DETERMINANTS OF DAY-NIGHT DIFFERENCE IN BLOOD PRESSURE IN SUBJECTS OF AFRICAN ANCESTRY

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A dissertation submitted to the Faculty of Health Sciences, University of the Witwatersrand, in fulfilment of the requirements for the degree of Master of Science

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DECLARATION

I, Joseph Muzi Maseko declare that this dissertation is my own work except to the extent indicated in the acknowledgements and references. It is being submitted for the degree of Master of Science in Medicine in the field of Physiology at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at this or any other university.

Joseph Muzi Maseko…….…….

…….day of ……., 2008.

I certify that the studies contained in this dissertation have the approval of the Committee for Research in Human Subjects of the University of the Witwatersrand, Johannesburg. The ethics approval number is M02-04-72

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Joseph Muzi Maseko

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Gavin R. Norton (supervisor) Angela J. Woodiwiss (supervisor)

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Date Date

This dissertation is dedicated to my wife Mokgadi and my three children

Thembi, Zinhle and Sibusiso

PUBLICATIONS AND PRESENTATIONS

The following is a list of publications and presentations offered in support of this dissertation.

Muzi J Maseko, Harold Majane, John Milne, Gavin R Norton, Angela Woodiwiss. Salt intake in an urban, developing South African community. Cardiovascular Journal of South Africa 2006; 17;186-191.

Muzi Maseko, Angela J Woodiwiss, Lutgarde Thijs, Jan Staessen, Gavin R Norton. Day-night differences in ambulatory blood pressure in subjects of African as compared to European descent. Oral presentation at the annual congress of the Physiology Society of Southern Africa 2005, Cape Town, South Africa 7-9 September.

Muzi Maseko, Angela J Woodiwiss, Lutgarde Thijs, Jan Staessen, Gavin R Norton. Determinants of day-night difference in ambulatory blood pressure in subjects of African ancestry. Poster presentation at the annual congress of the Physiology Society of Southern Africa 2005, Cape Town, South Africa 7-9 September.

ABSTRACT

Hypertension is a major risk factor for cardiovascular disease in both developed and developing countries. Blood pressure normally decreases at night and a number of studies have indicated that a reduced nocturnal decline in blood pressure (BP) increases the risk for cardiovascular disease. Nocturnal decreases in BP are attenuated in subjects of African as compared to European descent, but the mechanisms of this effect require clarity. In the present study I attempted to identify potentially modifiable factors that contribute toward nocturnal decreases in BP in a random sample of 171 nuclear families comprising 438 black South Africans living in Soweto.

Prior studies have suggested that adiposity and salt intake may determine nocturnal decreases in BP. Adiposity and salt intake were considered to be potentially important factors to consider in the present study as 67% of the group studied were either overweight or obese and in 291 subjects that had complete 24-hour urine collections (used to assess salt intake) and BP measurements, Na^+ and K^+ intake was noted to be considerably higher and lower respectively than the recommended daily allowance in the majority of people. Moreover, a lack of relationship between either hypertension awareness and treatment and Na^+ and K^+ intake suggested that current recommendations for a reduced Na^+ intake and increased K^+ intake in hypertensives do not translate into clinical practice in this community.

In order to assess whether adiposity or salt intake are associated with nocturnal decreases in BP in this community, ambulatory BP monitoring was performed using Spacelabs model 90207 oscillometric monitors. Of the 438 subjects recruited, 314 had

ambulatory BP measurements that met pre-specified quality criteria (more than 20 hours of recordings and more than 10 and 5 readings for the computation of daytime and night-time means respectively). To identify whether adiposity or salt intake are associated with a reduced nocturnal decline in BP, non-linear regression analysis was employed with indices of adiposity and urinary Na^+ and K^+ excretion rates and urine Na^+: K^+ ratios included in the regression model with adjustments for potential confounders. Neither body mass index, skin-fold thickness, waist circumference, waist-to hip ratio, urinary Na^+ and K^+ excretion rates, nor urine Na^+: K^+ ratios were associated with nocturnal decreases in systolic and diastolic BP. Indices of adiposity were however associated with 24 hour ambulatory systolic and diastolic BP. Unexpectedly, female gender was associated with an attenuated nocturnal decrease in BP.

In conclusion, in the first random, community-based sample with large sample sizes conducted with ambulatory BP monitoring in Africa, I found that neither adiposity nor salt intake are associated with a reduced nocturnal decline in BP. The lack of association between either salt intake or adiposity and nocturnal decreases in BP was despite a high prevalence of excessive adiposity in the community, as well as clear evidence that current recommendations for a reduced Na^+ intake and increased K^+ intake do not translate into clinical practice in this community. Thus, based on this study, the question arises as to whether primordial prevention programs targeting excess adiposity or inappropriate salt intake are likely to modify nocturnal decreases in BP, in urban, developing communities of African ancestry in South Africa. However, unexpectedly I noted that females were more likely to have an attenuated nocturnal decrease in BP. Thus further work is required to explain this finding.

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24DBP	24-hour Diastolic Ambulatory Blood Pressure
24SBP	24-hour Systolic Ambulatory Blood Pressure
ABP	Ambulatory Blood Pressure
ANOVA	Analysis of variance
APOGH	African Project On Genes in Hypertension
BMI	Body Mass Index
BP	Blood Pressure
DBP	Diastolic Blood Pressure
GLP	Good Laboratory Practice
HbA_{1C}	Glycated Haemoglobin
HDL	High Density Lipoprotein
IHD	Ischemic Heart Disease
LDL	Low Density Lipoprotein
LVM	Left Ventricular Mass
MI	Myocardial Infarction
NHANES	National Health And Nutrition Examination Surveys
NHSL	National Health System Laboratories
PVD	Peripheral Vascular Disease
RDA	Recommended Daily Allowance
SAS	Statistical Analysis Software
SE	Socio-economic

TG	Triacylglycerides
TOD	Target Organ Damage
U_{Na+}	Urine Sodium Concentration
U_{K+}	Urine Potassium Concentration
UK	United Kingdom
USA	United States of America