RISK FACTORS FOR CARDIOVASCULAR DISEASE IN SOSHANGUVE, SOUTH AFRICA

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ABSTRACT

Cardiovascular disease is the most common, yet one of the most preventable, causes of death globally. Well-known risk factors for cardiovascular disease include hypertension, diabetes, physical inactivity, obesity and smoking. The purpose of this study was to investigate the incidence of and risk factors for cardiovascular disease in Soshanguve, a township in Tshwane, South Africa. The area is an informal settlement with low educational levels and a high unemployment rate. A contextual, cross-sectional design with a purposive sample was used to determine the prevalence of the risk factors for cardiovascular disease. Two data gathering methods were used, namely self-reports and physical measurements. Data were analysed using descriptive statistics. The results indicated that risk factors for cardiovascular disease were prevalent in the Soshanguve community. Smoking and alcohol consumption were the main risk factors for males, whilst physical inactivity as well as unhealthy diets existed in both gender groups, but more so in females. In both genders, the prevalence of hypertension increased with age, becoming more prevalent after 40 years of age. As cardiovascular risk factors in the Soshanguve community were identified, it is important to initiate a health project to address these risk factors.

KEYWORDS: cardiovascular disease, hypertension, obesity, risk factors for cardio-vascular diseases

BACKGROUND

Cardiovascular disease is one of the most common, yet one of the most preventable, global causes of death (Bradshaw et al., 2003:685). The disease patterns in South Africa are characterised by a combination of poverty-related diseases together with emerging chronic diseases associated with urbanisation, industrialisation and a westernised lifestyle. Ischaemic heart disease remains fairly uncommon among the South African black population, accounting for only 10% of patients presenting at hospitals with heart

diseases (Sliwa et al., 2008:917). According to Initial Burden of Disease Estimates for South Africa report for 2000 (Bradshaw et al., 2003:685), more than half of deaths caused by chronic diseases, including heart diseases, occurred before the age of 65 years. These are premature deaths, which affect the workforce and have a major impact on the economy of the country. Stroke was the fourth most common cause of death, accounting for 6% of all deaths in South Africa during 2000.

Epidemiological studies (Smeltzer et al., 2009:60) describe the conditions which precede or accompany the onset of cardiovascular disease. Certain risk factors cannot be modified, treated, or controlled including a positive family history, increasing age and gender. Modifiable factors for cardiovascular diseases include hypertension, diabetes mellitus, physical inactivity, obesity, cigarette smoking and stress (Smeltzer et al., 2009:60).

Surveys undertaken throughout the 2000s, in the Limpopo and Mpumalanga provinces of South Africa, confirmed the high population prevalence of hypertension, diabetes and smoking, and also showed the high prevalence of obesity affecting approximately 50.0% of the adult female population (Thorogood et al., 2007:326). Cardiovascular disease is known to be preventable, in many instances, through lifestyle changes and can be detected early through routine screening examinations (Chambers, 2004:33). For this study, modifiable factors such as cigarette smoking, hypertension, diabetes mellitus, physical inactivity, obesity and unhealthy diets were investigated in Soshanguve.

PROBLEM STATEMENT AND PURPOSE OF THE STUDY

Cardiovascular disease is a major health priority. The purpose of the study was to determine the prevalence of risk factors for cardiovascular disease in Soshanguve.

DEFINITIONS OF KEY CONCEPTS

Cardiovascular diseases refer to any diseases of the heart and blood vessels. The most common are diseases of the heart muscle, heart failure and heart disease caused by high blood pressure (Steyn, 2007).

Hypertension implies an abnormally high blood pressure that is usually indicated by an adult systolic pressure of 140 mmHg or greater or a diastolic blood pressure of 90 mmHg or greater (Monahan et al., 2007:857).

Obesity or being overweight is a result of an imbalance between energy intake and expenditure. The energy balance equation proposes that increasing adiposity is the net result of inadequate energy expenditure for the energy being consumed (Baranowski et al., 2003:23s).

Risk factors for cardio-vascular diseases are certain conditions that precede or accompany the onset of cardiovascular disease. A risk factor may be modifiable or non-modifiable (Smeltzer et al., 2009:60).

RESEARCH METHODS AND DESIGN

Context

The geographical location for the study was Soshanguve community, a township situated approximately 45 km north of Pretoria, in South Africa, with a population of approximately 311 000 people (South Africa, 2001).

Design

A quantitative cross-sectional design (Burns & Grove, 2005:28) was used to determine the prevalence of cardiovascular risk factors amongst the study population.

Population and sample

A purposive sample from community members who met the inclusion criteria was selected during the period 1 April to 31 July 2008. The 406 community members were recruited from a wellness clinic managed by one researcher.

The inclusion criteria were community members (males and females) who were at least 18 years old, not pregnant and living in Soshanguve.

Data gathering

Two data gathering methods were used, namely self-reports and physical measurements. Structured interviews were conducted as many people are illiterate in Soshanguve (South Africa, 2001). The following data were gathered:

- Structured interview schedules. Independent variables were age, gender, level of education, occupation and type of housing. Dependent variables were diagnosed medical conditions, smoking history and alcohol consumption.
- Physical inactivity: data were collected with the International Physical Activity Questionnaire (IPAQ) long form, and can be reported as continuous data and as median metabolic equivalent (MET)-minutes (Meriwether et al., 2006:484).

- Dietary habits: 24-hour recording of a large group of participants (n=406) is an effective way to measure the average dietary consumption of the group (Luepker et al., 2004:142).
- Anthropometric measurements: height was measured with a foot scale, calibrated every day before measurements were taken. A steel tape anchored to a flat wall measured height; a wooden headrest allowed the measurement at a point perpendicular to the top of the head. A fibreglass tape measured the waist circumference – the males to the nearest 0.5 cm at the level of the umbilicus at expiration and the females at the narrowest point between the rib cage and the iliac crest. The hip circumference was at the level of the greater trochanter, with both measurements taken in the horizontal plane (Luepker et al., 2004:142).
- Blood pressure measurements were taken with a calibrated mercury sphygmomanometer. The first and fifth Korotkoff sounds were used for systolic and diastolic pressures, with a 9 cm cuff used for repondents with a mid-upper arm circumference of 22 to 36 cm and a 12 cm cuff for mid-upper arm circumferences exceeding 36 cm. Two measurements were taken from each respondent over a period of approximately 15 minutes and the second measurement was recorded (Luepker et al., 2004:146). One researcher did all the measurements to enhance the consistency of the measurements.

Validity and reliability

The questionnaire was validated in a similar study in Ga-Rankuwa (Li, 2007:55). It was also pre-tested using a small sample (n=10) of Soshanguve residents and these data were not included in the main study.

Two fieldworkers, living in Soshanguve, were employed because they could speak the local language (Sepedi) and shared the same culture as the people. The language used for the data gathering forms was English, with two trained and supervised fieldworkers assisting, to prevent language problems.

The physiological tests were conducted according to acceptable international methods. Anthropometric measurements were taken using standard methods and calibrated equipment.

DATA ANALYSIS

Data were analysed using the Statistical Package for Social Sciences (SPSS) version 16.0 program. During data analysis, the percentage distribution, mean and standard deviation of the variables, described the prevalence of risk factors for cardiovascular disease. Chi-squares (x2) were applied to examine the socio-demographic pattern of smoking. The identification of differences between the male and female groups was

done by a non-parametric test, namely the Mann-Witney-U test as proposed by Field (2005:12).

ETHICAL CONSIDERATIONS

Approval for the study was obtained from the Research Ethics Committee of the Tshwane University of Technology. Sufficient information in an understandable language about the study was provided to all respondents. The information leaflet and the letter of consent were in English. Each person completed a consent form before being interviewed. All information obtained in connection with the study was kept strictly confidential and the rights and privacy of the participants were protected at all times. Sequentially numbered interview schedules enabled the researcher to maintain anonymity and confidentiality. No known or expected harm was implied or caused to the respondents in the study.

FINDINGS

Demographic profile

Slightly more males (50.2%; n=204) than females (49.8%; n=202) participated in the study. The respondents' ages ranged from 18 to 84. The 18 to 30 year old age group had the highest proportion of both males (35.3%; n=72) and females (42.1%; n=85). For both genders, almost one third of the respondents (males 28.5%; n=58 and females 26.2%; n=53) only had primary school education or no education. Unemployment was high, with only 45 (22.1%) males employed and the majority of female respondents (91.1%; n=184) unemployed.

Clinical details: medical history

Only six (1.5%) of the sample (n=406) reported having had a myocardial infarction, two reportedly had had strokes and six (1.5%) had had rheumatic heart disease. Hypertension was reported by 35 (8.6%) respondents, with the percentage of males and females being 7.4% (n=15) and 9.9% (n=20) respectively. Self-reported diabetes mellitus was limited, at only four (2.0%) males and six (3.0%) females; only 10 (2.5%) had diagnosed Type 2 diabetes mellitus.

Smoking status

The prevalence of current cigarette smokers was 99 males (48.5%) and 10 females (5.0%). Current male smokers in the 41 to 50 year age group constituted the highest

proportion (64.2%; n=27) and only one female (14.3%) in the over 60 years old age group currently smoked.

Tobacco users were older and less educated than non-users. The number of current smokers increased with age, especially between the 18 to 50 year old group of males, and was inversely associated with educational level and more pronounced in males than females. Table 1 presents the association between smoking and age, gender, and educational status. The gender difference in smoking status was statistically significant ($\chi 2=101.685$, $p=0.001$) with males being significantly more likely to smoke than females. Internationally, smoking prevalence is higher among males than females. The education differences in smoking status were statistically significant in male groups ($\chi 2=6.013$, $p=0.05$), with better educated males being less likely to smoke.

Table 1: Differences between current smokers and non-smokers by gender, age and educational status (n=406)

Characteristics	Current smoker		Non- smoker		χ^2	p
	n	%	n	%		
Gender and age group						
Male					**6.800**	**0.10**
18–30	32	44.4	40	55.6		
31–40	29	49.1	30	50.9		
41–50	27	64.2	15	35.8		
51–60	8	36.4	14	63.6		
Over 60	3	33.3	6	66.7		
Total	99	48.5	105	51.5		
Female					**0.751**	**0.95**
18–30	7	8.2	78	91.8		
31–40	0	0	68	100.0		
41–50	2	6.5	29	93.5		
51–60	0	0	11	100.0		
Over 60	1	14.3	6	85.7		
Total	10	5.0	192	95.0		
Gender					**101.685****	**0.001**
Male	99	48.5	105	51.5		

Female	**10**	**5.0**	**192**	**95.0**		
Education						
Male					**6.013***	**0.05**
Primary	30	51.7	28	48.3		
Secondary	63	48.8	66	51.2		
Tertiary	6	35.3	11	64.7		
Female					0.898	0.75
Primary	3	5.7	50	94.3		
Secondary	5	3.6	133	96.4		
Tertiary	2	18.2	9	81.8		

**p<0.001 *p<0.05

Alcohol consumption

More than half of the males (54.7%; n=112) and one out of ten females (10.8%; n=22) reported that they consumed alcohol. Rates of current drinking differed substantially by the age group of males, with the highest levels reported by 41 to 50 year olds (66.7%; n=28), followed by respondents older than 60 years (55.6%; n=5) and the 31 to 40 age group (54.2%; n=32) respectively. For both males and females, the lowest rate of drinking was recorded in the 18–30 year age groups.

Both males and females, with low levels of education up to secondary education level, were more likely to drink alcohol than their more highly educated counterparts. The gender difference was statistically significant ($\chi 2$=95.254, p=0.001); males had a significantly higher prevalence of alcohol use than females.

Physical inactivity

The study found only 20.0% of respondents (n=81) met the American College of Sports Medicine and Centres for Disease Control's recommendation for health-enhancing physical activity (≥ 7 days of any combination of moderate and vigorous activity, ≥ 3 000 MET minutes per week) (WHO, 2005) with 40.0% of respondents (n=162) being inactive.

Table 2: Table 2: MET-minutes/week (IPAQ. 2005) physical activity of respondents in physical activity categories (n=406)

Physical activity category, all domains	Male	Female	Mann- Whitney U
	Median (25th, 75th)	Median (25th, 75th)	
Occupational physical activity	0.00 (0.00, 33.00)	0.00 (0.00, 0.00)	15882.00** p < 0.001
Transportation physical l activity	396.00 (247.50, 810.00)	198.00 (99.00, 297.00)	12839.00 p=0.569
Domestic physical l activity	1035.00 (460.00, 2160.00)	1470.00 (750.00, 2850.00)	11623.500** p < 0.001
Leisure-time physical l activity	99.00 (49.50, 297.00)	99.00 (33.00, 169.50)	17995.50* p=0.032
MET-minutes of sedentary (sitting)			
Minutes spent sitting/week	2520.00 (1260.00, 3960.00)	2880.00 (1440.00, 5220.00)	19906.00 p=0.611
Minutes spent sitting/day	360.00 (180.00, 565.71)	411.43 (205.71, 745.71)	19906.00 p=0.611
Physical activity by intensity			
Walking physical activity	396.00 (132.00, 810.00)	360.00 (180.00, 720.00)	15706.00* p=0.001
Moderate physical activity	1260.00 (725.50, 2160.00)	2160.00 (990.00, 3330.00)	14174.50* p=0.001
Vigorous physical activity	0.00 (0.00, 360.00)	0.00 (0.00, 0.00)	18196.00* p=0.018

**p<0.001 *p<0.05

Between groups, differences were analysed with the Mann-Whitney U Test (see table 2). The females had significantly higher domestic physical activity ($p < 0.001$), walking physical activity ($p=0.001$), moderate physical activity ($p=0.001$), and total physical activity ($p=0.018$) than the males. The males had significantly higher occupational physical activity ($p=0.001$), leisure-time physical activity ($p=0.032$), and vigorous physical activity ($p=0.018$) than the female respondents.

Dietary intake

Dietary intake can be categorised as energy, protein, total fat, carbohydrate and fibre (Steyn et al., 2001:143). A number of items appeared repeatedly on the meal lists in

this study such as tea, sugar, brown bread, maize porridge, full cream milk, potatoes, white bread, brick margarine, coffee and rice. Meat (chicken) was eaten by 40.0% of the group (n=162), with mutton and beef reported by 32.0% (n=130) and 28.0% (n=114) respectively, on the day of recall. Per capita consumption of fruit and vegetables amounted to an average of 205 grams per day.

Of the male respondents, those aged 18 to 30 years had the highest mean energy intake of 7862 kJ, carbohydrate intake of 248.3 g, fat intake of 25.5 g and cholesterol intake of 286.3 g, whilst those aged 31 to 40 years had the highest mean total protein intake of 67.6 g. The female respondents aged 18 to 30 years had the highest energy intake of 7259 kJ, carbohydrate intake of 263.8 g, fat intake of 23.8 g, protein intake of 63.4 g, and the highest mean added sugar intake of 47.5 g. Cholesterol values were the lowest amongst the 60 year olds in the female group as well as total protein and fat intake at 20.4 g and 30.9 g respectively. The male groups had higher energy, mean protein and total fat intake.

Physical measurements

The values of body mass index (BMI) were described in terms of normal weight, overweight, obesity and severe obesity. For the study, obesity was defined as a BMI ≥25 $kg/m^{2,}$ which includes the overweight, obese, and severely obese categories.

The mean BMI of males increased with age from 22.1 kg/m^2 at 18 years to 24.9 kg/m^2 between 51 to 60 years. At 18 to 30 years, 8.3% of males (n=6) were overweight and 1.4% of males (n=1) were obese, which increased to 36.4% (n=8) and 9.1% (n=2), respectively at age 51 to 60 years. The highest prevalence of obesity was found in males with the highest level of education. The overall prevalence of overweight in males was 19.5% (n=40) and of obesity 9.4% (n=19) in the study sample. The mean BMI of females increased with age from 27.9 kg/m^2 at 18 years to 31.4 kg/m^2 at 51 to 60 years. At 18 to 30 years, 28.2% of females (n=24) were overweight, with 25.9% (n=22) obese and 9.4% (n=8) severely obese, which increased to 54.5% (n=6), 18.2% (n=2) and 18.2% (n=2), respectively at age 51 to 60 years. The highest prevalence of obesity was found in females with the lowest level of education.

Waist-to-hip ratio

The cut-off point for the waist-to-hip ratio is 1.0 for males or 0.85 for females. Figure 1 provides a visual comparison of the difference between male and female waist-to-hip ratio. Less than 3.6% of the males (n=7) had a waist-to-hip ratio equal to or more than 1.0. This figure contrasts with 53.1% of females (n=107) with a waist-to-hip ratio above

the cut-off point. The percentage of females with a waist-to-hip ratio higher than the cut-off mark was prevalent in all age groups and increased with age.

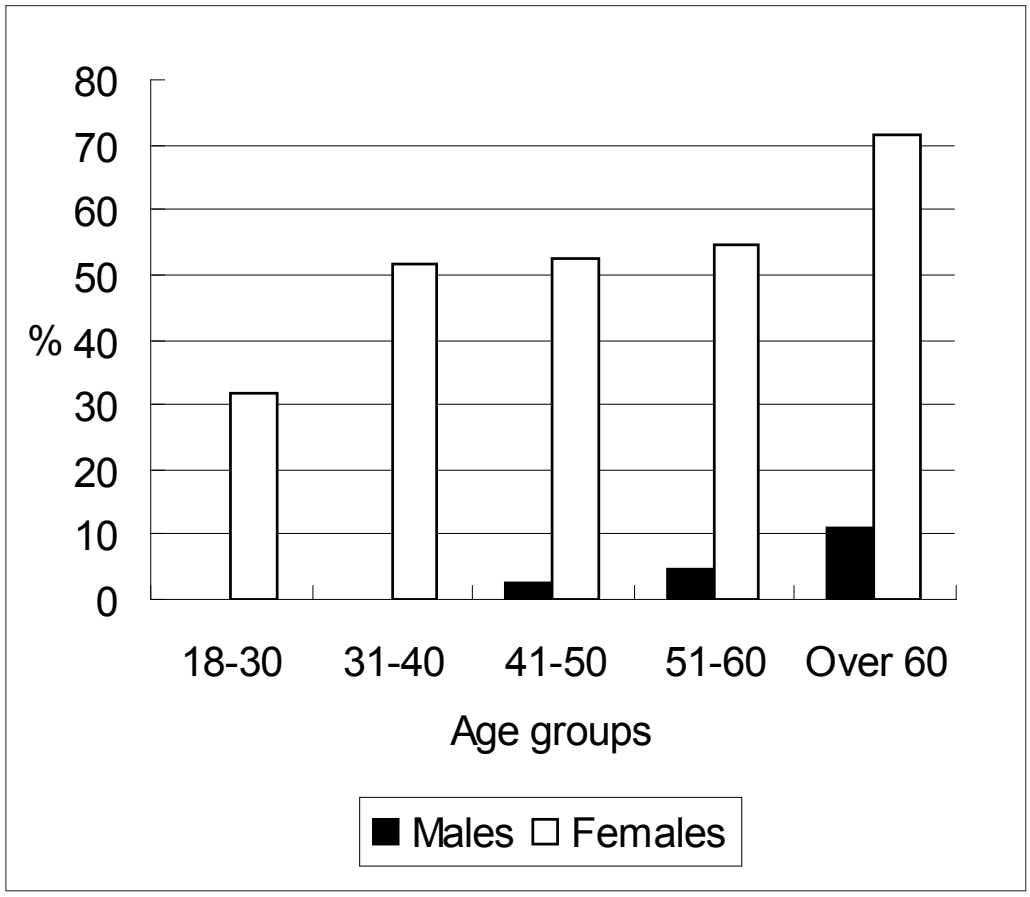

Figure 1: Waist-to-hip ratio by gender (n=406)

Hypertension

The prevalence of hypertension in terms of the age and gender distribution is depicted in Figure 2. In both genders, the prevalence of hypertension increased with age, more so after 41 years of age. In the female age group of 51 to 60 years, 72.7% females (n=8) were hypertensive. In the 41 to 50 year age group and 51 to 60 year age group, more females than males were hypertensive.

Females were more aware of hypertension, took more medications and controlled their blood pressure better than males. The awareness of hypertension, the use of medication and the control of hypertension (cut-off point < 140/90 mmHg) amongst hypertensive respondents increased with age. Young people (n=72) with hypertension had poor control over their hypertension which could last for many years.

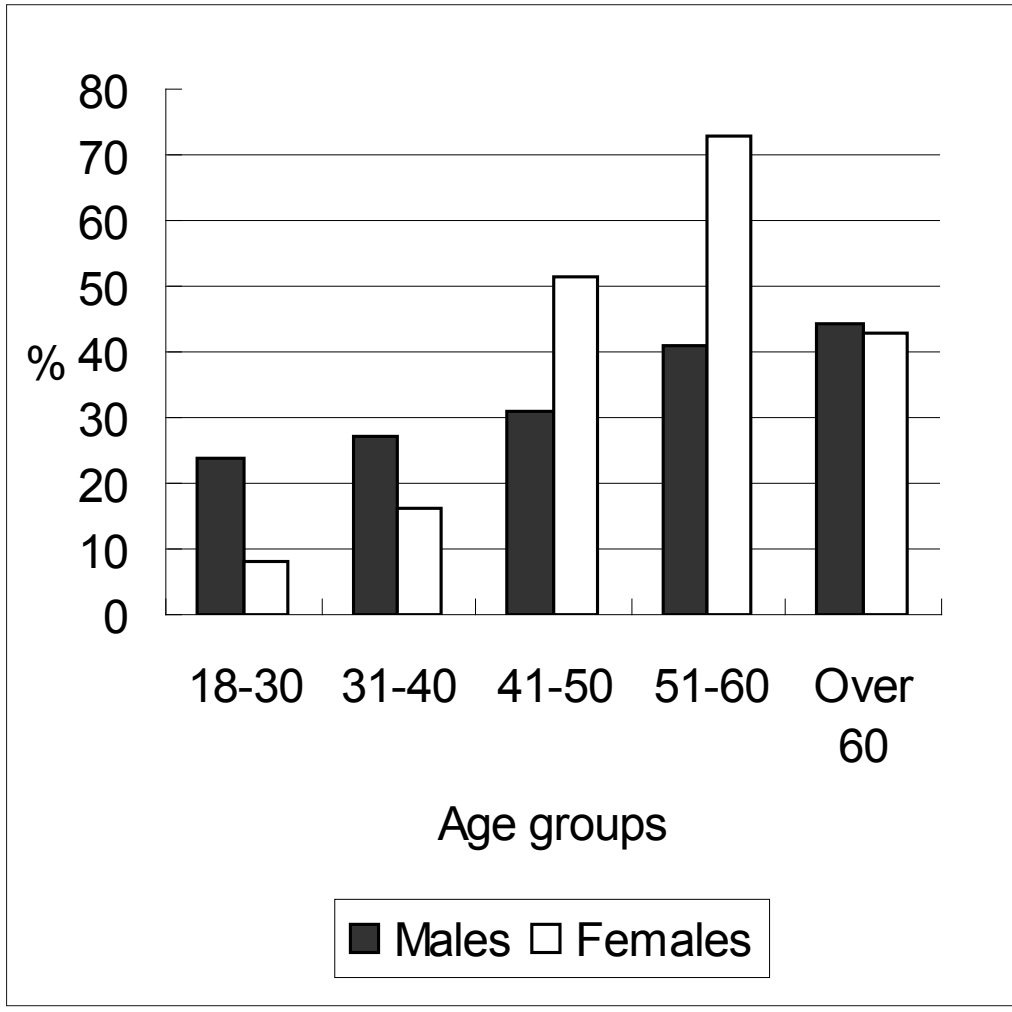

Figure 2: Prevalence of hypertension by gender in the sample (n=406)

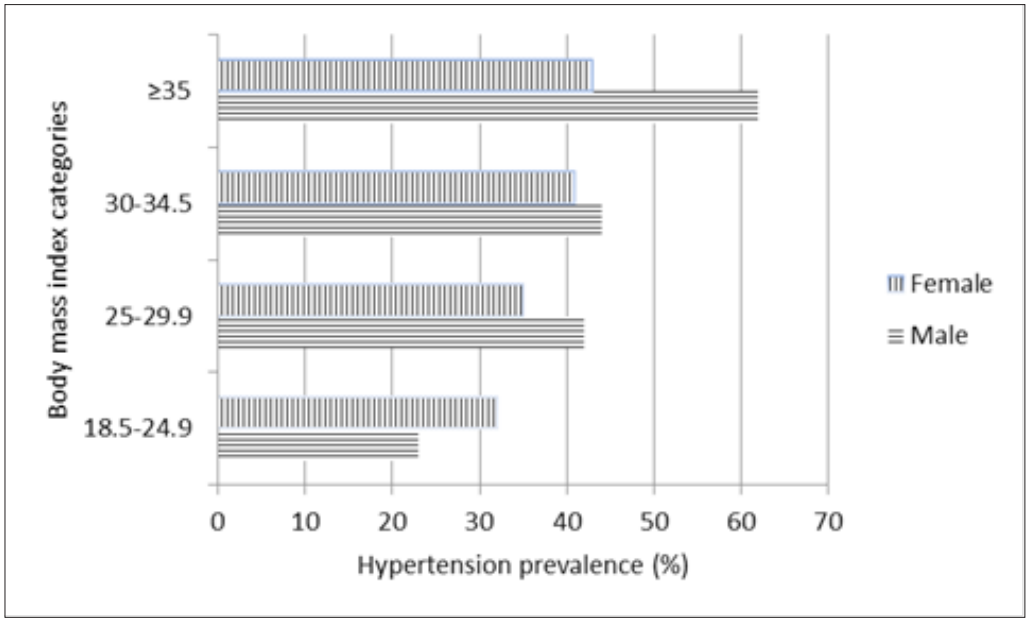

Figure 3: Age-adjusted odds of having hypertension over a range of BMI categories by both genders in sample

Age-adjusted odds of having hypertension over a range of BMI categories by both genders were also investigated, as displayed in Figure 3. Amongst males, the prevalence of hypertension increased progressively with increasing BMI, from 22.6% (n=25) at a BMI of 18.5-24.9 to 61.5% (n=8) at a BMI of ≥ 35. The prevalence of hypertension increased progressively from 32.9% (n=30) amongst females with a BMI of 18.5-24.9 to 44% of females (n=11) with a BMI ≥ 35. Higher BMI was associated with a higher prevalence of hypertension in all groups. Following an examination of age-adjusted prevalence of hypertension across all categories of BMI, the pattern was one of more prevalent hypertension with higher BMI's for both males and females. However, the slope appeared to be steeper for males at lower levels of BMI. To confirm this, an examination was conducted into the prevalence differences between BMI categories for both genders. There was a 20.3 kg/m2 percentage increase in prevalent hypertension for males between the BMI categories of normal weight and overweight. The highest hypertension prevalence differences in the study sample occurred in the higher BMI categories. Compared with females, males had a higher prevalence of hypertension with BMI categories of overweight.

DISCUSSION

The study provides unique data on the prevalence of cardiovascular risk factors in the Soshanguve community, South Africa. The results indicated that risk factors were common in the study sample, but different distributions of risk factors existed in various age groups. The results revealed a high unemployment rate, especially in the female group (91.1%; n=184) compared with males (72.5%; n=148). The employment status was lower than that reported by a previous study in the Ga-Rankuwa community (Li, 2007:53) which showed that 63.3% of females (n=171) and 42.8% of males (n=143) were unemployed.

The prevalence of current cigarette smokers was high despite the South African government's consistent tobacco control policy. The overall prevalence of cigarette smoking in the study (26.4%; n=107) was similar to that found previously in South Africa (Steyn, 2006:48). The daily smoking rate of the younger male group (18–30 years) was 44.4% (n=32). Other than broad public health objectives, the main aim of tobacco control policies is to reduce smoking among young people. Since most smokers start the habit whilst in their teens or early twenties, it follows that a programme which successfully reduces youth smoking is likely to yield good long-term public health benefits. One project, surveying Xhosa-speaking women aged 15 to 64 years living in Cape Town (Marks et al., 2001), showed that tobacco users were older and less educated than non-users. The study confirmed similar results as shown in Table 1. The gender difference in the smoking status was statistically significant ($\chi 2$=101.685, p=0.001); males were significantly more likely to be smokers than females. A possible explanation for the gender differences is that tobacco use is perceived to be taboo for black women and those who use it do so secretly, or only with trusted others. Some of the reasons given as to why women should not smoke were that it was disgraceful, shameful and a taboo for women to do so (Marks et al., 2001).

More than half of the males and one out of ten female respondents reportedly regularly consumed alcohol at the time of the interviews. Some respondents might have been dishonest about stigmatised behaviours. Siegfried et al. (2001:243) reported that the drinking of alcohol by females was disapproved of in Lesotho and was therefore likely to be underreported. The gender difference in the presented data was statistically significant ($\chi 2$=95.254, p=0.001). Males had a significantly higher prevalence of alcohol use than females. A possible explanation could be that it was socio-culturally less acceptable, a prevailing sentiment and one which appears to have been traditionally held since ancient times (WHO, 2005:122).

Physical activity in black South African populations has not been well studied. It is a problem to compare the results of the research with other data, as there is a lack of research on physical activity in the overall society, carried out using the IPAQ, in South Africa. The presented data confirmed that physical activity levels were lower than

reported by many studies. Males presented higher activity levels than females in terms of occupational physical activity, leisure-time physical activity and vigorous physical activity, similar to reports of previous studies (Monteiro et al., 2003:246).

The Soshanguve adults followed a prudent diet as far as compliance with the national guidelines was possible, having a very low fat and high carbohydrate intake, which is typical of the traditional type of diet found in African countries (Steyn, 2006:38). Health promotion introduced in South Africa emphasised the development and implementation of food-based dietary guidelines, one of which is to "eat fats sparingly" (Vorster et al., 2001:S5). Ideally, one should prevent the dietary fat intake from exceeding current WHO recommendations in adults. Since a large percentage of women are overweight and there is an increased prevalence of chronic diseases in developing countries, this recommendation is a prudent diet and aimed at preventing obesity-related conditions (WHO, 2003:30).

The prevalence of obesity was high amongst the females, especially those aged 30 years and older. Data showed that 25.9% of females (n=22) were obese and 9.4% (n=8) severely obese at the ages 18 to 30 and so primary prevention of obesity must start at a young age, particularly for females. The relationship between education and BMI is of interest because females with lower education had higher BMIs than those with higher levels of schooling.

The level of education appears to be related to overweight and obesity. Conversely, males with tertiary education had a higher BMI than those with less or no schooling. The findings were consistent with the National South African Demographic and Health Survey, in that incorrect perception of body weight was related to lower levels of education and those women with the smallest waists were the most educated (Steyn, 2006). This study found that 53.1% of the females (n=107) had a waist-to-hip ratio above the cut-off point of 0.85, whilst only 3.2% of the males (n=7) had a waist-to-hip ratio equal to or more than 1.0.

The study confirmed that hypertension in the Soshanguve community was common in both genders and the prevalence increased with age, being most prevalent in adults 41 years and older. In the female age group of 51 to 60 years, 72.7% females were hypertensive. According to Steyn (2006:88), the quality of hypertension care received by South Africans is reflected in the proportion of persons with hypertension who are aware of having the condition, the proportion taking anti-hypertension medication and the proportion with blood pressure levels below the accepted target blood pressure level. The study also confirmed that 5.8% of hypertensive respondents (n=8) were not being treated, with only 12.4% (n=17) having desirable levels of control with blood pressure under 140/90 mmHg.

Obesity in the current study was associated with a significantly increased risk of hypertension (see Figure 3). According to a recent population-based survey, including 195 005 randomly selected American adults, obesity was associated with a relative adjusted risk of 3.5 for hypertension (Mokdad et al., 2003:76). The association between hypertension and obesity has been well documented in many studies in South Africa (Van Rooyen et al., 2000:779).

CONCLUSIONS

The study provides substantial evidence of cardiovascular risk factors in the Soshanguve community. Although reported cardiovascular disease is still uncommon, the risk factors are prevalent in the Soshanguve community. The economic and social costs of this burden will be substantial, particularly in a community already burdened with poverty-related diseases such as malnutrition, infectious diseases and low-resourced healthcare facilities. Cardiovascular diseases are preventable and controllable through comprehensive and integrated actions. It is important to initiate an overall health project for implementing interventions to lower the risk factors for cardiovascular diseases in the Soshanguve community.

RECOMMENDATIONS

Future research should:

- explore the level of education provided by the PHC clinics as these clinics are the only health resources available to most community members;
- investigate the influence of the cultural environment on smoking, particularly for younger people and women;
- identify the habitual physical activity patterns of the community;
- develop and implement culturally specific interventions to reduce obesity with a particular focus on women; and
- determine the level of health literacy in the community as a basis for all future health promotion interventions.

LIMITATIONS

The study had a cross-sectional design and therefore no causality could be established. Physical activity was measured through answers to specific questions in the instrument (IPAQ), which might have been influenced by inaccurate reporting, recall bias and/or social desirability bias.

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