisher.com/index.php/JCNR
Online ISSN: 2208-3693
Print ISSN: 2208-3685

Exploring the Relationship between Obesity, Body Fat Percentage, Abnormal Blood Lipid Levels, and Prediabetes

Zhuangzhuang Luo[1], **Donglai Bao**[2]*

[1]Hangzhou City University, Hangzhou 310022, Zhejiang, China
[2]Yiwu Central Hospital, Yiwu 322000, Zhejiang , China

**Author to whom correspondence should be addressed.*

Abstract: *Objective:* To explore the relationship between obesity, body fat percentage (BF%), blood lipid levels, and prediabetes. *Methods:* A total of 91 patients with prediabetes who visited the hospital from February 2024 to February 2025 were included in the observation group, and 90 healthy individuals with normal blood glucose levels during the same period were included in the control group. Physical examination, body fat percentage, and biochemical indicators were checked, and the relationship between these indicators and prediabetes was analyzed. *Results:* The observation group had higher body weight (BW), waist circumference (WC), body mass index (BMI), fat mass (FM), total cholesterol (TC), low-density lipoprotein (LDL), triglycerides (TG), fasting blood glucose (FBG), and 2-hour postprandial blood glucose (2hPG) compared to the control group, with $P < 0.05$. The detection rates of obesity, abnormal WC, abnormal body fat percentage (BF%), abnormal TC, abnormal TG, and abnormal LDL were higher in the observation group than in the control group, with $P < 0.05$. Multivariate logistic regression analysis showed that WC, TC, TG, BF%, and BMI were independent high-risk factors for prediabetes, with $P < 0.05$. *Conclusion:* Obesity and dyslipidemia are high-risk factors for prediabetes. Scientific dietary planning and weight management should be implemented to reduce the incidence of diabetes.

Keywords: Prediabetes; Blood lipids; Body fat percentage; Obesity

Online publication: April 29, 2025

1. Introduction

Diabetes mellitus is characterized by defects in insulin function and inadequate secretion, which are related to reduced daily activity, changes in dietary structure, and variations in material living standards. It is a common chronic disease. Diabetes is a high-risk factor for cardiovascular and cerebrovascular diseases, and its incidence is closely associated with obesity. Obesity leads to excessive body fat, which in turn induces insulin resistance [1]. Additionally, the accumulation of excessive fat in the body can affect the body's metabolic function and increase the risk of metabolic diseases. Therefore, there is a correlation between changes in body fat percentage, blood lipid levels, and metabolic disorders [2]. Based on this, this article explores the relationship between obesity, body fat percentage, blood lipid levels, and prediabetes using a sample of 91 prediabetes patients and 90 healthy individuals who visited the hospital from February 2024 to February 2025.

2. Materials and methods

2.1. Materials

A total of 91 patients with prediabetes who visited the hospital from February 2024 to February 2025 were included in the observation group, including 46 males and 45 females, aged between 40–70 years, with a mean age of (54.19 ± 3.28) years. During the same period, ninety healthy individuals with normal blood glucose levels were included in the control group, consisting of 45 males and 45 females, aged between 41–69 years, with a mean age of (54.25 ± 3.36) years. The baseline data of the observation group were compared with those of the control group, with $P > 0.05$.

2.2. Inclusion and exclusion criteria

The inclusion criteria were: (1) The observation group met the criteria for prediabetes in the "Chinese Diabetes Prevention and Treatment Guidelines" [3]; (2) The control group had normal blood glucose levels; (3) Subjects provided informed consent.

The exclusion criteria included: (1) Abnormal liver or kidney function; (2) Urinary system diseases; (3) Cardiovascular diseases.

2.3. Methods

(1) Human body indicators: Ultrasonic physical examination machine was used to measure BW, WC, BMI (obesity defined as ≥ 24kg/m^2), and height (H). Body composition analyzer was used to determine BF% (abnormal defined as ≥ 35%) and FM.

(2) Serological indicators: Fully automated biochemical analyzer was used to detect TC (abnormal defined as > 5.72mmol/L), TG (abnormal defined as > 1.70mmol/L), LDL (abnormal defined as > 3.64mmol/L), high-density lipoprotein (HDL, abnormal defined as ≤ 0.91mmol/L), fasting blood glucose (FBG, normal range 3.9–6.1mmol/L), and 2-hour postprandial blood glucose (2hPG, normal defined as < 7.8mmol/L).

2.4. Statistical analysis

Data were processed using SPSS 21.0. Count data were tested using x^2 and recorded as percentages (%), while measurement data were tested using t-test and recorded as mean ± standard deviation (±s). Multi-factor logistic regression analysis was performed to explore the relationship between various indicators and prediabetes. Statistical significance was set at $P < 0.05$.

3. Results

3.1. Analysis of indicators in both groups

The observation group had higher BW, WC, BMI, FM, TC, LDL, TG, FBG, and 2hPG compared to the control group, with $P < 0.05$. See **Table 1** for details.

Table 1. Analysis of relevant indicators in both groups (±s,%)

Item	Observation group (n = 91)	Control group (n = 90)	t	P
BW(kg)	69.39 ± 1.28	63.82 ± 1.04	32.1100	0.0000
H(cm)	165.25 ± 3.26	164.87 ± 3.21	0.7901	0.4305
WC(cm)	86.29 ± 1.82	83.16 ± 1.21	13.6094	0.0000
BMI(kg/m^2)	25.31 ± 1.26	23.68 ± 1.01	9.5965	0.0000
FM(kg)	18.69 ± 2.11	16.08 ± 1.26	10.0896	0.0000
TC(mmol/L)	5.39 ± 0.26	5.25 ± 0.21	3.9826	0.0001
LDL(mmol/L)	3.15 ± 0.16	3.05 ± 0.13	4.6118	0.0000
TG(mmol/L)	1.69 ± 0.11	1.51 ± 0.10	11.5154	0.0000
HDL(mmol/L)	1.37 ± 0.32	1.41 ± 0.35	0.8026	0.4233
FBG(mmol/L)	6.35 ± 0.59	5.11 ± 0.57	14.3777	0.0000
2hPG(mmol/L)	8.24 ± 0.61	6.51 ± 0.58	19.5494	0.0000

3.2. Analysis of detection rates of obesity, body fat percentage, and dyslipidemia

The detection rates of obesity, abnormal WC, abnormal BF%, abnormal TC, abnormal TG, and abnormal LDL in the observation group were higher than those in the control group, with $P < 0.05$. See **Table 2** for details.

Table 2. Analysis table of detection rates of obesity, body fat percentage, and dyslipidemia(n, %)

Item	Observation group (n = 91)	Control group (n = 90)	x^2	P
Detection rate of obesity	62(68.13)	34(37.78)	16.7381	0.0000
Detection rate of abnormal WC	64(70.33)	32(35.56)	21.9677	0.0000
Detection rate of abnormal BF%	38(41.76)	6(6.67)	6.4950	0.0108
Detection rate of abnormal TC	42(46.15)	5(5.56)	30.2827	0.0000
Detection rate of abnormal TG	34(37.36)	4(4.44)	29.5607	0.0000
Detection rate of abnormal LDL	29(31.87)	3(3.33)	25.3149	0.0000
Detection rate of abnormal HDL	3(3.30)	2(2.22)	0.1945	0.6592

3.3. Multi-factor logistic regression analysis

Based on multi-factor logistic regression analysis, WC (waist circumference), TC (total cholesterol), TG (triglycerides), BF% (body fat percentage), and BMI (body mass index) were identified as independent high-risk factors for prediabetes, with a significance level of $P < 0.05$. The details are presented in **Table 3**.

Table 3. Multi-factor logistic regression analysis table

Indicator	β	SE	Wald x^2 value	OR value	95%CI	*P* value
WC	0.685	0.292	5.531	1.905	0.801-0.897	0.038
TC	0.627	0.294	4.602	1.858	1.053-3.284	0.033
TG	0.670	0.293	5.418	1.953	1.102-3.462	0.018
BF%	0.701	0.288	5.231	1.868	0.823-0.936	0.025
HDL	0.919	0.821	1.258	2.528	0.505-12.112	0.263
LDL	0.301	0.337	0.775	1.359	0.701-2.605	0.376
BMI	0.611	0.281	5.318	1.861	1.093-2.504	0.008

4. Discussion

Prediabetes refers to a condition where blood glucose levels are elevated but do not meet the diagnostic criteria for diabetes. However, at this stage, the body's blood glucose balance mechanism is disordered and unable to regulate blood glucose independently. Entering the prediabetes state, if FBG (fasting blood glucose) is between 6.1–7.0 mmol/L, it suggests impaired fasting glucose; if 2hPG (2-hour postprandial glucose) is between 7.8–11.1 mmol/L, it indicates abnormal glucose tolerance, which can increase the risk of developing diabetes. Clinically, lifestyle modifications can reduce the risk of prediabetes patients progressing to diabetes, making early identification of prediabetes extremely important.

Based on the data analysis presented in this article, the observation group had higher levels of BW, WC, BMI, FM, TC, LDL, TG, FBG, and 2hPG compared to the control group. Additionally, the detection rates of obesity, body fat percentage, and dyslipidemia were higher in the observation group ($P < 0.05$). These findings suggest that the obesity rate is higher among individuals with prediabetes compared to healthy individuals undergoing routine check-ups, indicating a close relationship between obesity and blood glucose fluctuations. Historically, BMI has been used as a basis for evaluating obesity in clinical settings, without fully considering the distribution of body fat and muscle content, which limits its ability to objectively reflect the obesity index.

Furthermore, while CT and MRI techniques can accurately assess obesity by scanning the area of visceral fat at the L4–L5 intervertebral disc, their high cost prevents them from being widely used as routine screening tools [4]. As research on obese populations continues to deepen, the BF% index has gradually been incorporated into obesity assessments. This index utilizes bioelectrical impedance technology to measure body fat content, addressing the limitations of BMI and providing precise feedback on the distribution of body fat, the extent of fat accumulation, and metabolic disorders. An increase in BF% may be associated with excessive fat content in obese individuals or a normal BMI but low muscle mass, leading to an increased proportion of fat content [5].

According to another set of data, multivariate logistic regression analysis identified WC, TC, TG, BF%, and BMI as independent high-risk factors for prediabetes ($P < 0.05$). The analysis suggests that WC is an important indicator for assessing obesity, particularly in individuals with central obesity who have excessive abdominal fat accumulation. This not only affects body aesthetics but also increases the release of toxic substances in the body, affecting insulin sensitivity and potentially leading to insulin resistance and increased diabetes risk. Additionally, long-term consumption of high-calorie and high-sugar foods in some individuals can contribute to continuous fat accumulation in the abdomen, further affecting blood glucose fluctuations [6]. Elevated TC levels can increase the risk of cardiovascular and cerebrovascular diseases, and since diabetes is a high-risk factor for these conditions, regulating TC levels can indirectly prevent diabetes. TG is closely related to the visceral fat index and provides feedback on the amount of fat stored in the body. If the lipid content exceeds the body's fat storage capacity, fat can be stored ectopically in other organs and cells, such as pancreatic beta cells, leading to impaired pancreatic cell function and potentially inducing diabetes [7].

BF% objectively reflects the proportion of body fat content. High BF% values suggest the presence of metabolic disorders and insulin resistance, thereby increasing the risk of diabetes. It is recommended that individuals with slightly elevated blood glucose levels maintain moderate exercise and follow a scientific diet to regulate body fat percentage and reduce insulin sensitivity, ultimately reducing the risk of diabetes [8]. BMI is a clinically important indicator for evaluating the degree of obesity. Higher BMI levels are associated with increased diabetes risk, which is related to insulin resistance commonly observed in obese individuals, leading to abnormal blood glucose levels. Obesity also increases the risk of metabolic disorders, further elevating the incidence of diabetes [9]. Therefore, scientific management and control of BMI are crucial for effective diabetes prevention.

5. Conclusion

In summary, individuals with prediabetes exhibit differences in obesity, body fat percentage, and lipid profiles compared to healthy individuals undergoing routine check-ups. Multivariate logistic regression analysis identified WC, TC, TG, BF%, and BMI as independent high-risk factors for prediabetes. Therefore, it is important for individuals with prediabetes to actively manage their weight, reduce BMI and BF%, and regulate their lipid profiles to lower the risk of developing diabetes.

Disclosure statement

The authors declare no conflict of interest.

References

[1] Ding Y, Wu X, Qin Y, et al., 2024, Study on the Relationship Between Lipid Accumulation Product and the Risk of Diabetes in Middle-Aged and Elderly People. Modern Medicine, 52(4): 515–522.

[2] Du H, Chen Z, Lin C, 2024, Correlation Analysis of Lipid Accumulation Product, Visceral Adiposity Index and Insulin Resistance in Healthy People Undergoing Physical Examination. Chongqing Medicine, 53(9): 1344–1347+1352.

[3] Chinese Diabetes Society, Zhu D, Guo L, 2025, Guidelines for the Prevention and Treatment of Diabetes in China (2024 Edition). Chinese Journal of Diabetes, 17(1): 16–139.

[4] Wu X, Wu J, Pang X, et al., 2023, Correlation Between Visceral Adiposity Index, Lipid Accumulation Product and Diabetic Cardiac Autonomic Neuropathy. Journal of Bengbu Medical College, 48(7): 954–959.

[5] Chen T, Zhao C, 2022, The Relationship Between Visceral Adiposity Index, Lipid Accumulation Product and Type 2 Diabetes. Progress in Clinical Medicine, 12(4): 3350–3355.

[6] Zhao L, Kang W, Wang Q, et al., 2022, Effects of Lipid Accumulation Product and Visceral Adiposity Index on Glucose Metabolism in First-Degree Relatives of Patients with Type 2 Diabetes. Clinical Focus, 37(9): 804–807.

[7] Shao Q, Wu Y, Jiang F, et al., 2022, The Relationship Between Lipid Accumulation Product and the Risk of Diabetes. Chinese Journal of Disease Control & Prevention, 26(2): 125–130 + 243.

[8] Wu D, Wang L, Tang C, et al., 2022, Correlation Analysis Between Cardiometabolic Index and Glucose Metabolism in Women with Gestational Diabetes One Year After Delivery. Practical Journal of Gynecological Endocrinology (Electronic Edition), 9(11): 9–13.
[9] Huang B, Liu J, Ji X, et al., 2021, The Relationship Between Lipid Accumulation Product and the Risk of Diabetes Among Adults in Rural Areas of Xinjiang. China Health Standard Management, 12(22): 9–11.