Lifestyle related risk factors of type 2 diabetes mellitus in Saudi Arabia

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ABSTRACT

الأهداف : تقييم مردود تأثير النظام الغذائي والنشاط البدني على مخاطر الإصابة بمرض السكر من النوع 2 في المملكة العربية السعودية بالرغم من وجود التاريخ العائلي المرضي لمرض السكر .

الطريقة : أجريت دراسة مقارنة مع مجموعة ضابطة لاختبار الفرضية أن الممارسات الغذائية والنشاط البدني يقلل من خطر الإصابة بمرض السكر من النوع 2 على الرغم من وجود تاريخ عائلي لهذا المرض . تم اختيار العينة من بين المواطنين السعوديين للفئة العمرية70–30 عام، شملت العينة 283 مريض يعانون من مرض السكر من النوع 2 وعدد 215 (عينة مراقبة) من المرضى الذين لا يعانون من مرض السكر وقد أجريت الدراسة من خلال عينات عشوائية في مراكز الرعاية الصحية بالقصيم، المملكة العربية السعودية خلال الفترة من سبتمبر إلى نوفمبر 2009م . تم جمع معلومات المتغيرات الجغرافية، والتاريخ العائلي، والعادات الغذائية، والنشاط البدني، واستخدام الانحدار اللوجستي، قدرنا كذلك ضبط نسب منطقة المسئولية للعادات الغذائية والنشاط البدني بعد ضبط آثار نوع الجنس، والعمر، ومستوى التعليم، والتاريخ العائلي لمرض السكر .

النتائج : هناك علاقة قوية بين مرض السكر من النوع 2 وتاريخ الأم المرضي للسكر، وكذلك بين مستوى التعليم، وقلة ممارسة الرياضة وعادات النظام الغذائي . كانت نسبة منطقة المسئولية 5.5 لتناول الكبسة بانتظام (95% CI: 2.3, 13.5)، وللخضار 0.4 (95% CI: 0.2-0.7) وللتناولالتمور1.8 (95% CI:1.0-3.3) ولنمط حياة الخمول 2.5 (95% CI:1.2-5.0) .

خاتمة : يؤدي اتباع نظام غذائي صحي وأسلوب حياة نشط إلى انخفاض كبير في خطر الإصابة بمرض السكر من النوع 2 على الرغم من وجود تاريخ عائلي بمرض السكر. وهناك حاجة إلى إتباع برامج التوعية الصحية الفعالة لتعزيز نظام غذائي صحي وممارسة التمارين الرياضية بانتظام للحد من عبء مرض السكر في المملكة العربية السعودية .

Objectives: To assess the impact of diet and physical activity on the risk of type 2 diabetes mellitus (T2DM) in the Kingdom of Saudi Arabia (KSA) after adjusting for family history of diabetes.

Methods: We conducted a case-control study in Al-Qassim, KSA to test the hypothesis that dietary practices and physical activity modify the risk of type 2 diabetes regardless of family history. Male and female Saudi citizens 30-70 years of age were eligible to participate. The sample included 283 cases (T2DM patients) and 215 non-diabetic controls randomly selected from patients visiting the primary health care centers from September to November 2009. We collected information on demographic variables, family history, dietary habits, and physical activity. Using logistic regression, we estimated adjusted odds ratios (AOR) for dietary habits and physical activity after controlling for the effects of gender, age, education, and family history of diabetes.

Results: There is strong association between diabetes and maternal history of diabetes, education, lack of exercise, and dietary habits. The AOR for regular eating of Kabsa was 5.5 (95% confidence limits [CL]: 2.3-13.5); for vegetables an AOR of 0.4 (95% CL: 0.2-0.7); for dates an AOR of 1.8 (95% CL: 1.0-3.3) ;and the AOR for sedentary lifestyle was 2.5 (95% CL: 1.2-5.0).

Conclusion: Healthy diet and active lifestyle may significantly decrease the risk of T2DM in spite of having a family history of diabetes. Effective health education programs promoting healthy diet and regular exercise are needed to reduce the burden of diabetes in Saudi Arabia.

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In the post World War II era, a general trend of affluence in Western countries triggered a change in lifestyles, leading to a significant increase in non-communicable diseases. The transition from communicable to non-communicable diseases arrived at the heels of demographic transition,[1] and led to a major shift in the paradigm of health and illness. Other developing countries have followed suit, where the demographic and epidemiologic transitions have been much faster than anticipated. The diabetes pandemic is an outstanding example: the estimated number of diabetic patients worldwide was 171 million in 2000, which is expected to increase to 366 million by 2030, and the percentage of diabetics living in developing countries is projected to increase from 74% in 2000 to 81% in 2030.[2] Type 2 diabetes mellitus (T2DM) is defined as a combination of insulin resistance (reduced ability of insulin to stimulate utilization of glucose in the body), and reduced secretion of insulin. Insulin resistance is believed to be associated with decreased physical activity and obesity. Family history of diabetes, obesity, and hypertension increases the risk of diabetes. Diabetes is also found to be more common among certain ethnic groups. Pre-diabetes is a condition characterized by abnormal blood glucose levels that are below the 'cut-off' point for diabetes.[3] Persons with pre-diabetes are at a higher risk of developing diabetes, but its onset can be delayed or prevented by diet control, reducing body weight, and increasing physical activity. Unhealthy dietary patterns and lack of exercise are therefore, the most important factors responsible for the increasing incidence of diabetes worldwide.[4]

The epidemiologic transition in the Kingdom of Saudi Arabia (KSA) has been fast and complete. Rapid economic growth during the last 4 decades led to a remarkable increase in living standards and adoption of a 'Westernized' lifestyle, characterized by unhealthy dietary patterns, and decreased physical activity.[5] An increase in the prevalence of T2DM is also observed during the same period, which is attributed to the dramatic changes in lifestyle, in addition to genetic predisposition of Saudi people to diabetes, and a high prevalence of consanguineous marriages.[6] A national survey in 2004 estimated that 23.7% of Saudi adults (age 30-70 years) suffered from T2DM, and another 14.1% had impaired fasting glucose.[7] Prevalence of diabetes was significantly higher in urban areas (25.5% versus 19.5% in the rural areas). The burden of diabetes in KSA is likely to increase to disastrous levels, unless a comprehensive epidemic control program is implemented rigorously promoting healthy diet, exercise and active lifestyles, and curbing obesity.[8,9] Family history has a major role in the cause of diabetes. First-degree relatives of diabetic patients have long been known to have an increased risk of developing T2DM. Recent studies in genetic research have also identified the genetic variants linked with T2DM.[10,11] Family history of diabetes is also used as a predictor of T2DM in population-based screening programs.[12] However, roughly half of the risk of T2DM can be attributed to lifestyle, and half to genetics. Lifestyle modification is particularly effective in the prevention, or delay of progression to diabetes among individuals with a family history of diabetes. However, the International Diabetic Federation[13] recommends that diabetes control programs should simultaneously promote lifestyle modification among high-risk individuals, as well as the entire population. Intake of dietary energy in excess of expenditure simply results in weight gain and increases the risk of T2DM. Physical inactivity has long been identified as a risk factor of T2DM independently of its effects on body size, and dietary patterns. Physical activity of moderate to vigorous intensity and duration, decreases the risk of conversion of impaired glucose tolerance into diabetes even in the absence of significant weight loss, and independently of other risk factors.[13] Regular strenuous exercise (not the minimal activity of modern day life) is needed to reduce the risk of type 2 diabetes among adults, which works in a dose response manner.[14] Similarly, the 'Western' dietary patterns have been attributed to a significant increased risk of diabetes in several studies.[15,16] In a 12-year prospective study in the USA,[17] the risk of diabetes was significantly increased among men with 'Western' dietary pattern (characterized by higher consumption of red/processed meat, French fries, high-fat dairy products, refined grains, sweets, and desserts), compared to those having a 'prudent' dietary pattern comprising of fresh vegetables and fruits, fish, poultry, and whole grains. The risk was significantly greater among obese men.[17] In the USA, poor dietary habits and obesity are closely linked with type 2 diabetes and its complications.[18] While the Arab populations are known to have a genetic predisposition to diabetes, dietary patterns and physical activity play an equally important role in its cause. A regional study in Qatar[19] found that obesity, family history, and

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smoking habits were equally associated with diabetes.In KSA, diabetes, along with hypertension and coronary artery disease has emerged as a major challenge to the health system. The World Health Organization estimates that non-communicable diseases will soon become the principal global cause of morbidity and mortality in KSA.[20] However, population-based epidemiological studies on type 2 diabetes are lacking in KSA. In particular, there is no information on the interaction between the genetic and environmental risk factors of diabetes. Moreover, certain dietary patterns are indigenous in KSA (such as regular eating of dates, bakery items, desserts, and rice and meat dishes with high contents of fat and carbohydrates). No population-based study has attempted to investigate the association between dietary patterns and the risk of type 2 diabetes independently of the effects of gender, age, education, and family history of diabetes. Our study attempts to fill these gaps by focusing on the behavioral and bio-social risk factors (dietary patterns, physical activity, and genetic predisposition) among the Saudi population. We estimate the net risk of behavioral risk factors after controlling for the effects of the bio-social risk factors. We believe this information will guide health education programs for prevention and control of diabetes in KSA. With this in mind, we aimed to identify the lifestyle-related risk factors associated with T2DM among adult Saudi citizens.

Methods. We conducted a retrospective case-control study from September to November 2009 in 6 primary health care centers (PHCC's) of Al-Qassim, KSA. We tested the hypothesis that dietary practices and physical activity impact the risk of type 2 diabetes regardless of its bio-social risk factors (age, family history of diabetes, and education). Our study population comprised of outdoor patients visiting the PHCC's in Al-Qassim. Male and female native Saudi citizens 30-70 years of age were eligible to participate. Diabetic patients visiting the PHCC's were recruited as cases, while the non-diabetic patients visiting the same PHCC's served as controls. The cases and controls were not matched. A random blood glucose level reading was obtained from all potential participants. Non-diabetic controls having random blood glucose level of ≥180 mg/100ml were excluded from the study, and were advised to consult their doctor immediately.

We used the StatCalc procedure of Epi-Info version 6.04 to calculate the sample size according to the following specifications: 95% confidence level; 90% power; assumed level of risk (odds ratio) ≥2.0; and 25% assumed rate of exposure among controls. The required number of cases and controls was 216 each, however, we aimed to interview about 300 subjects in each category. Every fifth patient visiting the PHCCs from September and November 2009, who met the eligibility criteria (either as case or control) was requested to participate in the study. In case of refusal, the next patient was approached with the same request. Each of the 6 participating PHCCs was required to interview 50 cases and 50 controls during the study period. The study protocol was approved by the Ethical Review Committee of the College of Medicine, Qassim University, Al-Qassim, KSA. Informed consent was obtained before the interview and before obtaining blood sample. All records were kept strictly confidential. Patient's name and address were not included in the database. Interviews were conducted by healthcare providers of the respective PHCCs, who had excellent rapport with their patients. They were rigorously trained to use a pre-coded questionnaire in Arabic, which included sections on demographic information (age, gender, education, marital status, and so forth), family history of diabetes, dietary habits, physical activity, consanguinity, and exposure to health education. Questions on dietary preferences, as well as a detail of food items consumed during the last 24 hours were also included. In addition, the cases were asked detailed questions on their dietary habits and physical activity before their diabetes was diagnosed. Every effort was made to minimize inter-observer bias, all questions were pre-coded, and most had simple yes/no answers. All interviewers were trained together.

Data were entered and analyzed using the Statistical Package for Social Sciences for Windows version 11.5 (SPSS Inc, Chicago, IL, USA). We conducted cross-tabulation between disease status (case/control) and our hypothesized risk factors. Odds ratios (OR) and 95% confidence limits were computed from these tables. We conducted logistic regression analyses using disease status (case/control) as the binary dependent variable. Adjusted odds ratios (AOR) and their 95% confidence limits were computed for the lifestyle-related risk factors of diabetes through logistic regression models controlling for the effects of age, gender, education, marital status, mother's history of diabetes, father's history of diabetes, and consanguinity between parents. Dietary patterns (Kabsa, dates, fish, vegetables, bakery items, potato chips and French fries, snacks, full fat dairy products, coffee/tea with sugar, and juices and soft drinks), and physical activity (sedentary, moderately active, and active) were included in the same model as independent variables to control for the effects of inter-relation between dietary patterns and physical activity. Hosmer-Lemeshow goodness of fit test and test of correlations of estimates were applied to check the adequacy of logistic regression models.

Results. At the end of the assigned data collection period, 286 cases and 291 controls were interviewed. Three cases and 76 controls had to be excluded, either because they did not meet the eligibility criteria, or due to incomplete information recorded in the questionnaire. As a result, the number of patients included in the present analysis is 283 for cases, and 215 for controls. **Table 1** presents the demographic characteristics of respondents and their sources of health information. Diabetic cases are significantly older than the controls; nearly 70% of cases, but only 27% of controls are >50 years (p=0.0000). The cases are also more likely to be widowed (p=0.0007). Only 25% of the cases, while 48% of controls have secondary school or university education (p=0.0000). Approximately 72% of the respondents received information materials on diabetes. The most common sources of information were PHCCs, and government hospitals. Cases were more likely to receive information than controls, both from the PHCCs (p=0.010) and government hospitals (p=0.0000). Only 59% respondents attended health education sessions on diabetes in PHCCs, and cases were more likely to attend these sessions than the controls (p=0.0000). **Table 2** presents the distribution of cases by age at onset and clinical presentation of diabetes. More than one third of the patients were diagnosed when they were <40 years (approximately 6% were diagnosed at <30 years of age). The mean age at onset was 42 years in females, and 46 years in males. Patients whose mothers were diabetic were diagnosed at a younger age, than those who did not have maternal history of diabetes (mean age at onset: 42 and 45 years). The most common reported symptoms at the onset of diabetes were increased frequency of urine, fatigue, tingling sensation in fingers, and weight loss. Among the patients, diabetes was diagnosed only after they started having vision problems. Another 44% of cases had vision problems after diagnosis. Weight changes, delayed healing of wounds, and tingling sensation in fingers and hands were the other complications arising after the diagnosis (**Table 2**). **Table 3** presents the unadjusted ORs and 95% confidence limits, estimating the risk ofT2DM for demographic variables and family history of diabetes. As expected, the risk of diabetes increases with age. The cases are approximately 3 times more likely to be widowed than the controls; they are also more likely to have maternal history of diabetes, and to have a sibling with type 2 diabetes. Case patients are less likely to have secondary school or university education. **Table 4** presents the unadjusted ORs estimating the risk associated with dietary habits and physical inactivity. Routine consumption of certain food items (Kabsa, dates, fish, bakery items, French fries/potato chips, full fat dairy products and coffee/tea with sugar) significantly increases the risk of T2DM. Physical inactivity also contributes toward increasing the risk of diabetes; persons leading a sedentary life are at significantly greater risk of diabetes than those having a more active lifestyle. Routine consumption

Table 1 - Percentage distribution of study participants by demographic characteristics and sources of health education.

Variables	Cases N=283	Controls N=215
	n (%)	
Age, years*		
30-39	28 (9.9)	86 (40.0)
40-49	56 (19.9)	71 (33.0)
50-59	115 (40.8)	43 (20.0)
60+	83 (29.4)	15 (7.0)
Gender		
Male	136 (48.1)	106 49.3)
Female	147 (51.9)	109 (50.7)
Marital status*		
Never married	4 (1.4)	9 (4.2)
Married	237 (83.7)	196 (91.1)
Divorced	9 (3.2)	1 (0.5)
Widowed	33 (11.7)	9 (4.2)
Education level (highest level achieved)*		
Primary school	168 (59.5)	87 (40.4)
Preparatory school	3 (1.1)	3 (1.4)
Secondary school	35 (12.5)	45 (20.7)
University degree	35 (12.5)	58 (26.8)
Other (professional diploma, and others)	42 (14.7)	23 (10.8)
Sources of health education on diabetes mellitus		
Received materials from PHCC*	215 (76.0)	140 65.0)
Received information from goverment hospital*	161 (57.0)	73 (34.0)
Received health education at PHCC*	201 (71.0)	97 (45.0)

*Differences between cases and controls are statistically significant (p<0.05). PHCC - Primary Health Care Centers

Table 2 - Percentage distribution of diabetic cases by certain characteristics of the disease.

Variables	Cases n=283 (%)
Age at onset of disease, years	
<30	18 (6.4)
30-34	35 (12.4)
35-39	45 (15.9)
40-44	47 (16.6)
45-49	58 (20.5)
54-54	38 (13.4)
55+	42 (15.0)
Presenting symptoms of disease	
Fatigue	139 (49.1)
Increased frequency of urine	195 (69.0)
Tingling sensation in hands and fingers	133 (47.0)
Weight loss	99 (35.0)
Vision problems	68 (24.0)
Other symptoms	48 (17.0)
Patients experiencing complications of diabetes	
Weight changes	82 (29.0)
Delayed healing of the wounds	74 (26.1)
Vision problems	125 (44.1)
Tingling sensation in fingers, hands, and extremities	116 (41.0)

Table 3 - Unadjusted odds ratios and 95% confidence limits of type 2 diabetes mellitus for selected demographic variables and family history of diabetes and obesity.

Variables	Odds Ratio	95% confidence limits
Age-group, years		
30-39 (reference)	1.0	--
40-49	2.4	1.4-4.2
50-59	8.2	4.7-14.3
60+	15.6	7.2-31.3
Gender		
Female (reference)	1.0	--
Male	0.9	0.7-1.4
Marital status		
Married (reference)	1.0	--
Single	0.4	0.1-1.2
Divorced/Widowed	3.5	1.7-7.1
Education		
Primary/Preparatory school (reference)	1.0	--
Secondary school	0.4	0.2-0.7
University degree	0.3	0.2-0.5
Other (professional diploma, and so forth)	0.9	0.5-1.7
Family history of diabetes (reference no family history)		
Mother	2.0	1.3-2.9
Father	1.2	0.8-1.7
Sibling	2.6	1.7-3.9
Maternal relatives	0.8	0.5-1.3
Paternal relatives	0.7	0.4-1.1
Consanguinity		
Parents are not first cousins (reference)	1.0	--
Parents are first cousins	1.1	0.7-1.8

Table 4 - Unadjusted odds ratios and 95% confidence limits estimating the risk of type 2 diabetes mellitus associated with dietary preferences, and physical activity.

Variables	Odds ratio	95% confidence limits
Food item consumed (reference: food items not consumed routinely)		
Kabsa	4.9	2.6-9.1
Dates (≥7 pieces per day)	2.4	1.6-3.5
Fish	2.9	1.9-4.4
Vegetables	1.1	0.8-1.6
Bakery items	3.0	2.1-4.4
Potato chips and/or French fries	2.1	1.4-3.0
Snacks and hummus	1.2	0.8-1.7
Full fat dairy products	3.5	2.4-5.1
Coffee and/or tea with sugar	1.6	1.1-2.5
Juices and soft drinks (regular)	1.3	0.9-1.9
Type of daily physical activity		
Do regular exercise (reference)	1.0	--
Have a job requiring physical exertion	1.9	1.2-2.8
Sedentary (not active on the job, or in daily life)	2.9	1.7-4.9

Table 5 - Adjusted odds ratios* and 95% confidence limits, estimating the risk of type 2 diabetes mellitus (DM) associated with dietary preferences and physical activity.

Variables	Odds ratio	95% confidence limits
Food item consumed routinely (reference food item not routinely consumed)		
Kabsa	5.5	2.3-13.5
Dates (≥ 7 pieces per day)	1.8	1.0-3.3
Fish	2.5	1.3-4.7
Vegetables	0.4	0.2-0.7
Bakery items	2.4	1.3-4.6
Potato chips and/or french fries	2.2	1.2-3.9
Snacks and hummus	0.9	0.5-1.7
Full fat dairy products	1.6	0.8-2.9
Coffee and/or tea with sugar	0.7	0.3-1.2
Juices and soft drinks (regular)	1.2	0.7-2.0
Type of daily physical activity		
Do regular exercise (reference)	1.0	--
Have a job requiring physical exertion	2.1	1.2-3.7
Sedentary (not active on the job or in daily life)	2.5	1.2-5.0

*Odds ratio for each variable shown is adjusted for all variables in this table, and age, gender, education, marital status, mother's history of diabetes, father's history of diabetes, and consanguinity; the estimates are derived through logistic regression

of vegetables, snacks, and juices/soft drinks does not appear to be associated with type 2 diabetes. **Table 5** presents the results of the logistic regression analysis. In this model, all the bio-social and lifestyle-related risk factors are included together. The AOR reflect the risks of acquiring type 2 diabetes after controlling for age, gender, education, marital status, mother's history of diabetes, father's history of diabetes, and consanguinity, and also take into account the inter-relationship between dietary patterns and physical activity. The AORs are estimates of the risk of diabetes associated with dietary habits and physical activity. Note that there are no remarkable differences between the unadjusted and adjusted risk estimates, except that AORs for dates, snacks, full fat dairy products, coffee/tea and juices/soft drinks are no more significant. After adjusting for the bio-social risk factors, routine consumption of Kabsa, fish, bakery items, and French fries/potato chips emerge as significant risk factors of diabetes, while a routine consumption of vegetables seems to play a protective role, decreasing the risk of acquiring type 2 diabetes. Finally, lack of regular exercise also increases the risk by 2-folds, compared to the persons who do regular exercise. Note that there is no difference in risk between individuals who have a job that requires physical exertion and those leading a sedentary life.

Discussion. The results of this study are consistent with those from several other studies in KSA and abroad[4-7] with regard to the association between type 2 diabetes and age, education, and family history of diabetes. Type 2 diabetes is more common among older, less educated persons, and those who have a family history of diabetes. Similarly, unhealthy dietary patterns and lack of physical activity are also linked with the risk of diabetes. However, our study was successful in identifying the specific dietary patterns that are responsible for increasing the incidence of type 2 diabetes in KSA. The dietary pattern of Kabsa, French fries and bakery items is very common in KSA. Our findings show that these food items are the most important determinants of T2DM in our study population. Our study also shows that persons not carrying out any form of regular exercise are at a significantly greater risk, even after adjusting for their dietary habits, age, and family history. Our results are consistent with previous studies[8] on the role of physical activity: leading a sedentary life increases the risk of diabetes considerably. Unfortunately, studies on the lifestyle-related risk factors have shown that physical inactivity and unhealthy dietary patterns are quite common among the Saudi population.

Several studies[15,16] have shown that healthy lifestyle can significantly reduce the risk of T2DM, and/or delay its onset among genetically susceptible individuals. Furthermore, diabetes is more effectively controlled among patients who have high levels of awareness, and who consciously make choices for a healthy lifestyle. Physical inactivity and obesity are among the most important risk factors associated with T2DM besides family history of diabetes. In a study in Qatar,[21] consanguinity came as a risk factor, especially if it is a first-degree consanguinity marriage.The same study found that adults between 30-39 years age are the fastest growing diabetic adult age group.[21] Our study confirms many of these findings, although we found no difference in the risk of diabetes with regard to consanguinity among parents. We found that the risk of T2DM is high only if the mother is diabetic, and that there is no increased risk if the father, or any other maternal or paternal relatives have the disease. It was not possible to assess the impact of health education on the risk of diabetes in this study. Nonetheless, we found that less educated individuals are at a higher risk, perhaps due to low levels of awareness on the disease and its causes. Health education and media campaigns targeting the less educated segments of population would facilitate an increase in the awareness regarding the risk factors of diabetes. Our study suggests that health education is offered mainly in the PHCCs, and less frequent in government hospitals. Moreover, diabetes patients are more likely to receive health education than the non-diabetic patients visiting health facilities. Several studies[9,13,20,22] have shown that health education plays a major role in the prevention of non-communicable diseases, particularly with reference to patient compliance to doctors' instructions regarding diet and exercise.[22] The effectiveness of health education through PHCCs has been proven in several developed and developing countries.[22] Indeed, the Framingham study in the USA (www.framinghamheartstudy.org) established as early as in the 1950s that information and education to general population to persuade them to lead a healthy and active life is the most cost-effective strategy to reduce the burden of non-communicable diseases. The Ministry of Health in Saudi Arabia has detailed guidelines for health education to diabetic patients,[23] but their implementation needs to be further strengthened.

Our study was constrained by several elements such as, the study population comprised the patients utilizing the PHCCs alone, therefore, it excluded a small but significant proportion of patients who visit private health facilities. Due to the limited time available for interviews in health facility setting, we could not use a more elaborate questionnaire on dietary habits (such as frequency, quantity, and others). In spite of these limitations, we believe that the results are applicable to the study population, and can be extended to other populations with similar socio-cultural practices.

In conclusion, unhealthy diet and physical inactivity are the most important risk factors of type 2 diabetes in our study population. These results can be extended to the entire population in KSA, as the dietary patterns and exercise habits in Al-Qassim are not unique to this region alone. However, more such prevention research studies are needed to facilitate developing community-based prevention programs. Epidemiologists, public health researchers, and health policy makers should work together to develop comprehensive programs for health promotion and disease prevention through increasing public awareness. We believe that our study is a step in that direction.

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