Original Research Article

CARDIOVASCULAR DISEASE RISK FACTORS AMONG OLDER PRISONERS IN THE ASHANTI REGION OF GHANA.

Prisons are environments that have been characterized by high rates of communicable diseases until recently when the prevalence of cardiovascular diseases have been assessed and high prevalence found. This study, involving 160 inmates assessed prevalence of cardiovascular risk factors among prisoners in the Ashanti Region of Ghana. BMI, waist circumference and blood pressure of all participants were checked. Additionally, lifestyle and dietary factors such as exercise and fruit intake as well as medical history of inmates was also assessed. Fasting blood samples were taken and analyzed for lipid profile and FBG. The mean systolic blood pressure of study participants was 141.1±23.2 mmHg, diastolic 88.9±15 mmHg, BMI 22.8±4.1kg/m^2, waist circumference 81±10.3cm, FBG 4.3±0.9mmol/L, HDL 1.4±0.4mmol/L and triglycerides 1.1±0.6mmol/L. Prevalence of hypertension and dyslipidaemia was 57.5% each. Prevalence of metabolic syndrome was 8.1%, and 21.9% had two cardiovascular risk factors. In conclusion prevalence of dyslipidaemia and elevated blood pressure were high among inmates and cardiovascular risk factors were higher among female inmates compared to males. Most inmates were sedentary and occasionally consumed fruits. Interventions of appropriate dietary provision and exercise schedule should begin within Ghanaian prisons to curb this menace.

Key words: Cardiovascular diseases, metabolic syndrome, inmates, prisons, risk factors

INTRODUCTION

Cardiovascular diseases are a major public health concern and their occurrence are strongly attributed to modifiable risk factors (1). These modifiable risk factors include elevated blood pressure, diabetes or glucose intolerance, dyslipidaemia and central obesity (2). According to the National Cholesterol Education Programme, Adult Treatment Panel III, presence of at least any three of these factors within an individual satisfies the diagnostic criteria for metabolic syndrome and it is an important predictor of future mortality and morbidity (3).

Prisons are stressful environments with meal provisions that predisposes to cardiovascular diseases (4, 5). In a study conducted in Istanbul, it was documented that cardiovascular diseases are the most common cause of natural death among prisoners (6). Additionally

Binswanger *et al.,* (2009) reported that in the United States, prisoners had a higher risk of cardiovascular diseases compared to the general population even with adjustments for important socio-demographic factors (7). Inappropriate diet, smoking, high alcohol consumption as well as physical inactivity have been outlined as the major causes of metabolic risk markers within prisons (8).

The 2012 annual report on inmate mortality by the Ghana Prisons Service indicates that cardiovascular disease is the major cause of mortality among Ghanaian inmates.

Older inmates aged forty (40) and above are of an increasing concern with regards to cardiovascular risk and health status compared to younger ones (9). This may be due to the fact that increasing age is an independent risk factor for cardiovascular disease coupled with the stressful prison environment and inappropriate diet (10, 11). High prevalence of cardiovascular diseases among inmates adds to the cost of their basic care which is already a burden for developing countries like Ghana but early assessment of these risk factors can enable timely interventions to be implemented(12-14).

The main aim of this cross sectional study was to assess the prevalence of cardiovascular risk factors among older prisoners in the Ashanti Region of Ghana.

METHODS

Study Population

This was a cross sectional study that involved 160 inmates from the Kumasi central (131), Kumasi female (10) and Manhyia local prisons (19) all in the Ashanti Region of Ghana. In all, the study was explained to 169 inmates who qualified to partake in the study but only 160 consented to participate.

Data collection

A detailed questionnaire was used to collect information on socio-demographic characteristics of inmates, medical history and voluntary exercise. A 5ml of fasting blood sample of each participant was taken and analyzed for lipid profile and FBS. About 2mls of the sample taken was dispensed into a fluoride tube for glucose analysis and the remaining sample into an activator gel tube for the analysis of lipids. The blood samples were kept in an ice chest containing ice packs and transported to the clinical analysis laboratory of KNUST for the biochemical analysis. The samples for lipid profile analysis were centrifuged for ten minutes at a speed of 4000 rotation per minute (r.p.m) using the eppendorf centrifuge 5804 to obtain the serum for the analysis. Lipid profile and FBS were analyzed using the Randox rx monza semi-automated spectrophotometer. FBS (mmol/L) was used to classify inmates as hypoglycaemic (>3.5), normoglycaemic (>5.6), pre-diabetic (5.6-7.0) and diabetic (>7.0) (ADA, 2010). Serum low density lipoprotein cholesterol (LDL-c) of (≥ 4.12mmol/L) and total cholesterol (TC) of (≥ 5.18) were classified as high (NCEP ATP III, 2002). Weight and height were also measured and used to calculate BMI (weight/height in metres^2). Waist circumference of all inmates was taken with a plastic tape and systolic and diastolic blood pressure of study participants was taken twice using a digital sphygmomanometer. The latter reading was used for the analysis. This was used to classify participants as normotensive (< 120/80 mm Hg), pre hypertensive (120-139 mm Hg systolic and or diastolic 80-89 mm Hg) and hypertensive (> 140/90mm Hg).

Metabolic syndrome was characterized by the components defined by the NCEP ATP III. These components include central obesity (waist circumference ≥ 102cm in men and ≥ 88cm in women), elevated blood pressure (≥ 130 mmHg systolic and or ≥ 85mmHg diastolic), impaired fasting plasma glucose (≥ 5.6mmol/L), decreased high density lipoproteins cholesterol (HDL-c) (< 1.03mmol/L) and elevated triglycerides (≥ 1.7mmol/L). BMI was

used to categorize inmates as underweight (>18.5kg/m^2), normal (18.5-24.9 kg/m^2), overweight (25-29.9 kg/m^2) and obese (>30 kg/m^2).

Inclusion and Exclusion criteria

Inmates aged forty and above who had been within prison for more than three months formed the inclusion criteria. Inmates who were less than forty years and those who were ill were excluded.

ETHICAL CONSIDERATION

Ethical consideration for the study was granted by the Committee on Human Research Publication and Ethics (CHRPE), School of Medical Sciences, KNUST, Kumasi; ref CHRPE/AP/407/16. Approval was also sought and granted by the Ghana Prisons Service headquarters before data collection at the prison facilities. Inmates who did not consent to the study were excluded and those that consented signed or thumb printed a consent form.

DATA ANALYSIS

SPSS version 20 was used for the analysis of data. Student T- test was used to compare the means of parameters of the study and chi-square was used to compare categorical data.

RESULTS

A total of one hundred and sixty (160) prisoners took part in the study of which 10 (6.3%) were females and the rest were males (93.8%). With respect to age distribution, 40.6% of the inmates were within the age range of 40-45, 22.5% within 46-50, 15.6% within 51-55, 6.9% within 56-60 and 14.4% were more than 60 years old. **Table 1** displays the socio-demographic and incarceration characteristics of inmates.

105 **Table 1: Socio-demographics and Incarceration Characteristics of Participants.**

Variable	Total n (%)	Kumasi central n (%)	Kumasi female n (%)	Manhyia local n (%)	P-value
Gender					
Male	150 (93.8)	131 (100)	0 (0)	19 (100)	
Female	10 (6.3)	0 (0)	10 (100)	0 (0)	
Age					
40-45 years	65 (40.6)	55 (42.0)	5 (50.0)	5 (26.3)	
46-50 years	36 (22.5)	28 (21.4)	3 (30.0)	5 (26.3)	0.143
51-55 years	25 (15.6)	16 (12.2)	2 (20.0)	7 (36.8)	
56-60 years	11 (6.9)	10 (7.6)	0 (0.0)	1 (5.3)	
>60 years	23 (14.4)	22 (16.8)	0 (0.0)	1 (5.3)	
Education					
None	30 (18.8)	27 (20.6)	1 (10.0)	2 (10.5)	
JHS	85 (53.1)	71 (54.2)	5 (50.0)	9 (47.4)	0.650
SHS	38 (23.8)	28 (21.4)	3 (30.0)	7 (36.8)	
Tertiary	7 (4.4)	5 (3.8)	1 (10.0)	1 (5.3)	
Marital status					
Single	24 (15)	22 (16.8)	1 (10.0)	1 (5.3)	
Married	101 (63.1)	83 (63.4)	5 (50.0)	13 68.4)	0.145
Divorced	28 (17.5)	21 (16.0)	2 (20.0)	5 (26.3)	
Widowed	7 (4.4)	5 (3.8)	2 (20.0)	0 (0.0)	
Religion					
Christian	122 (76.3)	98 (74.8)	7 (70.0)	17 (89.5)	
Muslim	33 (20.6)	28 (21.4)	3 (30.0)	2 (10.5)	0.805
Traditionalist	2 (1.3)	2 (1.5)	0 (0.0)	0 (0.0)	
None	3 (1.9)	3 (2.3)	0 (0.0)	0 (0.0)	
Previous occupation					
Low income	133 (83.1)	109 (83.2)	9 (90.0)	15 (78.9)	
Medium income	17 (10.6)	14 (10.7)	0 (0.0)	3 (15.8)	0.755
High income	10 (6.3)	8 (6.1)	1 (10.0)	1 (5.3)	
Length of sentence					
<1 year	6 (3.8)	2 (1.5)	1 (10.0)	3 (15.8)	
1-10 years	58 (36.2)	39 (29.8)	3 (30.0)	16 (84.2)	
11-20 years	58 (36.2)	57 (43.5)	1 (10.0)	0 (0.0)	0.000
21-30 years	19 (11.9)	19 (14.5)	0 (0.0)	0 (0.0)	
31-40 years	3 (1.9)	3 (2.3)	0 (0.0)	0 (0.0)	
Life imprisonment	8 (5.0)	8 (6.1)	0 (0.0)	0 (0.0)	
Remand	8 (5.0)	3 (2.3)	5 (50.0)	0 (0.0)	

Length of stay					
<1 year	40 (25.0)	27 (20.6)	7 (70.0)	6 (31.6)	
1-2 years	27 (16.9)	20 (15.3)	1 (10.0)	6 (31.6)	0.000
3-5 years	33 (20.6)	25 (19.1)	2 (20.0)	6 (31.6)	
>5 years	60 (37.5)	59 (45.0)	0 (0.0)	1 (5.3)	

Data is presented in percentages and frequencies with percentages in parenthesis.

Table 2 shows the means of metabolic parameters. The mean systolic and diastolic blood pressure of all study participants was 141.1±23.2 mm Hg and 88.9±14 mm Hg respectively. Mean BMI and waist circumference were 22.8±4.1kg/m^2 and 81.1±10.3cm respectively for all participants.

Table 3 displays metabolic characteristics of study participants. The overall prevalence of hypertension was 57.5% among all inmates followed by pre-hypertension (28.8%). Normotensive subjects constituted 13.8% of the total study population. Data on lipid profile was missing for one person. In total, those with dyslipidaemia constituted 57.5% of the study population.

Table 4 displays the physical activity levels of inmates. Most inmates were sedentary (55%) and those who exercised only did so occasionally (13.8%).

Table 5 displays the past medical history of inmates. Inmates with known hypertension constituted 11.9%. Out of this percentage10.6% were on medication but none was on special diet.

Table 2: Means of Metabolic Characteristics of Study Participants

Parameters	Mean ± SD	Gender		P-value
		Male	Female	
BMI (kg/m2)	**22.8±4.1**	**22.5±3.8**	**26.9±5.5**	**0.032***
Systolic(mm Hg)	**141.1±23.2**	**140.5±23.7**	**149.3±11.4**	**0.050***
Diastolic (mm Hg)	**88.9±14**	**88.4±14.2**	**96.7±9.0**	**0.019***

FBS (mmol/L)	**4.3±0.9**	**4.3±0.9**	**5.0±0.9**	**0.038***
HDL-c (mmol/L)	**1.4±0.4**	**1.4±0.4**	**1.4±0.2**	**0.821**
LDL-c (mmol/L)	**3.0±1.0**	**2.9±1.0**	**3.4±0.8**	**0.151**
Triglycerides (mmol/L)	**1.1±0.6**	**1.1±0.7**	**0.9±0.3**	**0.045***
Total Cholesterol (mmol/L)	**4.9±1.3**	**4.9±1.3**	**5.2±1.0**	**0.421**
Waist Circumference (cm)	**81.1±10.3**	**81.0±10.1**	**83.2±13.2**	**0.613**

Means of parameters are presented by gender. Independent sample T- test was used to compare males and females. *Significant differences exist at $p<0.05$.

Table 3: Prevalence of cardiovascular risk factors among inmates.

Variables	Total	Male	Female	P-value
Blood Pressure				
Normotensive	**22 (13.8%)**	**22(14.7)**	**0(0)**	
Prehypertension	**46 (28.8%)**	**45 (30.0%)**	**1(10%)**	**0.094**
Hypertension	**92 (57.5%)**	**83 (55.3%)**	**9 (90%)**	
Fasting blood glucose				
Hypoglycaemia	**11 (6.9%)**	**11 (7.3%)**	**0 (0%)**	
Normal blood glucose	**142 (88.8%)**	**135 (90.0%)**	**7 (70%)**	**0.000***
Pre-diabetes	**5 (3.1%)**	**2 (1.3%)**	**3 (30%)**	
Diabetes	**2 (1.2%)**	**2 (1.3%)**	**0 (0%)**	
BMI				
Underweight	**11 (6.9%)**	**11 (7.3%)**	**0 (0%)**	
Normal weight	**113 (70.6%)**	**109(72.7%)**	**4 (40%)**	**0.005**
Overweight	**26 (16.2%)**	**23 (15.3%)**	**3 (30%)**	
Obese	**10 (6.2%)**	**7 (4.7%)**	**3 (30%)**	
Waist circumference				
Normal waist circumference	**149 (93.1%)**	**143(95.3%)**	**6 (60%)**	**0.002***
Central obesity	**11 (6.9%)**	**7 (4.7%)**	**4 (40%)**	
Lipid profile				
Normal lipid levels	**67 (41.9%)**	**63 (42.3%)**	**4 (40%)**	**1.000**
Dyslipidaemia	**92 (57.5%)**	**86(57.7%)**	**6 (60%)**	
Metabolic syndrome (> 2 parameters)	**13 (8.1%)**	**9 (6.0%)**	**4 (40%)**	**0.004***

Categorical data on cardiovascular risk factors. Gender groupings were compared using chi-square test. *Significant differences exist at $p<0.05$.

Table 4: Physical activity and fruit intake by inmates

Voluntary exercise	**Yes n(%)**	**No n(%)**			
	72(45)	88(55)			
Time spent on exercise	**<30 minutes n(%)**	**30 minutes n(%)**	**45 minutes n(%)**	**>45minutes n(%)**	**None n(%)**
	31(19.4)	20(12.5)	16(10)	5(3.1)	88(55)
Frequency of exercise	**Daily n(%)**	**Weekly n(%)**	**Monthly n(%)**	**Occasionally n(%)**	
	29(8.1)	19(11.9)	2(1.3)	22(13.8)	
Fruit intake	**Daily n(%)**	**Weekly n(%)**	**Monthly n(%)**	**Occasionally n(%)**	**Never n(%)**
	3(1.6)	10(6.3)	9(5.6)	84(52.5)	54(33.8)

Data is presented categorically with percentage in parenthesis.

Table 5 : Medical history of inmates

Presence of chronic condition	**Yes n(%)**	**No n(%)**		
	24(15)	136(85)		
Type of chronic condition	**Hypertension**	**Diabetes**	**Dyslipidaemia**	**Hypertension plus diabetes**
	19(11.9)	3(1.9)	0(0)	1(6)
Medication for chronic disease	**Yes**	**No**		
	17(10.6)	7(4.4)		
Special diet for chronic disease	**Yes n(%)**	**No n(%)**		
	0(0)	24(15)		

Data is presented categorically with percentage in parenthesis.

DISCUSSION

Male inmates dominated the study population and a majority of participants belonged to the lowest age of inclusion. This is consistent with global data on the dominancy of males on the penal system and higher rates of crime among younger persons (15).

Prevalence of dyslipidaemia (57.5%) and hypertension (57.5%) were high among inmates and these can be attributed to inappropriate diet and high rates of physical inactivity observed

(16, 17). Elevated serum LDL, reduced HDL and hypertension are prominent metabolic risk factors and predispose inmates to cardiovascular diseases (18). Continual treatment and control of high blood pressure is essential in reducing future cardiovascular risk (19) but only 11.9% of all those whose blood pressure satisfied the diagnostic criteria for hypertension had been diagnosed and out of this percentage 10.6% were on medication but none of them was on special diet. Meanwhile, cardiovascular diseases are the leading cause of death among Ghanaian inmates. Other studies have also reported under diagnoses of diseases among prisoners (20) and this calls for regular health screening and improved health care to inmates.

Inmates who were overweight or obese by BMI constituted 22.6%. Prevalence of central obesity (6.9%) was low especially among male inmates. Most studies conducted in developed countries have found a higher mean BMI than what was found in this study. Leigey and Johnston (21) recorded a mean BMI of 28.8 among prisoners in the United States. Togas, Raikou (22) found a mean BMI of 25.68 among Greece prisoners.

Prevalence of diabetes was 1.2% and this may be linked to the low prevalence of obesity especially central obesity observed in this study. Other studies have however reported a relatively higher prevalence than what was found in this study. Bai, Befus (23) for instance reported a prevalence of 5.1%. Some inmates were hypoglycaemic (6.9%) and this can suggest improperly managed diabetes or hunger (24). Hypoglycaemia is associated with aggressive behaviour and can interfere with the reformation process (25).

The proportion of inmates with metabolic syndrome was 8.1%. Prevalence was higher among female inmates compared to males. Metabolic syndrome poses a double fold risk to the development of cardiovascular diseases and a five-fold risk to the development of diabetes mellitus. The prevalence found among inmates is lower than the percentage of 18% that Akpalu, Akpalu (26) found among the free Ghanaian population. Silverman-Retana, Lopez-

Ridaura (27) however reported a percentage of 2.91% among inmates included in their study and this is less than what was found in this study.

The mean BMI, mean diastolic and systolic blood pressure and mean FBS were significantly higher for female inmates. Female inmates present with more health challenges compared to their male counterparts. Prisons are male dominated environments with meal provision and routines that suit males better than females. The prison system should therefore be adapted for the benefit of females.

CONCLUSION

Inmates had high prevalence of hypertension (57.5%) and dyslipidaemia (57.5%) but the prevalence of diabetes and obesity were low. Most inmates were sedentary and occasionally consumed fruits. Females had higher prevalence of cardiovascular risk factors compared to their male counterparts. Frequent health screening, initiation of exercise programmes and appropriate dietary provision should commence within prisons as measures to curb metabolic risk factors among prisoners. Blood pressure check can be done routinely to detect cases of hypertension.

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