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Cardiovascular Risk in Men Aged Over 40 in Boa Vista, Brazil

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ABSTRACT

Background: Cardiovascular disease is the most common cause of disease in the developed world. Early detection and risk prediction are a key component in reducing cardiovascular mortality. The Framingham Risk Score uses age, sex, cholesterol, blood pressure, diabetes, and smoking to calculate the 10-year risk probability of developing cardiovascular disease for a given patient. The aim of this study was to examine cardiovascular disease risk in men aged over 40 years in Boa Vista, Brazil and identify socioeconomic factors contributing to the risk.

Methods: This was an epidemiological, cross-sectional, descriptive study. Physical examination and questionnaire survey were conducted on the participants.

Results: Of the 598 participants (average age = 55.38 ± 10.77 years), 346 completed all the examinations and answered the survey, while 252 completed the survey and the physical examinations but did not undertake the laboratory tests. A large proportion of participants were overweight (42.6%) or obese (23.6%), 14.5% were hypertensive, and 71.9% were prehypertensive. Consumption of red meat and junk food was high, while participation in the exercise was low. Framingham scores ranged from −3 to 13 (mean score: 3.86 ± 3.16). A total of 204 participants (34.1%) had a low risk of cardiovascular disease, 98 (16.4%) had a medium risk, and 44 (7.4%) possessed high risk. Increased abdominal circumference ($P = 0.013$), resting pulse ($P = 0.002$), and prostate-specific antigen levels ($P < 0.001$) were associated with increased risk of cardiovascular disease.

Conclusions: Our study highlights a worrying trend in increasing obesity and hypertension, most likely associated with increasingly poor diet and reduced participation in exercises. As the Brazilian population ages, this will drive increasing rates of cardiovascular mortality unless these trends are reversed. This study suggests that such campaigns should focus on men over the age of 40, who are married or divorced and of lower income.

Keywords: Cardiovascular disease risk, Framingham score, hypertension, obesity, socioeconomic factors

INTRODUCTION

Cardiovascular disease is the most common disease in the developed world. Across the world, there has been a steady increase in mortality due to cardiovascular causes. It is estimated that within the next 5 years, 1 in 3 deaths will be due to cardiovascular disease.[1] Notably, the World Health Organization estimate that 88% of this burden sits in lower and middle-income countries and that the prevalence of cardiovascular disease in these countries is growing more rapidly than in high-income countries.[1]

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Early detection and prediction of risk of developing the cardiovascular disease is a crucial factor in slowing the growth of cardiovascular-related mortality across the world.[2] Examining the causes and risk factors of cardiovascular disease was first initiated in the United States 65 years ago with an epidemiological study.[3] The Framingham Heart Study resulted in the development of the Framingham Risk Score for coronary heart disease (CHD), which used age, sex, low density lipoprotein (LDL) cholesterol, high-density lipoprotein (HDL) cholesterol, blood pressure (and also whether the patient is treated or not for his/her hypertension), diabetes, and smoking to calculate the 10-year risk probability of developing cardiovascular disease for a given patient.[4,5] The recent INTERHEART study across 52 countries demonstrated that high blood pressure, high cholesterol, diabetes, smoking, and obesity are the five modifiable cardiovascular risk factors that predict approximately 80% of the population-attributable risk of acute myocardial infarction.[6] As a result, these factors have become the focus of health campaigns to lower cardiovascular disease prevalence. However, cardiovascular disease still remains a growing concern across the globe.

Further to the risk factors contained within the Framingham Risk Score, there have been a multitude of studies that have examined additional modifiable risk factors for cardiovascular disease.[7,8] In developed countries, these include dietary factors such as intake of fruit and vegetables, alcohol abuse, and psychosocial stress. However, there has been criticism of the cardiovascular risk scores and their applicability worldwide because of the increasing evidence that other factors are important in determining cardiovascular disease risk.[9] These studies indicate that there is considerable cross-cultural variation in the factors determining cardiovascular disease risk. Moreover, ethnic differences may have underlying genetic causes, and it is suggested that identification of new risk factors may improve risk classification in many populations.[9-11] In addition, the priority given to individual risk factors may differ between populations due to variations in prevalence.

Within Boa Vista, Brazil, men over the age of 40 years represent 25% of the population. Data from public health campaigns suggest that 10.7% (n = 3,576/33,425) of this population have high blood pressure or diabetes, which is one of the key risk factors for cardiovascular disease. The Brazilian Government has recently stated that one of the most serious health problems faced by it now is mortality by nontransmissible diseases, with 151.7 deaths per 100,000 inhabitants caused by heart and circulatory diseases, representing a third of all deaths.[12] With a rapidly aging population (a result of decreased infant mortality rates and an increase in longevity), the burden of cardiovascular disease in Brazil is set to grow substantially over the coming decade.[13] Studies have found that men are more vulnerable to chronic disease than women and suggest that this may in part be due to failure to seek help.[12] This may also be due to difficulties in accessing healthcare during working hours, but may also be related to socio-cultural barriers such as maintaining their masculinity.[12] There is, therefore, an urgent need for focused health programs that are targeted to both reduce risk and increase early risk detection of cardiovascular disease in this population. Therefore, the aim of this study was to first examine the 10 years cardiovascular risk according to the Framingham score in men over 40 years old in Boa Vista, Roraima, Brazil, and second to identify additional factors that are associated with cardiovascular risk in this population.

METHODS

Study design and participants

This study was an epidemiological, cross-sectional, descriptive study with a quantitative approach to information, conducted in Boa Vista, Brazil. To ensure that the results of the study were accurately reflective of the representative sample, a simple random convenience sample was collected at the men's health campaign in March 2014. A total of 598 men participated in the study. Participants were enrolled into the study if they fulfilled the following criteria: Men; aged ≥40 years; agree to participate in the study by signing the informed consent form.

Ethical considerations

The study was conducted to comply with the code of ethics and was approved by the Ethics Committee (number: 1799613.2.0000.5302, 12/18/2013). Informed consent was obtained from all the participants, and the welfare and interest of all respondents were taken into consideration throughout the study.

Study's instrument and variables examination

Questionnaire survey

A 13-question questionnaire was constructed to obtain relevant information from participants about their demographics and health habits. Questions were agreed by a consensus process by the research team. Demographic data as specified in Table 1 were also collected. Information was collected based on a face-to-face interview of patients during man's health campaign in the state of Roraima, Brazil. Questions offered a variety of relevant set responses.

Table 1: Demographic details of study participants with/without Framingham score

Demographic	All (n=598) n (%)	Participants with Framingham score (n=346)	Participants without Framingham score (n=252)	*P*
Age				
40-50	237 (39.7)	125 (36.1)	112 (46.5)	0.462
51-60	172 (28.8)	104 (30.1)	68 (27.0)	
61-70	138 (23.1)	85 (24.6)	53 (21.0	
71-80	38 (6.4)	24 (6.9)	14 (5.6)	
81-90	10 (1.7)	5 (1.4)	5 (2.0)	
91-100	2 (0.33)	2 (0.6)	0	
101-110	1 (0.17)	1 (0.3)	0	
Area				
Downtown	41 (6.9)	16 (39.0)	25 (61.0)	<0.001
Inner city	154 (25.8)	130 (84.4)	24 (15.6)	
Outskirts of town	403 (67.4)	200 (49.6)	203 (50.4)	
Married	178 (29.8)	104 (30.1)	74 (29.4)	0.711
Single	72 (12.0)	47 (13.6)	25 (9.9)	
Stable union (living together)	284 (47.5)	159 (46.0)	125 (49.6)	
Divorced	43 (7.2)	24 (6.9)	19 (7.5)	
Widowed	21 (3.5)	12 (3.5)	9 (3.6)	
Skin				
Did not answer	2 (0.3)	2 (0.6)	0	<0.001
Brown	12 (2.0)	7 (2.0)	5 (2.0)	
White	85 (14.2)	45 (13.0)	40 (15.9)	
Dark	378 (63.2)	203 (58.7)	175 (69.4)	
Indian	86 (14.4)	73 (21.1)	13 (5.2)	
Black	35 (5.9)	16 (4.6)	19 (7.5)	
Number of children				
0	51 (8.5)	27 (7.8)	24 (9.5)	0.190
1	52 (8.7)	27 (7.8)	25 (9.9)	
2	81 (13.5)	43 (12.4)	38 (15.1)	
3	87 (14.5)	47 (13.6)	40 (15.9)	
4	104 (17.4)	57 (16.5)	47 (18.7)	
5	58 (9.7)	34 (9.8)	24 (9.5)	
6	52 (8.7)	32 (9.2)	20 (7.9)	
7	113 (18.9)	79 (22.8)	34 (13.5)	
Religion				
Catholic	339 (56.7)	197 (56.9)	142 (56.3)	0.664
Evangelical	201 (33.6)	115 (33.2)	86 (34.1)	
Spiritualist	6 (1.0)	3 (0.9)	3 (1.2)	
Buddhist	3 (0.5)	3 (0.9)	0 (0.0)	
None	49 (8.2)	28 (8.1)	21 (8.3)	
Income				
Up to Rs. 500.00	148 (24.7)	94 (27.2)	54 (21.4)	0.016
Rs. 500.00-1000.00	244 (40.8)	144 (41.6)	100 (39.7)	
Rs. 1000.00-1500.00	85 (14.2)	47 (13.6)	38 (15.1)	
Rs. 1500.00-2000.00	25 (4.2)	16 (4.6)	9 (3.6)	
Rs. 2000.00-2500.00	38 (6.4)	17 (4.9)	21 (8.3)	
Rs. 2500.00-3000.00	17 (2.8)	11 (3.2)	6 (2.4)	
>Rs. 3000.00	41 (6.9)	17 (4.9)	24 (9.5)	
Education				
Never studied	55 (9.2)	34 (9.8)	21 (8.3)	0.120
Know how to write	64 (10.7)	37 (10.7)	27 (10.7)	

Contd...

Table 1: Contd...

Demographic	All (n=598) n (%)	Participants with Framingham score (n=346)	Participants without Framingham score (n=252)	P
Grade school incomplete	161 (26.9)	105 (30.3)	56 (22.2)	
Grade school completed	94 (15.7)	50 (14.5)	44 (17.5)	
High school completed	178 (29.8)	101 (29.2)	77 (30.6)	
Graduate school completed	43 (7.2)	18 (5.2)	25 (9.9)	
Postgraduation completed	3 (0.5)	1 (0.3)	2 (0.8)	

P values are based on descriptive statistics

Physical examination

A physical examination was conducted for each participant, which included height, weight, abdominal circumference, systolic and diastolic pressure, and pulse rate.

Biological samples

Blood samples were taken from those participants who agreed. LDL, HDL, cholesterol, blood glucose, and prostate-specific antigen (PSA) levels were measured according to standard clinical laboratory procedures.

The risk of developing coronary artery disease was calculated according to the Framingham score.[5]

Statistical analysis

The qualitative data from the questionnaire were entered into a specifically designed Microsoft excel spreadsheet. Statistical analysis was conducted using SPPS version 21 (IBM Corp., Chicago, Illinois, USA). Descriptive statistics was used to present the demographic and survey data according to the questionnaire categories. Quantitative data between two independent groups (i.e., participants with and without biological sample) were compared using Student's *t*-test and Chi-square test. Risk factors associated with medium and high risk for the development of coronary artery disease risk were examined. Correlations between the physical, demographic, social, cultural, economic, and health history with the severity of hypertension factors were explored. To examine the correlation of risk with the survey data, each variable was grouped into three classes – low, medium, and high, where low represented no caffeine intake, medium represented moderate caffeine intake, and high represented frequent/high caffeine intake. Within group and between group correlations were evaluated by analysis of variance. Correlations were examined using the Chi-squared test, with Cramer's V correction for multiple categories. Correlations between biological variables were examined using Pearson's r bivariate correlation coefficient. Significance was set at the $P < 0.05$ level.

RESULTS

A total of 598 men participated in this study. Of these, 346 completed all examinations and answered the survey. The remaining 252 completed the survey and the physical examinations but did not undertake the laboratory tests. The demographics of the study population including age, area, marital status, skin, number of children, religion, income, education, etc., are presented in Table 1, while characteristics of the patient such as age, height, weight, body mass index (BMI), abdominal circumference, systolic pressure, diastolic pressure, and heart rate are summarized in Table 2. The survey data for all the three categories of cardiovascular disease risk (low, medium, and high) from the study is summarized in Table 3.[14]

A total of 346 of the 596 participants underwent blood testing for cholesterol, HDL, LDL, glucose, and PSA levels. Results of these biological characterization based on blood tests are also presented in Table 2. The majority of participants had levels, which fell within the desirable ranges as shown in the Table 2. Biological and physical data were used to calculate the Framingham Risk Score for the population, and the scores are summarized in Table 4. Framingham scores ranged from −3 to 13, with a mean score of 3.86 ± 3.16. A total of 204 participants (59%) had a score between −3 and 5, which equates to a low (<10%) risk of cardiovascular disease, 98 participants (28.3%) had a score between 6 and 8, equating to a medium (11–20%) risk and 44 participants (12.7%) had a score of 9 or more, equating to a high (>20%) risk of cardiovascular disease.

In order to check that the participants who provided blood samples were representative of the whole population, demographic and physical factors were compared with those that did not provide blood samples [Tables 1 and 2]. Overall, the two populations were well matched. Those who attended for a blood test were significantly more likely to live downtown or in the Inner City. Only one-third of those who lived on the outskirts of town attended for blood test, which suggest difficulties in traveling into town for the blood test. People with higher incomes were less likely to have a Framingham score, which may be due to difficulties in absenting from work to attend for a blood test. People with dark skin were more likely to present for blood tests and people with Indian skin were less likely. People presenting for blood tests were marginally shorter than those not presenting ($P < 0.001$), and had marginally slower heart rates ($P < 0.001$), although the effect sizes of these differences were small.

Table 2: Detail characteristics of the participants with/without Framingham score

	All participants (n=568)		Participants with Framingham score calculation (n=346)		Participants without Framingham score calculation (n=252)		P
	Mean±SD	Range	Mean±SD	Range	Mean±SD	Range	
Age	55.38±10.77	36-108	56.06±10.80	36-108	54.43±10.74	36-88	0.068
Height	1.66±0.08	1.42-1.93	1.65±0.08	1.42-1.93	1.67±0.07	1.47-1.87	<0.001*
Weight	74.41±13.35	35-130	73.66±13.19	47-130	75.45±13.52	35-120	0.104
BMI	26.96±4.23	12.7-44.65	27.05±3.89	17.68-43.39	4.43±26.96	12.70-44.65	0.802
Abdominal circumference	96.62±10.98	54-138	96.06±10.73	54-135	97.40±11.30	58-138	0.144
Systolic pressure	125.89±18.57	90-220	126.36±19.68	100-220	125.24±16.95	90-200	0.467
Diastolic pressure	81.32±10.66	50-130	80.98±10.25	60-130	81.79±11.20	50-120	0.363
Heart rate	71.48±9.81	42-108	70.14±9.60	42-106	73.32±9.81	50-108	<0.001*
Blood tests results**							
Cholesterol	185.43±38.24	89-319	-	-	-	-	-
HDL	52.95±15.57	19-135	-	-	-	-	-
LDL	95.67±38.37	0-200	-	-	-	-	-
Glucose	104.08±46.79	58-513	-	-	-	-	-
PSA	1.53±2.51	0-27.51	-	-	-	-	-

*Although significantly different, the effect size of this difference is small, **Number of participants is 346. P values are based on descriptive statistics. SD=Standard deviation, HDL=High density lipoprotein, LDL=Low density lipoprotein, BMI=Body mass index, PSA=Prostate-specific antigen

Table 3: Summary of survey data for all participants based on cardiovascular risk category

	Low n (%)	Moderate n (%)	High n (%)
Visit to doctor	209 (34.9)	182 (30.4)	194 (32.4)
Exercise	369 (61.7)	87 (14.5)	142 (23.7)
Meat consumption	51 (8.5)	99 (16.6)	448 (74.9)
Junk food consumption	190 (31.8)	319 (53.3)	89 (14.9)
Salt consumption	34 (5.7)	513 (85.8)	51 (8.5)
Soft drinks consumption	243 (40.6)	292 (48.8)	63 (10.5)
Sugar consumption	70 (11.7)	409 (68.4)	119 (19.9)
Coffee consumption	118 (19.7)	180 (30.1)	300 (50.2)
Alcohol consumption	391 (65.4)	174 (29.1)	33 (5.5)
Use of medication	70 (11.7)	157 (26.3)	371 (62.0)
Smoking	321 (53.7)	220 (36.8)	57 (9.5)
Sleep (in h)	284 (47.5)	133 (22.2)	181 (30.3)
Emotional state (on a scale of 1-5)	419 (70.1)	163 (27.3)	16 (2.7)

Low: <10% probability, Medium: 10-20% probability, High: >20% probability

Table 4: Framingham score risk distribution

Framingham score	Risk category	n (%)
−3-5	Low risk	204 (59.0)
6-8	Medium risk	98 (28.3)
≥9	High risk	44 (12.7)

Associations between cardiovascular risk according to the Framingham score and demographic, physical and epidemiological factors were examined. As would be expected, since they are used for calculation of Framingham score, age, systolic and diastolic pressure, cholesterol, LDL, and blood glucose levels were all significantly associated with cardiovascular risk [Table 5]. No association was found between cardiovascular risk and height, weight, or BMI. However, increased abdominal circumference ($P = 0.013$), increased resting pulse ($P = 0.002$), and increased PSA levels ($P < 0.001$) were all associated with increased risk of cardiovascular disease. High risk was significantly associated with being divorced or widowed ($P = 0.010$), while people at high risk were more likely to have a low level of education, although this did not quite reach significance ($P = 0.072$). Of the 13 survey questions, only smoking ($P < 0.001$), frequent medication usage ($P = 0.039$) and frequent visits to the doctor ($P = 0.001$) were significantly associated with cardiovascular risk. No other significant associations were observed.

The strength of association between biological variables was further examined using Pearson's r bivariate correlation coefficient. There was a positive correlation between PSA levels with age ($P < 0.001$) and systolic pressure ($P = 0.046$). Glucose levels were positively correlated with weight ($P = 0.022$), abdominal circumference ($P < 0.001$), and pulse ($P < 0.001$). LDL levels were positively correlated with age ($P = 0.012$), diastolic pressure ($P = 0.036$), pulse ($P = 0.042$), and cholesterol levels ($P < 0.001$). HDL levels were negatively correlated with weight ($P < 0.001, r = -0.241$), height ($P = 0.016$), BMI ($P < 0.001$), abdominal circumference ($P < 0.001$) and glucose levels ($P = 0.034$), and positively correlated with systolic pressure ($P = 0.029$), and cholesterol levels ($P = 0.025$). Cholesterol levels were positively correlated with height ($P = 0.033$), abdominal circumference ($P = 0.002$), systolic pressure ($P = 0.025$), diastolic pressure ($P = 0.005$), and pulse ($P = 0.020$). Pulse was positively correlated with height ($P = 0.001$,

Table 5: Association of risk factors with Framingham score

	Low risk (n=204)	Medium risk (n=98)	High risk (n=44)	P
Age	51.67±9.71	60.31±8.53	66.95±8.49	<0.001
Systolic	120.54±15.70	130.82±20.24	143.41±22.72	<0.001
Diastolic	79.02±9.15	83.16±11.54	85.23±10.00	<0.001
HDL	54.28±16.58	51.79±14.31	49.34±12.67	0.111
LDL	84.93±36.49	105.56±37.86	124.25±30.41	<0.001
Cholesterol	176.84±37.28	194.05±36.39	206.05±35.05	<0.001
Glucose	95.67±30.88	108.12±55.24	134.05±69.91	<0.001
Weight	73.21±13.84	75.75±12.92	71.03±9.87	0.108
Height	1.65±0.08	1.66±0.08	1.63±0.06	0.316
BMI	26.90±4.05	27.56±3.68	26.61±3.48	0.276
Abdominal circumference	94.66±10.76	97.83±10.76	98.59±9.54	0.013
Pulse	68.87±8.72	70.96±10.24	74.18±10.84	0.002
PSA	1.15±1.73	1.52±1.62	3.36±5.11	<0.001

P values are based on ANOVA. PSA=Prostate-specific antigen, HDL=High density lipoprotein, LDL=Low density lipoprotein, BMI=Body mass index, ANOVA=Analysis of variance

r = 0.176) and abdominal circumference (P = 0.003). Systolic pressure was positively correlated with age (P < 0.001) and negatively correlated with height (P = 0.007).

DISCUSSION

In this epidemiological, cross-sectional, descriptive study, we examined cardiovascular risk in men aged over 40 in the Boa Vista Region of Brazil. Most participants were found to have a low risk of cardiovascular disease, with a quarter having a moderate risk and one in eight having a high risk. We found a high incidence of men who were overweight or obese, in line with previous population reports of obesity rates in Brazil, and highlighting a worrying trend in increasing obesity.[15] The incidence of hypertension was in line with that reported in recent meta-analyses of studies conducted since 2000, although our study highlighted a concerning proportion of participants with prehypertension, highlighting this as a key area for future intervention.[16]

Smoking and alcohol consumption were generally low to moderate in our study, suggesting that these should be less of a priority within health campaigns aimed at reducing cardiovascular mortality in this population. However, participation in the regular exercise was low, while consumption of red meat and junk food was high. There have been a number of recent studies highlighting the transition of the Brazilian diet from a diet high in fiber and carbohydrates to one high in saturated fat and sugar, due to the increasing consumption of highly processed, convenience food.[17-20]

This is a worrying trend, and our study confirms that a priority for health campaigns should be a focus on encouraging the Brazilian population, particularly those at high risk of comorbidities such as cardiovascular disease, to reduce their consumption of red meat and junk food and to increase their consumption of vegetables. Interestingly, in our study, we found that men who were divorced or widowed, and those with lower income, had increased cardiovascular risk. This is in line with studies that have shown that divorced men, and those with lower income, have poorer diet and health and increased mortality, than married men and those with higher income.[21-23]

However, the limitations of our study are that we considered only a regional population in the sense that men of Amazon region and not the entire region of Brazil were considered. Only 346 completed the questionnaire survey and examination. The number of men studied in this study is a sampling of the regional population. It is relevant to note that there is only one center of excellence in men's health in the entire State of Roraima. Most of the population in the Roraima State live along the rivers; so it is difficult for men, especially those are providers of their families, to access healthcare center. As on date, it is difficult to compare the data of this investigation with other parts of Brazil because studies on cardiovascular risk on men over 40 in Brazil are scarce. To our knowledge, this is the first study on men's health in the Brazilian Amazon.

CONCLUSIONS

In summary, our study suggests that within Boa Vista, Brazil, obesity and hypertension are two key modifiable risk factors that should be targeted for intervention, and that health campaigns to reduce cardiovascular risk would have the highest impact if they were targeted at men aged over 40 who are widowed or divorced and of lower income. Moreover, long-term follow-ups are warranted to know the best predictors in the study population for CHD and sudden death.

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Conflicts of interest

There are no conflicts of interest.

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