Snuff use and the risk for hypertension among black South African women

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Abstract

Background: Snuff or smokeless tobacco, used orally or by nasal application, is the predominant form of tobacco used by black South African women. Little is known about the risk of cardiovascular disease associated with the use of snuff in developing countries. This study therefore sought to determine the association between snuff use and hypertension among black South African women.

Methods: This study involved secondary data analysis of a cross-sectional representative sample of black women aged 25 to 70 years (n = 4092) who participated in the 1998 South African Demographic and Health Survey, the largest to date. Data analysis included chi-square statistics, t-tests, ANOVA and multiple logistic regression analysis. The outcome measure was hypertension, defined as presenting with an average blood pressure (BP) of ≥ 160/95 mmHg, and/or reporting the use of antihypertensive medication.

Results: The prevalence of snuff use and hypertension was 14.6% and 18.0% respectively. Compared to non-users of snuff, those who used snuff more than eight times a day had significantly higher mean systolic (131 mmHg vs. 121 mmHg) and diastolic (84 mmHg vs. 77 mmHg) BP. Hypertension was more prevalent among snuff users than among non-users of snuff (23.9% vs. 17%; p<0.001). However, after adjusting for potential confounders, although current snuff use as compared to non-current use produced a dose response, it was not associated with a statistically significant increased risk for hypertension (OR = 1.12; 95% CI: 0.84-1.50).

Conclusion: This study failed to show a significant association between snuff use and hypertension. However, heavy snuff use significantly increased BP to levels that have been shown to increase the risk for cardiovascular diseases at a population level. While there is need for follow-up studies, this finding of the study highlights the need for primary care physicians to offer tobacco use cessation services to their patients, especially those who may already be exposed to other risk factors for hypertension.

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Introduction

Hypertension is a global health burden and a major risk factor for the development of cardiovascular diseases among all race groups.[1,2,3] A number of factors, including tobacco use, have been associated with the development of hypertension among both South African men and women, irrespective of their race/ethnicity.[2,3] However, the majority of black South African women who use tobacco products do so in the form of snuff, with a national prevalence estimated at 13.2% in 1998, compared to a smoking prevalence of 5.3% in the same population group.[4] Whereas the health consequences of smoking are well documented, only limited information is available on the health effects of smokeless tobacco or snuff use.

Some studies have shown that the use of oral snuff or smokeless tobacco may predispose a person to higher systolic and diastolic blood pressures,[5,6,7] and significantly increase the risk for myocardial infarction.[8] A few studies have also suggested an acute elevation of blood pressure following snuff-dipping, ascribed to the mineralocorticoid activities of nicotine, the high sodium content and possibly the effect of liquorice additives.[9,10,11] However, other studies have failed to confirm a significant association between the risk for hypertension or cardiovascular disease and the use of snuff.[12,13] Nevertheless, a more recent large-scale study suggests that snuff may increase mortality from heart disease and stroke.[14]

Among black South Africans, hypertension is the single most important risk factor for cardiovascular disease.[3] Most of the existing studies on the association of snuff with cardiovascular disease are derived mainly from the study of Caucasian male snuff-dippers in developed countries.[5,9,10,11,12,13] Due to the lack of consistent associations between snuff and major diseases (particularly in developed nations), snuff is promoted as a reduced-harm product.[15,16] Although snuff use in South Africa, which includes the nasal use of both moist and dry snuff, may be different from the pattern of use in developed nations,[17,18] it is similarly perceived by some South African adolescents as a safer alternative to cigarettes.[19]

Given the inconsistencies in the findings of previous studies and the lack of evidence for an association between snuff use and hypertension in South Africa, this study sought to determine the association between the use of snuff and hypertension among black South African women.

Methods

Data source and study design

Data for this study were obtained from individuals aged 25 to 70 years old who participated in the 1998 South African Demographic and Health Survey (SADHS). The 1998 SADHS was the first and, to date, the largest publicly available SADHS dataset. The 1998 SADHS was a nationally representative, cross-sectional household survey conducted between February and September 1998. The 1998 SADHS used a stratified, two-staged probability sample design. Methods of data collection, interviews and consent have been published previously.[4,20] Black African women who participated in the 1998 SADHS and were between the ages of 25 and 70 years were selected for analysis in this study (n = 4 092).

Risk-factor assessment for and definitions of cardiovascular disease

Data were collected using a questionnaire administered by trained and standardised fieldworkers. An asset index – a measure of socioeconomic status – was derived from a composite score of a list of household items (electricity, television, telephone, refrigerator and washing machine) owned by the respondents. The respondent answered "yes" (code 1) or "no" (code 0) to each of the listed household items on the questionnaire. The scale derived was considered very reliable, as indicated by a very good internal consistency (Cronbach alpha score = 0.80). The scores were then ranked in order to classify the respondents into three socioeconomic categories.

The questionnaire also included questions on the respondents' personal and family medical history, and their use of chronic medications. An interviewer inspected medication containers for listed drugs as part of the procedure for quality control of the data. Other information that was recorded, such as information on lifestyle and habits, included the respondents' history of tobacco and/or alcohol use and a subjective estimation of the respondents' discretionary salt intake.

The fieldworkers assessed anthropometric measurements and blood pressure (BP) using methods previously detailed and published.[17] Hypertension was defined using the then South African hypertension guidelines (BP $\geq$ 160/95 mmHg and/or on antihypertensive medication). Risk estimation was done using this reference point, which was higher than the usual reference point of 140/90 mmHg, to allow our results to be comparable with related published literature, while also providing some understanding of policy implications for the findings locally. Hypercholesterolaemia was defined as reporting a past history of diagnosis of high cholesterol/fat or being on current medication for high blood cholesterol. Similarly, diabetes mellitus cases were defined as having a past history of diagnosis by a health professional of diabetes or high "blood sugar problem".

Statistical analysis

Group differences were assessed using chi-square statistics and t-tests or ANOVA where the comparison included more than two groups. Statistical comparisons were made between categories of snuff use and known vascular disease risk factors and mean blood pressure readings. Multiple logistic regression models were constructed to determine an independent association of snuff use with hypertension, while adjusting for the influence of the covariates that have been identified in the literature and in our bivariate analysis as being significantly associated with hypertension and/or snuff use, i.e. the potential confounders. All statistical analyses were done using STATA software (Stata Corp 2003, Texas, USA), with appropriate weighting of and consideration for complex sample design. Odds ratios (OR) with a 95% confidence interval (CI) were used in estimating effect sizes. Statistical significance was set at 5%.

Results

The prevalence of snuff use and hypertension was 14.6% and 18.0% respectively. On average, the snuff users were significantly older than non-users (49.2 years vs. 43.0 years; $p<0.001$). The use of snuff was more common among the poor and those in the middle socioeconomic class than among the richest ($p<0.01$). Higher education was inversely associated with snuff use; the prevalence decreasing from 21.6% among women who had no schooling to 2.5% among those who had more than 12 years of schooling (see Table I). Participants with higher education levels also tended not to have hypertension in a bivariate analysis, but this was not significantly associated with hypertension after controlling for potential confounders in a multiple regression analysis.

Table I: Prevalence of snuff use and hypertension by socioeconomic and health/behavioural characteristics (weighted %)

Characteristics	Snuff use (%)	Hypertension (%)
Prevalence (95% CI)	14.6 (13.2–16.2)	18.0 (16.5–19.5)
Mean age (yrs) (SD)	49.2 yrs (13.0)	52.7 yrs (11.2)
Asset index (Tertiles) (N = 4078)		
Poorest	16.2	15.7
Middle	15.8	17.7
Richest	9.1	22.2
	P <0.01	*P* <0.001
Education level (N = 4078)		
None	21.6	23.5
1–7 years schooling	15.7	19.9
8–12 years schooling	11.2	14.0
>12 years schooling	2.5	9.6
	P <0.01	*P* <0.001
Lifestyle/habits		
Ever Smoked (N = 4092)		
No	15.6	17.6
Yes	1.1	21.8
	P <0.01	*P* = 0.16
Snuff use (N = 4092)		
No	-	17.0
Yes	-	23.9
		P <0.01
Body mass index (N = 3914)		
Underweight (<18.5 kg/m^2)	16.2	8.4
Normal (18.5–<25 kg/m^2)	13.6	11.8
Overweight (≥25–30 kg/m^2)	15.0	16.6
Obese (>30 kg/m^2)	15.1	25.1
	P = 0.74	*P* <0.001
Salt intake in food (N = 4088)		
Not salted	20.8	16.5
Lightly salted	13.2	17.0
Very salty	28.3	37.8
	P <0.01	*P* <0.001
Ever used alcohol (N = 4092)		
No	12.4	17.5
Yes	27.4	20.7
	P <0.01	*P* = 0.13

Compared to non-users, the mean systolic and diastolic blood pressure of snuff users were higher by at least 5 mmHg and 4 mmHg respectively ($p < 0.001$). A graded response was observed between the frequency of snuff use and mean systolic and diastolic BP (see Table II). Subsequent pair-wise post hoc contrast analysis (Bonferroni post-hoc test) showed that, compared to non-users, those who consumed snuff once to eight times and more daily had a significantly higher BP level than non-users (P <0.001). However, although those using snuff more than eight times a day had a higher BP than those consuming snuff less than eight times a day, the difference in BP was not statistically significant. The mean BP was also significantly raised among diabetics, but not significantly increased among respondents with hypercholesterolaemia. Hypertension was more prevalent among snuff users than among non-users – 23.9% vs. 17.0% [unadjusted odds ratio (OR) = 1.56; 95% confidence interval (CI): 1.20–2.02)].

Nonetheless, in a multivariate analysis adjusting for family history of hypertension and the other significant risk factors for hypertension that are illustrated in Tables I and II, snuff use was not statistically significant (OR = 1.12; 95% CI: 0.84–1.50).

Table II: Mean diastolic and systolic blood pressure by risk factors

	Mean systolic pressure (mmHg)		Mean diastolic pressure (mmHg)	
	Mean (SE)	*P* value	Mean (SE)	*P* value
Snuff use status				
Not current user (n = 3517)	121 (0.37)		77 (0.22)	
Use 1–8 times/ day (n = 504)	126 (1.10)		81 (0.61)	
> 8 times/day (n = 71)	131 (3.19)		84 (1.70)	
		P <0.001		*P* <0.001
Smoking history				
Never smoked (n = 3725)	121 (0.48)		78 (0.26)	
Quitted (n = 64)	123 (3.32)		79 (2.44)	
Current smoker (n = 303)	125 (1.71)		80 (0.88)	
		P <0.01		*P* <0.01
Diabetes				
No (n = 3923)	121 (0.36)		78 (0.21)	
Yes (n = 145)	130 (2.22)		80 (1.04)	
		P <0.001		*P* = 0.04
Hypercholesterolaemia				
No (n = 4031)	121 (0.36)		78 (0.21)	
Yes (n = 18)	126 (7.49)		82 (3.94)	
		P = 0.43		*P* = 0.17
Study population	121 (0.35)		78 (0.21)	

Nonetheless, a dose response, albeit not statistically significant, was observed (see Table III). The median number of cigarettes smoked per day (CPD) was four. A statistically significant dose response was observed among current smokers, even after adjusting for potential confounders.

Table III: Multiple logistic regression model predicting hypertension (BP ≥160/95)

		Fully adjusted* OR (95% CI)
Current snuff use	None	1
	1–8 times daily	1.01 (0.75–1.36)
	> 8 times daily	2.07 (0.89–4.82)
Body weight category	Normal (18.5–<25 kg/m^2)	1
	<18.5 kg/m^2	0.57 (0.30–1.11)
	25–30 kg/m^2	1.44 (1.08–1.94)
	Obese (>30 kg/m^2)	2.04 (1.53–2.73)
Smoking status	Never smoked	1
	Quitted	1.45 (0.63–3.31)
	Smokes 1–4 CPD	2.06 (0.98–4.34)
	Smokes > 4 CPD	2.11 (1.06–4.20)
Extent of salt in food	Not salty	1
	Lightly salty	0.98 (0.66–1.46)
	Very salty	1.82 (1.08–3.06)
Diabetes	No	1
	Yes	2.42 (1.56–3.76)
Family history of BP	No	1
	Yes	1.62 (1.27–2.05)

*The final multivariate model, in addition to the variables displayed above, also controlled for age, smoking duration and Asset Index.

OR = odds ratio; CI = confidence interval.

Discussion

As far as could be ascertained, this study is the first to explore the association between hypertension and snuff use using a representative sample outside of developed countries. This study illustrates that

snuff use is more prevalent among older women and those who are socio-economically disadvantaged. These women, who are often at a disadvantage in terms of access to quality health care, may thus be at greater risk for cardiovascular disease, given that snuff use was associated with an increase in BP. The observed increase in BP is consistent with findings from previous studies, which have suggested an increase in systolic and diastolic BP of the order of 10 to 20 mmHg and 6 to 12 mmHg respectively.[9] An increase in diastolic blood pressure of up to 5 mmHg has also been associated with increased risk for stroke, especially in normotensive populations.[21,22] It is well established that a reduction in BP towards set goals, either through lifestyle modification or pharmacological interventions, reduces the risk for stroke, heart attacks and heart failure.[23] Given that the findings of this study also suggest that snuff users are more likely to be those who tend to take in very salty foods, and that very salty food is associated in turn with a significantly increased risk for hypertension, interventions to prevent and control snuff use may therefore be critical in addressing cardiovascular risk among black South African women.

Traditional risk factors, such as increased salt intake, obesity, smoking and family history, were confirmed to be associated with hypertension in this study. It is also pertinent to note that this study demonstrated a significantly increased risk of hypertension among current smokers with smoking intensities as low as just over four cigarettes per day, compared to those who had never smoked. However, in contrast to findings from previous studies,[7,8] this study failed to show a significant independent association between the use of snuff and hypertension. The difference in this observation may be related to the differences in snuff products and additives used in the different countries and/or the differences in the socio-demographic characteristics of the study populations. The lack of statistical significance could also be explained by insufficient statistical power because of the small sample of heavy snuff users, as similarly noted in previous studies on the association between smokeless tobacco and cardiovascular disease.[13,24] As previously noted by Rothman, it is a fallacy to infer a lack of association from a single *P* value, which in this case is a 95% CI that includes the figure 1.[25] Nevertheless, consistent with some previous studies, the findings of this study support the view that constituents of tobacco smoke other than nicotine may be more strongly associated with the pathogenesis of hypertension.[24,26] This is demonstrated by the fact that snuff, which has been reported to deliver as much nicotine as cigarettes,[18] was not associated with a significant increase in the risk for hypertension, while cigarette smoking was – even at a relatively low intensity.

The major limitations of this study lie in the cross-sectional design and the reliance on self-reporting of tobacco use. This may result in reporting bias, especially with regard to smoking, which is considered a social taboo among black South Africans.[27] Furthermore, information on the duration and the type of snuff used by respondents was not available in the 1998 SADHS data set. This may indeed be significant, as it was observed that smoking status was only significant after the lifetime duration of smoking was included in a multivariate model. In addition, those who had used snuff and quit were not categorised separately, thus they were inadvertently grouped with the reference group – "never/non-current snuff users" (misclassification bias). It is conceivable therefore that those who had only recently quit using snuff may still carry some residual risk during this "washout" period. Therefore, the non-significant association found in this study should be interpreted with caution. Despite these limitations, this study provided useful information on the association between snuff use and blood pressure in an under-studied population.

Conclusions

This study did not find a statistically significant association between snuff use and hypertension. While there is a need for controlled follow-up studies, the results of this study have both clinical and policy implications. These findings highlight the need for vigilance, especially as the frequent use of snuff was associated with a considerable increase in diastolic blood pressure in magnitudes that may be important for the risk of cardiovascular disease. The findings also highlight the need for primary care physicians to offer tobacco use cessation services to their patients, especially those who may already be exposed to other risk factors for hypertension.

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