Original Article

The Prevalence of Cardiovascular Risk Factors in the Young and Middle-Aged Rural Population in Sarawak, Malaysia

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Abstract

***Background*: Coronary heart disease (CHD) was the second leading cause of death in Malaysia in 2006. CHD has known risk factors including hypertension, diabetes mellitus, and obesity.**

***Methods:* This cross-sectional study examined the prevalence of cardiovascular risk factors among 260 participants aged 20 to 65 years in a rural community in Sarawak.**

***Results:* The prevalences of overweight and obesity in this study were 39.6% and 11.9%, respectively. Approximately 13% of participants had hypertension, and 1.5% had a random blood sugar greater than 11.1 mmol/L. Chi-square tests showed significant associations between obesity and gender (P = 0.007), low high-density lipoprotein cholesterol and race (P = 0.05), high total cholesterol and age (P = 0.007), age and hypertension (P = 0.011), smoking and gender (P < 0.001), and smoking and income (P = 0.050). Age-adjusted logistic regression showed that women were 0.246 times more likely to be obese, that older participants (> 45 years) were 0.395 times more likely to have high cholesterol and that those with a higher monthly household income (> RM830) were 2.471 times more likely to smoke.**

***Conclusion:* These findings indicate that we should be concerned about the high rates of overweight in this rural community to prevent obesity.**

Keywords: *adult, cardiovascular diseases, epidemiology, obesity, prevalence, risk factors*

Introduction

The World Health Organisation (WHO) reported that cardiovascular diseases (CVD) caused 17.1 million deaths globally in 2004 and that 82% of these deaths took place in low- and middle-income countries (1). Of these deaths, 7.2 million were due to coronary heart disease (CHD), and another 5.7 million were due to stroke. The WHO also projected that Southeast Asia would have the largest percentage increase in CVD-related deaths by 2030 (1). CVD continues to exact a heavy burden in Malaysia. A study in one rural community in Peninsular Malaysia found that 26.3% of participants aged 15 years and older had hypertension (2). In another study, the prevalence of obesity was found to be 11.4% (3). Chia and Pengal (4) found that among 1417 participants aged 55 years and older in a semirural community in Malaysia, 34.9% were smokers, 18.8% had hypertension, 10.7% had diabetes mellitus, and 63.1% had total serum cholesterol levels greater than the desired upper limit of 5.2 mmol/L.

Hypertension, hypercholesterolaemia, and obesity are known risk factors for CHD. Rampal et al. (5) found a significant association between obesity and age, gender, ethnicity, urban/rural status, and smoking status. In urban China, being married was associated with the number of cigarettes smoked, while those with more education smoked significantly fewer cigarettes. In addition, participants with higher total family financial assets smoked less than participants with an average income did (6).

The Malaysian Non-Communicable Disease

(NCD) Surveillance 2005/2006 (7) reported that the prevalence of physical inactivity was 60.1%; smoking, 25.5%; obesity, 16.3%; central obesity, 48.6%; hypertension, 25.7%; elevated blood glucose (including cases of known diabetes mellitus and high fasting plasma glucose), 11%; and hypercholesterolaemia, 53.5%. Heart disease was the second leading cause of death in 2006, accounting for 15.5% of individuals who died in Malaysian government hospitals (8). Although CVD can be prevented and treated, an estimated 17 million people die of it every year around the world (9).

There is information about CVD in Malaysia, and studies have shown that CVD risk factors are seen in rural (2) and semirural communities (4). However, there is a relative lack of published information on this issue in Sarawak, especially among the major native groups in the rural community. The objective of this study was to determine the prevalence of CVD and CVD risk factors in the rural community of Sarawak.

Subjects and Methods

This study was conducted in a rural community of the Serian district of Sarawak. Sarawak is one of the states of Malaysia, situated on the Borneo Island. The Serian district is 1 of the 3 districts of the Samarahan division, which has 203 villages with a total population of 80 200. The highest proportion of the population comprises the Bidayuh group, followed by the Iban, the Chinese, the Malays, and other races (10). The primary focus of this study was the major native groups, as they are considered to have similar socio-economic characteristics. Thus, Chinese individuals and other races were excluded. This was a cross-sectional study using stratified proportionate fixed random sampling. This study was approved by the Ethics Committee of Universiti Malaysia Sarawak and and conformed to the requirements for ethical procedures for research in Malaysia.

Eight villages, including 3 Bidayuh, 3 Iban, and 2 Malay villages, were randomly selected. The total number of households was similar for each ethnic group. Therefore, two Malay villages were included (n = 1075). Once the villages were selected, a preparatory meeting was held with each village headman to obtain permission and to provide information about the survey. Every 4th house of each village was visited, and all eligible occupants of the household present at the time of the visit were interviewed. If the selected house was not occupied, the 3rd or the 5th house was included in the study. A total of 304 participants from 269 households were interviewed.

The age of the participants ranged from 20 to 65 years. Participants were included if they had not been diagnosed with hypertension, myocardial infarction, or angina pectoris. After informed consent was obtained, a trained research assistant (a trained nurse) used a pre-tested and structured questionnaire to interview the participants. The questionnaire asked for sociodemographic data, blood pressure (BP) measurements, smoking status, height, and weight. BP, weight, and height were measured by trained nurses. All anthropometric measurements, BP measurements, and blood specimens were obtained at the village community halls at a pre-arranged date and time. We collected random, rather than fasting, blood sugar because asking the participants to fast was deemed inappropriate; some of the villages were remote and road conditions were poor, so it was hard to ascertain the time of arrival of the research team.

BP was measured using an Accoson mercury sphygmomanometer (AC Cossor & Son [Surgical] Ltd, Essex, GB) while the participant was seated. The Malaysian Hypertension Consensus Guidelines (11) on the measurement of BP were used. The average of 2 BP measurements was used in the statistical analysis. Height was measured using a Seca body meter (Seca, JP), which was suspended upright against a straight wall. Each participant stood underneath the body meter, and the measuring beam was pushed down to rest on top of the participant's head. The visual display recorded the height to the nearest 0.1 cm. Participants were weighed in their street clothing without shoes using a calibrated Seca weighing scale (Seca, JP). Weight was recorded to the nearest 0.1 kg.

Blood samples were collected by a trained laboratory assistant; 5 mL of blood for cholesterol tests and 2 mL of blood for random blood sugar testing were drawn from the median cubital vein. All of the blood tests were conducted in the medical laboratory of Universiti Malaysia Sarawak. The blood was spun in a centrifuge at 1370 g for 5 minutes to obtain the serum, and total cholesterol, high-density lipoprotein cholesterol (HDL), and glucose were measured using a Hitachi 902 Automatic Analyser (Boehringer Mannheim Diagnostics, Indianapolis, IN, US).

Participants who had smoked in the last month were considered current smokers (4).

Hypertension was defined as BP ≥ 140/90 mmHg (11). Hypercholesterolaemia was defined as total cholesterol ≥ 5.2 mmol/L, and low HDL as HDL < 1.04 mmol/L (12). Impaired plasma glucose was defined as random plasma glucose ≥ 11.1 mmol/L (13). Participants with a body mass index (BMI) of 25 to 29.9 kg/m^2 were considered overweight, and those with a BMI of ≥ 30 kg/m^2 were considered obese (14). SPSS version 17 (SPSS Inc., Chicago, IL, US) was used to analyse the data. Between-group comparisons of categorical variables were performed using chi-square tests. Binary logistic regression analyses were performed to identify factors associated with high total cholesterol, low HDL, and obesity.

Results

A total of 304 participants provided consent and participated in the interview. However, 44 did not show up for blood tests and anthropometric and BP measurements; therefore, the final analysis was based on 260 (85.5%) participants. The sociodemographic data for the 44 excluded participants were similar to those of the participants included in the final analysis. Of the 260 participants, 34.6% (n = 90) were male and 65.4% (n = 170) were female. There were almost equal numbers of participants from the 3 indigenous groups (Malay, 32.3%, n = 50; Bidayuh, 33.1%, n = 65; Iban, 34.6%, n = 74). The mean age was 44.3 years (SD 9.8) and ranged from 20 to 65 years. More than 30% (n = 98) of the participants were farmers, 11.9% (n = 31) were labourers, 29.6% (n = 77) were housewives, and the rest were government employees or employed in some other occupation. Examining each indigenous group, 60% of Iban participants, 43% of Bidayuh participants, and 8.3% of Malay participants were farmers. The mean reported household income was RM643 with a standard deviation of RM559.1 (USD196, SD 170.3). Based on the poverty line index (PLI) of RM830 in Sarawak (15), 72.7% (n = 189) of the participants lived below the PLI. A higher percentage of Iban participants (82.2%) lived below the PLI compared with Bidayuh (75.6%) and Malay participants (59.5%). The male participants were slightly older than the female participants (mean age 47.0 years, SD 9.8, compared with 42.9 years, SD 9.2), but all of the other risk factors were comparable between the genders in this study.

Table 1 shows the demographic characteristics and means of some CVD risk factors of the participants.

Using the World Health Organization's cut-off points (14), 48.5% (n = 126) of participants were of normal weight, 39.6% (n = 103) were overweight, and 11.9% (n = 31) were obese. The percentage of participants with hypertension was 13.6% (n = 36), and 15.4% (n = 40) of the participants were current smokers. More than 26% (26.5%, n = 69) had a total cholesterol ≥ 5.2 mmol/L, 37.3% (n = 97) had low HDL cholesterol (≤ 1.04 mmol/L), and only 1.5% of participants had a random blood sugar higher than 11.1 mmol/L.

The associations between sociodemographic characteristics and hypertension, BMI, total cholesterol, high-density lipoprotein, and smoking status were analysed using chi-square tests. The results showed significant differences in the rates of obesity according to gender (χ^2 = 7.33, df = 1, P = 0.007), in the rates of hypertension (χ^2 = 6.54, df = 1, P = 0.01) and levels of total cholesterol (χ^2 = 7.34, df = 1, P = 0.07) according to age, as well as in the rates of low HDL according to race (χ^2 = 6.01, df = 1, P < 0.05) (Table 2).

Table 1: Means of cardiovascular disease risk factors

Parameter	All (n = 260)		Males (n = 90)		Females (n = 170)	
Age (years)	44.3	(9.8)	47.0	(9.2)	42.9	(9.8)
Systolic blood pressure (mmHg)	118.7	(16.5)	118.6	(11.9)	118.7	(18.5)
Diastolic blood pressure (mmHg)	76.3	(10.1)	76.9	(9.0)	75.9	(10.6)
Total cholesterol (mmol/L)	4.8	(1.2)	4.7	(1.0)	4.9	(1.3)
HDL cholesterol (mmol/L)	1.3	(0.9)	1.20	(0.7)	1.3	(1.0)
Random blood sugar (mmol/L)	4.1	(1.5)	4.3	(1.9)	3.9	(1.2)
Body mass index (kg/m^2)	25.1	(4.1)	25.3	(4.5)	24.4	(3.1)
Waist circumference (cm)	81.7	(11.4)	81.1	(10.9)	83.0	(12.3)

Data are expressed in mean (SD).

Logistic regression was undertaken to examine the impact of gender, race, and income on each of the cardiovascular risk factors: obesity, low HDL, high total cholesterol, and smoking status. Table 3 shows the results of this analysis. After adjusting for age, only 3 models containing all predictors were statistically significant—obesity, χ^2 (5, 260) = 10.303, P = 0.05; high total cholesterol, χ^2 (5, 260) = 13.824, P = 0.017; and smoking status, χ^2 (5, 260) = 8.891; P < 0.001—indicating that these models were able to distinguish participants who had the risk factors from those who did not.

Table 3 shows that gender was significantly associated with obesity. The odds ratio or Exp (B) value for gender was 0.246, indicating that female participants were 0.246 times more likely to be obese than male participants. Participants older than 45 years were 0.395 times more likely to have high total cholesterol than participants younger than 45 years old were. This study also found that participants who earned a monthly income of more than RM830 were 2.471 times more likely to be current smokers than those with a lower income.

Table 2: Association of sociodemographic characteristics and hypertension, obesity, high total cholesterol, low high-density lipoprotein (HDL), and smoking

Parameter	*n*	Hypertension	Obesity	High total cholesterol	Low HDL	Smoking
Gender						
Male	90	12.2 (5.3–19.1)	4.0 (0.1–8.8)	21.1 (12.5–29.7)	38.9 (28.6–49.2)	15.8 (14.9–16.9)
Female	170	14.7 (9.3–20.1)	15.9 (10.3–21.4)	29.4 (22.5–36.3)	36.7 (29.2–43.8)	19.0 (19.6–20.0)
P value		0.581	0.007 [a]	0.149	0.701	< 0.001 [a]
Race						
Malay	84	10.7 (4.0–17.5)	14.3 (6.7–21.9)	30.6 (20.9–41.1)	31.0 (20.9–41.1)	18.8 (18.1–19.5)
Iban	90	17.8 (9.7–25.8)	10.0 (3.7–16.3)	22.2 (13.4–31.0)	33.3 (23.4–43.3)	17.9 (17.0–18.7)
Bidayuh	86	12.8 (5.6–20.0)	11.6 (4.7–18.5)	26.7 (17.2–36.3)	47.7 (36.9–58.4)	18.7 (18.0–19.4)
P value		0.380	0.680	0.427	0.050 [a]	0.174
Age						
≤ 45 years	138	8.7 (3.9–13.5)	13.8 (8.0–19.6)	11.9 (11.2–12.6)	16.3 (15.6–17.2)	18.5 (17.9–19.1)
≥ 46 years	122	19.6 (12.5–26.8)	9.8 (4.5–15.2)	13.4 (12.6–14.3)	16.1 (15.3–17.0)	18.3 (17.7–19.0)
P value		0.011 [a]	0.329	0.007 [a]	0.703	0.672
Income						
≤ RM830	189	13.7 (8.8–18.7)	10.6 (6.2–15.0)	27.0 (20.5–33.4)	39.7 (32.6–46.7)	18.7 (18.2–19.2)
> RM830	71	14.1 (5.8–22.4)	15.5 (6.9–24.1)	25.4 (15.0–35.7)	40.0 (20.0–42.0)	17.7 (16.8–18.7)
P value		0.946	0.276	0.791	0.196	0.050 [a]

Data are expressed in percentage (95% confidence interval). High total cholesterol was defined as total cholesterol ≥ 5.1 mmol/L. Low HDL was defined as HDL ≤ 1.4 mmol/L.
[a] Significant different (P < 0.05) by chi-square test.

Table 3: Binary logistics regression analysis for cardiovascular risk factors

Variable	*n*	Obesity [a]		Low HDL [b]		High total cholesterol [c]		Smoking [d]	
		%	OR (95% CI, *P* value)	%	OR (95% CI, *P* value)	%	OR (95% CI, *P* value)	%	OR (95% CI, *P* value)
Gender									
Male	90	51.1	1.0	38.9	1.0	21.1	1.0	41.6	–
Female	170	32.4	0.246 (0.082–0.740, 0.013 [e])	36.7	1.014 (0.581–1.770, 0.923)	29.4	0.557 (0.293–1.057, 0.073)	1.8	–
Race									
Malay	84	46.4	1.0	31.0	1.0	30.6	1.0	11.9	1.0
Iban	90	46.3	0.928 (0.364–2.365, 0.875)	33.3	0.516 (0.270–0.985, < 0.05 [e])	22.2	1.133 (0.561–2.288, 0.727)	21.1	1.272 (0.499–3.245, 0.615)
Bidayuh	86	23.3	0.775 (0.289–2.075, 0.611)	47.7	0.524 (0.281–0.978, < 0.05 [e])	26.7	0. 615 (0.298–1.270, 0.189)	12.8	0.510 (0.223–1.167, 0.111)
Age									
≤ 45 years	138	50.7	1	36.2	1.0	19.6	1.0	14.5	1.0
≥ 46 years	122	52.5	1.235 (0.560–2.772, 0.601)	38.5	0.894 (0.530–1.508, 0.674)	34.4	0.395 (0.220–0.712, < 0.05 [e])	16.4	0.827 (0.348–1.968, 0.667)
Income									
≤ RM830	189	34.9	1.0	39.7	1.0	27.0	1.0	12.7	1.0
> RM830	71	49.3	0.655 (0.286–1.498, 0.316)	40.0	1.411 (0.773–2.574, 0.262)	25.4	1.146 (0.589–2.229, 0.689)	22.5	2.471 (1.171–5.218, 0.018 [e])

Obesity was defined as BMI ≥ 30 kg/m². High total cholesterol was defined as total cholesterol ≥ 5.1 mmol/L. Low HDL was defined as HDL ≤ 1.4 mmol/L.

[a] After adjusting for age, X^2 (5, 260) = 10.303, P = 0.05, Cox and Snell R square = 0.039, Nagelkerke R squared = 0.075, able to classify 88.1% of the cases.

[b] After adjusting for age, X^2 (5, 260) = 7.47, P = 0.188, Cox and Snell R square = 0.028, Nagelkerke R squared = 0.039, able to classify 63.1% of the cases.

[c] After adjusting for age, X^2 (5, 260) = 13.824, P = 0.017, Cox and Snell R square = 0.052, Nagelkerke R squared = 0.076, able to classify 73.5% of the cases.

[d] After adjusting for age, X^2 (5, 260) = 8.891, P < 0.001, Cox and Snell R square = 0.34, Nagelkerke R squared = 0.58, able to classify 84.6% of the cases.

[e] Significant (P < 0.05) by binary logistic regression test.

Discussion

The prevalence of hypertension in this study was 13.5%. This finding was low compared with the rate of 25.7% found in the Malaysian NCD Surveillance report 2005/2006 (5) and the rate found in another study in a rural community in Selangor, West Malaysia (3). The prevalence of hypertension in this study was also lower than in studies conducted in rural communities in other Asian countries and China (16,17). This difference could be related to differences in lifestyle, diet, and genetic composition of the indigenous people in the rural communities of Sarawak. Further studies are needed to explore this finding.

Women, participants who belonged to the Iban ethnic group, and participants older than 45 years of age were found to have higher rates of hypertension in this study. Other studies in Malaysia and other Asian countries also reported that the prevalence of hypertension increased with age (3,16–18). Our finding that women were more likely to have hypertension was inconsistent with a national study from Malaysia (18) and some studies in other Asian countries (16,17); however, another study (3) showed a higher prevalence of hypertension in women. The 13.5% of participants who were found to have hypertension reported that they were unaware of their condition. This finding is concerning, and future studies need to be conducted to investigate the detection of hypertension in rural communities.

Obesity is a well-documented risk factor for hypertension, cardiovascular disease, type 2 diabetes mellitus, cerebrovascular accidents, and the development of numerous types of cancer (14). In this study, 11.9% of the participants were obese, and 39.6% were overweight. Overweight and obese individuals are found equally in urban and rural populations at pervasive rates (19). Two studies found that rural populations in Malaysia were affected by overweight and obesity (20,21). Ng et al. (20) found that 23.5% of men and 46.0% of women were overweight, suggesting that the mild to moderate forms of obesity have reached alarming proportions in rural adult populations. In another study of 4600 rural villagers throughout Peninsular Malaysia, Khor et al. (21) found that 19.8% of men and 28.0% of women were overweight and that 4.2% of men and 11.1% of women were obese. The rate of overweight in this study was higher than in rural studies in other Asian countries including China and India (16,22).

This study found a significant association between BMI and gender. More females than males were obese. Although more Malays and adults 45 years and older were obese, the associations between race, age, and BMI were not statistically significant. This finding was consistent with other local studies (3,23) in which women were found to have a higher prevalence of obesity than that of men. One possible reason could be that women tend to gain weight during the childbearing years (23). Another possibility is that women tend to consume cheaper and less nutritious (more calorie dense) food (24). The higher rate of obesity in Malays may be related to their diet, lifestyle, or genetic factors, and further studies are needed to explore this finding.

The prevalences of smoking (15.4%), hypercholesterolaemia (22.6%), and obesity (11.9%) were all lower than the prevalences reported in the NCD surveillance (smoking, 25.5%; hypercholesterolaemia, 53.5%; obesity, 16.3%) (5). The NCD surveillance included participants from urban areas where the rates of cardiovascular risk factors were higher, and this difference could explain the different prevalences found. In comparison to a rural study in China (16), the current study also found lower rates of cardiovascular risk factors, except for overweight.

This study found that female gender was a predictor for obesity, but this conclusion was not supported by another study (25). Among the Bidayuh and Iban participants in this study, 43% and 60%, respectively, were farmers and were physically active most of the day. However, both groups were at risk of having low HDL. This finding is consistent with another study (26), which showed that increased exercise did not increase HDL. Age greater than 45 years was a predictor for high cholesterol, a finding that was somewhat expected. It has been proposed that aging disrupts lipid homeostasis. In particular, aging affects 3-hydroxy-3-methylglutaryl co-enzyme A reductase, the key rate-limiting enzyme in the cholesterol biosynthetic pathway (27). Gender was excluded from the smoker model because the percentage of female smokers was too small.

This was a preliminary study to explore the prevalence of some modifiable CVD risk factors. This study was carried out in selected villages in the rural areas of the Serian district in Sarawak, so one should only generalise these results to other sites with similar sociodemographic characteristics. We measured random, rather than fasting, cholesterol and glucose as a preliminary screen that only provided initial information about the participants. Further comprehensive diagnostic measures would be needed to confirm elevated blood glucose in the participants if the results obtained were above the recommended range.

Conclusion

The prevalence of some cardiovascular risk factors such as smoking, hypercholesterolaemia, elevated blood glucose, and hypertension were lower in this rural community, but the prevalence of overweight was rather high. Being female, belonging to the Iban and Bidayuh groups, and being older than 45 years were predictors for obesity, low HDL, and high total cholesterol, respectively. Individuals who were not extremely poor were more likely to smoke. Health promotion, increased public health capacity, and improved infrastructure are needed in rural areas to provide adequate surveillance and continuous monitoring of the health status of rural villagers and to promote healthy lifestyle practices.

Further longitudinal studies will be needed to obtain an accurate picture of the risk factors for cardiovascular disease.

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Authors' Contributions

Conception and design, obtaining of funding, provision of study materials, collection and assembly of the data, statistical expertise, administrative, technical, or logistic support: CTC Analysis and interpretation of the data, drafting, critical revision, and final approval of the article: CTC, PYL, WLC

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