Palestinian Medical and Pharmaceutical Journal

Prevalence of Prediabetes among University Staff and the Clinical Utility of the American Diabetes Association Risk Test as A Screening Tool: A Cross-Sectional Study 2022

Lubna Saudi[1,*] , Ibrahim Ali[1], Shaima Qashoo[1], Nadeen Ghanem[1] & Mohammad Abuawad[2]

(Type: Full Article). Received: 25th Mar. 2025, Accepted: 22nd May. 2025 Published: ××××, DOI: ××××

Manuscript accepted, In Press

Abstract: Prediabetes, a precursor to type 2 diabetes mellitus (T2DM), warrants urgent attention given its global prevalence and heightened burden in Palestine. This cross-sectional study assessed prediabetes prevalence, associated risk factors, and the validity of the American Diabetes Association (ADA) Prediabetes Risk Test among An-Najah National University (ANNU) staff. A 10-month investigation enrolled 365 adults (>18 years), collecting sociodemographic data via interviewer-administered questionnaires. Prediabetes was defined per WHO criteria (HbA1c 5.7%–6.49%), with blood glucose measured via HbA1c testing. The ADA risk test (English version) was employed, and statistical analyses (IBM SPSS v21.0) included sensitivity, specificity, predictive values, and ROC-AUC calculations. Among participants (60.8% male), prediabetes prevalence was 10.1%, with 8 undiagnosed T2DM cases identified. Multivariate regression identified age ≥50 years (50–59: OR=3.1, p=0.02; ≥60: OR=4.6, p=0.01) and obesity (BMI ≥30: OR=2.8, p=0.03) as significant predictors. The ADA test demonstrated moderate accuracy at a ≥4 cut off (sensitivity=72%, specificity=69%, AUC=0.738). This study highlights a concerning prevalence of prediabetes (10.1%) among ANNU staff, with age and obesity as critical modifiable risk factors in Palestine. The ADA tool's moderate predictive efficacy supports its use for non-invasive screening in resource-limited settings. These findings highlight the need for targeted public health strategies to enhance prediabetes awareness, promote early lifestyle interventions, and mitigate T2DM progression. Further regional studies are recommended to validate these associations and refine risk assessment protocols.

Keywords: Prediabetes, ADA risk test, University Staff, Palestine.

INTRODUCTION

Diabetes mellitus (DM) is a significant public health problem with impaired glucose metabolism that not only on affected people's but their families and communities [1, 2]. While the International Diabetes Federation (IDF) reported a global diabetes prevalence of 9.8% (536 million affected individuals) in 2021, the Palestinian population experiences a significantly higher burden, with 6.8% affected by the disease.[3] Type 2 diabetes mellitus (T2DM) which contributes to almost 90% of the diabetes burden worldwide [4] continues to be a major contributor to morbidity and mortality in all countries in all regions of the world.[5,6] Despite this massive burden, the exact etiological mechanisms leading to development of T2DM remain incompletely elucidated. [5]

Prediabetes, an intermediate state to normal blood glucose levels but not sufficiently elevated to be classified as type 2 diabetes mellitus (T2DM). This stage significantly increases the risk of developing diabetes. Studies indicate that 25% of prediabetic individuals will develop T2DM within three to five years, and in a lifetime, this risk can increase to 70%. [7,8]The Middle East faces a particularly alarming rise in prediabetes prevalence, with 13.7 million adults aged 20–79 affected across Arab nations.[9]The American Diabetes Association (ADA) classifies prediabetes by three key biomarkers impaired fasting glucose (IFG) 100–125 mg/dL, impaired glucose tolerance (IGT) 140–200 mg/dL), or haemoglobin A1c (HbA1c) levels ranging from 5.7%–6.49%.[10,11] Notably, observational studies associate prediabetes with early-onset diabetes-related complications [12], highlighting the critical need for early diagnosis and timely action to slow progression [11,12] and mitigate complications.[13,14] Research shows that lifestyle changes, such as adopting a healthier diet and engaging in regular exercise, can effectively reverse prediabetes .[8]

Global diabetes prevalence is projected to rise to 592 million cases by 2035 [12,15], yet the actual burden of

1 Department of Medicine, Faculty of Medicine and Allied Medical Sciences, An-Najah National University, Nablus, Palestine
* Corresponding author email: lubna_saudi@najah.edu
2 Department of Biomedical Sciences and Basic Clinical Skills, Faculty of Medicine and Allied Medical Sciences, An-Najah National University, Nablus, Palestine.

prediabetes remains poorly characterized. This knowledge gap hinders public health planning and policy development despite the condition's potential to escalate into widespread diabetes-related complications. [16]

Urgent action is needed to enhance awareness, implement cost-effective interventions, and validate risk assessment tools. The ADA's non-invasive prediabetes risk test, with demonstrated sensitivity (78.9%) and specificity (82%), offers a practical screening method.[14] Furthermore, the ADA recommends HbA1c measurement as a reliable diagnostic adjunct.[17]

Despite prediabetes' global prevalence and clinical significance, national prevention and management policies remain scarce. In Palestine, while diabetes management follows ADA guidelines, there is currently no national screening program for prediabetes. This pioneering study at An-Najah National University (ANNU) in Palestine aims to determine the prevalence of prediabetes among university staff using HbA1c screening, evaluate associated risk factors, and validate the ADA risk test as a screening tool within this population. By integrating HbA1c measurements with the ADA risk assessment, this study addresses a critical gap in regional data and provides insights essential for targeted public health strategies.

METHODS AND MATERIALS

Study Design and Methods

This observational study was carried out from January to October 2022 at An-Najah National University (ANNU) across its new and old campuses, utilized an interviewer-administered questionnaire combined with HbA1c measurements to assess prediabetes risk among university employees- a population selected for their diversity in educational backgrounds (ranging from administrative to academic roles) and varied professional responsibilities that influence lifestyle patterns. Participants were recruited via convenience sampling, and individuals diagnosed with diabetes or pregnancy were excluded. The required sample size of 365 participants was determined using the Open-Epi online calculator, applying the formula [n = [DEFF*Np (1-p)]/[(d2/Z21-α/2*(N-1) +p*(1-p)]], where Z = 1.96 corresponding to a 95% confidence level, P estimated proportion of prediabetes among staff, and d is the accuracy, with an estimated proportion of 50%, confidence level 95%, confidence limit 5% and DEFF 1.

Measurement tool

The methodology section was designed to systematically assess variables and collect data to evaluate prediabetes risk among participants. Prediabetes was classified based on the American Diabetes Association (ADA) guidelines, with an HbA1c range of 5.7% to 6.49%. Key variables included age (in years), gender (male or female), with additional questions for females regarding a history of gestational diabetes (yes/no), family history of diabetes (yes/no), marital status (married or unmarried), residency (urban or rural), history of hypertension (yes/no), presence of chronic diseases (specified if applicable), smoking status (yes/no, based on CDC criteria of having smoked 100 cigarettes in a lifetime or currently smoking), and physical activity (yes/no, based on WHO recommendations of at least 150 minutes of moderate-intensity weekly exercise). Sociodemographic factors such as education level (university degree, diploma, high school, or others), employment status (academic, administrative, or service) and department were also recorded. Anthropometric measurements included waist circumference (measured to the nearest 0.5 cm at the midpoint between the lowest rib and iliac crest), height and weight (measured without shoes using a stadiometer (nearest 0.5 cm) and a calibrated digital scale (nearest 100 grams; light clothing worn). Data was collected using a validated Arabic version, interviewer-administered questionnaire. [18]

The questionnaire comprised two sections: the first captured sociodemographic characteristics, while the second included the ADA prediabetes risk test, consisting of seven questions assessing age, sex, gestational diabetes, family history of diabetes, hypertension, physical activity, and obesity based on body mass index (BMI) via a weight-height chart). The risk score ranged from 0 to 11, with scores ≥5 indicating a high risk of type 2 diabetes. Blood glucose levels were measured using HbA1c kits in a JCI-accredited laboratory. HbA1c was selected as the preferred test for this screening tool due to its non-fasting requirement, which enhances practical utility. This approach aligns with ADA guidelines recommending HbA1c for prediabetes screening. Participants were recruited to visit the university clinic for blood sample collection under aseptic conditions by trained lab technicians, with samples subsequently transported to the medical laboratory centre at An Najah National University Hospital for analysis.

Statistical analysis

The collected variables and data were computerized and encoded for analysis. Statistical analysis was conducted using Social Package of Statistical Sciences (SPSS) version 21. Continuous variables are presented as mean +standard deviation (SD), while categorical variables were reported as frequencies with corresponding percentages. Group comparisons were performed using the chi-square test for categorical data and the independent t-test for continuous measures. Multivariate regression was employed to assess factors independently associated with prediabetes. Statistical significance was set at $p < 0.05$.

RESULTS

In this study 463 participants completed the questionnaire; however, only 365 individuals underwent the HbA1C test and were included in the final analysis, while 98 were excluded due to incomplete data. Table 1 presents the demographic characteristics of the study population, along with the frequency and risk factors associated with prediabetes. These factors include residency, marital status, employment status, smoking history, chronic disease history, age, gender, history of gestational diabetes, family history of diabetes, history of hypertension, physical activity levels, waist circumference, and BMI.

Among the 365 participants, 222 (60.8%) were male, and 143 (39.2%) were female. The participants were categorized into four age groups: those younger than 40 years constituted 52.3% of the sample, those aged 40–49 years represented 26.8%, those aged 50–59 years accounted for 15.1%, and those aged 60 years or older comprised 5.8%. In terms of residency, 72.1% resided in urban areas, while 27.9% lived in rural regions. Regarding marital status, 74.8% of participants were married. Academic degree varied, with 74.2% holding a university degree, 9.6% possessing a diploma, and 16.2% having completed high school. Employment status was distributed as follows: 45.8% were employed in administrative roles, 38.6% held academic positions, and 15.6% worked in service-related jobs.

Additional characteristics of the study population included a smoking prevalence of 41.6%, a chronic disease prevalence of 14.8%, and a history of gestational diabetes in 1.4% of participants. A family history of diabetes was reported by 57.8% of participants, while 26.0% had a history of hypertension. Furthermore, 64.1% of participants were classified as physically active. The mean waist circumference was 104.96 ± 10.9 cm for males and 89.9 ± 12.0 cm for females. The mean BMI was 28.7 ± 4.9 kg/m² for males and 26.4 ± 4.5 kg/m² for females.

Table (1): Sociodemographic characteristics of the participants (N=365*).

Variable	Frequency	Mean ± SD
Residency		
Urban	263 (72.1%)	
Rural	102 (27.9%)	
Marital status		
Married	273 (74.8%)	
Unmarried	92 (25.2%)	
Academic Degree		
University Degree	271 (74.2%)	
Diploma	35 (9.6%)	
High School	59 (16.2%)	
Employment Status		
Administrative	167(45.8%)	
Academic	141 (38.6%)	
Service	57 (15.6%)	
Smoking		
Yes	152(41.6%)	
No	213 (58.4%)	
Chronic Disease		
Yes	54(14.8%)	
No	311(85.2%)	
Age		
Less than 40 years	191 (52.3%)	
40-49 years	98 (26.8%)	
50- 59 Years	55 (15.1%)	
≥ 60 Years	21 (5.8%)	
Gender		
Male	222 (60.8%)	
Female	143 (39.2%)	
History Of Gestational Diabetes		
Yes	5(1.4%)	
No	90(24.6%)	
Inapplicable	270(74.0%)	
Family History of Diabetes		
Yes	211(57.8%)	
No	154(42.2%)	
History of High blood pressure		
Yes	95(26.0%)	
No	270(74.0%)	
Physical activity		
Yes	234 (64.1%)	
No	131 (35.9%)	
Waist Circumference		99.1 ± 13.5
Male		105 ±10.9
Female		89.9±12.0
Body Mass Index		27.7±4.9
Male		28.7±4.9
Female		26.4±4.5

* Includes eight participants with newly defined with DM

This study included 365 participants, with glycemic status categorized according to the ADA guidelines as follows: 37 participants (10.1%) were identified as having prediabetes (HbA1c range: 5.7–6.49%), 8 participants (2.2%) met the criteria for diabetes (HbA1c ≥ 6.5%), and the majority, 320 participants (87.7%), were classified as having normal glycemic levels (HbA1c ≤ 5.7%). These findings are visually summarized in Figure 1.

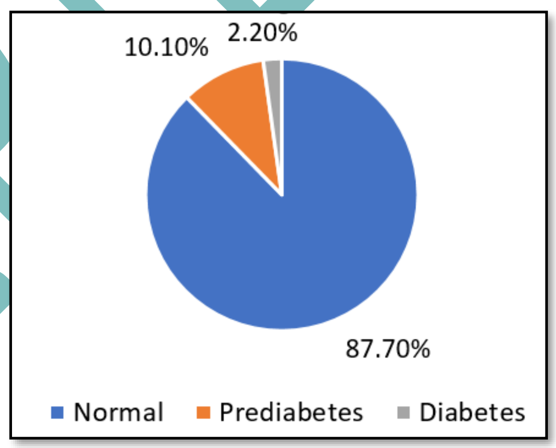

Figure (1): Prevalence of pre-diabetes and diabetes in the study population.

The analysis revealed that age, gender, physical activity level, marital status, and BMI were statistically significant factors associated with prediabetes, as detailed in Table 2. Specifically, prediabetes showed significant associations with age ($p = 0.001$), gender ($p = 0.008$), physical activity level ($p = 0.023$), marital status ($p = 0.011$), and BMI ($p = 0.005$).

In contrast, other variables, including residency, academic degree, employment status, smoking status, presence of chronic diseases, history of gestational diabetes mellitus (GDM), family history of diabetes mellitus (DM), history of hypertension (HTN), and waist circumference, were not statistically significant ($p > 0.05$) and demonstrated no significant relationship with the incidence of prediabetes.

Multivariate logistic regression analysis further identified age and BMI as the most dominant predictors of prediabetes. Participants aged 50–59 years had significantly higher odds of prediabetes ($p < 0.001$; adjusted odds ratio [aOR] = 6.5; 95% confidence interval [CI] = 2.3–18.8), as did those aged

≥60 years (p = 0.001; aOR = 10.6; 95% CI = 2.8–40.1). Additionally, participants classified as obese had a significantly higher likelihood of prediabetes (p = 0.044; aOR = 3.3; 95% CI = 1.0–10.7). These findings are summarized in Table 2.

Table (2): Characteristics of subjects in prediabetes and healthy group.

Variable	Prediabetes	Normal	P-value	aOR (95%CI)	aP-value
Age			**<0.001**		
Less than 40 years*	7(3.7%)	184(96.3%)		1	
40-49 years	11(11.3%)	86(88.7%)		2.6(0.9-7.3)	0.072
50- 59 Years	13(25%)	39(75%)		6.5(2.3-18.8)	**<0.001**
≥ 60 Years	6(35.3%)	11(64.7%)		10.6(2.8-40.1)	**0.001**
Gender			0.008		
Male	30 (13.8%)	187 (86.2%)		1.8(0.7-4.4)	0.261
Female*	7 (5.0%)	133 (95.0%)			
Physical activity			0.023		
Yes*	30(13.1%)	199(86.9%)			
No	7(5.5%)	121(94.5%)		2.3(0.9-5.7)	0.076
Residency					
Urban	23(8.9%)	234(91.1%)	0.16		
Rural	14(14%)	86(86%)			
Marital status					
Married	34(12.7%)	233(87.3)	0.011	1.9(0.5-7.1)	0.345
Unmarried*	3(3.3%)	87(96.7%)			
Academic Degree					
University Degree	25(9.4%)	242(90.6%)			
Diploma	2(5.9%)	32(94.1%)	0.11		
High School	10(17.9%)	46(82.1%)			
Employment Status					
Administrative	13(8%)	150(92%)			
Academic	16(11.6%)	122(88.4%)	0.34		
Service	8(14.3%)	48(85.7%)			
Smoking					
Yes	16 (10.7%)	134 (39.3%)	0.873		
No	21 (10.1%)	186 (89.9%)			
Chronic Disease					
Yes	8(16.3%)	41(83.7%)	0.14		
No	29(9.4%)	279(90.6%)			
History of Gestational Diabetes					
Yes	1(20%)	4(80%)	0.201		
No	5(5.6%)	84(94.7%)			
Family History of Diabetes					
Yes	26(12.6%)	180(87.4%)	0.102		
No	11(7.3%)	140(92.7%)			
History of High blood pressure					
Yes	12(13.3%)	78(86.7%)	0.285		
No	25(9.4%)	242(90.6%)			
Waist Circumference					
Normal*	13 (8.6%)	139 (91.4%)	0.334		
Abnormal	24 (11.7%)	181 (88.3%)		0.8(0.4-1.9)	0.617
Body Mass Index					
Normal*	5 (4.8%)	100 (95.2%)	**0.005**		
Overweight	14 (9.1%)	140 (90.9%)		2.3(0.7-7.1)	0.148
Obese	18 (18.4%)	80 (81.6%)		3.3(1.0-10.7)	**0.044**

**Reference Group.*

Table 3 presents the performance metrics of the ADA prediabetes risk assessment test across various cutoff points. At a cutoff of ≥6 points, the test demonstrated a sensitivity of 46% and a specificity of 86%. Lowering the cutoff to ≥5 points resulted in a sensitivity of 54% and a specificity of 74.7%. Further reducing the cutoff to ≥3 points yielded a sensitivity of 89% but a lower specificity of 35%. The area under the curve (AUC) for all cutoff values was 0.738, indicating moderate diagnostic accuracy.

The positive predictive value (PPV) varied across cutoff points: 27.5% for a cutoff of ≥6, 19.8% for ≥5, 17.7% for ≥4, and 13.7% for ≥3. Conversely, the negative predictive value (NPV) remained consistently high: 93% for cutoffs of ≥6 and ≥5, 96% for ≥4, and 96.5% for ≥3.

Additionally, the risk factor analysis revealed that higher cutoff points were associated with fewer high-risk individuals. Specifically, the high-risk population included 63 participants at a cutoff of ≥6, 101 at ≥5, 175 at ≥4, and 241 at ≥3. These findings are comprehensively summarized in Table 3.

Table (3): Performance characteristics of the ADA Prediabetes Risk Test for detecting undiagnosed prediabetes Among NNU staff.

ADA Diabetic Risk Test	High risk	Sensitivity	Specificity	PPV	NPV
Cut off at score ≥6	63	46%	86%	27.5%	93%
Cut off at score ≥5	101	54%	74.7%	19.8%	93%
Cut off at score ≥4	175	83.7%	55%	17.7%	96%
Cut off at score ≥3	241	89%	35%	13.7%	96.5%

Using a cutoff of ≥4 points, the receiver operating characteristic (ROC) curve analysis yielded an AUC of 0.738, with a 95% confidence interval (CI) ranging from 0.66 to 0.82 and a standard error of 0.041 (Table 4).

Table (4): Test Result Variable(s): ADA Score

Area	standard error	P value	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
0.738	0.041	<0.001	0.66	0.82

The test result variable(s): ADA Pre Diabetes Risk Test has at least one tie between the positive actual state group and the negative actual state group.

These results suggest that the ADA risk assessment tool provides moderate predictive utility for identifying individuals at risk of prediabetes. This cutoff value provided the best balance between sensitivity and specificity, with the point closest to the upper left corner of the ROC curve (Figure 2), indicating an acceptable o accuracy for screening individuals with prediabetes in this study.

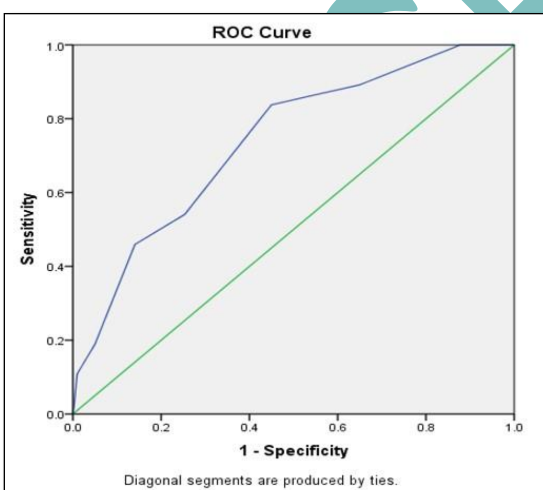

Figure (2): ROC Curve.

Discussion

The prevalence of T2DM among Palestinians was estimated to be 15.3% [19], which is significantly higher than the global average of 6%.[5] This alarming disparity underscores the urgent need for effective preventive measures and early detection strategies. The public health community has emphasized the importance of prioritizing T2DM prevention, particularly through the identification of individuals at risk before the onset of the disease. A quick, accessible, and reliable screening method for elevated glucose levels is essential to address this growing health concern.

This study aimed to assess the prevalence of prediabetes among Palestinian university staff using the ADA prediabetes risk assessment tool in conjunction with HbA1c testing. In addition, the study focused on identifying factors that increase the likelihood of developing and progressing to prediabetes. To our knowledge, this is the first study to evaluate the ADA prediabetes risk assessment tool within a Palestinian community, providing valuable insights into its applicability and effectiveness in this population.

The HbA1c test is widely regarded as a reliable indicator of impaired glucose homeostasis, as it reflects average blood glucose levels over a period of several months. Recognizing its diagnostic utility, the ADA has recommended HbA1c as a screening tool for prediabetes.[20] In this study, among the 365 participants enrolled, 37 individuals (10.1%) were identified as having prediabetes based on the ADA-defined HbA1c range of 5.7–6.49%. This prevalence aligns with the ADA's recommendations and provides sufficient evidence to establish the presence of prediabetes in the study population.[21] However, it is important to note that the prevalence reported in this study may be an underestimate, as it is based on a single HbA1c measurement rather than repeated testing over time.

The findings of this study demonstrate a significant association between age and the incidence of prediabetes ($p < 0.001$), identifying age as the most influential non-modifiable risk factor for prediabetes. This observation aligns with studies conducted in the United States [22] and China [23,24], which similarly reported age as a key determinant of prediabetes. Furthermore, a study conducted in Jeddah highlighted age as the primary predictor of diabetes and prediabetes in males, followed by elevated body fat levels.[25]

The aging process is often accompanied by increased peripheral insulin resistance, further exacerbated by obesity, sedentary behavior, and poor dietary habits. In individuals predisposed to prediabetes, these physiological changes can lead to the development of hyperglycemia. Additionally, environmental and lifestyle factors are critical in influencing both the rate and timing of prediabetes onset. [26] These findings underscore the importance of early screening and targeted interventions for older populations, particularly those with additional risk factors such as obesity and physical inactivity.

A significant association was observed between BMI and prediabetes ($p = 0.005$), with the obesity group demonstrating the strongest correlation in the multivariate logistic regression analysis (p = 0.044; prevalence ratio [PR] = 3.324; 95% confidence interval [CI]: 1.1–10.7). This finding aligns with existing literature, which consistently supports the link between obesity and the development of diabetes. [27] Furthermore, recent studies have highlighted that men are more likely than women to develop obesity. [28] Interestingly, while one study found that incorporating BMI into the analysis did not alter the association between type 2 diabetes and male gender, it also reported no significant relationship with visceral fat. [29]Additionally, a national health survey [30] revealed that the prevalence of diabetes was notably higher among obese individuals compared to non-obese individuals, even at younger ages. Collectively, these findings underscore that obesity is a primary risk factor for diabetes, irrespective of the presence or absence of other contributing factors.

In this study, 211 participants (57.8%) reported a family history of diabetes, among whom 26 were diagnosed with prediabetes. However, this association was not statistically significant (p = 0.102). Despite the lack of significance in our findings, existing literature suggests that a family history of DM can increase the risk of prediabetes and diabetes by approximately 2–4 times compared to individuals without such a history. [31] The absence of a statistically significant association in our study may be attributed to the lack of reliable and documented family medical histories, which could have provided more accurate information on the prevalence of T2DM among participants' families. Additionally, the blood sugar levels of many participants' family members were not routinely monitored, further limiting our ability to confirm a prior history of diabetes. These factors may have contributed to underestimating the role of family history as a risk factor for prediabetes in this study.

The findings of this study did not provide direct evidence of an association between smoking and diabetes. These results align with those of prior studies conducted in China [24] and Turkey. [32] However, contrasting evidence from other studies [33,34] has demonstrated a significant correlation between smoking and diabetes. This discrepancy may be attributed to methodological differences, as highlighted by a study conducted in Jeddah, which suggested that single-point estimations might overlook correlations between variables due to their inability to account for historical data.[25] Regardless of the presence or absence of a direct connection, smoking cessation efforts remain crucial, as they can significantly reduce the risk of developing other chronic diseases.

In this study, 64.1% of participants reported being physically active. However, among individuals diagnosed with prediabetes, only 13% were physically active. These findings appear to challenge the widely accepted notion that physical activity levels play a significant role in influencing the development of prediabetes. An unexpected finding was the higher prediabetes rate among physically active participants. This may be due to unmeasured confounders such as dietary intake, stress levels, sleep quality, or genetic predisposition. Additionally, self-reported physical activity may have led to misclassification. This contrasts with a study conducted among Saudi Arabians, which found that regular physical activity is associated with a reduced risk of prediabetes and T2DM. In contrast, physical inactivity increases the risk of these conditions.[35] The observed discrepancy may be attributed to differences in study populations, methodologies, or cultural and environmental factors influencing physical activity patterns.

In Palestine, the Ministry of Health has not officially approved a prediabetes screening tool. Based on our findings, the ADA risk score demonstrates moderate diagnostic accuracy and could serve as a practical tool for prediabetes screening in local communities. [36] Healthcare providers should prioritize educating patients about modifiable risk factors and implementing interventions to reduce the likelihood of developing prediabetes and type 2 diabetes mellitus. Early identification and management of these risk factors are critical to mitigating the growing burden of diabetes in the region.

Limitations and strength

This study has certain limitations that must be noted. A key constraint is its cross-sectional nature, which prevents definitive conclusions about causality or the longitudinal progression of risk factors associated with prediabetes. Second, the study population was predominantly male, which may not represent the general population. This imbalance was largely due to the male-dominated nature of certain professions within the participant pool, such as service and security roles. Third, as the study was conducted at an educational facility, the findings may not be generalizable to populations outside this setting or individuals without access to similar facilities. Additionally, a significant proportion of participants withdrew from the study during its second phase, primarily due to the requirement for blood sample collection at the clinical university lab, which may have introduced selection bias. Furthermore, the use of convenience sampling may also limit generalizability and increase the risk of selection bias.

It is also important to note that sociodemographic factors and living standards vary across different regions, which could influence the applicability of these findings to other educational or occupational settings. Despite these limitations, the study adhered to established WHO guidelines for evaluating obesity using both BMI and waist circumference. Furthermore, the diagnosis of prediabetes was based on HbA1c levels, a reliable and widely endorsed metric supported by the WHO and previous literature. Blood samples were collected by qualified physicians, ensuring the credibility and accuracy of the results. These methodological strengths provide a solid foundation for future research and contribute to establishing standardized approaches in this field.

CONCLUSION

The prevalence of prediabetes in the study population was 10.1%, highlighting a significant public health concern given the rapid progression from prediabetes to diabetes and the associated chronic complications of diabetes mellitus. Early intervention is critical to halting this progression. This study identified key risk factors prevalent in the population, particularly among Palestinians, with age (specifically individuals over 50 years) and obesity (as defined by BMI) emerging as statistically significant predictors of prediabetes and diabetes.

The ADA prediabetes risk test demonstrated moderate predictive accuracy in our study and may serve as a practical initial screening tool for identifying individuals at risk of prediabetes in similar settings. However, further validation in larger and more diverse populations is needed to confirm broader applicability. Increasing awareness and providing adequate information about prediabetes are essential steps in preventing its progression. Importantly, modifiable risk factors such as BMI underscore the potential for dietary and lifestyle interventions to play a pivotal role in improving health outcomes at the community level.

Disclosure Statements

- **Ethics approval and consent to participate:** Approval was obtained from Institutional Review Board "IRB" at (ANNU) in Palestine prior of the research conduction. N: Med. Jan. 2022/13, a study participant provided verbal informed consent for inclusion, which include study's purpose, objectives, and requirements, and their participation was totally voluntarily, all information was kept encrypted and secured and only researchers have access to the information as well as the clinician in the clinics and upon their result we sent recommendation message about clinical situation and the members who are at high risk asked to visit the clinic for follow up.
- **Consent for publication:** Not applicable
- **Availability of data and materials:** The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.
- **Author's contribution:** LS and MA have contributed to the design, analysis of data and writing the draft. NG, SQ and IA have contributed in data collection, analysis and interpretation of the results. All authors critically revised the final version of the manuscript and approved its submission for publication.
- **Competing interest:** The authors declare that they have no competing interests.

- **Funding:** No funding was provided for this study.
- **Acknowledgments:** We sincerely thank all the participants from An-Najah National University for their valuable contribution to this study. We also appreciate the medical laboratory team at ANNU for their assistance in collecting blood samples and providing the necessary kits. We are especially grateful to the Central Medical Laboratory at An-Najah National University Hospital for performing the blood tests and supplying the results. Lastly, we deeply appreciate the support and facilitation provided by the ANNU administration throughout this research.

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