ORIGINAL ARTICLE

A PILOT STUDY ON COMPARISON OF BODY COMPOSITION AND GENERAL HEALTH AMONG THE URBAN AND RURAL POPULATIONS IN MALAYSIA

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ABSTRACT

A cross sectional study to determine general health and body composition was conducted for comparison between rural samples (Teluk Intan, Perak) and urban samples (Klang Valley, Selangor). Systematic random sampling was used in 2 health clinics in Klang Valley and 4 health clinics in Teluk Intan, Perak. The results showed that urban population was more heterogeneous (Malay 63.7%, Indian 19.8%, Chinese 14.9%) compared with the rural population (Malay 75%, Indian 22.1%, Chinese 2.9%). Mean age for urban population was 44 ± 1.6 years and for rural was 50 ± 14.4 years. There was significant difference in the BMI ($p < 0.05$) between urban and rural populations where more people in the urban areas had higher BMI. There was a significant difference in the waist hip ratio ($p < 0.05$) between urban and rural areas where more people in the urban areas had above normal waist hip ratio. There was no significant difference in chronic diseases suffered and family medical history of the rural and urban samples.

Key words: body-composition, BMI, urban, rural

INTRODUCTION

A well-balanced diet provides sources of energy and nutrition for optimal growth and development. However, an inadequate or unbalanced diet may lead to problems with maintenance of body tissues, growth and development, brain and nervous system functions, as well as problems with bone and muscle systems[1].

Malnutrition is a condition that occurs when a person's body is not getting enough nutrients due to unbalance diet[1]. Worldwide, malnutrition continues to be a significant problem particularly in developing countries such as in southern Asia and sub-Saharan Africa[2,3]. Malnutrition increases one's susceptibility to and severity of bacterial and parasitic infections[4,5] and is the direct cause of about 300 000 deaths per year and is indirectly responsible for about 53% of all deaths in young children[6].

On the other hand, excess body weight or obesity is a condition that may occur by eating more calories than the body burns[7]. Recent studies in the United States found that overweight and obesity may account for 20% of all cancer deaths in women and 14% of all cancer deaths in men[8]. The studies reported that overweight or obese men had an increased risk of death from cancer of the stomach and prostate, and heavy post-menopausal women had an increased risk of death from cancers of the breast, uterus, cervix and ovaries[8].

The body composition may be determined by measuring the body mass index (BMI) and waist-hip ratio[9]. Values of body weight adjusted for height are referred to as BMI (kg/m^2). BMI values of: < 18.5 are considered as underweight, 18.5 to 24.9 as normal, 25.0 to 29.9 as overweight and ≥ 30 as obese[9]. The main assumption of BMI guidelines is that body mass adjusted for stature squared, is closely associated with body fatness and consequent morbidity and mortality[10,11]. Waist hip ratio is the ratio of the circumference of the waist to that of the hips. It measures the proportion by which fat is distributed around the torso. For women and men, the ideal waist-hip ratio is 0.8 or less and 0.95 or less respectively[9]. Typically, a person's body shape is classified as either an "apple" or a "pear" based on the area of the body that he or she tends to store excess fat. Apple-shaped people tend to store excess body fat in their abdomen mainly around their stomach and chest while pear-shaped people tend to store excess body fat below the waist in the hips, thighs and buttocks[12]. Various studies have demonstrated that carrying excess abdominal fat increases the risk for type 2 diabetes, heart disease and high blood pressure while excess weight carried below the waistline may contribute to varicose veins and orthopedic problems[12]. Therefore, maintaining the ideal body composition is crucial for general health.

The objective of this study is to determine the general health and body composition among the urban and rural populations in Malaysia in order to provide added information about the difference if any, for planning of health services in these areas.

METHODOLOGY

A cross-sectional, randomized study was successfully conducted in 2 health clinics in Klang Valley, Selangor and 4 health clinics in Teluk Intan, Perak within 1 week in August until November 2006 to assess the body composition and correlation to diseases among urban and rural populations in Malaysia. Klang Valley is designated as urban because it has a population of 6.5 million and comprising of land area of 3,200 km2. It is the heartland of Malaysia's industry and commerce[13]. Teluk Intan district is designated as rural, with an estimated population of around 213,000 and land area of 126.9 km^2. The main economic activities in Teluk Intan are oil palm cultivation and palm oil production[14].

Structured questionnaires were given using systematic random sampling to 248 respondents from the urban and 104 from the rural populations. The questionnaire was widely used by other researchers and available from the internet and published papers[9,15] and have been validated. The data were collected and analyzed using SPSS version 13.0.

RESULTS

Participant characteristics

Table 1 shows sociodemographic data of the participants. A total of 248 participants from the urban and 104 from the rural populations participated in this study. The urban population was more heterogeneous consisting of 63.7% Malays, 19.8% Indians and 14.9% Chinese compared to the rural population with Malays (75.0%), followed by 22.1% Indians and 2.9% Chinese. Majority of the urban population (42.0%) were ≥ 50 years old, 31.0% and 26.6% were in the range of 30 to 49 years old and 20 to 29 years old respectively while majority of the

rural population (62.6%) were ≥ 50 years old and 25.9% were in the range of 30 to 49. A similar distribution among gender were observed in both urban and rural populations i.e., 57.3% and 57.7% male and 42.7% and 42.3% female respectively, however 65.9% of the rural female was menopause compared to 48.0% among urban population.

Body composition assessment

Table 2 shows the body composition assessment data according to body mass index (BMI) calculation. One third of the urban (35.8%) and 48.5% of rural populations have normal BMI values in the range of 18.5 to 24.9. However another one third of both the urban (35.1%) and rural (31.1%) populations were overweight, while 22.6% and 14.6% were obese. Only a small number of both urban (6.5%) and rural (5.8%) populations were underweight.

The Chi square test for body composition according to BMI calculation among the urban and rural populations was 4.48 corresponding to a p value of less than 0.05. Therefore, there was a significant difference in the BMI among them (Table 2).

Table 2. Body composition according to body mass index (BMI) calculation among the urban and rural populations

BMI	Urban Frequency	%	Rural Frequency	%	Total
< 18.5	16	6.5	6	5.8	22
18.5–24.9	89	35.8	50	48.5	139
25 – 29.9	87	35.1	32	31.1	119
≥ 30	56	22.6	15	14.6	71
Total	248	100.0	103	100.0	351

$X^2 = 4.48$ $0.05 < p < 0.025$

Table 1. Sociodemographic data

Variables	Urban Freq	%			Rural Freq	%		
Race								
Malay	158	63.7			78	75.0		
Chinese	37	14.9			3	2.9		
Indian	49	19.8			23	22.1		
Others	4	1.6			-	-		
Age								
< 20	1	0.4			6	5.8		
20 - 29	66	26.6	Mean + SD	= 44.00 + 16.55	6	5.8	Mean + SD	= 50.00 + 14.38
30 - 39	35	14.1	Median	= 45	10	9.6	Median	= 54
40 - 49	42	16.9	Mode	= 27	17	16.3	Mode	= 60
50 - 59	51	20.6			28	27.0		
> 59	53	21.4			37	35.6		
Gender								
Female	106	42.7			44	42.3		
Male	142	57.3			60	57.7		
Menopause	72	48.0			29	65.9		

Table 3. Body composition according to waist-hip ratio among gender in the urban and rural populations

Waist-Hip ratio	Female				
	Urban		Rural		
	Frequency	%	Frequency	%	Total
0.8 or less	61	58.1	10	23.3	71
Above normal	44	41.9	33	76.7	77
Total	105	100.0	43	100.0	148

Waist-Hip ratio	Male				
	Urban		Rural		
	Frequency	%	Frequency	%	Total
0.95 or less	122	87.1	45	76.3	167
Above normal	18	12.9	14	23.7	32
Total	140	100.0	59	100.0	199

$X^2 = 15.88$ $p < 0.001$

Table 3 shows the body composition assessment data according to the waist-hip ratio calculation. More than half of the urban female (58.1%) has the ideal waist-hip ratio of between 0.8 or less compared to only 23.3% of the rural, however higher percentage of rural female (76.7%) was above 0.8 compared to the urban (41.9%). On the contrary to the female population, majority of both the urban (87.1%) and rural (76.3%) male populations have the ideal waist-hip ratio. Only 12.9% of urban and 23.7% of the rural male was above 0.95.

For body composition according to waist-hip ratio among gender in the two populations, the Chi square test was 15.88 corresponding to a p value of less than 0.001. Therefore, there

Table 3a. Body composition according to waist-hip ratio among the urban and rural populations

Waist-Hip ratio	Urban		Rural		
	Frequency	%	Frequency	%	Total
Normal	183	74.7	55	81.4	238
Above normal	62	25.3	47	18.6	109
Total	245	100.0	102	100.0	347

$X^2 = 3.89$ $0.05 < p < 0.025$

was a significant difference in the waist-hip ratio among them (Table 3).

Majority of both the urban (74.7%) and rural (81.4%) populations have the ideal waist-hip ratio, while 25.3% of urban and 18.6% of rural were above the ideal ratio. The Chi square test for body composition according to waist-hip ratio among the urban and rural populations was 3.89 corresponding to a p value of less than 0.05. Therefore, there was a significant difference in the body composition according to waist-hip ratio among them.

Health status
Majority of the urban and rural female participants who answered yes in the health status questions suffered from high blood pressure (52.6% and 62.5% respectively) and diabetes (36.8% and 29.2% respectively) while a small number suffered from coronary heart disease, vascular peripheral, stroke or angioplasty (10.5% and 8.3% respectively). However, the Chi square test for the health status (heart diseases $X^2 = 0.37$, p > 0.5; high blood pressure $X^2 = 1.24$, $0.5 < p < 0.25$; diabetes $X^2 = 0.61$, $0.5 < p < 0.25$) among the female shows no significant difference in both the urban and rural populations.

Table 4. Health status among the female in the urban and rural populations

Health status	Female					Statistical test X^2 (p value)
	Urban		Rural			
	Frequency	%	Frequency	%	Total	
Coronary heart disease, vascular peripheral, stroke or angioplasty	8	10.5	4	8.3	12	0.37 (p > 0.05)
High blood pressure	40	52.6	30	62.5	70	1.24 (p > 0.05)
Diabetes	28	36.8	14	29.2	42	0.61 (p > 0.05)
Total	76	100.0	48	100.0	124	

Table 5. Health status among the male in the urban and rural participants

Health status	Male					Statistical test X^2 (p value)
	Urban		Rural			
	Frequency	%	Frequency	%	Total	
Heart coronary disease, vascular peripheral, stroke or angioplasty	9	17	4	10.8	13	0 (p > 0.05)
High blood pressure	42	79.2	23	62.2	65	0.64 (p > 0.05)
Diabetes	2	3.8	10	27	12	0.62 (p > 0.05)
Total	53	100.0	37	100.0	90	

Similar pattern was also observed in male populations (Table 5). Majority of both urban and rural male participants who answered yes in the health status questions suffered from high blood pressure (79.2% and 62.5% respectively). Interestingly, only 3.8% of the urban population suffered from diabetes compared to 27% among the rural. On the contrary, 17% of the urban population suffered from coronary heart disease, vascular peripheral, stroke or angioplasty compared to 10.8% among the rural. However, the Chi square test for the health status (heart diseases $p > 0.5$; high blood pressure $0.5 < p < 0.25$; diabetes $0.5 < p < 0.25$) among the male shows no significant difference in both the urban and rural populations.

for the family medical history (pre-mature heart disease $0.5 < p < 0.25$; vascular peripheral disease $0.5 < p < 0.25$; stroke $p > 0.5$; angioplasty $p > 0.5$) among the male was not significant in both the urban and rural populations.

Table 6. Family medical history among the female participants

Family medical history	Female					P value
	Urban Frequency	%	Rural Frequency	%	Total	
Pre-mature heart disease	17	23.3	4	26.7	21	0.05
Vascular peripheral disease	22	30.1	6	40.0	28	> 0.05
Stroke	20	27.4	5	33.3	25	> 0.05
Angioplasty	14	19.2	0	0	14	> 0.05
Total	73	100.0	15	100.0	88	

Table 7. Family medical history among the male participants

Family medical history	Male					P value
	Urban Frequency	%	Rural Frequency	%	Total	
Pre-mature heart disease	20	29.9	7	38.9	27	> 0.05
Vascular peripheral disease	26	38.8	4	22.2	30	> 0.05
Stroke	13	19.4	5	27.8	18	> 0.05
Angioplasty	8	11.9	2	11.1	10	> 0.05
Total	67	100.0	18	100.0	85	

Table 6 shows that the majority of the urban and rural female participants who answered yes, has family medical history of premature heart disease (23.3% and 26.7% respectively), peripheral vascular disease (30.1% and 40% respectively) and strokes (27.4% and 33.3% respectively), while 19.2% of the urban female has a family medical history of angioplasty compared to none among the rural female participants. However, the Chi square test for the family medical history (pre-mature heart disease $p > 0.5$; vascular peripheral disease $0.5 < p < 0.25$; stroke $p > 0.5$; angioplasty $0.1 < p < 0.05$) among the female was not significant in both the urban and rural populations.

Majority of the urban and rural male participants who answered yes, have family medical history of premature heart disease (29.9% and 38.9% respectively), vascular peripheral disease (38.8% and 22.2% respectively) and stroke (19.4% and 27.8% respectively), while a comparable percentage of both the urban (11.9%) and rural (11.1%) male has a family medical history of angioplasty. However, the Chi square test

DISCUSSION

A total of 248 participants from the urban and 104 from the rural populations participated in this study. The mean and median age among the urban was 44 ± 1.6 years and 45 years respectively and 50 ± 14.4 years and 54 years respectively among the rural population. The Chi square test shows a significant difference for the body composition according to body mass index and waist-hip ratio among the urban and rural populations. There was also a significant difference in the waist-hip ratio among the gender in the two populations. Majority of both populations suffered from high blood pressure and have the family medical history of premature heart disease, peripheral vascular disease and stroke. However, the Chi square test shows no significant difference in the health status and family medical history in both the populations.

Our finding is in accordance with another study on the nutrition and health transition in Malaysia. The study reported that higher percentage of obesity were observed among the

urban population (8.8% female and 5.6% male) compared to the rural counterparts (2.6% female and 1.8%)[16]. Another recent survey in Vietnam reported that the urban population was likely to be overweight than the rural ones[17].

A healthy diet is critical in maintaining good health and fighting disease. Excess body weight is linked to major physical threats by increasing the risk of cardiac disease, type II diabetes and various cancers[18]. Studies have revealed that obesity is associated with increased cardiovascular disease mortality[18-20]. Furthermore, cardiovascular disease death rates are directly related to BMI in both men and women. The risk of cardiovascular disease mortality in obese persons who have a BMI 35 kg/m2 was 2 to 3 times higher compared to lean persons (BMI 18.5 to 24.9 kg/m^2)[21], and a 30% higher coronary heart disease mortality rate occurs for every 5-unit increment of BMI[22]. Other studies have reported that overweight and obesity are associated with increased risk for various cancers such as breast, uterus, cervix, ovaries (among postmenopausal women), stomach, prostate (among men), endometrium, esophagus, gallbladder, liver, colon, pancreas, and kidney23-26. A recent study suggested that obesity may account for 14% of cancers in men and 20% of cancers in women, and in this cohort, the heaviest men and women were 52% and 62% respectively, more likely to die of cancer[27].

The good news is that reducing the body fat may help in reducing the risk of diseases. Consistently documented evidences reported a reduced incidence of coronary artery disease and stroke in the more physically active and fit individuals[23,28]. Other studies have confirmed that moderate or higher levels of physical activity can reduce total and cardiovascular disease mortality among patients with Type 2 diabetes[29] and may decrease the risk of breast, endometrial, prostate, colon and lung cancer[23,30,31].

CONCLUSIONS

Our study and several other studies[16,17] have shown that the urban population is more overweight than the rural population, based on BMI and waist-hip ratio findings. Overweight person is more likely to develop heart disease, stroke, diabetes and cancer. Therefore, a healthy diet and regular exercise is crucial to maintain general health.

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REFERENCES

1. Medical Encyclopedia. United States National Library of Medicine, 11 January 2007, Available from http://www nlm.nih.gov

2. Muller O, Krawinkel M. Malnutrition and health in developing countries. CMAJ 2005; 173(3): 279-286.

3. World Health Organization. World Health Report. Geneva: The organization, 2002.

4. Brabin BJ, Coulter JBS. Nutrition-associated disease. In: Cook GC, Zumla AI, editors. Manson's tropical diseases. London: Saunders, 2003 (561-580).

5. Food and Agriculture Organization of the United Nations. Undernourishment around the world. In: The state of food insecurity in the world 2004. Rome: The Organization; 2004.

6. Black RE, Morris SS, Bryce J. Where and why are 10 million children dying every year? Lancet 2003; 361: 2226-2234.

7. Lee D, Conrad Stöppler M (2006). Disease prevention through diet & nutrition, 16 January 2007, Available from http://www.medicinenet.com/prevention/article htm

8. Calle E, Rodriguez C, Walker-Thurmond K, Thun MJ. Overweight, obesity, and mortality from cancer in a prospectively studied cohort of U.S. adults. N Engl J Med 2003; 348(17): 1625-1638.

9. World Health Organization. Obesity: preventing and managing the global epidemic. Report of a WHO consultation on obesity. Geneva. June 3-5, 1997. Geneva: WHO. 1998.

10. Gallagher D, Heymsfield SB, Heo M, Jebb SA, Murgatroyd PR, Sakamoto Y. Healthy percentage body fat ranges: an approach for developing guidelines based on body mass index. Am J Clin Nutr 2000; 72: 694-701.

11. Bray GA. Health hazards of obesity. Endocrinol Metab Clin North Am 1996; 25: 907-919.

12. Kendall P (2006). Waist-to-hip ratio helps predict heart risk. CSU Cooperative Extension, 5 February 2007, Available from http://www.ext.colostate.edu

13. Klang Valley, 28 April 2008, Available from http://en.wikipedia.org/wiki

14. Teluk Intan, 28 April 2008, Available from http://en.wikipedia.org/wiki

15. Pouliot MC, Despres JP, Lemieux S, Moorjani S, Bouchard C, Tremblay A, Nadeau A, Lupien PJ. Waist circumference and abdominal sagittal diameter: best simple anthropometric indices of abdominal visceral adipose tissue accumulation and related cardiovascular risk in men and women. *Am J Cardiol* 1994; 73: 460-468.

16. Noor MI. The nutritional and health transition in Malaysia. *Public Health Nutrition* 2002; 5(1A): 191-195.

17. Nguyen MD, Beresford SAA, Drewnowski A. Trends in overweight by socio-economic status in Vietnam. *Public Health Nutrition* 2007; 10(2): 115-121.

18. Klein S, Burke LE, Bray GA, Blair S, Allison DB, Pi Sunyer X, Hong Y and Eckel RH. Clinical implications of obesity with specific focus on cardiovascular disease. A statement for professionals from the American Heart Association Council on Nutrition, Physical Activity and Metabolism. *Circulation* 2004; 110: 2952-2967.

19. Albert CM, Chae CU, Grodstein F, Rose LM, Rexrode KM, Ruskin JN, Stampfer MJ, Manson JE. Prospective study of sudden cardiac death among women in the United States. *Circulation* 2003; 107: 2096-2101.

20. Stevens J, Cai J, Evenson KR, Thomas R. Fitness and fatness as predictors of mortality from all causes and from cardiovascular disease in men and women in the lipid research clinics study. *Am J Epidemiol* 2002; 156: 832-841.

21. Calle EE, Thun MJ, Petrelli JM, Rodriguez C, Heath CW Jr. Body-mass index and mortality in a prospective cohort of US adults. *N Engl J Med* 1999; 341: 1097-1105.

22. Selmer R, Tverdal A. Body mass index and cardiovascular mortality at different levels of blood pressure: a prospective study of Norwegian men and women. *J Epidemiol Community Health* 1995; 49: 265-270.

23. Eyre H, Kahn R, Robertson RM, Clark NG, Doyle C, Hong Y, Gansler T, Glynn T, Smith RA, Taubert K and Thun MJ. Preventing Cancer, Cardiovascular Disease, and Diabetes: A Common Agenda for the American Cancer Society, the American Diabetes Association, and the American Heart Association. *Circulation* 2004; 109: 3244-3255.

24. Chow WH, Gridley G, Fraumeni JF, *et al.* Obesity, hypertension, and the risk of kidney cancer in men. *N Engl J Med* 2000; 343: 1305-1311.

25. Michaud DS, Giovannucci E, Willett WC, *et al.* Physical activity, obesity, height, and the risk of pancreatic cancer. *JAMA* 2001; 286: 921-929.

26. Feigelson HS, Jonas CR, Teras LR, *et al.* Weight gain, body mass index, hormone replacement therapy, and postmenopausal breast cancer in a large prospective study. *Cancer Epidemiol Biomarkers Prev* 2004; 13: 220-224.

27. Calle EE, Rodriguez C, Walker-Thurmond K, *et al.* Overweight, obesity, and mortality from cancer in a prospectively studied cohort of U.S. adults. *N Engl J Med* 2003; 348: 1625-1638.

28. Goldstein LB, Adams R, Becker K, *et al.* Primary prevention of ischemic stroke: a statement for healthcare professionals from the Stroke Council of the American Heart Association. *Circulation* 2001; 103: 163-182.

29. Hu G, Eriksson J, Barengo NC, Lakka TA, Valle TT, Nissinen A, Jousilahti P and Tuomilehto J. Occupational, commuting and leisure-time physical activity in relation to total and cardiovascular mortality among Finnish subjects with Type 2 Diabetes. *Circulation* 2004; 110: 666-673.

30. Friedenreich CM, Courneya KS, Bryant HE. Influence of physical activity in different age and life periods on the risk of breast cancer. *Epidemiology* 2001; 12: 604-612.

31. Friedenreich CM. Physical activity and cancer prevention: from observational to intervention research. *Cancer Epidemiol Biomarkers Prev* 2001; 10: 287-301.