A cross-sectional survey on the lifestyle and health-seeking behaviour of Basotho patients with diabetes

Makinga PN, MBChB, DipObst(SA), DipHIVMan(SA), Advanced Health Management Program (Yale), MPH, MMedFamMed
Former Executive Medical Director, St Joseph's Hospital, Lesotho
Clinical Manager and Head of Obstetrics and Gynaecology, Northdale Hospital, South Africa
Beke A, MBChB, MMed(CommHealth), FCPHM(SA), FGCP, DTM&H, DPH, DHSM, DOH
Adjunct Professor, School of Health Systems and Public Health; University of Pretoria
Correspondence to: Polycarpe Makinga, e-mail: polymakinga@yahoo.com
Keywords: diabetes, health education, health-seeking behaviour, body mass index, hip circumference, waist to hip ratio, waist to height ratio

Abstract

Objectives: The objectives of the study were to determine the level of practice of a healthy lifestyle, to assess the health education provided to patients with diabetes and to determine the prevalence of obesity among Basotho patients with diabetes.

Design: A cross-sectional study enrolled 192 patients between November 2004 and July 2005. Descriptive statistics on demographic, socio-economic and lifestyle data were computed. Weight, waist circumference and hip circumference measurements were taken to compute body mass index (BMI), waist-to-hip ratio (WHpR) and waist-to-height ratio (WHtR).

Setting and subjects: Patients with diabetes attending three hospitals in Lesotho were recruited in the study.

Outcome measures: These included obesity indices, the quality and quantity of physical exercises, the quality and quantity of provided health education and the frequency with which the subjects sought medical help.

Results: The participants' mean age was 54.73 years. The prevalence of smoking (14.6%) was higher than that of drinking (9.4%). Only 20.8% of the participants participated in recommended physical exercise. Most participants (95%) consulted their physicians on a regular basis. The Health Education Quantity Index was very low: 49.9%. The prevalence of obesity measured by BMI, WHpR and WHtR was 67.7%, 69.8% and 95.3% respectively.

Conclusion: The practice of a healthy lifestyle was suboptimal, but help-seeking behaviour was satisfactory among participants. It is recommended that health education and the promotion of a healthy lifestyle are encouraged, that diabetes education is rendered by accredited educators or healthcare providers trained in communicating health messages, and that the fight against obesity is made a priority.

Introduction

Diabetes mellitus, a noncommunicable disease, is a global problem that affects people of all ages, gender and socio-economic background. Early diagnosis and appropriate management can successfully limit the impact of the disease on the affected individual, allowing him or her to sustain an optimal quality of life. It is the responsibility of family physicians to ensure that patients with diabetes who are under their care are treated optimally in order to prevent or mitigate acute and long-term complications.

Diabetes is a serious condition at a clinical and public health level. Its rapidly increasing prevalence is a significant cause for concern. In 2003, it was estimated that there were approximately 194 million adults with diabetes in the population living in the International Diabetes Federation regions, which makes up 90% of the world population. This number represented an increase from the 1995 global estimates of 135 million, published in a World Health Organization study in 1998.[1] These figures are projected to reach 350 and 366 million in 2025 and 2030, respectively.[1,2] In 2001, diabetes mellitus accounted for 1.7% of all deaths in Lesotho. In 2000, together with other endocrine disorders, it accounted for 1% of total hospital admissions in that country.[3]

There are three main types of diabetes. Type 1 diabetes has its onset mainly in subjects who are younger than 40 years and is caused by lack of insulin secondary to an autoimmune destruction of pancreatic Langerhans cells. Usually, type 2 diabetes mellitus occurs in subjects who are 40 years or older who are obese and insulin resistant, but these factors alone are insufficient to cause diabetes if there is no

impaired β-cell function.[4] Epidemiological studies provide evidence that overeating, particularly when combined with obesity, is associated with the development of type 2 diabetes.[4] It is likely that obesity acts as a diabetogenic factor by increasing insulin resistance in people who are genetically predisposed to developing type 2 diabetes.[4] Type 2 diabetes is often associated with other risk factors for cardiovascular diseases, such as dyslipidaemia and hypertension.[5] These factors, combined with obesity and insulin resistance, constitute what is known as "metabolic syndrome". Gestational diabetes is hyperglycaemia that might have started before or during pregnancy, but is discovered during the pregnancy and may persist after delivery.[6]

A number of studies suggest that diabetic care requires skilled healthcare staff. Saunders et al believe that health education for patients with diabetes should be conducted together with counselling and should be provided by a multidisciplinary team.[7] Zigbor et al, using data from the Pittsburgh Epidemiology of Diabetes Complications cohort study, demonstrated that patients with type 1 diabetes mellitus, who were largely managed by a specialist, developed fewer complications than those who were cared for by a generalist doctor.[8] A meta-analysis of randomised control trials conducted between 1982 and 1994 found that there was no significant difference in metabolic control between patients who received general practice care and those in hospital care. However, mortality was higher in general practice than that in hospital care.[9] The excess of deaths and loss to follow-up in general practice care occurred when there was no computerised prompting system to track patients who missed appointments.

Patients' age and education have been found to be significantly associated with knowledge of diabetes, but not with a health-promoting lifestyle. However, income was found to be significantly associated with the latter.[10-12] Some healthcare providers suggest that diabetes is harder to treat than other chronic conditions because its successful management relies on lifestyle changes to a greater extent, which are outside healthcare providers' control.[13]

As in other parts of the world, the management of diabetes in the Maseru District is becoming more patient centred. Therefore, it is important that family physicians, health promoters and healthcare providers are equipped with information that will assist in prioritising health programmes and health education topics with regard to diabetes care. The aim of the study was to determine the practice of a healthy lifestyle and the health-seeking behaviour of patients with diabetes in the Maseru District of Lesotho. The objectives of the study included determining the level of practice of a healthy lifestyle, e.g. physical exercise, smoking, alcohol use and help-seeking behaviour, assessing the health education provided to patients with diabetes and determining the prevalence of obesity among Basotho patients with diabetes.

Method

This cross-sectional survey enrolled 192 adult patients with diabetes from one public hospital and two state-aided hospitals in Lesotho between November 2004 and July 2005. Patients from urban and peri-urban areas were asked to consent to participate in the study. Pregnant women were excluded because of the difficulty in taking anthropometric measurements from them. Children below 18 years of age were also excluded because of lack of information on obesity cut-off points for various anthropometric indices in this age category. All patients who satisfied the inclusion criteria consented to participate in the study. By the end of July 2005, there were no more patients with diabetes attending the three hospitals who had not yet been enrolled in the study. In order to eliminate information bias, three nurses and three doctors, a pair from each hospital, were recruited and trained for data collection.

Face-to-face interviews were conducted, based on a predesigned structured questionnaire. Blood pressure measurements were carried out as recommended by a standard textbook of family medicine.[14] The landmarks for anthropometric measurements that were used in this study were an adaptation of those recommended by the European Health Risks Monitoring survey for a chronic diseases project.[15] Details of these landmarks and measurement procedures are published elsewhere and can be obtained on demand. Anthropometric measurements included weight in kilogrammes, height, waist circumference (WC) and hip circumference (HC) in centimetres. From these measurements, three indices were computed: body mass index (BMI), waist to hip ratio (WHpR) and waist to height ratio (WHtR). For the purpose of this study, participants with BMI > 29 or WHtR > 0.5 or WHpR > 0.85 for women/WHpR > 1 for men were considered obese. Descriptive statistics were computed using SPSS® (version 13.0.0) software.

The research protocol was approved by the Research and Ethics Committee of the University of Pretoria. Permission to conduct the study was obtained from the management of the three hospitals and the Lesotho Ministry of Health and Social Welfare.

Results

The study enrolled 192 participants with a mean age of 54.7 years (standard deviation = 12). The majority of participants were female, married and of African descent. The demographic and socio-economic characteristics of the participants are summarised in Table I.

Some lifestyle habits are considered to be risk factors for health in general, and for diabetes mellitus and cardiovascular diseases, in particular. These include smoking, drinking alcohol, a low level of physical exercise and a high-fat diet.[16-19] Generally, it is recommended that physical exercise is practised for at least 30 minutes per

Table I: Demographic and socio-economic characteristics of the participants

Characteristics	Number	Percentage
Gender		
Female	145	75.5
Male	47	24.5
Marital status		
Single	13	6.8
Married	131	68.2
Divorced	5	2.6
Widowed	40	20.8
Separated	3	1.6
Racial group		
Biracial	2	1
Black African	189	98.4
White	1	0.5
Employment status		
Employed	93	48.4
Unemployed	99	51.6
Completed education level		
None	5	2.6
Primary level	90	46.9
Secondary level	62	32.3
Tertiary level	27	14.1
Postgraduate level	8	4.2
Income in South African rand		
More than 2 500	21	10.90
1 000 to 2 500	45	23.40
Less than 1 000	79	41.10
Unknown	47	24.50

Table II: Lifestyle of participants

Lifestyle habits	Number	Percentage
Smoking		
Smoker	28	14.6
Non-smoker	161	83.9
Unknown	3	1.6
Drinking alcohol		
Current drinking	18	9.4
Stopped drinking ≥ 6 months ago	58	30.2
Never drank	111	57.8
Drinking habits unknown	5	2.6
Physical exercise		
Practising physical exercise as recommended	112	58.3
Practising physical exercise that is not recommended*	34	17.7
Practising no physical exercise	40	20.8
Unknown physical exercise practice habits	6	3.1
Help-seeking behaviour		
Consult physician monthly	79	41.1
Consult physician 2-3 times monthly	103	53.6
Consult physician only if in need	1	0.5
Unknown help-seeking behaviour	9	4.7

*: Daily living activities were not considered to comprise beneficial physical activities. Recommended activities were those that were practised on a regular basis, for at least 150 minutes per week, such as jogging, which increases the heart rate by at least 50% from normal baseline.

day, at least five times per week.[5,20] Table II summarises the lifestyle habits of the study participants.

Participants were asked whether or not they had received health education on the following seven selected topics: reducing alcohol drinking, stopping smoking, losing weight, participating in regular physical exercise, following a prudent diet, wearing wide or soft shoes and cutting their toenails horizontally. Only 11 participants (5.8%) had been educated on all seven selected topics. The most neglected topics were cutting their toenails horizontally (23%) and wearing wide, soft shoes (33.1%). The most discussed topics were adhering to a prudent diet (87.1 %) and participating in regular physical exercise (82%). Further details are presented in Table III.

The authors proposed an index that could be used to assess the quantity, not the quality, of health education provided by

a health facility. This index, the Health Education Quantitative Index (HEQI), is the sum of the product of the number of patients who were educated on a particular number of topics as a proportion of the product of the total number of the topic and the total number of patients who were educated. In this study, the HEQI was computed from the 189 patients who had received health education. Three patients were excluded because they did not answer this question. This index calculated the quantity of health education provided as a proportion of the expected quantity of health education to be provided. Ideally, all 189 participants were expected to be educated on all seven topics: 189 participants x 7 topics = 1 323. However, only 11 participants had been educated on all seven topics, nine on six topics, 25 on five, 52 on four, 48 on three, 21 on two and 10 on one topic only. Therefore, the HEQI was computed using the equation below.

A number of indices are used to evaluate the extent of obesity with cut-off points that separate normal weight to overweight, and overweight to obese. In this study, three indices were used to determine the prevalence of obesity

$$Health\ Education\ Quantitative\ Index\ = \frac{(7\times11)+(6\times9)+(5\times25)+(4\times52)+(3\times48)+(2\times21)+(1\times10)}{7\times189}\times100 = 49.9\%$$

Table III: Health education and counselling of the participants on the seven selected topics

	Number	Percentage
Participants educated on each health topic*		
Following a prudent diet	155	87.1
Partaking in regular physical exercise	146	82
Reducing weight	121	68
Reducing drinking	70	39.3
Stopping smoking	68	38.2
Wearing wide, soft shoes	59	33.1
Cutting toenails horizontally	41	23
Other (not specified by the participant)	1	0.6
On how many topics have you been counselled? (n = 189)**		
All 7 topics	11	5.8
6 topics	9	4.8
5 topics	25	13.2
4 topics	52	27.5
3 topics	48	25.4
2 topics	21	11.1
1 topic	10	5.3
0 topic	13	6.9

*: One patient could have been educated on more than one topic, leading to the total being > 192.

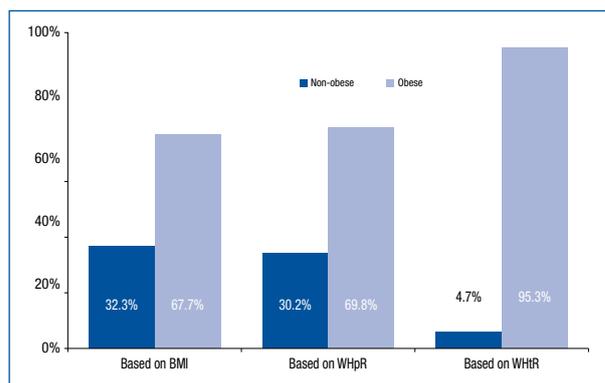**: Patients who did not indicate whether or not they had been educated or counselled were excluded from this analysis.

BMI: body mass index, WHpR: waist to hip ratio, WHtR: waist to height ratio

Figure 1: Proportion of obesity among participants based on body mass index, waist to hip ratio and waist to height ratio
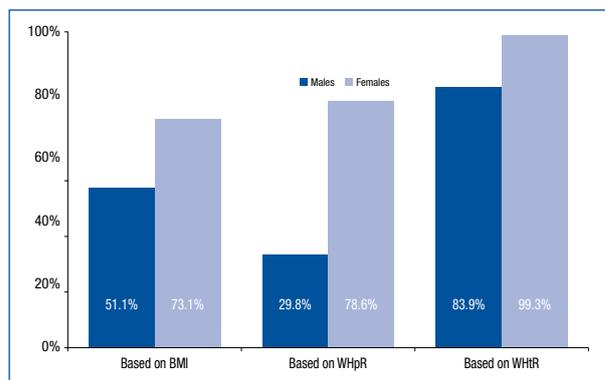
BMI: body mass index, WHpR: waist to hip ratio, WHtR: waist to height ratio

Figure 2: Distribution of obese participants in each gender category

among participants. Figure 1 shows the proportion of participants who were classified as obese, based on BMI, WHpR and WHtR (see cut-off points that were used in the Method section).

Thereafter, the sample was stratified according to gender. The proportion of obese participants within each stratum (gender) was computed. More women than men were obese. The number of obese women was 1.2, 1.4 and 2.6 times more than that of obese men when using WHtR, BMI and WHpR respectively as an assessment index. Figure 2 shows the distribution of obese participants within each stratum. For example, based on BMI, 51.1% of men and 73.1% of women were obese.

Discussion

The majority of participants were married, female and of African descent, with a mean age of 54 years. The low level of income in the study population was a direct consequence of a high level of unemployment (51.56%) and a low level of education: almost 50% of participants did not complete high school. Management of diabetes requires stringent sugar control in order to avoid complications. Low education and income levels have been found to be associated with poor sugar level control,[21] while high levels of education are associated with better knowledge of diabetes.[10] The management of diabetes used to be

clinician centred whereby the physician made decisions without considering what the patient thought, or what he or she was capable of achieving. Currently, every aspect of diabetes care has been transferred to the patient: from diet and lifestyle to drug administration and blood glucose testing. Therefore, it is essential that patients are educated on how they can manage their condition immediately after they are diagnosed. Better education and income levels are crucial to the management of diabetes.

Generally, participants reported good health habits with regard to smoking and drinking. Only 14.6% of the participants were currently smoking, while 9.4% were currently drinking alcohol. It is imperative that patients with diabetes are encouraged to stop smoking as it either accelerates or aggravates cardiovascular complications. Menzoian et al found that smokers presented with symptomatic peripheral vascular disease earlier than non-smokers (p-value < 0.05). Intermittent claudication is strongly associated with smoking.[22] Asymptomatic peripheral vascular disease also has been found to be associated with diabetes and smoking.[23] The American Heart Association suggests that when a smoking patient has diabetes, the risk of cardiovascular disease doubles. Thus, every effort should be made to convince patients with diabetes who smoke to give up this habit.[24] However, moderate alcohol drinking, as opposed to heavy alcohol drinking, does not impair

glycaemic control and may actually improve sensitivity to insulin.[25,26]

The majority of participants (58.3%) reported that they practised recommended physical exercise, such as brisk walking, aerobics and ball games. However, the rest either did not participate in physical exercise at all (20.8%) or took part in physical activities that were not beneficial (17.7%). Daily living activities should not be considered to be valuable physical exercise. It is recommended that aerobic physical exercise, such as jogging, is practised for 30 minutes a day, at least five times per week.[27] Patients need to be told what kind of physical exercise is recommended, and how often and for how long it should be practised. Correct physical exercise helps to control sugar levels and reduce blood pressure. Furthermore, Jonker et al suggest that at the age of 50 years, life expectancy free of diabetes is 2.3 years longer for moderately active people and at least four years longer for highly active people than for inactive people.[17]

Almost half of the patients reported that they consulted a physician monthly. The other half consulted one once every two or three months. This is an indication of good, self-reported, help-seeking behaviour. This difference may be attributed to the private-public sector divide. Patients who attended private (state-aided) health institutions paid cash for their medication. Therefore these patients are only able to pay for one month supply of medication. By contrast, chronic patients who attended public facilities did so once every three months. Scheduling follow-up appointments every three months is beneficial for public facilities where medications are free and patient workload is high.

The majority of participants (92.7%) reported having received health education, but only 5.8% had received health education on all seven selected lifestyle topics. Forty-one per cent of participants had been educated on three topics or less and 6.9% had not received any health education at all. The HEQI of 49.9% is very low. The acceptable range is 80-100%. Measures need to be put in place to provide for the evaluation and improvement of health education programmes in surveyed facilities. Healthcare professionals should be taught how to transfer skills and to motivate patients through effective communication. Studies have shown that educating healthcare professionals improves diabetic care.[28] Traditional education for patients with diabetes involved treating patients as receptacles for knowledge, to be filled with information from doctors, nurses and dietitians. To achieve a change in behaviour, education must encourage self-motivation and self-determination.[29] Perhaps diabetes education should be entrusted to accredited educators as it is currently done in the USA.[29]

The prevalence of obesity among participants on the basis of BMI, WHpR and WHtR was 67.7%, 69.8% and 95.3%, respectively. Vikram et al found a high prevalence of obesity in Indian men (53.9%) and women (88.6%) using cut-off values of WHpR > 0.95 for men and > 0.80 for women.[30]

Australian patients with diabetes have a low prevalence of obesity. Only 20.8% of Australians had a BMI ≥ 30, and only 15.8% had a WHpR ≥ 1 (for men) or ≥ 0.85 (for women) in a diabetes study.[31] These low rates may be attributed to a healthier lifestyle.

In this study, the prevalence of obesity was higher in women than in men. This is in keeping with the findings of the South African demographic surveys that evaluated the prevalence of obesity and found it to be more common in women than in men.[32] The following eight factors were found to be associated with obesity in the above survey: genetic makeup, intrauterine and early life influences, physical inactivity, dietary habits, parity, education level, socio-cultural factors and stress.

Limitations of the study

The accurate measurement of HC and WC required a full-length mirror marked with horizontal lines which would have assisted research assistants to place the measuring tapes horizontally around the waist or hip. Instead, data collectors were asked to stand to the side of the patient and check both the front and the back to ensure that the tape was horizontally placed in all instances. It is well documented that 14 different body sites exist where WC can be measured. Each site has its own advantages and disadvantages. The investigators chose to measure WC at the level of one centimetre above the iliac crest. The advantage of this position is that it is easy to locate, although there was some difficulty in placing the tape horizontally and properly for some women.[33]

Conclusion and recommendations

This study found that patients with diabetes from the Maseru District in Lesotho did not receive adequate health education and counselling. While most patients were educated on the benefits of physical exercise, few undertook any appropriate physical activities. Smoking prevalence and the low HEQI indicate the extent of the challenge that lies ahead for health promoters. The prevalence of obesity, whether estimated according to BMI, WHpR or WHtR cut-off points is quite high and continues to be a contributing factor to diabetes in the area. While most Basotho patients with diabetes demonstrated good help-seeking behaviour, the requirement for participation in physical exercise, combating obesity and providing diabetes health education and counselling remains.

Based on the above findings, the following is recommended:
• Health programmes, with the goal of promoting a healthy lifestyle that combats obesity, should be strengthened and well monitored in order to decrease the prevalence of obesity in the Basotho population. A multidisciplinary approach may be of great value. The government should promote a culture of physical exercise by creating gymnasium centres in communities

and promoting physical education and sport activities in schools.

- Healthy eating habits need to be promoted by all stakeholders.

- Healthcare providers in Lesotho must be trained on key health promotion messages and issues that are to be communicated to patients with diabetes.

- Health education programmes should be strengthened in the surveyed hospitals and other health facilities in Lesotho. There is a need to employ qualified, trained health educators, instead of using nurses and doctors, because of their heavy workloads. Apart from the subject area of a prudent diet, in which adequate knowledge and practice were reported, healthcare providers should address topics such as foot care, smoking, weight reduction and appropriate physical exercise.

- Health education messages need to avoid ambiguity. Patients should be told what kind of exercise is beneficial and for how often and for what length of time it should be performed.

Conflict of interest

No conflict of interest arose during the execution of the research.

References

1. International Diabetes Federation. Diabetes prevalence. Available from http://www.idf.org/home/index.cfm?node=264# (Accessed [Date of access, please. Apply throughout]).

2. Wild S, Roglic G, Green A, Sicree R, King H. Global prevalence of diabetes: estimates for the year 2000 and projections for 2030. Diabetes Care[Remember to abbreviate journal names according to Index Medicus where applicable.] 2004 May;27(4):1047–53.

3. World Health Organization. WHO country cooperation strategy, Kingdom of Lesotho 2004–2007. Available from http://www.who.int/countryfocus/cooperation_strategy/countries/ccs_lso_final_en.pdf (Accessed).

4. Frier B, Fisher B. Diabetes mellitus. In: Haslett C, Chilvers ER, Boon NA, Colledge NR, eds. Davidson's principles and practice of medicine. 19th edition. London: Churchill Livingstone; 2002:641–82.

5. Mokdad AH, Ford ES, Bowman BA, et al. Prevalence of obesity, diabetes and obesity-related healt risks factors, 2001. JAMA 2003;289:76–9.

6. Coetzee E. Diabetes mellitus in pregnancy. In: Cronjé H, Grobler C, eds. Obstetrics in Southern Africa. 2nd edition. Pretoria: Van Schaik; 2003:525–33.

7. Saunders J, Pastors J. Professional issues in facilitating lifestyle change for people with type 2 diabetes. Diabetes Spectrum 1999;12(1):17.

8. Zgibor J, Songer T, Kelsey S, Drash A, Orchard T. Influence of healthcare providers on the development of diabetes complications. Diabetes Care 2002 Sep;25(9):1584–90.

9. Griffin S. Diabetes care in general practice: meta-analysis of randomised control trials. British Medical Journal 1998 Aug;317:390–5.

10. Chilton L, Hu J, Wallace D. Health-promoting lifestyle and diabetes knowledge in Hispanic American adults. Home Healthcare Management & Practice 2006 Aug;18(5):378–85.

11. Arcury T, Skelly A, Gesler W, Dougherty M. Diabetes meanings among those without diabetes: explanatory models of immigrant latinos in rural North Carolina.

12. Chapman-Novakofski K, Karduck J. Improvement in knowledge, social cognitive theory variables, and movement through stages of change after a community-based diabetes education program. Journal of the American Dietetic Association 2005;105:1613–6.

13. Larme A, Pugh J. Attitudes of primary care providers towards diabetes. Diabetes Care 1998 Sep;21(9):1391–6.

14. Hilmon C. Hypertension. In: ER[Correct surname.] R, ed. Textbook of family practice. 4th edition. Philadelphia: W.B. Saunders Company; 1990:870–3.

15. Tolonen H, Kuulasmaa K, Laatikainen T, Wolf H. European Health Risk Monitoring: recommendation for indicators, international collaboration, protocol and manual of operations for chronic disease risk factor surveys. Available from http://www.ktl.fi/publications/ehrm/product2/product2.pdf (Accessed).

16. Johnson R, Williams S, Spruill I. Genomics, nutrition, obesity, and diabetes. Journal of Nursing Scholarship 2006 Jan-March;38(1):11–8.

17. Jonker J, De Laet C, Franco O, Petters A, Mackenbach J, Nusselder W. Physical activity and life expectancy with and without diabetes: life table analysis of the Framingham Heart Study. Diabetes Care 2006 Jan;29(1):38–43.

18. Sturm R. The effects of obesity, smoking, and drinking on medical problems and costs. Health Affairs 2002 Mar-Apr;21(2):245–53.

19. Franceschi S, Talamini R, Barra S, et al. Smoking and drinking in relation to cancers of the oral cavity, pharynx, larynx, and esophagus in northern Italy. American Association for Cancer Research Journals 1990 October 15[Volume/issue?]:6502.

20. National Heart Lung and Blood institute – National Institutes of Health. Guide to physical activity. Available from http://www.nhlbi.nih.gov/health/public/heart/obesity/lose_wt/phy_act.htm (Accessed).

21. Schillinger D, Barton L, Karter A, Wang F, Adler N. Does literacy mediate the relationship between education and health outcomes? A study of a low-income population with diabetes. Public Health Reports 2006 May-June;121:245–53.

22. Menzoian J, LaMorte WW, Paniszyn CC, et al. Symptomatology and anatomic patterns of peripheral vascular disease: differing impact of smoking and diabetes. Annals of Vascular Surgery 1989 July 3(3):224–8.

23. Eason SL, Petersen NJ, Suarez-Almazor M, Davis B, Collins TC. Diabetes mellitus, smoking, and the risk for asymptomatic peripheral arterial disease: whom should we screen? J Am Board Fam Pract 2005 2005;18:355– 61.

24. Grundy SM, Garber A, Goldberg R, et al, eds. Lifestyle and medical management of risk factors. Prevention Conference VI: Diabetes and Cardiovascular Disease; 2001.

25. Howard AA, Arnsten JH, Gourevitch MN. Effect of alcohol consumption on diabetes mellitus: a systematic review. [Name of journal]2004 Feb;140(3):211–9.

26. Van de Wiel A. Diabetes mellitus and alcohol. Diabetes/Metabolism Research and Reviews 2004 Jul-Aug;20(4):263–7.

27. Chase HP. Understanding insulin-dependent diabetes. Barbara Davis Center for Childhood Diabetes, University of Colorado Health Sciences Center; 2000.

28. Van Zyl D, Rheeder P. Physician education programme improves quality of diabetes care. South African Medical Journal 2004 Jun;94(6):455–9.

29. Fox C, Klivert A. Intensive education for lifestyle change in diabetes. British Medical Journal 2003 Nov;327:1120–1.

30. Vikram N, Misra A, Pandey R, et al. Anthropometry and body composition in northern Asian Indian patients with type 2 diabetes: receiver operating characteristics (ROC) curve analysis of body mass index with percentage body fat as standard. Diabetes, Nutrition & Metabolism – Clinical & Experimental 2003 Feb;16(1):32–40.

31. Dalton M, Cameron A, Zimmet P, et al. Waist circumference, waist-hip ratio, and body mass index and their correlation with cardiovascular disease risk factors in Australian adults. Journal of Internal Medicine 2003 Dec;254(6):555–63.

32. Goedecke JH, Jennings CL, Lambert EV. Obesity in South Africa. In: Steyn K, Fourie J, Temple N, eds. Chronic diseases of lifestyle in South Africa since 1995-2005: Technical Report May 2006:65–79.

33. Wang J, Thornton J, Bari S, et al. Comparisons of waist circumferences measured at 4 sites. The American Journal of Clinical Nutrition 2003;77:379–84.

Social Science & Medicine 2004;59(11):2183–93.