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RESEARCH

A survey of risk factors associated with hypertension in the adult population of Kang, Kgalagadi North, Botswana

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Background: Sustainable and aggressive population-based programmes on hypertension awareness, prevention, treatment and control are key to the successful control of this epidemic. The objective of the study was to determine to what extent hypertension and risk factors for its development were prevalent in the Kang village community in Botswana, and specifically to assess its prevalence in the adult population and its relationship with high blood pressure, anthropometric measures and lifestyle factors, i.e. diet and the use of tobacco products and alcohol.

Method: A population-based cross-sectional study was conducted on 161 adult residents of Kang aged 18 years and older from November to December 2008. A questionnaire adapted from the World Health Organization stepwise approach to the surveillance of chronic disease was used for the data collection.

Results: The prevalence of hypertension in the adult population of Kang was found to be 32% (95% confidence interval: 25-40). There was no significant sex difference in the prevalence rate in men (28%) versus women (34%), ($p = 0.59$). Hypertension was more prevalent in the overweight group than in the normal-weight group ($p = 0.3$), in the obese group than in the normal-weight group ($p = 0.002$), and in the obese group than in the overweight group ($p = 0.04$).

Conclusion: This study showed that hypertension affected almost a third of the adult population of Kang, and was significantly associated with overweight and obesity.

Keywords: Botswana, cross-sectional study, hypertension awareness, hypertension prevention, hypertension treatment, life-style factors, risk factors

Introduction

Hypertension is a common condition in sub-Saharan Africa, and poses a risk factor for heart attacks, strokes, left ventricular hypertrophy, renal disease and blindness.[1] It is universally under-diagnosed and/or inadequately treated, resulting in extensive target organ damage and premature death.[2] Since many people with hypertension are asymptomatic and unaware of their illness, screening may help to identify individuals who have it.[1]

Botswana, a developing country, faces the burden of hypertension, together with human immunodeficiency virus (HIV) infection. The true Botswana hypertension prevalence is not known.

The association between hypertension, anthropometric measurements [such as body mass index (BMI) and waist circumference (WC)], and lifestyle (such as diet, tobacco smoking and alcohol consumption) has been reported in several studies.[3–6] The risk factors associated with elevated blood pressure (BP) depend both on the degree of BP elevation, and the presence of other cardiovascular risk factors, such as age, sex, lipid disorders, smoking and diabetes mellitus.[7] Therefore, sustainable and aggressive population-based programmes on hypertension awareness, prevention, treatment and control are key to limiting this epidemic in sub-Saharan Africa.[1]

This study sought to investigate the risk factors associated with high BP in the adult population of Kang, Kgalagadi North, Botswana.

The objectives were to:

- Determine the demographic details of the population.
- Measure the BP of the population.
- Assess the population's social behaviour (e.g. alcohol and smoking).
- Determine the anthropometric measurements of the population.
- To enquire about the population's participation in physical activity.
- To determine a relationship between high BP and the identified associated risk factors in this population.

Significance of the study

To our knowledge, at the time of the study in 2008, a population-based study had not yet been conducted in Kang to investigate the prevalence of hypertension and its association with lifestyle and anthropometric risk factors. It was hoped that the study would address the absence of information in this regard in this geographical area, which could then be used by healthcare practitioners to provide evidence-based health care awareness and service delivery.

Method

Setting

The study setting was Kang, a village situated in Kgalagadi North, Botswana. The 2001 census estimated the Kang population to be 3 744. The population projection in 2008 was 5 076.[8]

Sampling

The sample size was calculated using the StatCalc® programme in Epi Info™ Version 6. A representative sample size was determined to be 94 participants at the confidence level (CI) of 95% and the confidence limits of 10%. To increase the power of the study, we oversampled to 161 participants. On average,

each household in Kang comprised four adults. From the total number of houses (1 270), a representative sample of the households to be considered in the village was computed to be 295. To achieve an even spread of the households to be selected for recruitment, we conducted a systematic sampling method and selected every fourth household (1 270 ÷ 295) from a random start which was determined by the throw of a dice. When the adult members of a household were absent, the next house in the row was selected. Consenting adults in the household were asked to sign a written consent form. The study was conducted over a two-month period from 1 November to 30 December 2008.

Design and procedure

A population-based survey was conducted among the adult residents in Kang aged 18 years and older. Those who were already on treatment for hypertension were included as well. However, participants with known pregnancy or physiological abnormalities (e.g. Cushing's syndrome and Addison's disease), gross anatomical deformities of the arms (to be used for the purposes of BP measurement), those who declined participation, and those who had participated in the pilot study, were excluded.

A questionnaire adapted from the World Health Organization (WHO) stepwise approach (STEPS) to the surveillance of chronic disease was used for data collection.[9] The questionnaire was translated into Setswana by a linguistic expert at the University of Botswana. Data consisting of socio-demographic characteristics and lifestyle behaviour, such as physical activity, physical measurements (weight, height, WC and hip circumference) and BP were collected according to the WHO standardised procedure[10–12] using digital automatic apparatus (Welch Allyn® OSZ 4 and 5). Data were collected by a team of five health auxiliaries at Kang clinic and five additional lay assistant clerks hired from the village. The researcher's role was to supervise the team on the ground. Socio-demographic data, BP, anthropometric data and details on lifestyle behaviour were collected during the first week. Average systolic BP (SBP) and diastolic BP (DBP) were determined for each participant from the second and third measurements. The mean of the last two measurements was used. Participants were classified as hypertensive if a SBP ≥ 140 mmHg and/or DBP ≥ 90 mmHg were recorded, or there was self-reported use of antihypertensive medication. The International Diabetes Federation guidelines for WC with a cut-off point of 80 cm for women and 94 cm for men (and 90 cm for Asian men) were used in this study,[13] together with a waist to hip ratio (WHR) cut-off point of 0.8 for women and 1.0 for men.

A pilot study was conducted to refine the questionnaire, and to ensure that it was acceptable to the intended audience. Test-retest reliability of the BP and anthropometric measurements were assessed during the pilot study. The devices used for the BP and anthropometric measurements gave the same readings.

Collected data were checked, fed into the computer and analysed using Epi Info™ version 6 software. The chi-square test or Fisher's exact test was used to assess the association between hypertension and anthropometric measurements and the participants' lifestyle behaviour. The level of significance was set at $p < 0.05$.

Ethical considerations

Ethics approval was obtained from the Medunsa Campus Research Ethics Committee (MCREC) of the University of Limpopo, South Africa (Ethics Clearance Number MCREC/M/173/2008), and the Health Research Unit of the Ministry of Health, Botswana [PPME-13/8/1 PS Vol. III (50)]. Permission for data collection at the study site was obtained from the Kgalagadi District Council (USF: Primary Health Care Manager/Us 12910). The principles of patient autonomy, beneficence, non-maleficence and justice were maintained throughout the study. Each consenting participant was asked to sign a written consent form.

Results

A total of 173 participants were included in the survey. Twelve of the forms were discarded, five were not completed properly and seven participants could not be found on the second and/or third visit. Thus, the sample size that was ultimately analysed comprised 161 participants. BP was the mean of three readings taken on three consecutive weeks.

Demographic characteristics of the Kang population

Of the 161 participants, 60 (37%) were men and 101 (63%) were women (Table 1). The participants' ages ranged from 20–82 years, with a mean age of 41 (95% CI: 38–43). The mean age of the hypertensive participants was 53 years (95% CI: 49–58). The frequency of hypertension increased with age (Figure 1). Hypertension was observed in one third (32%, 95% CI: 25-40) of participants. The prevalence of hypertension in the men was not significantly different to that observed in the women [men (28%) vs. women (34%)], ($p = 0.59$).

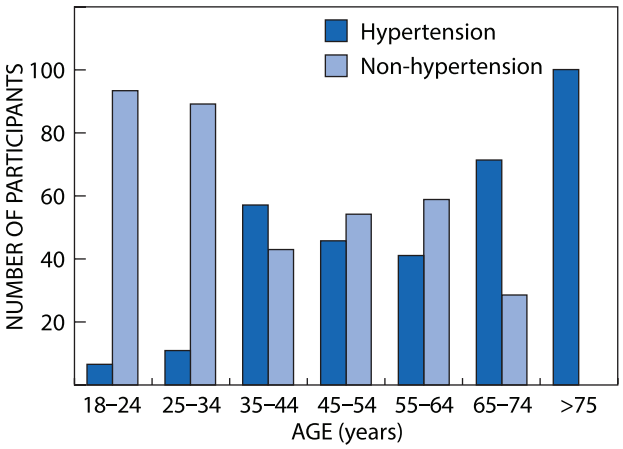

Figure 1: Bar chart demonstrating the prevalence of hypertension by age group in Kang participants, Botswana, in 2008

Table 1: Description of the demographic characteristics of the Kang participants, Botswana, in 2008

Characteristics	Total number, *n* (%)	Hypertension	
		Yes (*n* = 51) *n* (%)	No (*n* = 110) *n* (%)
Gender			
Male	60 (37.2)	17 (28.3)	43 (39)
Female	101 (62.7)	34 (33.7)	67 (61)

Table 2: Frequency of reported fruit and vegetable consumption by the Kang participants per occurrence of hypertension, Botswana, in 2008

Days of consumption per week	Fruit						Vegetables					
	Hypertension				Total fruit		Hypertension				Total vegetables	
	Yes		No				Yes		No			
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
0–2 days per week	12	18	48	72	60	67	17	25	52	75	69	63
3–4 days per week	5	28	13	72	18	20	7	35	13	65	20	18
> 5 days per week	3	27	8	73	11	13	6	29	15	71	21	19
Total	**20**	**24**	**69**	**76**	**89**	**100**	**30**	**27**	**80**	**73**	**110**	**100**
Unknown*	30	43	40	57	70	44	20	39	31	61	51	32

*The participants were unsure of how many days in a week they ate fruit or vegetables

Blood pressure measurements

The mean ± standard deviation (SD) for SBP was 127 (17) for the men and 129 (22) for the women, while the mean ± SD for DBP was 80 (12) for the men and 79 (17) for the women. Of the participants with a raised BP or on drugs to reduce the BP, the SBP mean was 150 mmHg (95% CI: 146–155) and the DBP mean was 91 mmHg (95% CI: 88–94 mmHg).

Lifestyle measures

Reported tobacco product use

One third (50, 31%) of the participants reported the use of any type of tobacco product, 15 (26%) participants reported the use of smokeless tobacco, like snuff. Fifteen participants (58%, 95% CI: 37–77) did not know for how long they had used tobacco products. The prevalence of hypertension in those who reported the use of a tobacco product was not significantly different to that in those who did not report it (32% vs. 64%) ($p = 0.46$).

Reported alcohol use

One third (50, 31%) of the participants reported that they had consumed alcohol in the past 12 months. Of these, 17 participants (34%) responded daily alcohol consumption. Half (27, 54%) of the participants did not know how many alcoholic drinks they consumed in one day, and for how long they had used alcohol in their lifetime. Significant differences were not observed in the prevalence of hypertension when the different categories of alcohol consumption were compared ($p > 0.05$).

Reported fruit and vegetable consumption

Eighty nine and 110 participants responded on the consumption of fruit and vegetables in a week, respectively (Table 2). The majority (60/89, 67%) reported that they did not eat fruit or ate fruit two days or less in a week. While 69 of the 110 participants (63%) reported consuming vegetables.

Close to half of the participants (70/159, 44%) said that they were unsure of how many days in a week they ate fruit. One third (51/160, [32%]) of participants said the same about vegetables (Table 2). A significant difference was not observed with regard to the prevalence of hypertension when different categories of fruit and vegetable consumption were compared, except when respondents who ate fruit 0–2 days per week were compared with those who could not recall their fruit and vegetable consumption (number of days in a week on which they ate fruit and vegetables) (18% vs. 43%, $p = 0.009$).

Physical activity

Respondents with and without hypertension both reported that on average, they participated in vigorous-intensity and

Table 3: Frequency distribution of elevated blood pressure, according to body mass index, waist circumference and waist to hip ratio in Kang participants, Botswana, in 2008

Anthropometric risk factors	Total *n* (%)	Hypertension *n* (%)	Non-hypertension *n* (%)
Body mass index			
Underweight (≤ 18.4 kg/m^2)	8 (4.9)	1 (13)	7 (87)
Normal (18.5–24.9 kg/m^2)	77 (48)	15 (19)	62 (81)
Overweight (25–29.9 kg/m^2)	42 (26)	18 (42.8)	24 (57.2)
Obese (≥ 30 kg/m^2)	34 (21)	17 (50)	17 (50)
Waist circumference			
≤ 79.9 cm (women)	26 (26)	4 (15)	22 (85)
≥ 80 cm (women)	75 (74)	30 (40)	45 (60)
≤ 93.9 cm (men)	47 (78)	10 (21)	37 (79)
≥ 94 cm (men)	13 (22)	7 (54)	6 (46)
Waist to hip ratio			
≤ 0.79 (women)	15 (15)	1 (6.6)	14 (93)
≥ 0.8 (women)	86 (85)	33 (38)	53 (62)
≤ 0.99 (men)	57 (95)	15 (26)	42 (74)
≥ 1.0 (men)	3 (5.0)	2 (67)	1 (33)

moderate-intensity activity five and six days a week. Hypertension prevalence was not significant in participants who reported involvement in vigorous-intensity or moderate-intensity activities that caused a large increase in the breathing or heart rate (e.g. for at least 10 minutes continuously) [14 (24%) vs. 36 (34%)] (p = 0.22], compared to those who did not do so [36 (26%) vs. 24 (40%)] (p = 0.70).

Anthropometric measurements

The mean ± SD for BMI was 23 (4.7) for the men and 29 (6.1) for the women. A WC equal to or above the ideal of 80 cm was measured in three quarters (75, 74%) of the women, while a WC equal to or above 94 cm was recorded in less than a quarter of the men (13, 22%) (Table 3). An elevated BP was seen with significant frequency in the overweight group compared to the normal-weight group (43% vs. 20%) (p = 0.03), in the obese group compared to the normal-weight group (50% vs. 20%) (p 0.002), and in the obese group compared to the overweight group (50% vs. 43%) (p = 0.04). However, there was no difference when hypertension prevalence was compared between the normal-weight group with the underweight group, and the overweight group and the underweight group: 20% vs. 13%) (p = 0.64), and 43% vs. 13% (p 0.14), respectively. There was a significant difference in the prevalence rate of hypertension when low WC and high WC were compared in the women (6.6% vs. 38%) (p = 0.04), and in the men and (26% vs. 67%) (p = 0.03).

Discussion

The frequency of hypertension increased with age. The reason for the rise in BP with age can be attributed to multiple factors, such as increased social stress, hardening and shrinking of the arteries, obesity and the failure of the individual to adhere to healthy lifestyle practices.

This study did not show an association between hypertension and sex, with a prevalence of 28.3% in the men versus 33.6% in the women (p = 0.59). This finding was similar to that in a study conducted on the adult population in Addis Ababa, in which a hypertension prevalence of 31.5% in the men and 28.9% in the women (p > 0.05) was reported.[14] However, the South African Demographic and Health Survey reported dissimilar results of 51% in the women and 26% in the men (p < 0.05).[15] Conflicting findings were reported in a review study which examined the prevalence of hypertension in different world regions.[16]

Prevalence of hypertension

This study found that one third (32%) of the participants had hypertension, compared to the high prevalence thereof of 36.9% reported in Nigeria, and 56% in a health facility-based study in Soweto in South Africa.[17,18] However, a low prevalence of 20.1% was reported in a community study conducted in rural north-western India.[19] The age differences between the studied subjects, variability with regard to the definition of hypertension (and the cut-off level of the BP beyond which the disease is diagnosed), the time of the study and the urban versus rural characteristics of the populations were eye-catching in the design dissimilarity of these studies. Despite the fact that standardisation in the methods of hypertension studies was suggested, researchers were still using non-standarised methods. This created difficulties for a proper comparison to be made between the various populations.

Lifestyle measures

Reported tobacco product use

Close to one third (31%) of participants reported using tobacco products, with smokeless tobacco (snuff) being reported by 26% of the tobacco users in the present study. A similar prevalence of tobacco use was reported in other studies.[20,21] The current study established that tobacco products were not associated with an increase in the prevalence of hypertension (p = 0.46). This finding was consistent with the report from an Eastern Cape province study (adjusted odds ratio 1.12, 95% CI: 0.84–1.50).[21] However, a survey conducted in India employees in a mega industry in South Gujarat reported that the prevalence rate of hypertension was significantly higher in persons who consumed tobacco (29.6%, p < 0.001).[22]

Reported alcohol use

In our study, half of the participants (52%) reported that they had had alcohol daily in the past 12 months, and half of the hypertensive participants who consumed it (55%) did not know how many alcoholic drinks they had had per day, and for how long they had been consuming alcohol over the course of their lifetime. This finding can be explained by the fact that Kang village is a rural setting, and characterised by a low level of formal education. Therefore, recall and quantification of the amount of alcohol consumed would be difficult. In this study, an association was not observed between hypertension and the different categories of alcohol consumption. An Indian study conducted on the employees of a mega industry in South Gujarat reported a dissimilar finding as the prevalence rate of hypertension was significantly higher in persons who consumed alcohol (37.0%) (p < 0.001).[22]

Reported fruit and vegetable consumption

The findings indicated that the mean number of days of reported fruit and vegetable consumption was two days a week for both the hypertensive and non-hypertensive respondents. This can be explained by the fact that Kang village is in the heart of Kgalagadi Desert, so fruit and vegetables are rare products. An association between the prevalence of hypertension and the different categories of fruit and vegetable consumption was not observed in this study, with the exception of the group of participants who consumed fruit and vegetables 0–2 days per week (p = 0.009).

Physical activity

The study found no association between hypertension and individuals who were not involved in vigorous-intensity or moderate-intensity activity (p = 0.22 and p = 0.70, respectively). Dissimilar findings have been reported in several studies. For example, a study conducted in the USA reported that there was an inverse association between physical activity and hypertension.[26] The majority of Kang residents are farmers. This could explain why the findings indicated that the mean number of days of vigorous-intensity activity was 5 for both hypertensive and non-hypertensive respondents, and that the figure for moderate-intensity activity was 6, again for both sets of respondents. The failure of our study to support an inverse association between vigorous-intensity activity or moderate-intensity activity and hypertension may be attributable to self-report and interviewer bias, which could have resulted in non-differential misclassification.

Anthropometric measurements

This study showed an association between hypertension and anthropometric measurements, such as BMI and WC for both sexes, and the WHR for women (p = 0.04, 0.03 and 0.04, respectively). A similar finding was reported in a multicentre study conducted in Ethiopia, Vietnam and Indonesia.[23] However, hypertension prevalence did not vary markedly across BMI quintiles in the Ethiopian women, suggesting that BMI might not be an important determinant of BP in this group.[23]

Central obesity was reported in close to one quarter (22%) of the men and three quarters (74%) of the women in the present study, using 80 cm for men and 94 cm for women as the cut-off point. A lower central obesity prevalence of 7.98% in men and 43.3% in women was reported in a study from the Free State, although cut-off points of 102 cm and 88 cm were used for the men and women, respectively.[24] It has been suggested that obesity in women can be attributed to their comparatively more sedentary lifestyle compared with men, coupled with hormonal factors. There is also a cultural belief that female beauty is associated with obesity, while a slender build is associated with the stigma attached to the HIV/acquired immune deficiency syndrome pandemic. [25]

The study's limitations

A major limitation of our study was the cross-sectional design. As time advances, complications impede the ability to obtain quality data and the seamless collection thereof. This design limited any inference of a causal association between the risk factors and hypertension, and in addition prevented the determination of the direction of the association between risky lifestyle behaviour and hypertension. This study was conducted in only one area of Botswana. Therefore generalisation of the results is difficult. Further studies are needed to determine the countrywide prevalence of hypertension, using a large sample.

Recommendations

It is recommended that a follow-up study should be conducted to investigate the risk factors associated with high BP in the adult population of Botswana, using a large community-based sample and the WHO STEPwise approach.

Conclusion

Hypertension is a common problem in the adult Kang population, with a prevalence of 32%. Hypertension prevalence was found to be associated with anthropometric measures, such as overweight and obesity. A significant association was not found between hypertension and the use of tobacco products, alcohol consumption and vigorous-intensity and moderate-intensity activity.

Conflict of interest – The authors declare that they had no financial or personal relationships which may have inappropriately influenced them in writing this article.

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