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CLINICAL & BASIC RESEARCH

Spousal Concordance of Diabetes Mellitus among Women in Ajman, United Arab Emirates

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التوافق في مرض السكري عند النساء المتزوجات المراجعات للمؤسسات الصحية في عجمان، الإمارات العربية المتحدة

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ABSTRACT: ***Objectives:*** Spousal concordance is defined as similar behaviours and associated health statuses between spouses. This study aimed to identify the concordance of diabetes mellitus (DM) and related variables among genetically unrelated couples in Ajman, United Arab Emirates (UAE). ***Methods:*** This cross-sectional study included 270 married women attending either the Mushairef Health Center or the Gulf Medical College Hospital in Ajman between May and November 2012. A validated questionnaire was designed to determine sociodemographic characteristics and a history or family history of DM, hypertension, coronary artery disease or dyslipidaemia among the women and their husbands. The weight, height, body mass index, waist circumference, fasting blood sugar and glycated haemoglobin (HbA1c) levels of all women were measured. ***Results:*** Of the women, 39.3% of those with diabetic husbands and 39.9% of those with non-diabetic husbands were diabetic themselves (P >0.050). The prevalence of DM spousal concordance was 17.8%. A history of hypertension, coronary artery disease and dyslipidaemia was significantly more frequent among women whose husbands had a history of the same conditions (P = 0.001, 0.040 and 0.002, respectively). Spousal concordance of abnormal glycaemia among non-diabetic women with diabetic husbands was significant (P = 0.001). Having a diabetic husband (P = 0.006) and being obese (P = 0.009) were the only significant predictors of hyperglycaemia among non-diabetic women after controlling for confounding factors. ***Conclusion:*** There was significant concordance of abnormal glycaemia among non-diabetic women with diabetic husbands. The spouses of diabetic patients may therefore be a target population for regular hyperglycaemia and DM screening.

Keywords: Spouses; Women; Diabetes Mellitus; Hyperglycemia; United Arab Emirates.

الملخص: أهداف: يعرف التوافق الزوجي بأنه التشابه في السلوكيات و ما يرتبط بها من الأوضاع الصحية بين الزوجين. هدفت هذه الدراسه إلى التعرف على وجود التوافق في مرض السكري و المتغيرات ذات الصله بين الأزواج الغير مرتبطين وراثيا في عجمان، الإمارات العربية المتحدة. **منهجية:** شملت هذه الدراسة المقطعية 270 سيدة متزوجة من المراجعات إلى مركز مشيرف للرعاية الصحية أو مستشفى كلية الخليج الطبية في عجمان بين شهري مايو ونوفمبر 2012. تم تصميم استمارة استبيان باللغة العربية تم التحقق منها لتحديد الحالة الإجتماعية و الديموغرافية والتاريخ العائلي و الشخصي لمرض السكري، ارتفاع ضغط الدم، مرض الشريان التاجي و إضطراب الدهون في الدم بين النساء و أزواجهن. تم قياس الوزن والطول و مؤشر كتلة الجسم، ومحيط الخصر و مستوى السكر في الدم في حالة الصيام ونسبة الهيموغلوبين الغليكوزيلاتي (HbA1c) لجميع النساء. **نتائج:** من بين النساء، كانت 39.3% من اللواتي يعاني أزواجهن من مرض السكري و 39.9% من اللواتي لا يعاني أزواجهن من مرض السكري مصابات بمرض السكري (P >0.050). كان إنتشار التوافق الزوجي لمرض السكري 17.8%. كان تاريخ ارتفاع ضغط الدم و مرض الشريان التاجي و اضطراب الدهون في الدم الأكثر شيوعا وبشكل ملحوظ عند النساء اللواتي لدى أزواجهن تاريخ لنفس الحالات (P = 0.001، 0.040 و 0.002 على التوالي). كان هناك توافق زوجي ذو أهمية بين المنسوب غير الطبيعي للسكري عند الزوجات غير المصابات بالسكري مع أزواجهن المصابين بالسكري (P = 0.001). وجود زوج مصاب بالسكري (P = 0.006) و السمنة (P = 0.009) هما المتغيران الوحيدان ذوي الأهمية المتنبأن بوجود فرط سكر الدم عند الزوجات غير المصابات بالسكري بعد ضبط عوامل التدقيق الأخرى. **خاتمة:** كان هناك توافق زوجي هام بين و جود فرط سكر الدم للزوجات غير المصابات بالسكري مع أزواجهن المصابين بالسكري. لذلك فإن أزواج الأشخاص المصابين بالسكري يمكن أن يكونوا من السكان المستهدفين بالمسوحات الصحية لمرض السكري وفرط سكر الدم.

كلمات مفتاحية: الأزواج؛ النساء؛ مرض السكري؛ فرط سكر الدم؛ الإمارات العربية المتحدة.

Advances in Knowledge

- *In the current study, there was significant spousal concordance of abnormal glycaemic levels. Non-diabetic women with diabetic husbands were 2.5 times more likely to have abnormal glycaemic levels than those with non-diabetic husbands.*

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Application to Patient Care

- *The concept of spousal concordance provides an insight into which conditions or lifestyle behaviours may put the spouses of diabetic patients at risk of developing diabetes mellitus (DM) themselves. This information can then be utilised as a supportive measure in DM awareness, education and screening interventions.*
- *The findings of this study indicate that the spouses of diabetic patients should be targeted for routine hyperglycaemia screening.*

Diabetes mellitus (DM) is currently one of the most common health concerns worldwide, with a potentially detrimental effect on the everyday life of those affected by the condition.[1,2] In 2010, 190 million people had DM; this is estimated to increase to 330 and 366 million by 2025 and 2030, respectively.[2] Although genetic factors are important in the development of type 2 DM, they alone cannot explain the rapid rise of this disease and it is believed that the condition results from an interaction between genetic and environmental factors.[3,4]

Spousal association/concordance has been identified as a similar connection between spouses in behaviour and in health status.[5] Studies have found that married couples often have associated or concordant health statuses.[6,7] Spouses often share a common living environment, social habits, eating patterns, physical activity levels and other health-related behaviours, but are usually genetically unrelated; thus, similarities in disease patterns between spouses mainly reflect underlying environmental aetiologies.[6,8] Previous research has shown that the marital relationship influences the health of spouses living within the same household.[9] It has been found that social support—particularly spousal support—has a positive impact on patient outcomes, health behaviours and self-care management strategies.[6,10,11] Simple lifestyle modifications have proven effective in the prevention of type 2 DM and interventions targeting married couples are reportedly more effective than those aimed at individuals.[12,13] Targeting both patients and their spouses may enhance the collective efficacy of behavioural interventions for chronic illnesses in comparison to patient-oriented approaches. In addition, interventions aimed at couples enhance long-term maintenance of behavioural changes.[9]

In the United Arab Emirates (UAE), the prevalence of DM is 24% among citizens and 17.4% among expatriates.[14] In 2013, the International Diabetes Federation (IDF) ranked the prevalence of type 2 DM in the UAE as the fifth highest in the Middle Eastern and North African region.[15] However, no literature yet exists regarding the spousal concordance of DM or abnormal glycaemic levels in the UAE. The objective of the current study was therefore to investigate the spousal concordance of DM among married women in Ajman, UAE.

Methods

This cross-sectional study was conducted at two health centres in Ajman, the Gulf Medical College Hospital and Mushairef Health Center, between May and November 2012. The inclusion criteria included all women between 30 and 75 years old who been married for at least one year to a man who was not their genetic relative and who were attending either of these two health institutions during the study period. Pregnant women, women who were related to their husbands and those who could not communicate adequately in Arabic or English were excluded. The sample size was determined according to a 20% prevalence of DM in the UAE using the following formula:

$$n = Z^2 pq/L^2$$

where p was 0.2 and q was 0.8, with a marginal error of 5% and a significance level of 95%.[3,16] According to this, the required sample size was 246 participants. A consecutive sampling technique was used to recruit 270 women for the study according to the inclusion criteria.

Data collection was carried out during direct interviews with the participants by a member of the research team. A pilot-tested questionnaire was designed to determine the participants' sociodemographic and other health-related variables. Specific items on the questionnaire required the women to report a history or family history of DM, gestational DM, hypertension, coronary artery disease (CAD) or dyslipidaemia for both themselves and their husbands. Participants also reported their own and their husband's smoking status and physical activity level (mild, moderate/vigorous or none). The Global Tobacco Surveillance System definition for a current tobacco smoker was used to identify current smokers.[17] The recommendations of the World Health Organization (WHO) were used to define physical activity levels.[18] The content of the questionnaire was validated by two specialists in internal medicine and community medicine. The questionnaire was then translated from English into Arabic and the Arabic version subsequently validated.

Weight, height, waist circumference (WC), fasting blood glucose (FBG) and glycated haemoglobin (HbA1c) measurements were taken for all of the women. Abnormal glycaemia was defined as

Table 1: Self-reported characteristics of women and their husbands according to married women attending primary health centres in Ajman, United Arab Emirates (N = 270)

Characteristic	n (%)	
	Women	Husbands
Age in years		
30–39	77 (28.5)	45 (16.7)
40–49	87 (32.2)	59 (21.9)
50–59	71 (26.3)	75 (27.8)
≥60	35 (13.0)	91 (33.7)
History of DM		
Yes	107 (39.6)	122 (45.2)
No	163 (60.4)	148 (54.8)
Treatment for DM		
Diet and oral hypoglycaemic drugs	79 (73.8)	100 (82.0)
Oral hypoglycaemic drugs and insulin	22 (20.6)	21 (17.2)
Diet only	6 (5.6)	1 (0.8)
History of HTN		
Yes	97 (35.9)	121 (44.8)
No	173 (64.1)	149 (55.2)
History of CAD		
Yes	13 (4.8)	35 (13.0)
No	257 (95.2)	235 (87.0)
History of dyslipidaemia		
Yes	99 (36.7)	112 (41.5)
No	171 (63.3)	158 (58.5)
Smoker status		
Current smoker	5 (1.9)	71 (26.3)
Ex-smoker	0 (0.0)	23 (8.5)
Never smoker	265 (98.2)	176 (65.2)
Level of physical activity		
Mild	148 (54.8)	134 (49.6)
Moderate/vigorous	23 (8.5)	47 (17.4)
None	99 (36.7)	89 (33.0)

DM = diabetes mellitus; HTN = hypertension; CAD = coronary artery disease.

HbA1c levels of ≥5.7%.[19] Pre-diabetes and DM were diagnosed according to the criteria of the WHO, IDF and American Diabetes Association.[19,20] Weight and height measurements were used to determine body mass index (BMI). Obesity and abdominal obesity were defined as a BMI of ≥30 kg/m^2 and a WC of ≥88 cm, respectively.

Statistical analysis was carried out using the Statistical Package for the Social Sciences (SPSS), Version 19 (IBM Corp., Chicago, Illinois, USA). Data were described using means ± standard deviations for continuous variables and proportions for categorical variables. Comparisons between group characteristics were made with Chi-squared, Z- and t-tests. A logistic regression analysis was used to assess the odds of abnormal glycaemic levels among non-diabetic women according to the diabetic status of their husbands. Univariate logistic regression analyses were performed as potential predictors of abnormal glycaemia among non-diabetic women. All potential predictors were entered into a multivariable regression analysis and the variables that most accurately predicted outcomes were identified. A *P* value of <0.05 was considered statistically significant.

This study was approved by the Ethics Committee of the Gulf Medical University and the UAE Ministry of Health. The Ministry of Health Ethics Committee approved data collection from the Mushairef Health Center, while the Gulf Medical University Ethics Committee approved data collection from the Gulf Medical University Hospital. The nature and procedures of the study and the rights of the participants were explained to all women enrolled in the study. All of the subjects gave informed consent before participating in the study.

Results

The sociodemographic data of the participants and their husbands are presented in Table 1. In comparison to the women, a history of DM (45.2% versus 39.6%), hypertension (44.8% versus 35.9%), CAD (13.0% versus 4.8%) and dyslipidaemia (41.5% versus 36.7%) was more common among the husbands. In addition, more husbands were current smokers (26.3% versus 1.9%) and undertook moderate/vigorous physical activity (17.4% versus 8.5%). A total of 107 women (39.6%) and 122 husbands (45.2%) were diabetic. The mean duration of DM was 6.2 ± 5.9 years among diabetic women and 7.4 ± 5.9 years among diabetic husbands. The frequency of obesity among diabetic and non-diabetic women was 61.7% (n = 66) and 57.7% (n = 94), respectively.

The frequency of DM among women with diabetic and non-diabetic husbands was 39.3% (n = 48) and 39.9% (n = 59), respectively (Z = 0.1; *P* >0.050). Spousal concordance of DM was found among 48 couples, resulting in a prevalence rate of 17.8%. A history of

Table 2: Clinical variables of married women attending primary health centres in Ajman, United Arab Emirates, according to the diabetic status of their husbands (N = 270)

Variable	Mean ± SD	
	Women with diabetic husbands (n = 122)	Women with non-diabetic husbands (n = 148)
FBG in mmol/L	6.7 ± 6.3	6.0 ± 1.8
HbA1c %	6.2 ± 1.3	6.2 ± 1.2
BMI in kg/m^2	31.7 ± 6.6	32.0 ± 6.4
WC in cm	90.5 ± 14.2	91.0 ± 12.3

SD = standard deviation; FBG = fasting blood glucose; HbA1c = glycated haemoglobin; BMI = body mass index; WC = waist circumference.

Table 3: Proportion of non-diabetic married women attending primary health centres in Ajman, United Arab Emirates, according to their glycaemic level and the diabetic status of their husbands (N = 163)

Glycaemic level	Non-diabetic women with diabetic husbands (n = 74)	Non-diabetic women with non-diabetic husbands (n = 89)	Total
Abnormal*	42	33	75
Normal	32	56	88

**Glycated haemoglobin levels of >5.7%.[19]*

Table 4: Predictors of abnormal glycaemic levels* among non-diabetic married women attending primary health centres in Ajman, United Arab Emirates (N = 163)

Predictor	OR (95% CI)	*P* value
Age	1.01 (0.98–1.04)	0.362
Duration of marriage	1.01 (0.98–1.04)	0.341
Duration of stay in the UAE	1.01 (0.98–1.02)	0.536
Being a housewife	1.37 (0.71–2.66)	0.343
Having a diabetic husband	2.22 (1.18–4.18)	0.013
Obesity†	3.08 (1.60–5.94)	0.001
Abdominal obesity‡	2.99 (1.57–5.68)	0.001
History of GDM	0.94 (0.69–1.28)	0.685
Family history of DM	0.83 (0.44–1.55)	0.570
Smoking	1.18 (0.07–19.12)	0.900

OR = odds ratio; CI = confidence interval; UAE = United Arab Emirates; GDM = gestational diabetes mellitus; DM = diabetes mellitus.

**Glycated haemoglobin levels of >5.7%.[19] †Body mass index of ≥30 kg/m^2. ‡Waist circumference of ≥88 cm.*

hypertension (46.3% versus 27.5%; Z = 3.2; *P* = 0.001), CAD (11.4% versus 3.8%; Z = 2.0; *P* = 0.040) and dyslipidaemia (47.3% versus 29.1%; Z = 3.1; *P* = 0.002) was significantly more frequent among women whose husbands also had these conditions in comparison to those whose husbands did not. Women whose husbands currently smoked were more frequently current smokers themselves compared to those with non-smoker husbands (3.3% versus 1.1%; Z = 1.3; *P* >0.050). A greater number of the women with diabetic husbands undertook no physical activity than those with non-diabetic husbands (53.3% versus 32.4%). Furthermore, fewer women with diabetic husbands undertook mild (41.8% versus 56.1%) or moderate/vigorous (4.9% versus 11.5%) in comparison to those with non-diabetic husbands.

There were no significant differences between mean FBG, HbA1c, BMI and WC measurements among women with non-diabetic husbands compared to those with diabetic husbands (*P* <0.050 each). However, women with diabetic husbands had slightly higher mean FBG values (6.7 ± 6.3 mmol/L versus 6.0 ± 1.8 mmol/L) than those married to non-diabetics [Table 2]. Table 3 shows the glycaemic levels of the non-diabetic women. The total prevalence of abnormal glycaemia among non-diabetic women was 46.0% (n = 75). The rates of abnormal glycaemia among non-diabetic women with diabetic husbands was significantly more frequent than those with non-diabetic husbands (56.8% versus 37.1%; Z = 3.2; *P* = 0.001).

An unadjusted logistic regression analysis for independent predictors of abnormal glycaemia in non-diabetic women demonstrated a significant increase in the probability of abnormal glycaemia among those with diabetic husbands (*P* = 0.013) and those with general and abdominal obesity (*P* = 0.001 each). Other factors, including age, duration of marriage and smoking status, were not significant [Table 4]. However, the adjusted odds ratio (OR) for abnormal glycaemia was only significant for women with a diabetic husband (OR = 2.5, 95% confidence interval [CI]: 1.31–4.86; *P* = 0.006) and for those who were obese (OR = 1.06, 95% CI: 1.01–1.12; *P* = 0.009). Non-diabetic women with diabetic husbands were 2.5 times more likely to have abnormal glycaemic levels in comparison to those with non-diabetic husbands, although this was not significant (OR: 2.5, 95% CI: 1.3–4.8; *P* <0.050). In addition, there was a 6% increase in the rate of abnormal glycaemic levels among obese women.

Discussion

Type 2 DM results from defective insulin secretion and response (e.g. insulin resistance) as well as a range of environmental factors.[21] Evidence suggests that environmental factors could modulate the phenotypic expression of DM and disease progression in high-risk individuals with impaired glucose tolerance.[22] Spousal concordance may reflect environmental and lifestyle factors relating to DM diagnoses among genetically unrelated couples; the concept has been attributed to a shared environment, common behaviours and the tendency of individuals to choose a spouse with similar characteristics.[23] The current study showed significant spousal concordance of abnormal glycaemic levels among non-diabetic women. This is in agreement with the findings of Khan *et al*., who found a significantly increased risk of developing type 2 DM among the spouses of diabetic patients as compared to those with non-diabetic spouses.[24] Furthermore, the prevalence of DM concordance among the couples in Khan *et al*.'s study was lower than that of the current study (7.8% versus 17.8%).[24]

In the present study, a history of hypertension, CAD and dyslipidaemia was significantly more frequent among women whose husbands had the same conditions. This is consistent with findings from a systematic review which revealed significant spousal concordance for many CAD risk factors, including hypertension, DM, obesity and smoking.[23] Stimpson *et al*. revealed significant spousal concordance of hypertension, DM, arthritis and cancer among older Mexican-American couples, after adjusting for other factors such as age, BMI and smoking habits.[25] Suarez *et al*. suggested that age, duration of cohabitation and the extent of shared activities among married or cohabiting couples should be considered when interpreting familial aggregation of blood pressure.[26] However, age and duration of marriage did not show a significant correlation with abnormal glycaemia in the current study. Nevertheless, a high prevalence of abnormal glycaemia was noted among the non-diabetic women; this could be attributed to the similarly high prevalence of obesity among this group. Evidence has linked obesity with multiple endocrine, inflammatory, neural and cell-intrinsic changes associated with insulin resistance; it is also a major risk factor for cardiovascular disease and type 2 DM.[27] Some researchers have advocated for regular hyperglycaemia screening among high-risk groups in developing countries.[28] In the present study, having a diabetic husband and being obese were the only significant predictors of hyperglycaemia among non-diabetic women after controlling for confounding factors. This finding is important as it indicates that both the spouses of diabetic patients and obese individuals should be included in hyperglycaemia and DM screening programmes.

Clinical trial data recommends that obese patients undergo lifestyle modifications with regards to diet and exercise; this is known to help prevent and reduce rates of DM by attenuating insulin resistance and subsequent hyperinsulinaemia, reflecting the importance of promoting preventative strategies to tackle the growing DM epidemic.[29] With regards to spousal concordance, lifestyle modification interventions should be targeted at both diabetic patients and their spouses in order to eliminate risk factors for both individuals. Sexton *et al*. have indicated the effectiveness of this strategy for patients with cardiovascular diseases.[30] In the UAE, current management strategies directed at type 2 DM patients include pharmacological therapy for hyperglycaemia, medical nutrition therapy and psychosocial assessment and care.[31] The researchers suggest including the spouses of diabetic patients in DM management strategies in order to reduce the risk of DM spousal concordance.

The present study has a number of limitations. First, only female participants were included in the study due to logistical issues; however, the authors believe that spousal concordance can be observed in both genders. Second, the findings of this study cannot be generalised to the wider population of the UAE because of the nonprobability sampling method used to recruit the participants. Third, with regards to the multicultural society of the UAE, more evidence is needed to show the role of spousal concordance in lifestyle-related and chronic diseases, including DM. Fourth, selection bias may have been possible due to the study design, although the authors tried to reduce this bias by employing a consecutive sampling technique. Finally, the random effect of spousal concordance of abnormal glycaemia was not calculated, which could have had an effect on the results of the multivariable analysis.

Conclusion

There was significant concordance of abnormal glycaemia among non-diabetic women with diabetic husbands in the current study. The spouses of diabetic patients may therefore be a target population for regular hyperglycaemia and DM screening.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

References

1. Alavi NM, Ghofranipour F, Ahmadi F, Emami A. Developing a culturally valid and reliable quality of life questionnaire for diabetes mellitus. East Mediterr Health J 2007; 13:177–85.
2. Waly MI, Essa MM, Ali A, Al-Shuaibi YM, Al-Farsi YM. The global burden of type 2 diabetes: A review. Int J Biol Med Res 2010; 1:326–29.
3. Shanker J, Kanjilal S, Rao VS, Perumal G, Khadrinarasimhiah NB, Mukherjee M, et al. Adult nontwin sib concordance rates for type 2 diabetes, hypertension and metabolic syndrome among Asian Indians: The Indian Atherosclerosis Research Study. Vasc Health Risk Manag 2007; 3:1063–8.
4. Lee YM, Yon HJ, Lee Y, Lee BJ, Koh JH, Chung CH. Development of diabetes mellitus in married couples according to environmental factors. J Korean Diabetes Assoc 2005; 29:133–9.
5. Falba TA, Sindelar JL. Spousal concordance in health behavior change. Health Serv Res 2008; 43:96–116. doi: 10.1111/j.1475-6773.2007.00754.x.
6. Meyler D, Stimpson JP, Peek MK. Health concordance within couples: A systematic review. Soc Sci Med 2007; 64:2297–310. doi: 10.1016/j.socscimed.2007.02.007.
7. Wilson SE. The health capital of families: An investigation of the inter-spousal correlation in health status. Soc Sci Med 2002; 55:1157–72. doi: 10.1016/S0277-9536(01)00253-2.
8. Leong A, Rahme E, Dasgupta K. Spousal diabetes as a diabetes risk factor: A systematic review and meta-analysis. BMC Med 2014; 12:12. doi: 10.1186/1741-7015-12-12.
9. Martire LM, Schulz R, Helgeson VS, Small BJ, Saghafi EM. Review and meta-analysis of couple-oriented interventions for chronic illness. Ann Behav Med 2010; 40:325–42. doi: 10.1007/s12160-010-9216-2.
10. Trivedi RB, Piette J, Fihn SD, Edelman D. Examining the interrelatedness of patient and spousal stress in heart failure: Conceptual model and pilot data. J Cardiovasc Nurs 2012; 27:24–32. doi: 10.1097/JCN.0b013e3182129ce7.
11. Tang TS, Brown MB, Funnell MM, Anderson RM. Social support, quality of life, and self-care behaviors among African Americans with type 2 diabetes. Diabetes Educ 2008; 34:266–76. doi: 10.1177/0145721708315680.
12. World Health Organization. Diabetes: Fact sheet N°312. From: www.who.int/mediacentre/factsheets/fs312/en/ Accessed: Jan 2016.
13. Macken LC, Yates B, Blancher S. Concordance of risk factors in female spouses of male patients with coronary disease. J Cardiopulm Rehabil 2000; 20:361–8. doi: 10.1097/00008483-200011000-00005.
14. Al-Maskari F, El-Sadig M, Norman JN. The prevalence of macrovascular complications among diabetic patients in the United Arab Emirates. Cardiovasc Diabetol 2007; 6:24.
15. International Diabetes Federation. IDF Diabetes Atlas, 6th ed. Brussels, Belgium: International Diabetes Federation, 2013.
16. Bennett S, Woods T, Liyanage WM, Smith DL. A simplified general method for cluster-sample surveys of health in developing countries. World Health Stat Q 1991; 44:98–106.
17. Global Tobacco Surveillance System (GTSS). Global Adult Tobacco Survey (GATS) Indicator Guidelines: Definition and syntax. From: www.who.int/tobacco/surveillance/en_tfi_gats_indicator_guidelines.pdf Accessed: Jan 2016.
18. World Health Organization. Global strategy on diet, physical activity and health: Physical activity and adults. From: www.who.int/dietphysicalactivity/factsheet_adults/en/ Accessed: Jan 2016.
19. American Diabetes Association. Standards of medical care in diabetes: 2012. Diabetes Care 2012; 35:S11–63. doi: 10.2337/dc12-s011.
20. World Health Organization and International Diabetes Federation. Definition and diagnosis of diabetes mellitus and intermediate hyperglycaemia. From: apps.who.int/iris/bitstream/10665/43588/1/9241594934_eng.pdf Accessed: Jan 2016.
21. Murea M, Ma L, Freedman BI. Genetic and environmental factors associated with type 2 diabetes and diabetic vascular complications. Rev Diabet Stud 2012; 9:6–22. doi: 10.1900/RDS.2012.9.6.
22. Knowler WC, Barrett-Connor E, Fowler SE, Hamman RF, Lachin JM, Walker EA, et al. Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. N Engl J Med 2002; 346:393–403. doi: 10.1056/NEJMoa012512.
23. Di Castelnuovo A, Quacquaruccio G, Donati MB, de Gaetano G, Iacoviello L. Spousal concordance for major coronary risk factors: A systematic review and meta-analysis. Am J Epidemiol 2009; 169:1–8. doi: 10.1093/aje/kwn234.
24. Khan A, Lasker SS, Chowdhury TA. Are spouses of patients with type 2 diabetes at increased risk of developing diabetes? Diabetes Care 2003; 26:710–12. doi: 10.2337/diacare.26.3.710.
25. Stimpson JP, Peek MK. Concordance of chronic conditions in older Mexican American couples. Prev Chronic Dis 2005; 2:A07.
26. Suarez L, Criqui MH, Barrett-Connor E. Spouse concordance for systolic and diastolic blood pressure. Am J Epidemiol 1983; 118:345–51.
27. Qatanani M, Lazar MA. Mechanisms of obesity-associated insulin resistance: Many choices on the menu. Genes Dev 2007; 21:1443–55. doi: 10.1101/gad.1550907.
28. Echouffo-Tcheugui JB, Mayige M, Ogbera AO, Sobngwi E, Kengne AP. Screening for hyperglycemia in the developing world: Rationale, challenges and opportunities. Diabetes Res Clin Pract 2012; 98:199–208. doi: 10.1016/j.diabres.2012.08.003.
29. Kashyap SR, Louis ES, Kirwan JP. Weight loss as a cure for type 2 diabetes? Fact or fantasy. Expert Rev Endocrinol Metab 2011; 6:557–61. doi: 10.1586/eem.11.42.
30. Sexton M, Bross D, Hebel JR, Schumann BC, Gerace TA, Lasser N, et al. Risk-factor changes in wives with husbands at high risk of coronary heart disease (CHD): The spin-off effect. J Behav Med 1987; 10:251–61. doi: 10.1007/BF00846539.
31. UAE National Diabetes Committee. National Diabetes Guidelines United Arab Emirates: 2009. From: cms.wounds-uk.com/media/NationalDiabetesGuidelinesUAE.pdf Accessed: Jan 2016.