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Body Mass Index and Nutritional Status of Adults in Two Rural Villages in Northern Malaysia

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ABSTRACT

There has been a change in the lifestyles of populations, including reduced physical activity and consumption of foods high in calories. Overweight and obesity are now replacing the more traditional public health concerns such as under-nutrition and infectious diseases as some of the most significant contributors to ill health. Determination of the body mass index (BMI) profile and nutritional status of adults of two rural coastal villages in Northern Malaysia was part of a community diagnosis in a community survey. Height and weight were measured and BMI calculated. Blood pressure was measured using a manual sphygmomanometer according to WHO guidelines. A standardised questionnaire was used to interview the villagers concerning their health. Out of the total population, 504 were above 20 years of age. Data was available for 441 persons for analysis. There were 210 (47.6%) males and 231 (52.4%) females. The prevalence of underweight was 9.8% (n=43), overweight 25.9% (n=114) and obesity 17% (n=75). The problem of over-nutrition was significantly higher among females, especially housewives. ($p< 0.05$). Those in ages 41-70 years were the majority with problems of over-nutrition ($p=<0.05$). More than half (52.9%; n=39) of those who were obese had hypertension ($p=<0.05$). Results show that a higher number of women especially housewives were obese and more than half of those obese subjects had hypertension. A more thorough nutritional profile using waist, hip and body fat measurement as well as an assessment of the dietary intake and activity regime of these villagers is needed. Interventions need to be carried out before more serious complications of obesity become rooted in this community.

INTRODUCTION

Poverty eradication is the ultimate goal among the Millennium Development Goals (MDGs), and Malaysia's achievement in this regard is remarkable. Just below half of all households were poor in 1970. This proportion was halved in about 15 years, and more than halved again in the next 15 years. By 2002, just 5.1 per cent of households were poor. The decline in the incidence of poverty in Malaysia is revealed by trends in other direct measures of welfare, including nutritional indicators (UNDP, 2005). The per capita increase in calories has increased from 2,518 in 1970 to 2,969 in 1999. However there appears to be a decline in consumption of protein from 95 g in 1970 to 85 g in 1987- 89 (UNDP, 2005).

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Change in lifestyles both in urban and rural communities have caused changes in food purchases and consumption habits. These changes, compounded by sedentary lifestyles, have resulted in many facets of malnutrition. Malnutrition has been defined as "a pathological state resulting from a relative or absolute deficiency or excess of one or more essential nutrients". It can comprise four forms – under-nutrition, over-nutrition, imbalance and specific deficiency (Park, 2000).

These changes in food consumption and physical activity have led to a rising prevalence of overweight and obesity in men and women (Park, 2000). In addition to these problems of over-nutrition, problems related to under-nutrition including protein-energy malnutrition and micronutrient deficiency, particularly iron, vitamin A, iodine and folate continue to have detrimental effects on vulnerable groups in many countries that are undergoing the nutritional transition (Khor & Zalilah, 2003).

Obesity levels are not just a problem of developed nations. It is now a global problem. Obesity levels in some low income and transitional countries are equal if not higher than those reported in developed countries. Shifts in diet and activity are consistent with these changes (Popkin & Doak, 1998). Malaysia is no exception to this global problem.

Report of a WHO consultation on obesity recognised that overweight and obesity represent a rapidly growing threat to the health of populations and increasing numbers of countries worldwide (WHO, 1997). Obesity is a disease, which is prevalent in both developing and developed countries and affects children and adults alike. Overweight and obesity are now so common that they are replacing the more traditional public health concerns such as under-nutrition and infectious diseases as some of the most significant contributors to ill health. Obesity has been associated with premature death from diabetes, hypertension and coronary heart disease (Park, 2000). Heart diseases are the second principal cause of death in Ministry of Health hospitals (MOH, 2004)

Body weight and height can be used in combination as simple and reliable measurements for evaluating nutritional and overall health status, and in screening for overweight (Kuczmarski & Flegal, 2000). The most commonly used measure of nutritional status for adults is Body Mass Index (BMI), which is body weight (kg) divided by height (m) squared. Body Mass Index is well recognised as an easy, well established and widely used measurement to determine a person's nutritional status (MOH, 2004). As BMI is independent of age and reference population, it can be used for comparison internationally (Kuczmarski & Flegal, 2000). It has been shown that BMI > 25 at age 18 is associated with significantly increased mortality within 20 years of follow up (Reilly *et al.,* 2003). A higher BMI has been associated with a higher prevalence of hypertension (Bell *et al.,* 2002).

In Malaysia, the prevalence of obesity is 5.5% and more females are overweight (7.2%) as compared to males (3.8%) (WHO, 1998). In a study done in northeastern Malaysia, the prevalence of overweight was 21.3% while the prevalence of obesity was 4.5% and the overweight were significantly younger than the lean subjects (Mohamad *et al.,* 1996). Similarly another study conducted in Malaysia found the prevalence of obesity was higher in women than in men (Ismail *et al.,* 2002).

A general health survey was conducted by the department of Community Medicine of Asian Institute of Medicine, Science and Technology (AIMST). As a part of the survey, BMI measurements were taken to determine the BMI profile and nutritional status of adults in two rural villages in northern Malaysia. This paper describes the nutritional pattern of the population surveyed.

METHODOLOGY

A general demographic and health survey was conducted in two coastal villages of rural Kedah, Malaysia. Nutritional status assessment was carried out for the entire population. This was restricted to measurements of height and weight. Waist-hip-ratio and measurement of body fat were not included given the cultural sensitivity of examining women and the gender and racial mix of investigators.

The total population of both these villages was 895. All the villagers were Malays with the majority of them working as fishermen or farmers.

The survey was conducted among the total population of the village. For each household, one responsible member was interviewed using a standard questionnaire regarding their age, sex, education and occupation and other information of all the family members. Height, weight and blood pressure were measured for all members. Repeat visits were made where necessary. All data obtained are anonymous at source. Each household was given a unique identifier number which was used in all handling of data.

The investigators were trained to measure height and weight using standardised equipment (SECA 900, Germany) for measuring body weight and height. A structured questionnaire was used to ask questions concerning their health.

Blood pressure was measured for all adults using a manual sphygmomanometer according to WHO guidelines and the procedure was explained to the participant and verbal permission obtained. Blood pressure was measured on 3 separate occasions and should be more than 140 mmHg systolic or more than 90 mmHg diastolic on all 3 occasions for a positive diagnosis of hypertension to be made. This is in line with current criteria for diagnosis of hypertension in all adults (including the elderly) from the World Health Organization (WHO) and International Society of Hypertension (ISH) (JAMA, 1997).

The present analysis is restricted to those who were above 20 yrs of age. Those who were 20 years and below and those who refused to participate were excluded from the analysis.

The body mass index (BMI) was calculated as follows:

$$\text{BMI} = \frac{\text{weight in kg}}{(\text{Height in meters})^2}$$

The BMI was classified thus (WHO, 1998):

BMI less than 18.5 = underweight.
BMI between 18.5 to 24.9 = normal weight
BMI between 25 to 29.9 = over weight
BMI more than 30 = obese

Descriptive statistics and cross-tabulations were done using SPSS. Suitable multivariate analysis was done.

RESULTS

The total number of eligible participants were 504, comprising 241 males and 263 females. However complete data were available for 441 participants and further analysis was restricted to them. The mean age of those who participated was 45.5 years. All were Malays, with 47.6% (n=210) males and 52.4% (n=231) females. Table 1 summarises the demographic data and nutritional status of the study population descriptive data. The mean BMI was 25 kg/m^2. The prevalence of underweight was 9.8% (n=43), overweight 25.9% (n=114) and obesity 17% (n=75). Among the females, the majority of them had problems with over-nutrition, with 27.3% (n=63) of them being overweight and 21.25% (n=49) of them obese, while another 10.4% were underweight. The difference in BMI status between sexes was significant.

Figure 1 shows the relationship between BMI and occupation of study subjects. Among the housewives, most of them had problems of over-nutrition with 33% (n=33) of them overweight and 23% (n=23) being obese (p=<0.05). 18.5% of those not working were underweight. However 33% in this group were overweight or obese. Though the difference in prevalence of overweight and obesity between working and non-working subjects was significant, age could be a possible confounder for this observation.

There was no statistically significant difference for malnutrition between those who were illiterate, those with education up to form five and those with education higher than form five (Table 1).

Figure 2 shows the distribution of nutritional status by age of study subjects. The figure shows the prevalence of overweight and obesity was highest in the age group 41-50 years (61%). Among those between the ages 51-60 years, 33.8% (n=26) were overweight and 23.4% (n=18) of them were obese. In the age group 61-70 years, 24.1% (n=13) were overweight and 14.8% (n=8) were obese. It is important to note that only 63.3% in the age group 21-30 years, the age group which should be the fittest, were in the normal weight range. Both under-nutrition and overweight were problems in this age group; 22% were overweight or obese whereas 14% were underweight. For those above 81 years, though the number of subjects studied is

Table 1. Factors associated with malnutrition

	Underweight	*Normal*	*Overweight*	*Obese*
Prevalence	9.8% (43)	47.4% (209)	25.9% (114)	17% (75)
Sex **				
Male	9% (19)	54.3% (114)	24.3% (51)	12.4% (26)
Female	10.4% (24)	41.1% (95)	27.3% (63)	21.2% (49)
Occupation **				
Not working	18.8% (15)	47.5% (38)	17.5% (14)	16.3% (13)
House wife	8% (8)	36% (36)	33% (33)	23% (23)
Retired	13.3% (2)	60% (9)	6.7% (1)	20% (3)
Working	7.3% (18)	51.2% (126)	26.8% (66)	14.6% (36)
Education				
Illiterate	14.5% (8)	41.8% (23)	21.8% (12)	21.8% (12)
Education up to form five	9% (33)	47.1% (173)	27.2% (100)	16.6 (61)
Education higher than form five	11.1% (2)	66.7% (12)	11.1% (2)	11.1% (2)
Age (years)**				
21-30	14.7% (16)	63.3% (69)	11.9% (13)	10.1% (11)
31-40	7.4% (5)	47.1% (32)	32.4% (22)	13.2% (9)
41-50	5.1% (5)	33.7% (33)	35.7% (35)	25.5% (25)
51-60	5.2% (4)	37.7% (29)	33.8% (26)	23.4% (18)
61-70	13% (7)	48.1% (26)	24.1% (13)	14.8% (8)
71-80	12% (3)	56% (14)	20% (5)	12% (3)
81 and higher	30% (3)	60% (6)	0% (0)	10% (1)

**Significantly different between groups

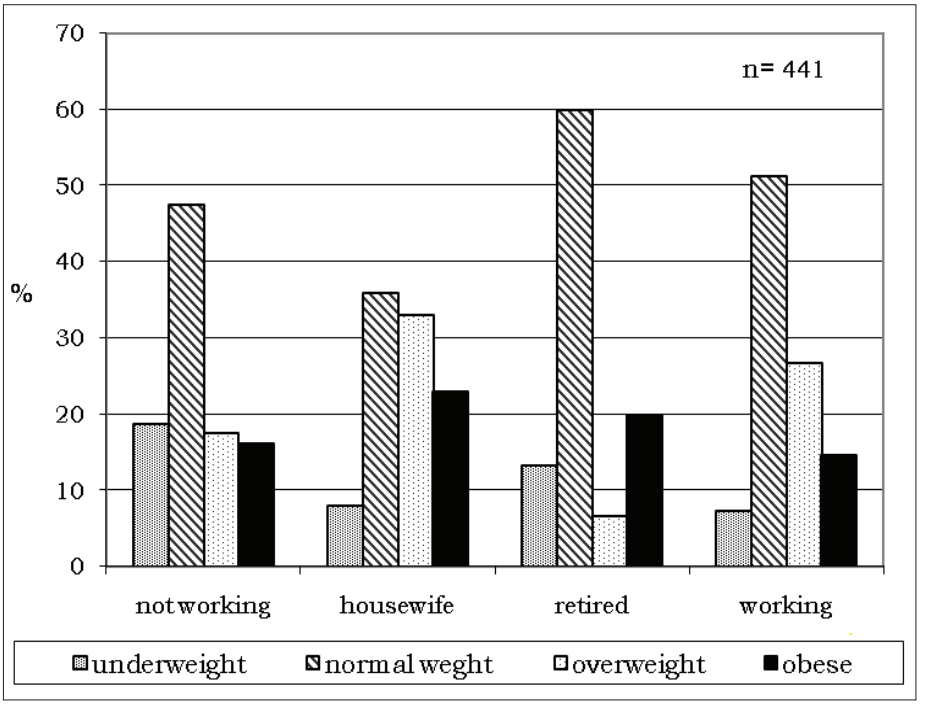

Figure 1. Weight status of study subjects by occupation

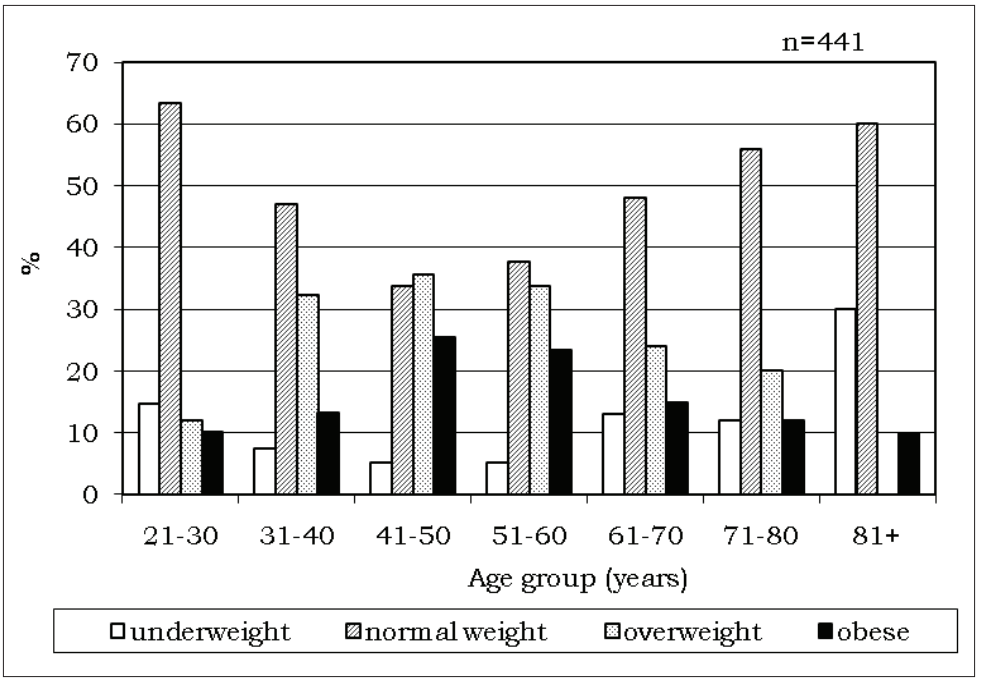

Figure 2. Weight status of study subjects by age

small (n=10) it is important to note that 30% were underweight. This is an important finding with reference to the nutritional needs of the aged. The differences in BMI between the age groups were found to be significant.

Data on hypertension was missing for 10 respondents. Those with a systolic blood pressure higher than 140 or with a diastolic pressure more than 90 were classified as hypertensive. Systolic and diastolic hypertension was similarly categorised. Table 2 shows the percentage of hypertensive subjects for each group of subjects categorised according to weight status (ie underweight, normal, overweight or obese). Those who were obese had the highest prevalence of hypertension. The findings were similar for both systolic and diastolic hypertension, where the prevalence of hypertension showed a significant linear association with weight status. Those who were overweight or obese were found to have higher prevalence of hypertension than those who were normal or undernourished. Both systolic and diastolic mean blood pressures increased with increasing BMI, with the rise being steep for those with BMI above 25 (Figure 3). Though this is a known fact, the very high rates of both obesity and hypertension in this population is a cause for concern.

Table 2. Percentage hypertensive in subjects with different weight status[1,2]

Blood pressure	*Underweight*	*Normal*	*Overweight*	*Obese*
Hypertension	17.1% (6)	25.0% (52)	39.5% (45)	52.7% (39)
Systolic hypertension	14.3% (5)	16.3% (34)	27.2% (31)	41.9% (30)
Diastolic hypertension	8.6% (3)	19.2% (40)	25.4% (29)	39.2% (29)

[1] p=<0.05
[2] Linear association

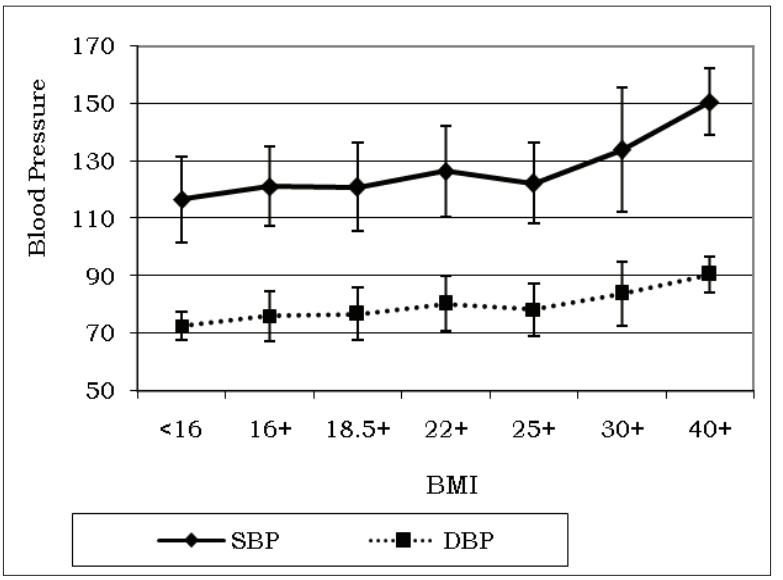

Figure 3. Association between mean blood pressure and BMI

DISCUSSION

The importance of the BMI profile is that it is community-based in a rural population. Rural populations used to be considered at a lesser risk of overweight and obesity than urban populations, but the situation may have changed owing to influences of urban lifestyles.

The nutritional status of Malaysia is undergoing a nutrition transition (Khor, 2002). The Second Health and Morbidity survey reported prevalence of obesity as 4.4% and overweight 16.6%, as quoted in Rahman *et al.,* (2003). In our study we found the prevalence of overweight alarmingly higher than other reports at 25.9%, and the prevalence of obesity at 17%. In a study in rural Selangor (central Malaysia), the prevalence of obesity was found to be 11.4% (Mohd Yunus *et al.,* 2004). In a study conducted among attendees of health clinics in Sepang district in Malaysia, 31% were found to be overweight and 13.8% obese (Rahman *et al.,* 2003). Widespread decline in physical activity in most societies combined with rising fat intake are associated with rapidly rising rates of obesity (WHO, 1997). The same factors could be causing the problems in this community.

Obesity among females (21.2%) is a matter of concern, as it is significantly higher than in males (12.4%), though this is lower than the findings of the study in rural Selangor, many other studies have shown higher rates among females (Khor & Zalilah 2003; Mohd Yunus *et al.,* 2004). Housewives are particularly at risk of becoming obese. Detailed investigations into the dietary habits and physical activity in this population are required. A preliminary rapid enquiry into the dietary habits of this population revealed severe imbalances in dietary constituents. There was a very high consumption of salted fish. These problems of malnutrition, both under- and over-nutrition, therefore, is starting very early in this community. This is despite the fact that the community belongs to the lower socio-economic level with 40% having an average income less than RM 500 and another 40% between RM 500 and 1000.

Another factor for concern is the relationship of overweight and obesity with age. We found that 35.7% of those in the age group 41- 50 years were obese, 33.8% in the age group 51 – 60 years and 24.1% in the age group 31-40 years. Prevalence of overweight in the age group 41-50 years was 35.7%, in the 51-60 years group was 33.8%, followed by 24.1% in the age group 31-40 years. Similarly, obesity was highest among the age group 41-50 years (25.5%). These results show similarities with findings of a study in central Malaysia, the higher prevalence was among those aged 40 to 49 years (22.7%) followed by 30 to 39 years (14.4%) (Mohd Yunus *et al.,* 2004). In another study conducted among attendees of health clinics in Sepang district in Malaysia (central Malaysia), majority of those with normal weight were between ages 30 and 39 (Rahman *et al.,* 2003). This finding suggests probably that those aged 41 and above start to either reduce their level of activity or increase their food intake or both. There are no cohort data to show increasing obesity with age. However, if it is assumed, especially after the age of forty, that the prevalence of overweight and obesity will increase, then the present cohort of 41- 50 will only show higher prevalence when they reach the 51 – 60 age bracket.

Obesity has been recognised to be a risk factor for increased blood pressure (WHO, 1999; Harrison & Marshall, 2006). Higher BMI has been associated with a higher prevalence of hypertension in all ethnic groups (Bell *et al.,* 2002). The study in Selangor found no association between obesity and hypertension (Mohd Yunus *et al.,* 2004), but in our study we found 52.7% of those who were obese had hypertension. This information would be valuable for advocacy programmes in this population.

CONCLUSIONS

A general health survey has shown high prevalence of overweight and obesity among rural villagers, especially housewives, who are obese and are at higher risk of hypertension. These high rates of obesity are a matter of concern as overweight and obesity are the underlying risk factors not only for hypertension and diabetes but other conditions such as osteoarthritis. Obesity can further compound the effects of both hypertension and diabetes.

There are some limitations to these findings. Waist-hip-ratio and the body fat measurements need to be used to identify the true obese. There is also a need to carry out an assessment of physical activity and dietary patterns of this community. Most importantly, there is a need to bring about changes in both physical activity and dietary pattern, with the involvement of the community.

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