Original Article

Prevalence of Obesity and Metabolic Derangement Among the Rural Population of Kiulu District of Sabah, Malaysia: A Health Screening Programme Findings

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ABSTRACT

Malaysia has high prevalence of general and central obesity which can be signified by measurements of BMI and waist circumference respectively. Both parameters are established risk factors and predictors for non-communicable diseases including diabetes and hypertension. A health screening programme was conducted in a rural district of Sabah, Malaysia where a total of 42 participants were examined for weight, height, BMI, waist circumference, systolic and diastolic blood pressure, pulse rate and capillary blood glucose. Mean age of the participants was 52.4 ± 14.9 years old. General obesity based on BMI was 42.9% while central obesity based on waist circumference was 26.2%. Proportion for hypertension and hyperglycaemia were equal at 33.3%. BMI was strongly correlated to waist circumference (r = 0.873, p < 0.001). Moreover, both BMI and waist circumference were independently correlated with systolic blood pressure (r = 0.418, p = 0.006 and r = 0.383, p = 0.012 respectively). Finally, systolic blood pressure was directly correlated with weight of the participants (r = 0.350, p = 0.023). These findings were found to be closely similar and comparable to currently available epidemiological data.

Keywords: obesity, metabolic derangement, rural population, health screening

INTRODUCTION

Malaysia has higher prevalence of obesity than the world prevalence with approximately 1 in every 2 Malaysians (50%) are obese[1]. In 2016, WHO reported that the global prevalence of obesity was 13% in adults aged 18 years and older[2]. Obesity is strongly associated with various chronic non-communicable diseases including diabetes and hypertension that may lead to more severe complications such as heart diseases[3 – 5]. Sedentary lifestyle and lack of physical activities are major contributors for obesity[6, 7]. The National Health and Morbidity Survey in 2015 reported that although the overall self-reported physical activity were quite high in Malaysian population (66.5%), only 25.4% were HEPA active (HEPA: health-enhancing physical activity; highly active category) while the other 41.1% were only active minimally[8]. In contrast, other research have found that Malaysia was one of the least active countries in the world with more than 50% of men and women aged 15 years and older to be physically inactive[9]. In relation to that, sedentary lifestyle and prevalence of obesity were comparatively lower in rural residence than urban populations[10.] This might indirectly affect the prevalence of non-communicable diseases and general health of rural communities as a whole.

Indeed, previous studies have reported higher prevalence of hypertension in urban than rural population though they differ only slightly (10.1% versus 9.7%)[11]. Furthermore, the prevalence of hypertension was also high in urban men and women than among rural men and women (16.4%, 12.1%, 5.4% and 5.9% respectively)[12]. Meanwhile, urban population had two-fold larger proportion of diabetes mellitus than its rural counterpart measuring at 8.1% and 4.6% respectively[13]. Epidemiological studies have identified higher BMI and waist circumference as risk factors and strong predictors of these chronic medical illnesses. Development of these diseases usually take years without external symptoms. Often times, patients seek medical help from healthcare professionals when they were already in late stage of the diseases. This delineates the importance of conducting serial health screening in apparently healthy general population from time to time.

Rural communities have restricted access to modern medical facilities leading to inequalities of medical services as compared to urban population especially in economically under-developed and developing countries[13 – 15]. In Malaysia, primary healthcare centres known as Klinik Kesihatan have been set up to cater for these communities[16]. Apart from providing treatment for minor illnesses, rural health teams also conducted series of health camps to educate the community regarding healthy lifestyle as well as to screen for various non-communicable diseases along with assessment of their risk factors. This paper reported the findings during health screening in a rural community in the Kiulu District of Sabah, Malaysia. The programme was jointly conducted by the Department of Biomedical Sciences and Therapeutics, Faculty of Medicine and Health Science, Universiti Malaysia Sabah and the Kiulu Health Clinic, Sabah State Health Department, Ministry of Health Malaysia.

MATERIALS AND METHODS

This health screening programme was conducted at the Kiulu District of Sabah, Malaysia in April 2016. Convenience sampling method was used whereby every person registered and participated for the health screening activities was included in this study. They represented six different rural villages that are located within the district.

Anthropometry

Age and gender of the participants were recorded before proceeding to the health screening stations. Weight of the participants were measured using a standard weighing scale. Participants were weighed on their loose clothing and without shoes. Heights were measured by using a standard stadiometer. Participants were instructed to stand with their back straight and measurements were taken when the stadiometer head plate lightly rested on the participants' head.

The body mass index (BMI) were calculated using the formula BMI = [weight (kg) ÷ height^2 (m^2)]. World Health Organization (WHO) International Classification for Asian population were adopted to categorize the BMI of the participants[17]. A BMI of ≤27.4 kg/m^2 was categorized as non-obese while BMI of ≥27.5 kg/m^2 was categorized as obese.

Waist circumferences (WC) were measured by using a measuring tape wrapped around the abdomen horizontally at the level of iliac crest while participants were at tidal respiration. According to the measurement, the participants were categorized into normal and centrally obese based on the widely accepted cut-off points for WC[18]. For male, cut-off points were set at ≤102 cm for normal and >102 cm for centrally obese. Meanwhile for female, cut-off points were set at ≤88 cm and >88 cm for normal and centrally obese respectively.

BLOOD PRESSURE, PULSE RATE AND CAPILLARY BLOOD GLUCOSE MEASUREMENT

Blood pressures were measured using electronic blood pressure device (Omron® SEM-1) after 5 minutes of rest. The right arm was supported at the heart level and appropriate-sized cuff was applied. Blood pressures were categorized into normal (≤139/89 mmHg) and hypertensive (≥140/90 mmHg) according to the Joint National Committee-8 (JNC-8) criteria[19]. Pulse rate of the participants were also measured for one minute at right radial artery after each blood pressure measurement. Lastly, capillary blood glucose levels were measured using standard glucometer device (Accu-Chek® Performa). Normal and hyperglycaemia were defined as capillary blood glucose ≤7 mmol/L and ≥7.1 mmol/L respectively according to Malaysian Clinical Practice Guideline[20].

Statistical analysis

The data collected were entered into IBM® SPSS® Statistics (Version 23) software for analysis. Data from both male and female participants were combined to improve the power of statistical analysis. Continuous parameters were expressed in mean ± standard deviation (SD). Association among various parameters were analysed by performing Pearson correlation coefficient test.

RESULTS

Participants in the health screening programme were aged between 19 to 75 years old with the mean age of 52.4 (SD = 14.9) years. Mean and SD for other parameters were summarized in Table 1.

Table 1 Descriptive analysis

Parameters	Mean ± SD	Min.	Max.
Age (years)	52.4 ± 14.9	19	75
Weight (kg)	60.1 ± 11.3	35.8	85.0
Height (cm)	151.2 ± 7.9	140.0	172.0
Body mass index (kg/m²)	26.2 ± 4.2	17.6	36.6
Waist circumference (cm)	87.6 ± 11.1	66.0	109.0
Systolic blood pressure (mmHg)	131.1 ± 18.1	103	176
Diastolic blood pressure (mmHg)	78.7 ± 9.4	61	97
Pulse rate (bpm)	83.6 ± 10.9	60	102
Glucometer (mmol/L)	6.5 ± 1.3	4.7	9.4

Mean and standard deviation (SD) were used to measure the central tendencies and dispersion for all parameters.

Table 2 Frequencies and relative frequencies for body mass index, blood pressure, waist circumference and capillary blood glucose

Parameters		n	%
Body mass index (BMI)	Non-obese	24	57.1
	Obese	18	42.9
Blood pressure (BP)	Normal	28	66.7
	Hypertensive	14	33.3
Waist circumference (WC)	Normal	31	73.8
	Centrally obese	11	26.2
Capillary blood glucose (Glu.)	Normal	28	66.7
	Hyperglycaemia	14	33.3

Table 3 Measurement of central obesity based on waist circumferences

WC	Male, n (%)	WC	Female, *n* (%)	Total, *n* (%)
≤102 cm	16 (100.0)	≤88 cm	15 (57.7)	31 (73.8)
>102 cm	0 (0.0)	>88 cm	11 (42.3)	11 (26.2)

Table 4 Pearson correlation coefficient among Wt., Ht., SBP, DBP, PR and Glu.

		Wt.	Ht.	SBP	DBP	PR	Glu.	BMI	WC
Wt.		1							
Ht.	*r*	0.572	1						
	Sig.	0.000[b]							
SBP	*r*	0.350	0.032	1					
	Sig.	0.023[a]	0.843						
DBP	*r*	0.340	0.225	0.390	1				
	Sig.	0.028[a]	0.151	0.011[a]					
PR	*r*	0.169	0.213	–0.003	0.360	1			
	Sig.	0.285	0.176	0.985	0.019[a]				
Glu.	*r*	0.238	0.021	0.106	–0.073	–0.030	1		
	Sig.	0.128	0.894	0.506	0.647	0.852			
BMI	*r*	0.809	–0.015	0.418	0.266	0.065	0.259	1	
	Sig.	0.000[b]	0.926	0.006[b]	0.089	0.680	0.097		
WC	*r*	0.824	0.186	0.383	0.186	0.048	0.196	0.873	1
	Sig.	0.000[b]	0.238	0.012[a]	0.239	0.765	0.212	0.000[b]	

[a] Correlation is significant at the 0.05 level (2-tailed).
[b] Correlation is significant at the 0.01 level (2-tailed).
Abbreviation: Wt. = weight, Ht. = height, SBP = systolic blood pressure, DBP = diastolic blood pressure, PR = pulse rate and Glu. = capillary blood glucose.

Almost half of the participants were categorized as obese (n = 18, 42.9%) with mean BMI of 26.2 kg/m^2 (SD = 4.2). About one-third were hypertensive (n = 14, 33.3%) whereas the other two-third had normal blood pressure (n = 28, 66.7%) (Table 2). In contrast to BMI, much less proportion of the participants had central obesity (n = 11, 26.2%) with their waist circumferences fell above the gender-based cut-off points (Table 3). Mean waist circumference was 87.6 cm (SD = 11.1). Similar to blood pressure, only one-third of the participants had high capillary blood glucose (n = 14, 33.3%) while the other one-third were normoglycemic (n = 28, 66.7%). Mean capillary blood glucose was 6.5 mmol/L (SD = 1.3).

Pearson correlation coefficient test were performed to look for association among various parameters measured on participants of this health screening programme (Table 4). Weight was strongly correlated with BMI (r = 0.809, $p < 0.001$) and waist circumference (r = 0.824, $p < 0.001$). Positive correlation was also seen between weight and both systolic and diastolic blood pressure (r = 0.350, p = 0.023 and r = 0.340, p = 0.028 respectively). Additionally, weight had direct correlation with height (r = 0.572, $p < 0.001$). Systolic blood pressure was found to have positive correlation with diastolic blood pressure (r = 0.390, p =0 .011) while diastolic blood pressure was positively correlated with the pulse rate (r = 0.360, p = 0.019). Meanwhile, positive correlation was also seen between BMI and systolic blood pressure (r = 0.418, p= 0.006) as well as BMI with waist circumference (r = 0.873, $p < 0.001$).

DISCUSSION

This paper reported on the findings obtained during a health screening programme conducted in Kiulu; a rural district community in Sabah, Malaysia. This half-day programme consisted of health educational talks, blood donation drive and health educational booths along with general health screening[21]. While the programme attracted a big crowd, only a handful participated in the health screening activities resulted in a small number of participants

($n = 42$). Hence, parameters from both men and women were combined to increase the power of statistical analysis.

Mean age of 52.4 ± 14.9 years old reflected that the population in this district was mainly composed of middle-to older-aged group as younger generation tend to migrate to the urban region. Among these participants, the BMI showed strong positive correlation with the waist circumference similar to other study ($r = 0.873$, $p < 0.001$ vs $r = 0.78$, $p < 0.01$)[22]. Additionally, based on BMI, nearly half of the participants had general obesity whereas according to waist circumference, only one-quarter (26.2%) had central obesity. These findings reflect current epidemiological statistics in which approximately every 1 in 2 person in Malaysia has obesity as was reported by Chan et al. (2017)[1]. Using similar cut-off points for waist circumference of >102 cm for men and >88 cm for women, the Malaysia national prevalence of central obesity in 2015 was reported at 23% which was almost equal with our data[8].

Currently, there is a growing support for measurement of WC in complement to BMI in determining the obesity status that corresponds to higher risk of having several non-communicable diseases including diabetes, hypertension and cardiovascular diseases[23 – 26]. This is in part due to the inaccuracy of BMI to differentiate between lean mass and adipose mass; thus, reduces the efficiency of BMI to classify obesity especially in person with larger percentage of muscle tissue such as muscle builders and those who are highly active[27]. Therefore, higher BMI may not truly reflect obesity among the participants. Since rural population commonly engaged in high physical activities such as farming, gardening and other labour intensive activities, their muscle mass might be larger which might result in higher BMI[28, 29]. Lower percentage of obesity as determined by WC in this report was not only conform to the national prevalence, it also corresponds to findings from previous studies. For example, a study conducted in rural regions from four states of India found that abdominal obesity was ranged between 8.7% to 32.1% and they were statistically lower than the urban populations of the same states[30].

Apart from that, participants of this health screening programme had percentage of hypertension and hyperglycaemia of 33.3% for both parameters which were comparable to previous findings. Among two rural communities from a Northern Peninsular state of Malaysia, 50 out of 168 subjects were reported to be hypertensive with a prevalence rate of 29.8%[31]. On the other hand, another study conducted among rural residence of Vietnam found that the combined crude prevalence for impaired fasting glucose (IFG), impaired glucose tolerance (IGT) as well as diabetes was recorded at 17.3% (or 9.2%, 4.4% and 3.7% respectively)[32].

Even though high measurement of WC and BMI are established risk factors and predictors for diabetes mellitus and hyperglycaemia as reported by various studies[23], current report showed otherwise. There was no significant correlation between glucose level with either WC or BMI that can be partly explained by small number of participants in this health screening. Recruitment of more subjects by conducting longer duration of health screening program as well as organized visit into the heart of these villages may lead to changes in the current findings.

Otherwise, there were strong positive correlation between both BMI and WC with systolic blood pressure which was comparable to previous report. Mohammadifard et al. (2013)[25] found that among 12,514 adult participants in the Isfahan Healthy Heart Program, prevalence of hypertension in both male and female were significantly associated with higher quartile of BMI and WC with $p < 0.001$. In addition, a cross-sectional study by Gierach et al. (2014) found that among 839 Peruvian patients diagnosed with metabolic syndrome, BMI or WC were strongly correlated with arterial hypertension ($r = 0.63$, $p < 0.05$).

CONCLUSION

Findings during this health screening programme were comparable to several currently available data despite having small number of participants. Further studies are recommended to include larger sample size as well as equal inclusion of subjects from various villages in rural districts of Sabah. Apart from that, more detail assessment regarding demography, physical activities and other risk factors for obesity as well as non-communicable diseases need to be addressed in future studies to truly reflect the health status of rural communities in Sabah.

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CONFLICT OF INTEREST

The authors declare that they have no competing interests in publishing this paper.

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