Research Article

Prevalence of prediabetes in Family and Community Medicine Department, Security Forces Hospital, Riyadh, Saudi Arabia

Medhat A Ghoraba, Omar A Shiddo, Murhaf Almuslmani, Ibrahim Jallad, Anhurallah Khan, Gina Maranan, Mariam Alharbi, Abeer Alsaygh

Family Medicine Department, Security Forces Hospital, Riyadh, Saudi Arabia.
Correspondence to: Medhat A Ghoraba, E-mail: medhatghoraba@hotmail.com

Received December 11, 2015. Accepted December 16, 2015

Abstract

Background: Diabetes is one of the most challenging health problems in twenty-first century. The number of people with diabetes is increasing (366 million people in 2011) due to population growth, aging, urbanization, and increasing prevalence of obesity and physical inactivity. Prediabetes, (global prevalence of impaired glucose tolerance [IGT] 8.3%), typically defined as blood glucose concentration higher than normal, but lower than diabetes thresholds, is a high-risk state for diabetes development. The joint prevalence of diabetes and IGT in Saudi Arabia for people above 30 is 40%.

Objective: To study the prevalence of prediabetes in Family and Community Medicine Department, Security Forces Hospital, Riyadh, Saudi Arabia.

Materials and Methods: This was a descriptive cross-sectional study carried out at Family and Community Medicine Department, Security Forces Hospital in Riyadh, between January 12, 2015 and March 12, 2015.

Result: Our data showed prevalence of prediabetes as 23.6%, while 3.8% respondents were newly diagnosed diabetics.

Conclusion: Prediabetes has high prevalence in Saudi population; 23.6% of which predict high prevalence of diabetes mellitus in the next few years. Prevalence of prediabetes associated with risk factors, which by lifestyle intervention and educational sessions could be minimized.

KEY WORDS: Prevalence, prediabetes, Security Forces Hospital, Saudi Arabia

Introduction

Diabetes is one of the most challenging health problems of the twenty-first century. The number of people with diabetes is increasing (366 million in 2015)[1] due to population growth, aging, urbanization and increasing prevalence of obesity and physical inactivity.

Access this article online	
Website: http://www.ijmsph.com	Quick Response Code:
DOI: 10.5455/ijmsph.2016.11122015277	

The joint prevalence of diabetes and impaired glucose tolerance (IGT) in Saudi Arabia for people above 30 is 40%.[2,3] Diabetes prevalence in adults in Bahrain, Kuwait, Oman, Saudi Arabia, and the United Arab Emirates (UAE) are among the highest national level in the world.[2]

Prediabetes (global prevalence of IGT 8.3%),[1] typically defined as blood glucose concentration that is higher than normal but lower than diabetes thresholds, is a high-risk state for diabetes development.

Indeed, the World Health Organization (WHO) use the term intermediate hyperglycemia, and an International Expert Committee recently convened by the ADA (American Diabetes Association) prefers the “high-risk state of developing diabetes” to prediabetes.[4]

The Diabetes Prevention Program showed that about 11% of people with prediabetes developed type 2 diabetes each year during the average 3 years of follow-up.[5] The conversion

rate varies with population characteristics and prediabetes definition.

According to an ADA expert panel, up to 70% individuals with prediabetes will eventually develop diabetes. Women with gestational diabetes have a 20%–60% risk of developing diabetes 5–10 years after pregnancy.[6,7]

Because type 2 diabetes typically progresses slowly over an extended time of 10–12 years, prediabetic individuals are at increased risk for developing microvascular and macrovascular complications prior to diagnosis.[8]

Although diagnosis of prediabetes is a good opportunity to identify patients at increased risk for type 2 diabetes and to implement interventions that can delay or prevent type 2 diabetes and its complication; unfortunately, this opportunity is often unrecognized by health-care providers.[9]

We hypothesized that there is a significant correlation between weights expressed by body mass index (BMI), central obesity expressed by waist circumference, history of diabetes mellitus (DM), lack of physical activities, hypertension, history of gestational DM, and the high-risk state of developing diabetes.

To evaluate this hypothesis, we decided to run a cross-sectional study among Saudi adult populations, not known diabetic, attending FM department, SFHP, Riyadh, KSA, from January 12, 2013 to March 12, 2013 adopting the ADA criteria for defining the high-risk state of developing diabetes in 2013.

Materials and Methods

This was a descriptive cross-sectional study carried out at the Family and Community Medicine Department, Security Forces Hospital in Riyadh, between January 12, 2015 and March 12, 2015.

The study protocol was approved by the research and ethic committee of the hospital.

Study subjects recruited through advertising by stands in main Family Medicine Department entrance and leaflets distributed in both male and female waiting areas.

A short-session study awareness was given to all family medicine physicians about inclusion and exclusion criteria. Two research nurses trained how to fill up the questionnaire, gathering data from patients; standard measurements required, that is blood pressure, weight, height, BMI, and waist circumference.

Five hundred and ten (510) subjects were consecutively recruited using convenience sampling technique till the desired sample was achieved. The recruited respondents were patients or their accompanying relatives who were requested to participate in the study and to come for screening.

Screening was conducted in two triage areas. Subjects gave their voluntary informed consents to participate in the study.

In a standardized manner, information was obtained on relevant sociodemographic characteristics such as age, gender, education (none, primary, secondary/high, or university), occupation (Military, civilian, housewife, teacher, student, or retired), physical activities (defined as doing 30 min a day of physical activities for 5 days a week), family history of DM, previous history of gestational diabetes for female all done with the aid of an interview-administered semistructure questionnaire.

Anthropometric and blood pressure measurements

All anthropometric measurements were made by two trained research nurses. Weight was taken to the nearest 0.1 kg using a weighing scale while for height measurement, a stadiometer was used. BMI was then calculated from weight (in kilograms) divided by the square of the height (in meters). Central obesity was defined as waist circumference measurement greater than 80 cm for female and 94 cm for male. Blood pressure was measured in the left arm in the sitting position with the aid of digital sphygmomanometer and repeated once more to confirm if the first reading above 140/90 mmHg.

Biochemical sample collection

After 8 h overnight fast, venous blood samples were obtained from the subjects. The blood was immediately centrifuged while the serum obtained was analyzed for glucose. Serum glucose was analyzed at the hospital's central laboratory by the same laboratory technician.

For ethical issues, subjects informed that those back with abnormal results either in the range of diabetes or prediabetes will be called, offered one appointment to see family medicine consultant to discuss the result, and share management plan with appropriate follow-up with their own general practitioner.

Definition of terms

BMI (kg/m^2) was categorized suiting the WHO definition.[10]

JNC7 classification was used for hypertension classification.[11]

Prediabetes was defined using the ADA criteria for defining the high-risk state of developing diabetes in 2013.[12]

Result

Sociodemographic characteristics of respondents are given in Table 1.

Clinical characteristics of respondents

Clinical characteristics of the respondents are given in Table 2.

As shown in Figure 1, sample prevalence of prediabetes was 23.6% while 3.8% respondents were newly diagnosed diabetics.

Among demographic characteristics, age, level of education, occupation, and having a diabetic sibling were associated with prediabetes (P-value < 0.001) as in Table 3.

Among clinical characteristics, prediabetes was associated with central obesity, BMI, and past history of gestational diabetes (P-value < 0.001) as in Table 4.

Predictors of prediabetes and strength of association

In univariate analysis (Figure 2 and Table 5), the identified predicators of prediabetes are as follows: Age—when compared

Table 1: Demographic characteristics of the respondents

Characteristics	Number	Percent
Gender		
Male	230	45.1
Female	280	54.9
Age		
18–35 Years	205	40.2
36–50 Years	193	37.8
51-62 Years	112	22.0
Education		
Illiterate	54	10.6
Primary	114	22.4
Secondary/high	192	37.64
University	149	29.3
Occupation		
Military	124	24.3
Civilian	91	17.8
House wife	197	38.6
Teacher	40	7.8
Student	58	11.4
Family history		
Yes	370	72.7
No	139	27.3
Father diabetic		
No	240	53.6
Yes	208	46.4
Mother diabetic		
No	213	46.9
Yes	241	53.1
Brother/sister diabetic		
No	317	75.7
Yes	102	24.3

The respondents comprised 54.9% female, 59.8% were above 35 years of age (37.8% for age group 36–50 years and 22.0% for age group 51–65 years).

Out of the respondents, 37.7% were with high school education, and 38.6% were house wives.

Family history fordiabetes mellitus was positive among 72.7% of respondents.

Table 2: Clinical characteristics of respondents

Characteristics	Number	Percent
Central obesity		
Normal	224	44.1
Obese	284	55.9
BMI		
Underweight	9	1.8
Normal	58	11.4
Overweight	144	28.2
Obese I	173	33.9
Obese II	80	15.7
Morbid obese	46	9.0
SBP		
≥140	52	10.63
<140	437	89.37
DBP		
≥90	6	1.23
<90	483	98.77
Gestational diabetes		
Yes	78	27.85
No	202	72.15
Physical activity		
Yes	90	17.6
No	420	82.4

SBP, systolic blood pressure; DBP, diastolic blood pressure.

Central obesity was found in 55.9% of respondents (using waist circumference measured), majority of our respondents were with blood pressure less than 140/90 mmHg.

Out of the respondents, 82.3% were without a history of gestational diabetes while 82.4% of respondents were physically inactive.

to the young (18–35 years), the prevalence was higher among the age group of 36–50 years and 51–65 years with odds ratio (OR [95% CI]) 3.97 (2.19–7.19) and 10.45 (5.59–19.52), respectively.

Educational level—the prevalence was low in illiterates, secondary/high school, and university education with OR (95%CI) 0.44 (0.22–0.88), 0.22 (0.06–0.74), and 0.22 (0.10–0.47), respectively.

Occupation—compared to military, the prevalence of prediabetes was higher among students OR (95% CI): 2.59 (1.30–5.15), while it was lower among teachers with OR (95%CI) 0.08 (0.01–0.67).

Within the family, those who have a diabetic sibling have significantly higher prevalence of prediabetes with OR (95% CI) 2.88(1.65–5.00).

In clinical characteristics, the prevalence was significantly higher among participants with central obesity and high BMI (obese I, obese II, and morbidly obese) compared to normal and in those who have a history of gestational diabetes with OR as shown in Figure 3 and Table 6.

Discussion

The Diabetes Prevention Program showed that about 11% of people with prediabetes developed type 2 diabetes each year during the average 3 years of follow-up.[5] The conversion rate varies with population characteristics and prediabetes definition.

Type 2 diabetes is the world's fastest growing public health problems, with 366 million anticipated to fulfil the diagnostic criteria by 2030.[13,14]

Table 3: Association between demographic characteristics and prediabetes

Variables	Categories	Normal	Prediabetic	*P*-value
Gender	Male	164 (74.89%)	55 (25.11%)	0.790
	Female	205 (75.93%)	65 (24.07%)	
Age	18–35 Years	181 (91.41%)	17 (8.586%)	<0.001
	36–50 Years	134 (72.83%)	50 (27.17%)	
	50–65 Years	54 (50.47%)	53 (49.53%)	
Education	Illiterate	30 (61.22%)	19 (38.78%)	<0.001
	Primary	65 (58.56%)	46 (41.44%)	
	Secondary/high	146 (79.78%)	37 (20.21%)	
	University	127 (87.59%)	18 (12.41%)	
Occupation	Military	90 (77.59%)	26 (22.41%)	<0.001
	Civilian	72 (82.76%)	15 (17.24%)	
	House wife	136 (71.58%)	54 (28.42%)	
	Teacher	39 (97.5%)	1 (2.50%)	
	Student	32 (57.14%)	24 (42.86%)	
Family history	Yes	270 (76.49%)	83 (23.51%)	0.467
	No	99 (73.33%)	36 (26.67%)	
Father	Yes	159 (79.5%)	41 (20.5%)	0.460
	No	195 (82.28%)	42 (17.72%)	
Mother	Yes	179 (77.49%)	52 (22.51%)	0.271
	No	170 (81.73%)	38 (18.27%)	
Brother/sister	Yes	66 (70.21%)	28 (29.79%)	<0.001
	No	272 (87.18%)	40 (12.82%)	

Table 4: Association between clinical characteristics and prediabetes

Variables	Categories	Normal	Prediabetic	*P*-value
Central obesity	Normal	182 (82.73%)	38 (17.27%)	<0.001
	Obese	186 (69.66%)	81 (30.34%)	
BMI	Underweight	9 (100.00%)	0 (0.00%)	<0.001
	Normal	52 (91.23%)	5 (8.772%)	
	Overweight	113 (80.71%)	27 (19.29%)	
	Obese I	119 (72.56%)	45 (27.44%)	
	Obese II	47 (61.84%)	29 (38.16%)	
	Morbidly obese	29 (67.44%)	14 (32.56%)	
SBP	>140	36 (69.23%)	16 (30.77%)	0.269
	≤140	333 (76.20%)	104 (23.80%)	
DBP	>90	5 (83.33%)	1 (16.67%)	0.990
	≤90	364 (75.36%)	119 (24.64)	
Gestational diabetes	Yes	44 (58.67%)	31 (41.33%)	< 0.001
	No	154 (81.91%)	34 (18.09%)	
Physical activity	Yes	64 (73.56%)	23 (26.44%)	0.650
	No	305 (75.87%)	97 (24.13%)	

SBP, systolic blood pressure; DBP, diastolic blood pressure.

Table 5: Odds ratio with 95% CI for prediabetes and demographic characteristics

Variables	Category	OR (95%CI)	*P*-value
Gender	Female	1	
	Male	1.05 (0.69–1.6)	0.790
Age	18–35 Years	1	
	36–50 Years	3.97 (2.19–7.19)	<0.001
	50–65 Years	10.45 (5.59–19.52)	<0.001
Education	Illiterate	1	
	Primary	1.11 (0.56–2.22)	0.751
	Secondary/high	0.40 (0.20–0.79)	0.020
	University	0.22 (0.10–0.47)	<0.001
Occupation	Military	1	
	Civilian	0.72 (0.35–1.46)	0.364
	House wife	1.37 (0.80–2.35)	0.246
	Teacher	0.08 (0.01–0.67)	0.019
	Student	2.59 (1.30–5.15)	0.006
Family History	Yes	0.84 (0.53–1.33)	0.467
	No	1	
Father diabetic	Yes	1.19 (0.74–1.93)	0.460
	No		
Mother diabetic	Yes	1.29 (0.80–2.08)	0.271
	No	1	
Brother/sister Diabetic	Yes	2.88 (1.65–5.00)	<0.001
	No		

Table 6: Odds ratio with 95% CI for prediabetes and clinical characteristics

Variables	Category	OR (95%CI)	*P*-value
Central _obesity	Normal	1	
	Obese	2.08 (1.34–3.22)	<0.001
BMI	Normal	1	
	Overweight	2.48 (0.90–6.81)	0.077
	Obese I	3.93 (1.47–10.47)	0.006
	Obese II	6.41 (2.29–17.93)	0.0004
	Morbidly obese	5.02 (1.64–15.35)	0.004
SBP	>140	1.42 (0.75–2.66)	0.269
	≤140	1	
DBP	>90	0.66 (0.07–5.28)	0.990
	≤90	1	
Physical activity	Yes	1.13 (0.66–1.91)	0.65
	No	1	
Gestational diabetes	Yes	3.19 (1.76–5.76)	<0.001
	No	1	

SBP, systolic blood pressure; DBP, diastolic blood pressure.

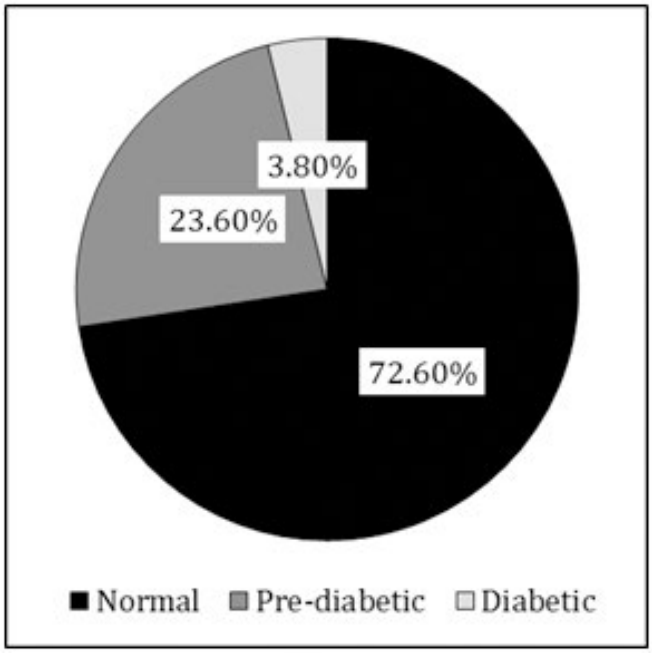

Figure 1: Prevalence of prediabetes.

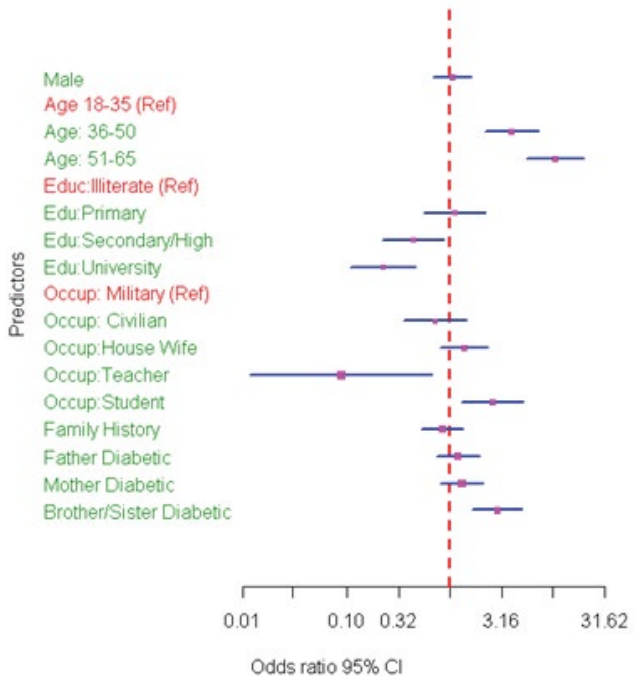

Figure 2: Association between demographic characteristics and prediabetes.

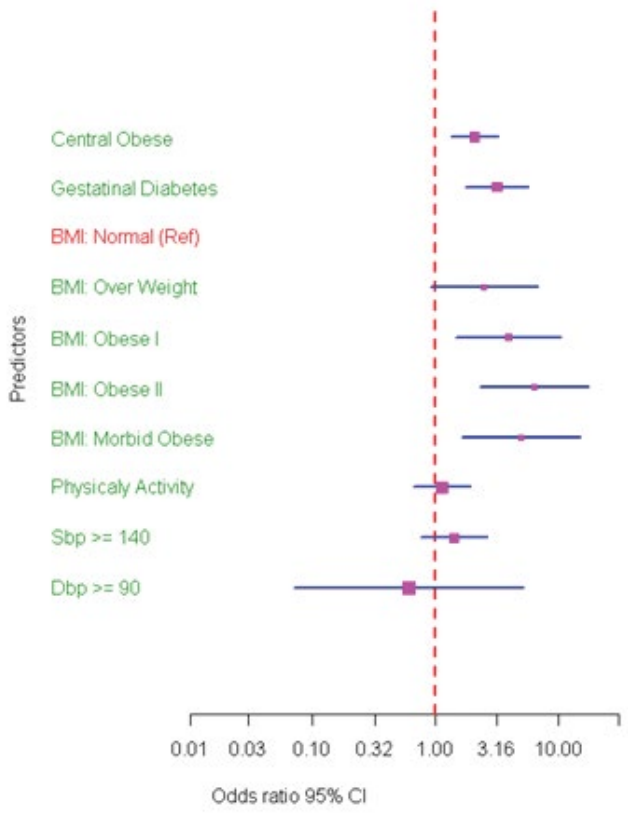

Figure 3: Association between clinical characteristics and prediabetes.

Our study aimed to find out the prevalence of prediabetes and its association with demographic and clinical characteristics in a sample of the adult Saudi population.

Emerging evidence suggests that people identified in a prediabetic status could be given health education to arrest or reverse progression of diabetes.[14]

The percentage of Saudi subjects who had an impaired fasting glucose (IFG) in the range 6.1–7.0 mmol/L was 14.7% in 2007[15]; however, our study in 2013 came up with a prevalence of prediabetes (23.6%) among adult Saudi population.

It is consistent with the trend in neighboring countries such as UAE, Kuwait, Bahrain, and Oman. In Oman, prediabetes prevalence is up to 35% by either IGT or IFG test, and 9% by both measurements.[16,17]

Specifically in Qatar, prevalence of prediabetes diagnosed with IGT was 12.5% while 1.3% with IFG with a total of (13.8%).[16]

Comparing our results and those of Gulf area with other countries around the world, prediabetes prevalence was found to be 10% in an Irish regional homeless population[17] and 18.7% in the Republic of Ireland[19] ranging from 8.3%–14.6% In India (three states and one union territory),[20] by IGT (11.4%) and by IFG (2.8%) in Spain, 22.7% prevalence of prediabetes in Korea,[21] but a higher rate was reported in the

United States, where the prevalence of IGT and IFG was 15% and 26%, respectively.[22]

The substantially high prevalence of prediabetes in Saudi population predicts a further increase in the prevalence of DM over the next few years.

Variables such as age group (>35 up to 65), low educational level (illiterates or primary education), students, and those with family history (brothers and sisters with DM) were found to be strongly associated with a prediabetes state.

Furthermore, variables such as central obesity, high BMI, and history of gestational diabetes were also found to be strongly associated with prediabetes.

Similar risk factors have been identified for other population in the region.[22,23]

Our results failed to show a relation between gender and prevalence of prediabetes, which showed high prevalence in male gender of Omani population.[4]

The results showed high prevalence of prediabetes with participants having a diabetic sibling but not either of the parents, while other studies used family history as one variant without subdivision to mother, father, brother, or sister. We might explain this as the respondandents' lack of information or failure to recall their parents' health issues. Sedentary lifestyle of the new generation may also have a role.

Surprisingly, our study did not show association between physical activities and prevalence of prediabetes, which has been found consistently in different population.[16] Which we might explain it to each individual understanding of physical activities as some patients understands few steps walking every week as being physically active.

There are several limitations for our study. First, a cross-sectional study design does not necessarily support the causal relation between variables and the prediabetes prevalence.

Second, as the recruitment of subjects is from the Department of Family Medicine (primary care) of one center, there may be a possibility that this sample is biased or not representative of general population.

Third, data collection depending on participants' memory may be inaccurate especially in relation to their family's history (fathers/mothers), which might be living in a far province with no close contact or they might be deceased.

Despite these, to our knowledge, this is the first study in Riyadh, Saudi Arabia, exploring the magnitude of prediabetes and its correlation with risk factors.

Conclusion

Prediabetes has high prevalence in Saudi population (23.6%), which predicts high prevalence of DM in the next few years. Prevalence of prediabetes associated with risk factors, which, by lifestyle intervention and educational sessions, could be minimized, and the incidence could be subsequently reduce the prediabetes as well incidence of overt diabetes.

Acknowledgments

We acknowledge our respondents for their participation in this study, FM-in-charge nurse in SFHP, patient relation representative in FM Department for calling patients newly diagnosed with DM or with abnormal results for counseling, and FM Department secretary for calling and typing jobs.

Conflict of Interest

None

References

1. International Diabetes Federation. *IDF Diabetes Atlas*, 5th edn. Brussels, Belgium. www.idf.org/diabetesatlas/5e/the-global-burden.
2. ADA. Total prevalence of diabetes and pre-diabetes. American Diabetes Association, 2009. http://www.diabetes.org/diabetes-statistics/prevalence.jsp.
3. CDC. National diabetes fact sheet, 2007. Centers for Disease Control and Prevention, 2007. http://www.cdc.gov/diabetes/pubs/factsheet07htm.
4. WHO, International Diabetes Foundation. Definition and diagnosis of diabetes mellitus and intermediate hyperglycaemia report of a WHO/IDF consultation. Geneva: World Health Organization, 2006.
5. Overview and Case Study II: Screening for Type 2 Diabetes and Pre-diabetes with HbA1c. Falls Church, VA: The Lewin Group, September 2009.
6. Kim C, Newton KM, Knopp RH. Gestational diabetes and the incidence of type 2 diabetes: a systematic review. Diabetes Care 2002;25:1862–8.
7. Lauenborg J, Hansen T, Jensen DM, Vestergaard H, Mølsted-Pedersen L, Hornnes P, et al. Increasing incidence of diabetes after gestational diabetes: a long-term follow-up in a Danish population. Diabetes Care 2004;27:1194–9.
8. Diabetes Care 2000;23 (Suppl 1):S20–23. It's fact sheet of WHO.
9. Freeland-Graves JH1, Nitzke S; Academy of Nutrition and Dietetics. J Acad Nutr Diet 2013;113(2).
10. http://www.who.int/mediacentre/factsheets/fs311/en/update march 2013.
11. The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure, Table 3, Page 12.
12. Diabetes Care 2013;36(Suppl 1), January 2013 By the Professional Practice Committee.
13. Wild S, Roglic G, Green A, Sicree R, King H. Global prevalence of diabetes: estimates for the year 2000 and projection for 2030. Diabetes Care 2004;27:1047–53.
14. Al-Shafaee MA, Bhorgava K, Al-Farsi YM, Mcilvenny S, Al-Mandhari A, Al-Adawi S, et al. Prevalence of pre-diabetes and associated risk factors in an adult Omani population. Int J Diab Dev Ctries.2011;31;166–74.
15. Al-Nuaim AR: Prevalence of glucose intolerance in urban and rural communities in Saudi Arabia. Diabet Med 1997;14(7): 595–602.

16. Mabry RM, Reeves MM, Eakin EG, Owen N. Gender differences in prevalence of the metabolic syndrome in Gulf. Cooperation Council Countries: a systematic review. Diabetes Med.2010; 27:593–7.
17. Bener A, Zirie M, Janahi IM, Al-Hamaq AQ, Musallam M, Wareham NJ. Prevalence of diagnosed and undiagnosed diabetes mellitus and its risk factors in a population–based study of Qatar. Diabetes Res Clin Protct 2009;84:99–106.
18. The prevalence of diabetes, pre-diabetes and the metabolic syndrome in an Irish regional homeless population. QJM. 2013 Jun;106(6):547-53. doi: 10.1093/qjmed/hct063. Epub 2013 Mar 27.
19. Diabetes in General Practice Audit Report. UCC ... Journal of Epidemiology and Community Health.
20. Prevalence of diabetes and prediabetes (impaired fasting glucose and/or impaired glucose tolerance) in urban and rural India: phase I results of the Indian Council of Medical Research-INdia DIABetes (ICMR-INDIAB) study.
21. Lee J-E, Jung S-C, Jung G-H. Prevalence of diabetes mellitus and prediabetes in Dalseong-gun, Daegu City, Korea. Diabetes Metab J 2011;35:255–63.
22. Davidson MB, Genuth S, Fagan TF, Palangio MA. American Diabetes Association Consensus statement on IFG and IGT. Clin Insights DM 2007;2–3.
23. Al-Isa A, Akanji AO, Thalib L. Prevalence of metabolic syndrome among female Kuwaiti adolescents using two different criteria. Br J Nutr2010;103:77–81.
24. Al-Shoumer KA, Al Asousi AA, Doi SA, Vasanthy BA. Serum leptin and its relationship with metabolic variables in Arab with type 2 diabetes mellitus. Ann Saudi Med 2008;28:367–70.

How to cite this article: Ghoraba MA, Shiddo OA, Almuslmani M, Jallad I, Khan A, Maranan G, Alharbi M, Alsaygh A. Prevalence of prediabetes in Family and Community Medicine Department, Security Forces Hospital, Riyadh, Saudi Arabia. Int J Med Sci Public Health 2016;5:777-784

Source of Support: Nil, **Conflict of Interest:** None declared.