PREVALENCE OF PRE-DIABETES AND ITS RELATED FACTORS AT HOC MON GENERAL HOSPITAL IN 2023

Nguyen Tran Huu Tuan*, Lam Ai Lien*, Nguyen Thi Truc Chi*, Le Truong Vinh Phuc, Huynh Thanh Hau***

ABSTRACT

This study aimed to determine the prevalence of pre-diabetes among outpatients visiting Hoc Mon General Hospital and its related factors. A cross-sectional study was conducted on 617 patients visiting the Outpatient Department, Hoc Mon General Hospital from April 2023 to July 2023. Fasting plasma glucose test and HbA1c test were performed to indicate the patient's pre-diabetes status. Height, weight, waist, and hip circumference were measured by calibrated scales. The patient's socio-economic information and other potential risk factors were collected by a standardized questionnaire and confirmed by medical records. Among participants, the prevalence of pre-diabetes was 25.6%. High triglyceride levels (PR: 1.2 [95% CI: 1.04 – 1.3], p-value: 0.009), having hypertension (PR: 1.7 [95% CI: 1.1 – 2.4], p-value: 0.009), and having a family history of diabetes (PR: 1.4 [95% CI: 1.02 – 2.2], p-value: 0.037) were significant risk factors for pre-diabetes. Blood sugar level and blood pressure monitoring, and annual health examination are recommended for early detection of pre-diabetes and for the prevention of type 2 diabetes development. Hospital's health promotion programs focus on the importance of screenings and lifestyle changes are necessary to raise people's awareness about pre-diabetes, thus helping effectively manage the disease.

Keywords: *prevalence, pre-diabetes, related factors, Hoc Mon General Hospital.*

** Hoc Mon General Hospital*
*** University of Medicine and Pharmacy at Ho Chi Minh City*
Responsible person: Le Truong Vinh Phuc
Email: vinhphuc0104@gmail.com
Date of receipt: 5/8/2024
Date of scientific judgment: 9/9/2024
Reviewed date: 7/10/2024

I. INTRODUCTION

Pre-diabetes, a condition with blood sugar levels above normal but not yet diabetic, raises a significant public health concern recently. The International Diabetes Federation reports a six-fold increased risk of diabetes development for prediabetic individuals, along with rising healthcare costs. In 2021, an estimated 464 million people worldwide had pre-diabetes, putting them at high risk for developing the disease. The number is projected to rise significantly to 587 million people by 2045 [6]. Recent studies in Vietnam further emphasize the urgency, with a 2020 national survey revealing a pre-diabetes prevalence of nearly 18% among adults aged 30-69 [1].

Since 2020, Hoc Mon General Hospital has implemented Decision No. 3087/QĐ-BYT, promulgating the "Guidelines for diagnosis and treatment of pre-diabetes". This study aimed to determine the prevalence of pre-diabetes among the patients visiting Hoc Mon General Hospital and its related factors, thus suggesting solutions to improve screening and prevention strategies for pre-diabetes in specific, and contribute to better management of non-communicable diseases in the hospital in general.

II. METHODOLOGY

1. Time and location: from April 2023 to July 2023, at the Outpatient Department of Hoc Mon General Hospital.

2. Study subjects: patients attending the Outpatient Department of Hoc Mon General Hospital for routine medical examinations

and/or treatment. Patients were excluded if they had any of the following conditions: diagnosed with diabetes; had acute conditions such as hypertensive emergencies, acute coronary syndrome symptoms, or acute heart failure; had acute heart failure or stroke sequelae; had serious infectious conditions; inability to complete the questionnaire; declined participation.

3. Sample size and sample selection:

Using the formula for estimating proportional sample size:

$$n = \frac{z^2_{1-\alpha/2}\,\mathrm{p}(1-\mathrm{p})}{d^2}$$

with a desired margin of error of 5%, a significance level of alpha (α) set at 0.05, and a pre-diabetes prevalence of 61.17% referred from a recent study conducted among outpatients at E Hospital in 2021 [4], the minimum sample size of 365 participants was required. All participants who visited the Outpatient Department from April 2023 to July 2023 were continuously invited to join the study. In the end, a total of 617 participants were included in the study.

4. Method of data collection: Data was collected on weekday mornings at the Outpatient Department of Hoc Mon General Hospital. After giving consent, the participant's anthropometric indexes including height, weight, hip, and weight circumference were measured two times by standardized scales. Hypertension status was collected from the participant's report and confirmed by the electronic sphygmomanometer. Socio-economic information and other potential risk factors were collected by a face-to-face interviewing questionnaire. Fasting plasma glucose test and HbA1c test were also performed to indicate the participant's pre-diabetes status. Medical records, prescriptions, and test results were also reviewed to confirm information obtained by questionnaires.

Pre-diabetes was identified if the participant met any of the two criteria regulated by the Vietnamese Ministry of Health's 2020 Guidelines for diagnosing pre-diabetes: 1) Fasting plasma glucose between 5.6 mmol/L and 6.9 mmol/L, or 2) HbA1c from 5.7% to 6.4%. The body mass index (BMI) categories were classified according to the Asia-Parcific classification system by the World Health Organization as follows: underweight (below 18.5), normal (18.5–22.9), overweight (23–24.9), and obesity (25 or above). Hypertension was identified when participants reported "Yes" from the questionnaire, or the confirmed blood pressure measuring result of 140/90 mmHg or higher.

5. Data analysis

Data was entered by using Epidata software, statistical analysis was performed using SPSS software.

Descriptive statistical results are reported as frequency and proportion for qualitative variables, and mean and standard deviation for quantitative variables.

The Chi-square test was applied to examine the association between pre-diabetes and related factors. Fisher's exact test was applied if more than 20% of the total cells have expected value >5 or have cells with expected value <1. The multi-variable logistic regression model was applied to determine factors related to the prevalence of pre-diabetes.

The relationships between pre-diabetes and independence variables were quantified by prevalence ratio (PR) with a 95% confidence interval (CI). All analysis was reported at the statistical significance level of 0.05.

5. Ethical considerations: This study was approved by the Ethics Council of Hoc Mon General Hospital, ensuring adherence to ethical research guidelines. All participants provided informed consent after receiving a thorough explanation of the study procedures. Participation was voluntary, and participant retained the right to withdraw at any point without consequence or impact on their medical care. Participants received no incentives for participation. Confidentiality of participant information was strictly maintained. All personal information and medical records were anonymized using a numbering system and encryption to guarantee participant privacy. Medical records will be securely stored according to hospital protocols. Participants identified as having pre-diabetes were informed and counseled by a doctor for appropriate diet and exercise regimens and were scheduled for follow-up appointments.

III. RESEARCH RESULTS

Among 617 participants, the majority were male (38.6%), 60 or above years old (45.5%), and had a healthy BMI index (49.1%). A high percentage of fat belly (63.2%) and hypertension (54.2%) were observed. The laboratory tests identified 158 participants (25.6% of the total) being diagnosed with pre-diabetes. (Table 1).

Table 1. ***Participant's characteristics***

Characteristics	n = 617
Gender (male), n (%)	238 (38.6)
Age, mean (sd)	56.7 (13.2)
Age group, n (%)	
Under 45	103 (16.7)
45 – 59	233 (37.8)
60 or above	281 (45.5)
BMI, mean (sd)	23.1 (2.3)
BMI classification, n (%)	
Underweight	11 (1.8)
Healthy weight	303 (49.1)
Overweight	207 (33.5)
Obesity	96 (15.6)
Waist (cm), mean (sd)	85.1 (8.4)
Hip (cm), mean (sd)	94.8 (7.2)
Fat belly status (yes), n (%)	390 (63.2)
Fam. history of diabetes (yes), n (%)	232 (37.6)
Hypertension (yes), n (%)	334 (54.2)
Physical activity (yes), n (%)	64 (10.4)
Cholesterol (mmol/L), mean (sd)	5.3 (1.5)
Triglyceride (mmol/L), mean (sd)	2.1 (2.7)
***Pre-diabetes* (yes), n, %**	**158 (25.6)**

Table 2 shows the relationship between qualitative factors and pre-diabetes among participants. Male participants had a higher rate of pre-diabetes than female participants. Individuals in the 60 or above age group were significantly more likely to have pre-diabetes compared to younger age groups. A higher prevalence of pre-diabetes was found in participants with a family history of diabetes. The presence of hypertension was associated with an increased risk of pre-diabetes. Engaging in physical activity was associated with a higher risk of pre-diabetes. No statistically significant associations were found between pre-diabetes and BMI classification, or having a fat belly (p-value > 0.05).

Table 2. ***Relationship between pre-diabetes and qualitative variables (n= 617)***

Characteristics	Pre-diabetes		PR (95% CI)	p-value
	Yes (n= 158)	No (n=459)		
Gender				
Female	85 (22.4%)	294 (77.6%)	1	
Male	73 (30.7%)	165 (69.3%)	1.5 (1.1 – 2.2)	0.022*
Age group				
Under 45	16 (15.5%)	87 (84.5%)	1	
45 – 59	59 (25.3%)	174 (74.7%)	1.8 (1.00 – 3.4)	0.047*
60 or above	83 (29.5%)	198 (70.5%)	2.3 (1.3 – 4.1)	0.005**
BMI classification				
Healthy weight	71 (23.4%)	232 (76.6%)	1	
Overweight	58 (28.0%)	149 (72.0%)	1.3 (0.8 – 1.9)	0.242
Obesity	28 (29.2%)	68 (70.8%)	1.3 (0.8 – 2.2)	0.257
Underweight	1 (9.1%)	10 (90.9%)	0.3 (0.04 – 2.6)	0.184[a]
Fat belly status				
No	56 (24.7%)	171 (75.3%)	1	
Yes	102 (26.2%)	288 (73.8%)	1.1 (0.7 – 1.6)	0.684
Family history of diabetes				
No	87 (22.6%)	298 (77.4%)	1	
Yes	71 (30.6%)	161 (69.4%)	1.5 (1.04 – 2.2)	0.027*
Hypertension				
No	57 (20.2%)	225 (79.8%)	1	
Yes	101 (30.2%)	233 (69.8%)	1.7 (1.2 – 2.5)	0.005**
Physical activity				
No	135 (24.4%)	418 (75.6%)	1	
Yes	23 (35.9%)	41 (64.1%)	1.7 (1.01 – 3.0)	0.046*

[a]: Fisher's exact test: p-value < 0.05**: p-value < 0.01*

There was a statistically significant positive association between age and pre-diabetes. Higher triglyceride levels were significantly associated with a higher risk of pre-diabetes. BMI, waist circumference, hip circumference and cholesterol level did not show statistically significant associations with pre-diabetes (Table 3).

All potentially related factors from the univariate analysis were selected and analyzed with the multivariable logistic regression model. As the final accepted model (p-value < 0.001) shows in Table 4, a family history of diabetes (adjusted PR = 1.4, p-value = 0.037), and hypertension (adjusted PR = 1.7, p-value = 0.009) were significant risk factors. Higher triglyceride levels were also associated with an increased risk of pre-diabetes (adjusted PR = 1.2, p-value = 0.009).

Table 3. ***Relationship between pre-diabetes and quantitative variables***

Characteristics	PR (95%CI)	p-value
Age	1.02 (1.004 – 1.03)	0.011*
BMI	1.06 (0.98 – 1.14)	0.154
Waist	1.02 (0.99 – 1.04)	0.130
Hip	1.02 (0.99 – 1.04)	0.261
Cholesterol	1.07 (0.95 – 1.22)	0.254
Triglyceride	1.17 (1.05 – 1.31)	0.005**

: p-value < 0.05: p-value < 0.01*

Table 4. ***Multivariable logistic regression model of pre-diabetes and related factors***

Characteristics	Crude PR (95%CI)	p-value	Adjusted PR (95%CI)	p-value
Gender (male)	1.5 (1.1 – 2.2)	0.022*	1.4 (0.98 – 2.1)	0.064
Family history (yes)	1.5 (1.04 – 2.2)	0.027*	1.4 (1.02 – 2.2)	0.037*
Hypertension (yes)	1.7 (1.2 – 2.5)	0.005**	1.7 (1.1 – 2.4)	0.009**
Physical activity (yes)	1.6 (1.1 – 2.3)	0.011*	1.6 (0.9 – 2.8)	0.108
Trilyceride	1.2 (1.05 – 1.31)	0.005**	1.2 (1.04 – 1.3)	0.009**

: p-value < 0.05: p-value < 0.01*

IV. DISCUSSION

4.1 Prevalence of pre-diabetes

Our study found a number of 25.6% of participants were diagnosed with pre-diabetes. This result is higher than the number reported from the 2020 National Survey, in which 17.8% of Vietnamese adults aged from 30 to 69 were diagnosed with pre-diabetes [1]. Other studies conducted in community settings also reported a lower prevalence of pre-diabetes, at 18.5% [5] or 8.1% [8]. In comparison, individuals who seek medical care in the hospital have a greater tendency to underlying health conditions, e.g. pre-diabetes, than the general population. On the other hand, as same as other diseases, individuals with mild or no clear signs of prediabetic symptoms may lack interest in participating in health screening programs in the community, which may lead the pre-diabetes to be undiagnosed.

The prevalence of pre-diabetes, however, varies from studies conducted in different hospitals. The result from our study is lower than the study conducted in the Outpatient Department of Hospital E in 2021 (61.17% by Fasting plasma glucose criteria and 71.36% by HbA1c criteria) [4]. On the other hand, we found a higher prevalence than that reported in a study conducted on a military hospital [2]). The differences between studies may be explained by the differences between study populations. Hoc Mon Hospital is a general hospital, therefore the participants in our studies have a broader range of health conditions and risk factors; they may also suffer a lower severity of diseases than participants in a specialized hospital. In contrast, a healthier lifestyle, more regular medical checkups, physical activities, and stricter dietary may actively affect the prevalence of pre-diabetes among military participants. However, it is worth noting that the compatibility of our discussion is limited due to the lack of similar published data from general hospital settings.

4.2 Related factors of pre-diabetes

Results from the multivariable regression model found that high triglyceride levels, the presence of hypertension, and a family history of diabetes are associated with the high prevalence of pre-diabetes in our study. Among lipid markers, triglyceride is the single most significant factor associated with any level of type 2 diabetes, including pre-diabetes [7]. High triglyceride levels can also contribute to metabolic syndrome, which may cause insulin resistance and further increase the risk of pre-diabetes and type 2 diabetes. A previous study also confirmed the considerably higher pre-diabetes prevalence among individuals with hypertension compared to those with normal blood pressure [3]. Our findings are, therefore, consistent with existing literature

on the disease's risk factors. Besides the factors mentioned above, in low- and middle-income countries, the prevalence of pre-diabetes may also be influenced by a complex interplay of factors, including globalization, unhealthy lifestyles, lack of awareness, and limitations in pre-diabetes intervention programs.

V. LIMITATIONS

Due to the frequent overload of patients in the hospital's Outpatient Department, the oral glucose tolerance test could not be applied in our study, although it is one of the criteria for pre-diabetes diagnosis from the Ministry of Health guidelines. Therefore, the prevalence of pre-diabetes found in our study may be underestimated. This study provides data on the prevalence of pre-diabetes in a specific target population of patients at a Hoc Mon General Hospital; therefore, the study's generalization ability is limited. The lack of similar studies conducted in the different general hospitals may also reduce the compatibility of our comparisons and discussion.

VI. CONCLUSION

The prevalence of pre-diabetes among the participants was 26.5%. Individuals with high triglyceride levels, having a family history of diabetes, or having hypertension are recommended to monitor blood sugar levels and blood pressure frequently and actively engage in annual health examinations for early detection of pre-diabetes and for the prevention of type 2 diabetes development. Hospital's health promotion programs focus on the importance of pre-diabetes screenings and lifestyle changes are necessary to raise people's awareness about the pre-diabetes, thus helping effectively manage the disease.

REFERENCES

1. **Phan Huong Duong.** Summary of scientific research report investigating the prevalence of diabetes, pre-diabetes and some related factors in Vietnam in 2020. Endocrine Central Hospital. [9 January 2023]. Avalable from: https://benhviennoitiet.vn/.
2. **Ngo Thi Phuong.** Study on the prevalence and characteristics of pre-diabetic patients at Military unit A in Hanoi. Journal of Clinical Medicine. 2023. 18(3):41-48.
3. **Dang Tran Quan.** Risk factors in pre-diabetes patients. Vietnam Journal of Diabetes and Endocrinology. 2014. 13:83-87.
4. **Vu Thi Thu, Le Thi Ngoc.** Research on the rate of pre-diabetes in the Outpatient Department of Hospital E and predict the risk of diabetes in 10 years according to the FINDRISC scale. Hospital level scientific research. 2021 [9 January 2023]. Available from: https://api.benhviene.com.
5. **Nguyen Hai Thuy.** Update on diagnosis and treatment of pre-diabetes. Journal of Endocrinology and Diabetes. 2021. 46(150):9-25.
6. **International Diabetes Federation.** IDF Diabetes Atlats - Ninth edition. 2019. [9 January 2023] Available from: https://diabetesatlas.org/.
7. **Sung KC, Reaven G.** Fasting plasma triglyceride concentration: a possible approach to identify increased risk of statin-induced type 2 diabetes. Diab Vasc Dis Res. 2015. 12(5):373-376.
8. **Van Dat Nguyen, Quang Mai Vien, Thai Hung Do, Cong Danh Phan, Huu Chau Nguyen, Van Tuyen Nguyen, et al.** Prevalence of undiagnosed diabetes and pre-diabetes and its associated risk factors in Vietnam. J Glob Health Sci. 2019. 1(1):1-12.