Obesity in Malaysia

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Summary

This study was undertaken to assess the recent data on Malaysian adult body weights and associations of ethnic differences in overweight and obesity with comorbid risk factors, and to examine measures of energy intake, energy expenditure, basal metabolic rate (BMR) and physical activity changes in urban and rural populations of normal weight. Three studies were included (1) a summary of a national health morbidity survey conducted in 1996 on nearly 29 000 adults ≥20 years of age; (2) a study comparing energy intake, BMR and physical activity levels (PALs) in 409 ethnically diverse, healthy adults drawn from a population of 1165 rural and urban subjects 18–60 years of age; and (3) an examination of the prevalence of obesity and comorbid risk factors that predict coronary heart disease and type 2 diabetes in 609 rural Malaysians aged 30–65 years. Overweight and obesity were calculated using body mass index (BMI) measures and World Health Organization (WHO) criteria. Energy intake was assessed using 3-d food records, BMR and PALs were assessed with Douglas bags and activity diaries, while hypertension, hyperlipidaemia and glucose intolerance were specified using standard criteria. The National Health Morbidity Survey data revealed that in adults, 20.7% were overweight and 5.8% obese (0.3% of whom had BMI values of >40.0 $kg\,m^{-2}$); the prevalence of obesity was clearly greater in women than in men. In women, obesity rates were higher in Indian and Malay women than in Chinese women, while in men the Chinese recorded the highest obesity prevalences followed by the Malay and Indians. Studies on normal healthy subjects indicated that the energy intake of Indians was significantly lower than that of other ethnic groups. In women, Malays recorded a significantly higher energy intake than the other groups. Urban male subjects consumed significantly more energy than their rural counterparts, but this was not the case in women. In both men and women, fat intakes (%) were significantly higher in Chinese and urban subjects. Men were moderately active with the exception of the Dayaks. Chinese women were considerably less active than Chinese men. Chinese and Dayak women were less active than Malay and Indian women. In both men and women, Indians recorded the highest PALs. Hence, current nutrition and health surveys reveal that Malaysians are already affected by western health problems. The escalation of obesity, once thought to be an urban phenomenon, has now spread to the rural population at an alarming rate. As Malaysia proceeds rapidly towards a developed economy status, the health of its population will probably continue to deteriorate. Therefore, a national strategy needs to be developed to tackle both dietary and activity contributors to the excess weight gain of the Malaysian population.

Keywords: BMI, energy balance, obesity and comorbidities.

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Introduction

Malaysia has been experiencing a rapid phase of industrialization and urbanization in recent decades and has often been recognized as a role model for developing economies. Statistics available from several Ministries for the last two decades suggest that as the population achieve affluence, their intake of energy, fats and sugars increase, as reflected in the rising and now substantial size of the food importation bills. The 'westernization' of global eating habits has also brought about an increase in the number of fast-food outlets in Malaysia during the last decade (1). At the population level, a high prevalence of obesity results from a complex interaction between changes in the population's lifestyle, involving a higher energy and fat consumption and an increasingly sedentary existence (2), the effects of these changes being particularly severe if the population has an inherited metabolic predisposition to fatness (a 'thrifty genotype'). Several previous studies, albeit not representative of the population, have reported that obesity is prevalent in all age-groups, namely: in children, male 12.5% and females 5.0% (3); in male adolescents, 1.0% in 1990 to 6% in 1997 (4); and in adults, 21.0% overweight and 6.2% obese using World Health Organization (WHO) (2) criteria (5) Given the newly recognized global epidemic of obesity, it is valuable and timely to assess the impact of the economic transition in the Malaysian population.

Materials and methods

Study 1

The principal information comes from a recently published National Health Morbidity Survey (6) conducted in 1996. At present the published survey is confined to body mass index (BMI) analyses and to data on weights and heights; additional information on the comorbidities of overweight and obesity will be available at a later time-point. The sample of 28 737 adults was very carefully chosen to be representative of the Malaysian population, and suitable statistical adjustments were made to take account of the need to have sample sizes which truly reflected the age, gender and ethnic structure of the adult Malaysians. Trained observers measured the heights and weights of the participants using standardized equipment.

Study 2

This study is part of a comprehensive survey to assess the energy requirements of adult Malaysians from four regions, namely Sarawak and the northern, eastern and southern regions of Peninsular Malaysia. A total of 1165 adults (age-range: 18–60 years) were screened and a subsample of 409 (212 men and 197 women) with a BMI of 20.1–25.0 $kg\,m^{-2}$ for men and 18.7–23.8 $kg\,m^{-2}$ for women (7) were selected for the study. The parameters measured included weight and height (using the digital SECA balance with its height attachment, Model 713; Vogel & Halke, Hamburg, Germany), and skinfold thicknesses using Harpenden calipers (British Indicators, W. Sussex, UK) at four sites (8). Body fat, as a percentage of body weight, was calculated from the sum of four measurements (9). Energy and nutrient intake were measured using a 3-d food record (10) and standard household measures. The diet's nutritional content was calculated using the Malaysian Food Composition Tables (11) and the Food Composition Tables for use in East Asia (12). The ratio of energy intake (EI) to basal metabolic rate (BMR) was calculated for each subject. Activity patterns were recorded on a diary card (13) and reported as a mean of 3 d, carried out on the same days when food intake was measured. Energy costs of habitual activities were measured by indirect calorimetry using the Douglas bag technique. Energy cost of activities that were not measured were adopted from the FAO/WHO/UNU (7) report. Total daily energy expenditure (TDEE) was calculated by summing up the energy cost of each activity, multiplied by the duration of the activity. BMR was measured under standardized conditions (i.e. after a 12-h overnight fast) between 06.00 and 08.30 h in a room with temperature and humidity ranging from 23 to 26 °C and 758–770 mmHg, respectively. Triplicate samples of expired air (10 min each) were collected using Douglas bags (Harvard Ltd, Edenbridge, UK) and analysed using a Servomex (model 570A) oxygen analyser, (Servomex, East Sussex, UK) which was calibrated frequently using oxygen-free nitrogen gas. The volume of expired air (corrected to standard temperature and pressure) was determined using a digital dry gas meter (Harvard Ltd). The energy expenditures of subjects were derived using the Weir (14) formula. The BMR values were considered to be technically valid when the intrasubject coefficient of variation (c.v.) was 2.5% or less (15). A statistical analysis package (SAS) was used and subjects compared using analysis of variance (ANOVA) and the Duncan test.

Study 3

This is a more recent study of 609 adults (age-range 30–65 years) conducted from 1997 to 1999 as part of a community-based analysis of two rural Malay populations in the eastern region of Malaysia; non-healthy adults were excluded. The smoking habits, blood pressure, and waist and hip circumferences of the study participants were measured as well as their heights and weights, using standardized procedures. Overnight fasting blood was taken for analysis of lipid and glucose levels, with a subsample of 360 subjects undergoing a standardized oral glucose tolerance test according to the WHO (16) criteria and with glucose being measured using a hexokinase automated pro-

cedure. Full details of this study are provided by Nawawi *et al.* (17).

Results

Figure 1 shows the increasing mean BMI values in all ethnic groups with age, the increase being particularly prominent in women.

It is noteworthy that there is a progressive increase in weight (and therefore of BMI) in both men and women up to about 50 years of age, with women attaining a higher mean BMI. The increase is particularly marked in the 20–29-years age-group, amounting to ≈5–6 kg in men and 6–7 kg in women, with Indian men and women showing the greatest increase. Table 1 shows the prevalence of underweight, overweight and obesity for the four ethnic categories investigated. Obesity appears to be more prevalent in women than men and the rate in female Indians and Malays is particularly high.

For adults as a whole in Malaysia, 20.7% are overweight with a BMI between 25.0 and 29.9; a further 5.8% have BMIs of >30 (of whom 0.3% exceed the extreme WHO cut-off point of 40). The Malays have a greater prevalence of underweight, but overweight and obesity dominate the picture in all ethnic groups. Male Chinese show the greatest prevalence of obesity, with Malay adults showing the greatest spread of values in terms of both underweight and of overweight and obesity prevalences.

Study 2 provides some insight into the current energy intake, energy expenditure, BMR and physical activity levels of normal-weight adult Malaysians according to ethnic group and area. In men (Table 2), the energy intakes for all ethnic groups were below the recommended daily amount (RDA) for Malaysian men (10.5 MJ d^{-1}) but their measured TDEEs suggest that the intakes of the Malay men and the Indigenous group matched their energy expenditures, so their current energy requirements were being met. The discrepancies between the intakes and expenditures of the Chinese and Indian men probably reflect modest underreporting based on the measured TDEEs. These TDEEs are greater than those of the other ethnic groups in absolute terms and in part reflect the higher body weights of Chinese

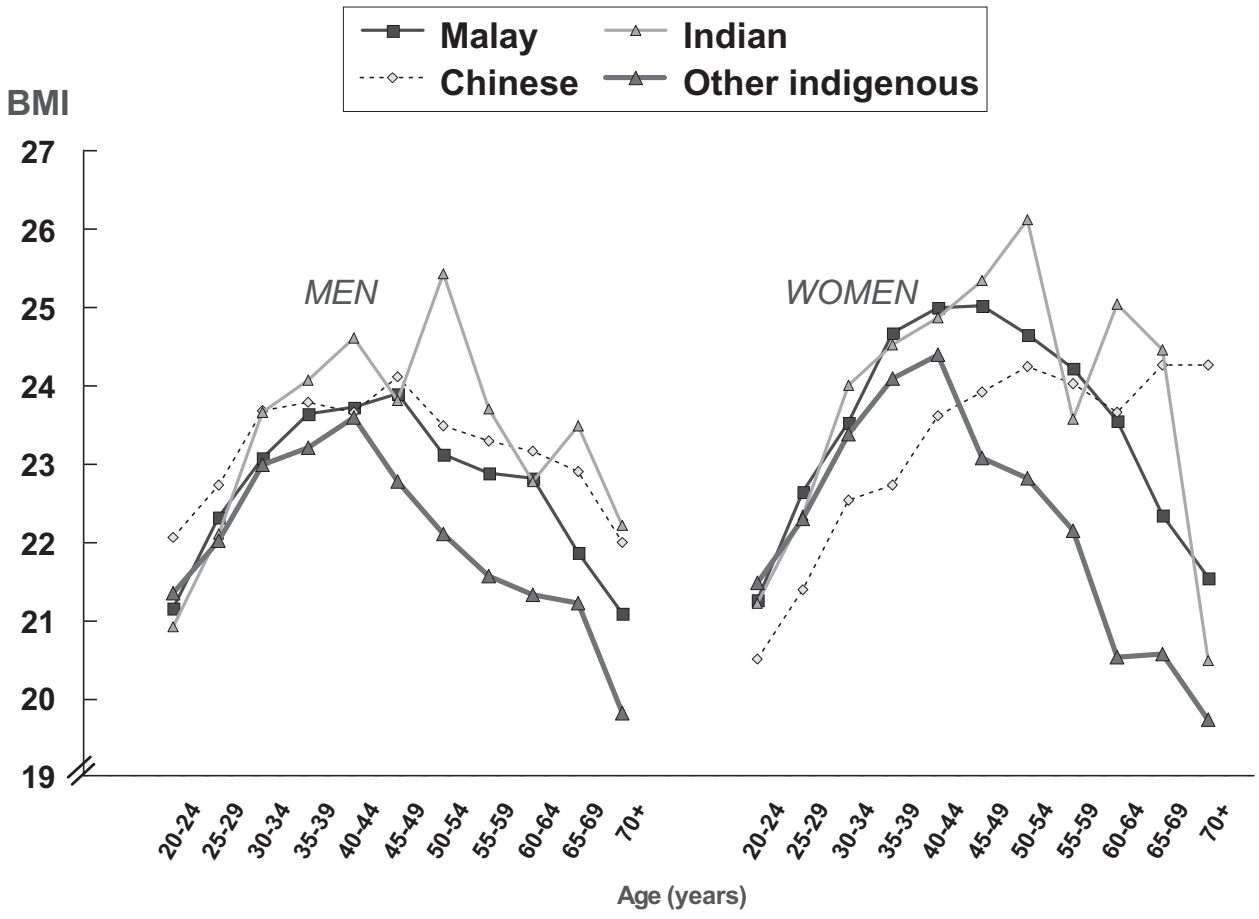

Figure 1 Increasing mean body mass index (BMI) in all ethnic groups with age.

Table 1 The age-adjusted prevalences of underweight, overweight and obesity in Malaysian men and women of different ethnic groups

	Underweight <18.5*	Overweight 25.0–29.9*	Obesity 2 30.0–39.9*	Obesity 3 >40.0*
Men				
All groups	11.5	20.1	3.8	0.2
Malay	12.3	19.9	4.2	0.2
Chinese	9.2	23.9	4.7	0.1
Indian	10.7	23.7	3.7	0.1
Other indigenous	11.6	17.1	2.8	0.0
Women				
All groups	14.1	21.4	7.2	0.4
Malay	14.7	23.9	9.0	0.6
Chinese	14.1	17.7	4.6	0.4
Indian	12.9	25.1	9.2	0.3
Other indigenous	16.6	19.6	6.3	0.1

*Body mass index (BMI) value, expressed in kg m^{-2}.
Extracted and recalculated from Lim *et al.* (6).

Table 2 Physical characteristics, food intake, basal metabolic rate (BMR), total daily energy expenditure (TDEE) and physical activity level (PAL) values of adult Malaysian men according to ethnic group and area

	Malay (n = 105)	Chinese (n = 41)	Indians (n = 42)	Indigenous (n = 24)	Urban (n = 117)	Rural (n = 95)
Age (years)	39 ± 10	41 ± 8	39 ± 7	34 ± 10	39 ± 9	39 ± 10
Weight (kg)	56.70 ± 4.3†	61.60 ± 5.4*	60.00 ± 5.7*	56.6 ± 5†	59.50 ± 5.5*	56.8 ± 4.8†
Height (m)	1.60 ± 0.05†	1.64 ± 0.05*	1.65 ± 0.05*	1.61 ± 0.05†	1.63 ± 0.05*	1.61 ± 0.05†
BMI (kg m^{-2})	22.00 ± 1.3†	22.80 ± 1.4*	22.00 ± 1.4†	22.00 ± 1.6†	22.40 ± 1.4*	21.90 ± 1.2†
Body fat (%)	17.80 ± 4.3‡	24.20 ± 3.2*	21.50 ± 3.0†	18.00 ± 3.9‡	21.00 ± 4.7*	18.30 ± 4.1†
Energy intake (MJ d^{-1})	9.13 ± 2*	8.46 ± 2.1*	8.27 ± 2.9†	9.34 ± 2.8*	9.52 ± 2.0*	8.47 ± 2.3†
BMR (MJ d^{-1})	5.60 ± 0.53†	5.63 ± 0.61†	5.89 ± 0.58†	6.13 ± 0.85*	5.62 ± 0.56†	5.72 ± 0.64*
Intake ÷ BMR	1.63	1.50	1.40	1.52	1.69	1.48
Fat intake (%)	20 ± 6†	32 ± 5*	22 ± 6†	21 ± 8†	29 ± 6*	19 ± 7†
TDEE (MJ d^{-1})	9.28 ± 1.4†	9.58 ± 2.0†	10.42 ± 2.0*	9.14 ± 1.3*	9.31 ± 1.8	9.73 ± 1.5
PAL (TDEE ÷ BMR)	1.65	1.69	1.77	1.49	1.65	1.70

Values with different superscripts indicate a significant difference ($P < 0.05$) between the groups in each set of values.

and Indian men. Nevertheless, the physical activity levels (PALs) were still greater in the Chinese and Indian men who are therefore more active. Although the results also show that the energy intake of urban men was significantly higher than that of rural men, these data are again not matched by the TDEE values and the PALs, indicating, as expected, that the rural men are relatively more active. It seems probable therefore that the rural group tended to under-report their intake. With the exception of the indigenous men – the Dayaks, who were observed to be very inactive with a high level of unemployment – the other ethnic groups were moderately active, with PALs of 1.65–1.77. The BMRs reported were 10–13% lower than the BMR estimated using the FAO/WHO/UNU (7) formula, but only differed by 3% when compared with the formula of Henry & Rees (18) for populations living in the tropics.

One of the striking features of the data is the very substantial increase in the fat intakes of urban men, which is also evident in the values for the Chinese, who live predominantly in the urban setting whereas the Malays and Indigenous groups dominate the rural community.

In women (Table 3), similar trends were observed in that all ethnic groups reported consuming less energy than the RDA of 8.4 MJ d^{-1}. While the Malays recorded a significantly higher energy intake than the others, they appear to be in energy balance (EI = TDEE). The Chinese, Indians and Dayak women were, theoretically, in negative energy balance, but again their lower EI : BMR ratio suggested an under-reporting of their habitual food intake. The PAL values were also systematically lower than those of the men, in keeping with an observed lower involvement in physical activity. With the exception on the Indian women (who were, in general, moderately active as palm oil estate workers in the morning and employed in an electronic company in the evening), the others were relatively sedentary. This pattern is also seen in young adult women

Table 3 Physical characteristics, energy intake, basal metabolic rate (BMR), total daily energy expenditure (TDEE) and physical activity level (PAL) values of adult Malaysian women according to ethnic group and area

	Malay ($n = 91$)	Chinese ($n = 33$)	Indians ($n = 46$)	Indigenous ($n = 27$)	Urban ($n = 83$)	Rural ($n = 114$)
Age (years)	38 ± 10	35 ± 10	36 ± 8	37 ± 12	34 ± 8†	39 ± 10*
Weight (kg)	47.40 ± 4.7†	51.70 ± 4.2*	49.1 ± 4.6†	47.6 ± 4.1†	49.90 ± 4.7*	47.50 ± 4.6†
Height (m)	1.49 ± 0.05†	1.55 ± 0.04*	1.53 ± 0.05*	1.48 ± 0.04†	1.53 ± 0.06*	1.50 ± 0.05†
BMI (kg m^{-2})	21.30 ± 1.5*†	21.50 ± 1.2*†	21.00 ± 1.4†	21.70 ± 1.3*	21.4 ± 1.3	21.20 ± 1.5
Body fat (%)	30.30 ± 4.8†‡	32.30 ± 3.2*	31.10 ± 3.0*†	29.10 ± 3.9‡	31.10 ± 3.7	30.30 ± 4.5
Energy intake (MJ d^{-1})	7.85 ± 1.8*	6.95 ± 1.3†	6.40 ± 1.1†	6.63 ± 1.1†	7.19 ± 1.6	7.16 ± 1.6
BMR (MJ d^{-1})	4.72 ± 0.42†	4.74 ± 0.39†	4.57 ± 0.35†	5.15 ± 0.70*	4.77 ± 0.43	5.13 ± 0.64
Intake ÷ BMR	1.66	1.47	1.40	1.29	1.51	1.40
Fat intake (%)	22 ± 6†	32 ± 6*	22 ± 8†	19 ± 7†	30 + 6*	21 + 7†
TDEE (MJ d^{-1})	7.82 ± 1.8†	7.19 ± 1.0†	8.15 ± 1.3*	8.13 ± 1.1*	7.64 ± 1.2	8.23 ± 1.2
PAL (TDEE ÷ BMR)	1.65	1.52	1.78	1.58	1.60	1.60

Values with different superscripts show a significant difference ($P < 0.05$) between the groups.

Table 4 The prevalences (%) of comorbidities in rural Malaysian adults

	Women ($n = 346$)	Men ($n = 263$)
Age (years)	44.0	45.2
BMI 25–29.9 kg m^{-2}	35.1	32.6
BMI >30.0 kg m^{-2}	15.4	6.1
Waist : hip ratio (>0.8 in women and >0.9 in men)	60.4	33.1
Total cholesterol >5.2 mmol L^{-1}	63.0	73.0
Low HDL-c (<0.9 mmol L^{-1})	9.3	19.4
Hypertension	30.9	29.8
Diabetes mellitus	7.5	4.7
Glucose intolerance	16.1	10.9

BMI, body mass index; HDL-c, high-density lipoprotein cholesterol.

(18–30 years of age) with PAL values ranging from 1.47 to 1.57. The TDEEs, PALs and the mean energy intake between urban and rural populations were similar, but the contribution of fat to the total energy intake of urban subjects was substantially higher than in their rural counterparts and in keeping with the men's fat intake. The Chinese women also had a significantly higher fat intake than women of the other groups. The measured BMRs of the women were also lower by between 5 and 10% when compared with the FAO/WHO/UNU (7) standards, but only differed by 1–2% when the equations of Henry & Rees (18) were used.

Table 4 summarizes some results from the recent Study 3 on the comorbidities of Malays living in rural areas. What is intriguing is the far greater prevalences of overweight and obesity in these rural populations than in Malays in general. Only 2 years elapsed between the national study and this local study so the differences are probably genuine, especially as the villagers were not included in the local study if they were already known to have had cardiovascular disease. The measurements of the waist : hip ratio also showed a very high prevalence of abdominal obesity, which was substantially more prevalent than that previously seen in a group of senior civil servants serving in Kuala Lumpur (19) who were also less obese. Having already excluded subjects with previous strokes and clinical coronary disease, the prevalence of coronary risk factors is extremely high.

The prevalences of diabetes and glucose intolerance are also exceptionally high, so this rural population is clearly at great risk.

Discussion

Although it is only recently that concern has been raised about the problem of obesity in Malaysia, these preliminary data suggest that Malaysia can expect to see a very high rate of cardiovascular disease and diabetes in the near future as a consequence of the high prevalences of overweight and obesity. All ethnic groups in Malaysia seem to be involved in nutritional transition, with rapidly increasing rates not only of overweight but particularly of abdominal obesity with its recognized serious health outcomes. There are new analyses underway in the Ministry of Health which will allow a clear national picture to be constructed of the national prevalences of lipid disorders, hypertension and diabetes. However, the current summary suggests that the problems are already serious.

Other studies also highlight the very low levels of physical activity in young Malaysian adults, who, even in their twenties, are gaining weight at substantial rates. Inactivity could well be a major contributor as to why women are more prone to obesity problems than men. Given the known interactions of the energy density of the diet and physical activity (20), and the emergence of substantial

rates of overweight in these populations on only a 20% fat intake, it is becoming clear that a 30% fat intake is high if this occurs in relatively inactive or only modestly active adults. The recent WHO (2) report noted, in addition to the benefit of maintaining good physical activity, that the optimum fat intake for preventing weight gain was probably only 20–25%. This contrasts with the usual advice for the prevention of cardiovascular disease where the emphasis is on the fatty acid content of the diet, with a 30% total fat value being a pragmatically derived goal as part of the need to limit saturated fatty acid intakes. Clearly there is the need for a national strategy to tackle both contributors to the excess weight gain of the Malaysian population.

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