

Daily Energy Intake from Meals and Afternoon Snacks: Findings from the Malaysian Adults Nutrition Survey(MANS)

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ABSTRACT

Meal and snack patterns are associated with energy and nutrient intakes and consequently health and nutritional status. The aim of this paper is to describe the percentage of daily energy intake from meals and afternoon snack among Malaysian adults. The study included a representative sample of adults aged 18-59 years (n=7349) from a nationwide Food Consumption Survey conducted by the Ministry of Health. Information on dietary intake was obtained using a one day 24-hour diet recall (24-HDR). Dietary data on 6886 adults were analysed using Nutritionist Pro™ and statistical analysis was carried out using the SPSS 13.0. The median percentage of daily energy intake is reported only for adults consuming meals and afternoon tea and by socio-demographic characteristics as well as body mass index (BMI) status. More than 80% of Malaysian adults consumed morning meals, lunch and dinner and 54% reported having afternoon tea. The median percentage of energy intake from morning meals, lunch, dinner and afternoon tea was 29.9%, 30.5%, 32.4% and 17%, respectively. There were variations in the median percentage of energy from meals and snacks according to the socio-demographic variables and BMI status. It is important to understand the eating patterns of Malaysians as the information can assist in efforts to address obesity and diet-related chronic diseases among adults.

INTRODUCTION

Frequency of eating, types of food taken for meals and snacks, meal formats, daily or weekly meals and feast-type meals are influenced by cultural rules which eventually could impact dietary intakes

(Bryant *et al.*, 2003). Although there is no clear definition of meals and snacks, quantitative definitions have been frequently used to differentiate meals from snacks including the contribution of calories, different types and portion sizes of foods, and minimal time interval between eating

occasions (Gibney & Wolever, 1997). Consequently, the lack of uniformity in the definitions and the ambiguous meanings of meals and snacks have contributed to the difficulty in identifying the health and nutritional implications of such eating occasions (Gatenby, 1997).

Meal and snack patterns have been shown to have effects on body weight (Song *et al.*, 2005; Ma *et al.*, 2003), lipid profiles (Titan *et al.*, 2001, Mann, 1997; Edelstein *et al.*, 1992), cognition (Rampersaud *et al.*, 2005), carbohydrate tolerance (Jenkins, 1997) and cardiovascular outcomes (Redondo *et al.*, 1997; Fabry *et al.*, 1968). The effects of meal and snack patterns on human health, however, may depend on the types and distribution of foods consumed throughout the day, the frequency and size of meals and snacks as well as physical activity level and total energy intake (Bellisle, McDevitt & Prentice, 1997; Jenkins *et al.*, 1994). In other words, the association between meal and snack patterns with health and nutritional status may be mediated predominantly through the intakes of macro-nutrients and micro-nutrients or diet quality (Kerver *et al.*, 2006)

Description of meal and snack patterns of a population is important as it can enhance our understanding of both the physiological effects and health-related behaviours associated with a specific meal and snack pattern (Gibney & Wolever, 1997). The information is pertinent in efforts to address the increasing rate of obesity and diet-related chronic diseases in many populations worldwide. Therefore, this paper aims to describe the percentage of energy intake from meals (morning meal, lunch and dinner) and afternoon snacks among the Malaysian adults.

MATERIALS AND METHODS

Sampling

The Malaysian Adult Nutrition Survey, a cross-sectional population survey, was carried out between 2002 and 2003 in Peninsular Malaysia, Sabah and Sarawak. The survey utilised stratified random sampling which covered six zones (Southern, Central, East Coast and Northern zones of Peninsular Malaysia, Sabah and Sarawak) and sampling units (Enumeration Blocks (EB) and Living Quarters (LQ)) that were proportionate to the size of the adult population in Malaysia. Sample size (N=8670) for the survey was calculated based on the estimated prevalence of obesity and overweight (21%) from the Second National Health and Morbidity Survey 1996, 95% level of confidence, 5% margin of error and a non-response rate of 50%

Subjects

A total of 7349 adults between the ages 18-59 years were interviewed and this sample size corresponded to the total estimated population of 14,178,135. The adults comprised 51% men and 49% women. About 60% and 40% of the estimated population was from the urban (metropolitans and cities) and rural (towns, villages) areas, respectively. In this survey, there were 54.4% Malays, 24.9% Chinese, 9.7% Indians, 4.4% Bumiputera Sarawak (Bumiputra groups other than Malays), 4.1% Bumiputera Sabah (Bumiputra groups other than Malays), 2.0% Other Bumiputra (Bumiputra groups other than Malays, Bumiputra Sabah, Bumiputra Sarawak and Orang Asli of Peninsular Malaysia) and 0.5% Orang Asli. About 30% of the adults were in the 20-29 years age

group, followed by 30-39 years (25.8%), 40-49 years (20.5%), 50-59 years (13.5%) and 18-19 years (10.2%). More than one-third (34.6%) had achieved upper secondary level of education and proportions completed primary, lower secondary, matriculation/form 6, college/university were 19.1%, 20.3%, 5.6% and 15.5%, respectively. About 4.9% did not receive any formal education.

Measurements

Socio-demographic variables

A questionnaire was developed to obtain socio-demographic information which included gender, ethnicity, age group, educational level, strata (rural/urban) and zone (South, Central, East-Coast, North, Sabah and Sarawak).

Anthropometric measurements

Respondents were measured for weight and height for the calculation of body mass index (BMI, kg/m^2). Respondents were then categorised as underweight (<18.5), normal (18.5-24.9), overweight (25-29) and obese (≥ 30) (WHO, 1995).

Dietary intake

Dietary intake information was obtained using an adapted and pre-tested interactive 24-hour dietary recall method (24-HDR) (Gibson & Ferguson, 1999). A one-day 24-hour dietary recall was obtained from all respondents. The respondents were asked on the meal type, time and venue of consumption, description and quantities of foods and beverages (including alcohol) consumed over a 24-hour period (midnight to midnight) of the day prior to the day of interview. Dietary assessment aids such as the food album (MOH, 2004) and household measures were used to facilitate the

respondents in identification of foods and quantification of portion sizes eaten. The food album consisted of photographs of commonly consumed foods by Malaysians.

The 24-HDR questionnaire was interviewer-administered. All interviews were conducted in Bahasa Malaysia (BM) by trained enumerators. However, in situations where the respondents were not able to understand the language, the interview was conducted in the respective vernacular medium.

Dietary Intake Analysis

The dietary intake analysis of the Malaysian Adult Nutrition Survey 2003 was based on 6886 individuals (3316 males and 3415 females) between the ages of 18-59 years. However, the analysis on energy intake from meals and snack is based only on data of respondents who reported consuming the morning meal ($n=6197$), lunch ($n=6094$), dinner ($n=6328$) and afternoon snack ($n=3718$). Data cleaning and quality control checks were carried out before dietary intake analysis was performed. Nutritionist Pro™ (First Data Bank, USA) software was used for energy and nutrient analysis. Food databases utilised in the analysis included USDA Food Database, Malaysian Food Composition Tables, Singapore Food Composition Guide, ASEAN Food Composition Tables and The Composition of Chinese Food. For local complex mixed cooked dishes that were not available in any of the food databases, local recipe books were used to identify at least two recipes for each dish. These recipes were analysed for energy and nutrient values and the average of these values were entered into Nutritionist Pro™ software to be used as a standard for dietary analysis of the food. For processed and packaged foods that have energy and nutrient information on their labels, the

information was entered into the software for dietary analysis of these foods. Energy and nutrient estimates were based exclusively on food consumption. Vitamin and mineral supplements were not considered in the analysis of nutrient intakes.

The definitions for morning meals, lunch, dinner and afternoon tea are based on the time period that the foods were consumed by the respondents –

Morning meals : 12 am – 11 am
 Afternoon meal or lunch : 11 am – 3 pm
 Afternoon tea : 3 – 6 pm
 Evening meals or dinner : 6 pm – 11.59 pm

The morning meals included early morning meal or 'sahur' and morning tea. We used this definition for two reasons. First, to address the first eating occasion of the day which usually occurs during this time period. Second, to account for respondents who had the first meal (foods or beverages) that did not yield $\frac{1}{4}$ of the required daily energy intake but eventually had meals within this time period to compensate for the inadequate intake. The evening meals include both dinner and supper. Afternoon tea was reported as it is the most common snack consumed by Malaysians.

Statistical Analysis

Data on energy and nutrient intakes were analysed using Statistical Package for Social Sciences (SPSS) version 13.0 for complex sampling design. A weight was calculated for sampling design, non-response and post-stratification for stratum, age and sex and added in the analysis for extrapolation of the findings to the Malaysian population. As the distribution of energy intake was skewed, the median percentage of energy

was determined to characterise population intake levels. The median percentage of energy was determined only for those who reported consuming the meals and snack and was calculated separately for total population, men, women, and according to socio-demographic (zone, strata, ethnicity, age and education level) characteristics and BMI status. The use of median, however, is not recommended for statistical comparison among levels of the independent variables, that is, socio-demographic characteristics and BMI status.

RESULTS

Morning Meals

Table 1 shows the median percentage of energy from morning meals by socio-demographic characteristics and BMI status of Malaysians. The median percentage of energy intake from morning meals for Malaysians was 29.90% with similar medians reported for men (29.94%) and women (29.86%).

Men and women in all zones, except for the Central and Sabah zones, had similar median percentages of energy from morning meals. The range of median percentage for the total population was 25.2% - 31.5% with populations in Sarawak and Southern zone having the lowest and highest median percentages, respectively. Similar trends were also observed in men but not in women. Men and women of both urban and rural areas had similar energy intakes from morning meals. In each sex and total population, the rural population (30.2%-30.7%) consumed slightly more energy from morning meals than the urban population (29.2-29.6%).

Other Bumiputra men (30.0%) had higher median percentages than women in

the same group. On the other hand, Orang Asli (31.2%) and Bumiputra Sarawak (26.7%) women had higher median percentages than men. Bumiputra Sarawak total population (25.7%) and men (25.5%), and Other Bumiputra women (26.3%) had the lowest median percentages. The highest median percentages were observed for Orang Asli total population (31.0%) and women (31.2%) and Indian/Punjabi men (31.4%).

Men and women in all age groups had similar median percentage of energy from morning meals. Total population (30.3%) and men (31.6%) in the youngest age group (18-19 years) had the highest median percentage of energy from morning meals. The lowest percentage of energy from morning meals was observed in total population (29.5%) and men (29.0%) of 50-59 years. Women in all age groups had similar median percentages of energy from morning meals (29.4 - 30.1%).

The median percentages of energy from morning meals in all education groups were similar between men and women, except that for the Matriculation/Form 6 group. Matriculation/Form 6 women (29.4%) and College/University men (29.4%) and total population (29.2%) had the least median percentages. The highest median percentages were observed for women in Others group (30.6%), Lower Secondary School total population (30.5%) and men with Matriculation/Form 6 (30.5%).

Men and women in all BMI groups did not differ in median percentages of energy from morning meals. While underweight Malaysians (total population, men and women) tend to have the lowest median percentages (28.3%-28.8%) of energy from morning meals, obese Malaysians had the highest median percentages (30.5%).

Lunch

The median percentages of energy from lunch by socio-demographic characteristics and BMI status are shown in Table 2. Lunch contributed to about 30.5% of the total daily energy intake of Malaysians with a higher median percentage reported for women (31.0%) than men (30.0%).

Men from the East Coast (28.4%) and Sabah (31.7%) consumed a lower percentage of energy from lunch than East Coast (29.6%) and Sabahan (32.2%) women. While the East Coast population (men – 28.4%, women – 29.6%, total population – 29.1%) had the lowest median percentages, Sarawakians (men – 31.7%, women – 32.4%, total – 32.1%) had the highest consumption of energy from lunch. Compared to the urban men (29.9%), urban women (31.0%) had higher median percentage of energy from lunch. In both men and women, energy intake from lunch is similar in rural and urban areas.

Chinese, Indian/Punjabi, Orang Asli and Bumiputra Sabah women had higher median percentages of energy from lunch than men. The lowest median percentages were observed for Indian/Punjabi total population (29.8%), men (29.3%) and women (30.4%) while the highest intakes were for Bumiputra Sarawak men (32.99%) and Orang Asli total population (33.3%) and women (37.7%).

Women in the age groups of 20-29 years (30.8%) and 30-39 years (31.2%) consumed more energy from lunch than men (29.2% and 29.4%). Men in the age groups of 18-19 years (30.7%) and of 20-29 years (29.2%) had the highest and lowest percentages of energy from lunch, respectively. The total population (30.1 - 30.8%) and women (30.8 - 31.5%) in all age groups had similar energy intakes from lunch.

Table 1. Median percentage of energy from morning meal by socio-demographic characteristics and BMI status

<i>Characteristics</i>	<i>Total</i>		<i>Men</i>		<i>Women</i>	
	<i>Median</i>	<i>Estimated Population</i>	<i>Median</i>	<i>Estimated Population</i>	<i>Median</i>	<i>Estimated Population</i>
Malaysia Zone^a	29,90	13.027.227	29,94	6.575.195	29,86	6.452.032
South	31,48	2.690.313	31,50	1.363.117	31,47	1.327.195
Central	29,91	4.870.100	30,43	2.483.004	29,28	2.387.096
East coast	31,42	1.514.148	31,10	772.374	31,96	741.774
North	29,90	1.776.759	29,73	856.269	29,96	920.490
Sabah	28,46	1.066.190	29,11	550.248	28,09	515.942
Sarawak	25,21	1.109.718	24,86	550.184	25,25	559.534
Strata ^b						
Urban	29,41	7.650.564	29,64	3.842.990	29,16	3.807.574
Rural	30,44	5.376.663	30,20	2.732.205	30,69	2.644.458
Age Groups						
18-19	30,33	1.209.905	31,60	616.230	29,63	593.675
20-29	29,99	3.784.148	29,94	1.877.338	30,11	1.906.809
30-39	29,72	3.406.998	30,03	1.709.368	29,40	1.697.630
40-49	29,96	2.775.831	30,02	1.412.695	29,93	1.363.136
50-59	29,48	1.850.346	29,03	959.564	29,95	890.782
Ethnic Groups^c						
Malay	30,82	7.064.253	30,83	3.580.059	30,79	3.484.194
Chinese	28,50	3.257.348	28,79	1.628.524	28,20	1.628.824
Indian/Punjabi	30,61	1.240.969	31,37	621.223	29,59	619.746
Orang Asli PM	31,05	69.202	29,46	38.171	31,21	31.031
Bumiputra Sabah	29,55	547.173	29,70	270.250	29,28	276.923
Bumiputra Sarawak	25,69	586.439	25,46	297.289	26,72	289.149
Other bumiputra	27,46	261.843	30,04	139.678	26,31	122.165
Educational Level						
Primary School	29,61	2.596.818	29,48	1.171.108	29,82	1.425.710
Lower Secondary School	30,53	2.652.407	30,49	1.505.393	30,53	1.147.014
Upper Secondary School	29,95	4.466.561	30,02	2.273.440	29,92	2.193.121
Matriculation/ Form 6	29,64	720.854	30,53	283.345	29,39	437.510
College/ University	29,23	1.954.118	29,43	1.154.086	28,85	800.032
Others	30,23	620.744	29,86	187.823	30,55	432.921
BMI Status						
Underweight	28,48	1.183.162	28,75	545.610	28,30	637.552
Normal	29,96	6.461.394	29,91	3.462.905	30,11	2.998.489
Overweight	29,82	3.512.139	29,78	1.907.755	29,85	1.604.385
Obese	30,48	1.585.874	30,38	634.939	30,54	950.935

^a South=Negeri Sembilan, Melaka, Johor; Central=Perak, Selangor, Wilayah Persekutuan; East Coast=Kelantan, Terengganu, Pahang; North=Perlis, Kedah, Pulau Pinang

^b Urban=metropolitans, cities; Rural=small towns, villages

^c Bumiputra Sabah=Bumiputra groups other than Malays; Bumiputra Sarawak=Bumiputra groups other than Malays; Other Bumiputra=Bumiputra groups other than Malays, Bumiputra Sabah and Sarawak, Orang Asli of Peninsular Malaysia

Table 2. Median percentage of energy from lunch by socio-demographic characteristics and BMI status

<i>Characteristics</i>	<i>Total</i>		<i>Men</i>		<i>Women</i>	
	<i>Median</i>	<i>Estimated Population</i>	<i>Median</i>	<i>Estimated Population</i>	<i>Median</i>	<i>Estimated Population</i>
Malaysia Zone^a	30,49	12.551.243	29,99	6.376.417	30,99	6.174.826
South	30,36	2.583.028	29,98	1.325.117	31,07	1.257.911
Central	30,27	4.691.213	29,99	2.396.524	30,49	2.294.689
East coast	29,14	1.407.561	28,44	749.618	29,57	657.943
North	30,86	1.749.481	30,26	835.465	31,23	914.016
Sabah	31,30	1.013.856	30,27	511.177	32,22	502.679
Sarawak	32,14	1.106.104	31,65	558.516	32,39	547.588
Strata ^b						
Urban	30,45	7.391.340	29,97	3.717.765	31,01	3.673.575
Rural	30,56	5.159.903	30,09	2.658.652	30,99	2.501.251
Age Groups						
18-19	30,78	1.230.800	30,71	604.313	31,50	626.487
20-29	30,06	3.724.365	29,22	1.899.288	30,79	1.825.078
30-39	30,41	3.273.441	29,42	1.642.017	31,16	1.631.424
40-49	30,84	2.604.215	30,61	1.346.585	31,04	1.257.630
50-59	30,52	1.718.422	30,49	884.215	30,81	834.208
Ethnic Groups^c						
Malay	29,98	6.752.996	29,61	3.494.023	30,45	3.258.973
Chinese	30,77	3.172.137	30,12	1.605.935	31,52	1.566.202
Indian/Punjabi	29,84	1.203.081	29,28	550.080	30,37	653.001
Orang Asli PM	33,33	65.908	29,82	38.171	37,69	27.737
Bumiputra Sabah	31,67	523.462	29,80	249.213	32,43	274.249
Bumiputra Sarawak	32,97	581.191	32,99	302.304	32,91	278.887
Other bumiputra	31,68	252.469	31,83	136.691	31,05	115.777
Educational Level						
Primary School	31,30	2.493.790	31,01	1.119.539	31,58	1.374.252
Lower Secondary School	30,29	2.480.331	30,27	1.464.309	30,40	1.016.022
Upper Secondary School	29,99	4.321.797	29,14	2.168.498	30,66	2.153.298
Matriculation/ Form 6	29,34	715.413	29,24	276.317	29,59	439.096
College/ University	30,02	1.908.219	29,55	1.146.563	31,04	761.656
Others	31,94	620.510	31,10	197.117	32,84	423.393
BMI Status						
Underweight	30,00	1.228.876	29,85	602.137	30,05	626.739
Normal	29,83	6.240.033	29,26	3.387.309	30,34	2.852.724
Overweight	30,78	3.337.840	30,42	1.783.438	31,01	1.554.403
Obese	32,54	1.457.479	32,10	584.750	32,89	872.729

^a South=Negeri Sembilan, Melaka, Johor; Central=Perak, Selangor, Wilayah Persekutuan; East Coast=Kelantan, Terengganu, Pahang; North=Perlis, Kedah, Pulau Pinang

^b Urban=metropolitans, cities; Rural=small towns, villages

^c Bumiputra Sabah=Bumiputra groups other than Malays; Bumiputra Sarawak=Bumiputra groups other than Malays; Other Bumiputra=Bumiputra groups other than Malays, Bumiputra Sabah and Sarawak, Orang Asli of Peninsular Malaysia

Women with non-formal, higher secondary and college/university education had higher percentage of energy from lunch than men with similar educational levels. Among the educational groups, men (31.1%), women (32.8%) and total (31.9%) in Others group had the highest median percentages. The lowest median percentages were observed for total (29.3%) and women (29.6%) with Matriculation/Form 6 and men (29.1%) with higher secondary education.

Normal weight women (30.3%) consumed higher percentages of energy from lunch than normal weight men (29.3%). Total population (29.8%) and men (29.3%) with normal weight and underweight women (30.0%) had the lowest median percentages while obese men (32.1%), women (32.9%) and total population (32.5%) had the highest median percentages.

Dinner

The median percentages of energy from dinner by socio-demographic characteristics and BMI status are presented in Table 3. Among the meals (breakfast, lunch and afternoon tea) consumed by Malaysians, dinner contributed the highest percentage (32.4%) of total daily energy intake with men (33.4%) having a higher median percentage than women (31.1%).

In all zones, men consumed more percentage of energy from dinner than women. The lowest median percentages were observed among population (men – 31.9%, women – 27.8%, total – 29.9%) on the East Coast, while the highest were among the Sarawakians (men – 34.9%, women – 33.2%, total – 34.2%). Urban (34.3%) and rural (32.3%) men consumed higher percentages of energy from dinner than urban (32.7%) and rural (29.7%) women. In general, the urban population had higher median percentages than the rural population.

Except for Chinese and Indian/Punjabi, men in other ethnic groups had higher median percentages than women. While Chinese total population (36.1%), men (36.2%) and women (36.1%) had most energy during dinner, the Orang Asli total population (27.7%) and women (22.7%) and Malay men (32.1%) had the least.

Men aged 20 years and older had higher median percentages of energy from dinner than women in the same age group. Individuals (men, women and total population) in the oldest age group (50-59 years) had the lowest median percentage energy intake from dinner. Total population (34.67%) and women (34.8%) in the youngest age group (18-19 years) and men 20-29 years (35.6%) consumed the highest percentage energy during dinner.

In all education groups, higher median percentages were reported for men than women. Malaysians (men – 35.7%, women – 33.4%, total – 34.7%) with college/university education had the highest median percentage of energy from dinner. Lowest median percentage of energy from dinner was observed among Malaysians with non-formal education (men – 32.1%, women – 30.1%, total – 30.7%).

Underweight men and women had similar median percentages of energy from dinner but in other BMI groups, men had higher median percentages than women. While obese women (30.2%) reported the least median percentage of energy from dinner, obese men (34.9%) reported the highest median percentage. Underweight women (34.4%) and normal weight men (33.0%) had the highest and lowest median percentages, respectively. For the total population, underweight individuals (34.4%) had the least percentage of energy from dinner while overweight individuals (32.2%) had the highest.

Afternoon Tea

Table 4 shows the median percentage of energy from afternoon tea for Malaysians who reported taking afternoon tea. Afternoon tea contributed about 16.8% of the total daily energy intake with similar median percentages observed for men (16.5%) and women (17.1%).

While men and women in the Southern and Central zones had similar percentages of energy from afternoon tea, women in other zones had a higher percentage of energy from afternoon tea than men. In general, the population on the East Coast had the highest (19.1%) while those in Sarawak (12.3%) had the lowest median percentages of energy from afternoon tea. The percentage energy from afternoon tea was lowest among Sarawakian men (10.8%) and women (13.6%) and highest among men and women of the Central (18.2%) and East Coast (20.4%) regions, respectively.

A similar percentage of energy was observed in urban men and women but a higher percentage was reported for rural women (16.7%) than men (15.4%). Compared to the urban population (17.4%), the rural population (16.0%) had a lower median percentage of energy from afternoon tea. Similarly, rural men (15.4%) and women (16.7%) had lower median percentages of energy from afternoon tea than urban men (17.3%) and women (17.5%).

Orang Asli, Bumiputra Sabah and Bumiputra Sarawak women had a higher percentages of energy than men while the reverse was true for Chinese. While Orang Asli men consumed the lowest (8.4%) energy percentage from afternoon tea, the Orang Asli women had the highest (26.5%) energy percentage. Malay men (17.9%) and Bumiputra Sarawak women (12.1%) had the highest and lowest percentage of energy from afternoon tea, respectively.

Men and women in all age groups, except for 18-19 and 40-49 years, had similar percentages of energy from afternoon tea. The percentage of energy from afternoon tea decreases with increasing age of the population. The 18-19 age group showed the highest (19.3%) median percentage while the 50-59 age group had the lowest (14.3%) energy percentage from afternoon tea. A similar pattern was observed among men but the percentage contribution of energy from afternoon tea was variable in women.

Men with Matriculation/Form 6 education group consumed lower percentage energy than women in the same education group. On the other hand, more women than men with non-formal, primary and college/university education had a higher percentage of energy intake. The lowest median percentage of energy from afternoon tea was observed in total population (14.1%), men (12.07%) and women (14.5%) in the Others group. Total population (17.8%) and men (19.0%) with Matriculation/Form 6 education and women with lower secondary school education (17.8%) had the highest energy percentage from afternoon tea.

Except for underweight group, men and women in the other BMI groups had similar percentages of energy. Population (16.2%), men (15.7%) and women (16.6%) with normal BMI had the lowest median percentage of energy from afternoon tea. While obese population (17.8%) and women (17.7%) consumed the highest energy percentage from afternoon tea, underweight men had the highest (18.2%) energy percentage.

DISCUSSION

About 90% of Malaysian adult population consumed morning meals and the median percentage of total daily energy intake from

Table 3. Median percentage of energy from dinner by socio-demographic characteristics and BMI status

<i>Characteristics</i>	<i>Total</i>		<i>Men</i>		<i>Women</i>	
	<i>Median</i>	<i>Estimated Population</i>	<i>Median</i>	<i>Estimated Population</i>	<i>Median</i>	<i>Estimated Population</i>
Malaysia Zone^a	32,35	13.357.420	33,36	6.834.077	31,14	6.523.343
South	32,45	2.769.460	33,73	1.414.750	31,18	1.354.710
Central	33,48	5.127.395	34,01	2.641.183	32,66	2.486.211
East coast	29,90	1.502.806	31,96	782.049	27,77	720.757
North	31,34	1.764.240	32,80	863.448	30,29	900.792
Sabah	31,60	1.048.464	33,19	543.776	30,07	504.688
Sarawak	34,19	1.145.055	34,97	588.871	33,19	556.184
Strata^b						
Urban	33,65	7.975.060	34,26	4.062.588	32,71	3.912.472
Rural	30,86	5.382.360	32,25	2.771.489	29,70	2.610.871
Age Groups						
18-19	34,67	1.298.043	34,67	648.633	34,82	649.411
20-29	33,63	3.978.838	35,64	2.043.893	32,18	1.934.944
30-39	31,48	3.474.628	32,17	1.774.848	30,63	1.699.780
40-49	32,01	2.769.336	33,17	1.420.490	30,79	1.348.845
50-59	30,80	1.836.575	31,91	946.212	29,70	890.362
Ethnic Groups^c						
Malay	30,51	7.179.132	32,13	3.748.734	28,90	3.430.398
Chinese	36,11	3.420.415	36,23	1.713.676	36,09	1.706.739
Indian/Punjabi	32,91	1.310.349	33,09	628.712	32,83	681.637
Orang Asli PM	27,71	61.634	32,82	36.710	22,66	24.924
Bumiputra Sabah	31,05	539.515	32,36	269.865	29,36	269.651
Bumiputra Sarawak	34,15	588.911	35,16	303.633	32,44	285.277
Other bumiputra	31,00	257.465	33,46	132.748	30,11	124.717
Educational Level						
Primary School	31,52	2.539.694	32,91	1.162.627	30,60	1.377.067
Lower Secondary School	32,43	2.707.372	33,08	1.547.763	30,66	1.159.609
Upper Secondary School	32,34	4.600.174	33,20	2.367.322	31,61	2.232.852
Matriculation/ Form 6	31,13	737.747	32,67	293.995	30,39	443.753
College/ University	34,67	2.117.485	35,69	1.261.488	33,42	855.998
Others	30,75	635.148	32,12	196.809	30,14	438.339
BMI Status						
Underweight	34,40	1.275.694	34,58	629.927	34,36	645.767
Normal	32,18	6.633.782	33,01	3.588.238	30,94	3.045.544
Overweight	32,17	3.560.872	33,17	1.926.315	30,93	1.634.557
Obese	32,50	1.591.617	34,92	666.661	30,20	924.956

^a South=Negeri Sembilan, Melaka, Johor; Central=Perak, Selangor, Wilayah Persekutuan; East Coast=Kelantan, Terengganu, Pahang; North=Perlis, Kedah, Pulau Pinang

^b Urban=metropolitans, cities; Rural=small towns, villages

^c Bumiputra Sabah=Bumiputra groups other than Malays; Bumiputra Sarawak=Bumiputra groups other than Malays; Other Bumiputra=Bumiputra groups other than Malays, Bumiputra Sabah and Sarawak, Orang Asli of Peninsular Malaysia

Table 4. Median percentage of energy from afternoon tea by socio-demographic characteristics and BMI status

<i>Characteristics</i>	<i>Total</i>		<i>Men</i>		<i>Women</i>	
	<i>Median</i>	<i>Estimated Population</i>	<i>Median</i>	<i>Estimated Population</i>	<i>Median</i>	<i>Estimated Population</i>
Malaysia Zone^a	16.79	7,514,065	16.51	3,848,783	17.09	3,665,282
South	16.53	1,490,825	16.85	766,392	16.25	724,433
Central	18.07	2,772,347	18.21	1,433,970	17.83	1,338,377
East Coast	19.13	962,810	16.80	489,745	20.41	473,065
North	17.47	954,724	16.56	457,657	18.18	497,067
Sabah	14.19	630,320	13.18	342,081	15.06	288,239
Sarawak	12.32	703,040	10.84	358,939	13.59	344,101
Strata^b						
Urban	17.44	4,347,772	17.30	2,248,506	17.50	2,099,266
Rural	16.01	3,166,293	15.43	1,600,278	16.69	1,566,015
Ethnic Group^c						
Malay	18.24	4,411,502	17.92	2,250,051	18.62	2,161,450
Chinese	15.42	1,484,822	16.18	783,495	14.47	701,326
Indian/ Punjabi	14.28	729,063	14.32	359,961	14.05	369,102
Orang Asli SM	23.59	39,909	8.40	27,201	26.50	12,709
Bumiputra Sabah	14.79	325,072	12.05	168,889	15.39	156,183
Bumiputra Sarawak	10.97	368,365	9.73	180,852	12.10	187,513
Other Bumiputra	14.43	155,333	14.41	78,335	14.43	76,999
Age Group (years)						
18-19	19.32	724,957	20.21	412,505	17.45	312,451
20-29	18.39	2,125,686	18.11	1,049,862	18.67	1,075,824
30-39	17.05	2,052,986	17.05	1,043,256	17.02	1,009,731
40-49	15.35	1,520,827	14.55	784,242	16.67	736,585
50-59	14.34	1,089,609	13.68	558,918	14.60	530,691
BMI Status						
Underweight	17.19	735,471	18.18	358,166	16.62	377,306
Normal weight	16.17	3,674,760	15.74	2,031,540	16.61	1,643,220
Overweight	16.85	2,002,822	16.85	1,080,097	16.84	922,725
Obese	17.76	906,916	18.07	365,707	17.71	541,209
Educational Level						
Primary School	15.09	1,459,386	13.76	664,257	16.36	795,129
Lower Secondary School	17.38	1,533,517	17.23	865,591	17.83	667,925
Higher Secondary School	17.36	2,638,572	17.19	1,395,874	17.48	1,242,698
Matriculation/Form 6	17.80	427,517	19.02	160,599	17.34	266,918
College/Universiti	16.46	1,097,323	15.77	637,697	17.34	459,626
Others	14.09	351,064	12.07	120,691	14.53	230,373

^a South=Negeri Sembilan, Melaka, Johor; Central=Perak, Selangor, Wilayah Persekutuan; East Coast=Kelantan, Terengganu, Pahang; North=Perlis, Kedah, Pulau Pinang

^b Urban=metropolitans, cities; Rural=small towns, villages

^c Bumiputra Sabah=Bumiputra groups other than Malays; Bumiputra Sarawak=Bumiputra groups other than Malays; Other Bumiputra=Bumiputra groups other than Malays, Bumiputra Sabah and Sarawak, Orang Asli of Peninsular Malaysia

morning meals is 29.9%. This value is higher than the 15-20% energy distribution from breakfast of adults as reported by other dietary surveys (Song *et al.*, 2005; Singapore Ministry of Health, 2001; Nicklas *et al.*, 1998). However, this higher value could also be due to the inclusion of 'sahur' and morning tea as breakfast is defined as any food consumed between 12 am to 11 am. There are variations in energy percentage from morning meals by zones, strata, ethnicity, age group, BMI status and education level. The variations indeed reflect many factors such as the type of foods consumed for breakfast, breakfast habits, propensity to eat, body image, economic productivity, and cultural influences. For examples, rural people may consume more energy-dense (that is, rice, noodles, tapioca) foods for breakfast due to their labour intensive work and people on the East Coast are more likely to consume rice (that is, *nasi kerabu*, *nasi berlauk*, *nasi dagang*) for breakfast than populations in other regions of Malaysia.

Promoting breakfast consumption and healthy breakfast food choices is important as breakfast has been shown to confer many health benefits to adults such as sustenance of energy level throughout the morning, provision of quality diets, enhancement of physical activity and mental alertness, increased efficiency in energy expenditure and self-control and maintenance of healthy body weight (Song, Gorman & Evans, 2005; Holt *et al.*, 1999; Kirwan *et al.*, 1998; Nicklas *et al.*, 1998; Benton & Parker, 1998).

Lunch was taken by 88.5% of Malaysian adults and provided about 30.49% of total daily energy intake for Malaysians. Dinner was consumed by 91.9% of the population and provided the most (32.35%) energy among the three meals. The findings from the National Nutrition Survey of Singapore (Singapore Ministry of Health, 2001) indicated that the percentages of

energy from lunch and dinner were 31.6% and 36%, respectively. Several trends in lunch and dinner patterns by zone, age group and BMI status were observed. Sarawak has the lowest percentage of energy from morning meals but the highest from lunch and dinner. On the other hand, the East Coast was among the zones with highest energy percentage from morning meals but consistently had lowest energy contribution from lunch and dinner. While the younger age groups seemed to have higher energy intakes for morning meals and dinner, the older age groups had lower energy intakes for these meals. Compared to other BMI groups, overweight and obese Malaysians tend to consume more energy for morning meals and lunch and less for dinner (except for obese men).

Afternoon tea is a popular snack time among Malaysians which is taken between late afternoon and dinner. In this survey, afternoon tea was consumed by 54% of the population. A study on snacking patterns among adults and children in the US also indicated that afternoon was the most popular time for snacking in all age groups while morning was the least common snack time (Cross, Babicz & Cushman, 1994). A variety of traditional sweet and savory cakes, bakery products, sweet porridge and spicy foods are commonly consumed by Malaysians during afternoon tea. Afternoon tea contributed to about 16.8% of total daily energy for Malaysian adults who reported consuming this meal.

For Singaporeans, the recommendation on the percentage of energy from snack is 20% and the reported energy percentage from snacks was 14.1% (Singapore Ministry of Health, 2001). However, the finding did not specify the time (e.g. morning, afternoon or evening) that the snack was consumed. Our finding that 17% of energy came from afternoon snack is

similar to a study on free-living French adults (Bellisle *et al.*, 2003). In this study, an average of 1.3 snacks were recorded each day and yielded about 18.5% of total daily energy intake. By socio-demographic characteristics, the highest percentages of energy from afternoon snacks could be observed in the East Coast (zone) and among 18-19 year-old adults (age group), adults with Matriculation/Form 6 education, urban population (strata) and the Orang Asli of Peninsular Malaysia.

Snack foods consumed between meals can contribute significantly to daily energy and nutrient intakes (Haveman-Nies, Groot & Van Staveren, 1998; Siega-Riz, Carson & Popkin, 1998; Cross *et al.*, 1994). Kerver *et al.* (2006) reported that adults consuming breakfast, lunch, dinner and snacks (1 or \geq 2) had lower total fat intake and higher energy, carbohydrate and micronutrient intakes except for cholesterol, vitamin B6 and sodium than adults consuming the three meals without snacks. Besides the frequency and amount of snacks and the percentage energy contributed by snacks, it is also important to consider the quality of snacks in the relationship between snack consumption with energy and nutrient intakes. However, this report is not able to describe the latter.

One of the limitations in this study is the use of the one day 24-hour diet recall for estimation of habitual energy intake. Multiple 24-hour recalls are recommended, however, its use may increase respondent burden. Under-reporting of energy intake is also common with the use of 24-hour diet recall due to the characteristics of the foods consumed (e.g. condiments, gravies, between meal snacks) or the characteristics of the respondents (e.g. age, sex, body mass index). To address these limitations, quality control measures were taken such as using a defined protocol to standardise dietary interviews,

food albums and graduated household measurements to assist respondents in recalling the amount of foods and beverages and collection of local food recipes for dietary analysis. Using morning meals that include early morning meals (sahur) and morning tea may also be a potential bias in the study. The dietary intake of fasting individuals may not reflect their habitual energy and nutrient intakes as well as meal patterns. Also, with the inclusion of morning tea, the percentage of energy contributed by morning meals may be higher than if only breakfast is considered. Nevertheless, the use of this definition of morning meals may reflect the actual breakfast consumption patterns of Malaysians. Finally, the survey was stratified according to only stratum, age and sex. Consequently, there may be under-representation of certain ethnic groups (Orang Asli, Bumiputra Sabah and SarwakOther Bumiputra) and education groups (Others, Matriculation/Form 6). This under-representation could affect the reported median percentage of energy from meals and afternoon tea. For instance, the high percentage of energy from morning meals reported for the Orang Asli (total population and women) must be interpreted with caution as the values may not necessarily reflect the actual median energy intake of this ethnic group.

CONCLUSION

This paper describes the meal and snack patterns in terms of the percentage of energy from morning meals, lunch, dinner and afternoon tea, of Malaysian adults of various socio-demographic backgrounds and weight status. This is an initial step in understanding the nutritional importance of such eating patterns which eventually can lead to further analysis on the relationship between meal and snack patterns with

health and nutritional status. As Malaysia is going through a rapid nutritional transition that affects both the nation's food consumption and lifestyle, information on the population's eating patterns becomes essential in understanding the relationship between meal and snack patterns with health and nutritional status. With this information, efforts to address the rising rates of obesity and diet-related chronic diseases can be planned and implemented.

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REFERENCES

- Bellisle F, McDevitt R & Prentice AM (1997). Meal frequency and energy balance. *Br J Nutr* 77(Suppl.1): S57-S70.
- Bellisle F, Dalix AM, Mennen L, Galan P, Hercberg S, de Castro JM, Gausseres N (2003). Contributions of snacks and meals in the diet of French adults: a diet-diary study. *Phy & Beh* 79: 183-189.
- Benton D & Parker PY (1998). Breakfast, blood glucose and cognition. *Am J Clin Nutr* 67 (Suppl): S772-S778.
- Bryant CA, De Walt KM, Courtney A & Schwartz J (2003). *The Cultural Feast*. 2nd Ed. Wadsworth/Thomson Learning, California.
- Cross AT, Babicz D & Cushman LF (1994). Snacking patterns among 1800 adults and children. *J Am Diet Assoc* 94: 1398-1403.
- Edelstein SL, Barret-Connor EL, Wingard DL & Cohn BA (1992). Increased meal frequency associated with decreased cholesterol concentrations; Rancho Bernado, CA, 1984-1987. *Am J Clin Nutr* 55: 664-669.
- Fabry P, Fodor J, Hejl Z, Geizerova H & Balcarova O (1968). Meal frequency and ischaemic heart disease. *Lancet* 2: 190-191.
- Gatenby SJ (1997). Eating frequency: methodological and dietary aspects. *Br J Nutr* 77(Suppl 1): S7-S20.
- Gibney MJ & Wolever MS (1997). Periodicity of eating and human health: present perspective and future directions. *Br J Nutr* 77(Suppl 1): S3-S5.
- Gibson RS & Ferguson EL (1999). *An Interactive 24-hour Recall for Assessing the Adequacy of Iron and Zinc Intakes in Developing Countries*. International Life Sciences Institute Press, Washington DC.
- Haveman-Nies A, Groot LPGM & Van Staveren WA (1998). Snack patterns of older Europeans. *J Am Diet Assoc* 98: 1297-1302.
- Holt SH, Delargy HJ, laton CL & Blundell JE (1999). The effects of high-carbohydrate vs high-fat breakfasts on feelings of fullness and alertness and subsequent food intake. *Int J Food Sci Nutr* 50: 13-28.
- Jenkins DJ (1997). Carbohydrate tolerance and food frequency. *Br J Nutr* 77 (Suppl 1): S71-S81.

- Jenkins DJA, Jenkins AL, Wolever TMS, Vukson V, Rao AV, Thompson LU & Josse RG (1994). Low glycemic index: carbohydrates and physiological effects of altered food frequency. *Am J Clin Nutr* 59 (Suppl): 706S-709S.
- Kerver JM, Yang EU, Obayashi S, Bianchi L & Song WO (2006). Meal and snack patterns are associated with dietary intake of energy and nutrients in US adults. *J Am Diet Assoc* 106: 46-53
- Kirwan JP, O’Gorman D & Evans WJ (1998). A moderate glycemic meal before endurance exercise can enhance performance. *J Appl Physiol* 84: 53-59
- Mann J (1997). Meal frequency and plasma lipids and lipoproteins. *Br J Nutr* 77 (Suppl 1): S83-S90
- Ma Y, Bertone ER, Stanek EJ, Reed GW, Hebert JR, Cohen NI, Merriam PA, Ockene IS (2003). Association between eating patterns and obesity in a free-living US adult population. *Am J Epidemiol* 158:85-92.
- Ministry of Health (MOH) (2004). *Album Saiz Sajian Makanan Malaysia. Kajian Pengambilan Makanan Malaysia*. MOH, Putrajaya.
- Nicklas TA, Myers L, Reger C, Beech B & Berenson GS (1998). Impact of breakfast consumption on nutritional adequacy of the diets of young adults in Bogalusa, Louisiana: Ethnic and gender contrasts. *J Am Diet Assoc* 98: 1432-1438
- Rampersaud GC, Pereira MA, Girard BL, Adams J & Metzler JD (2005). Breakfast habits, nutritional status, body weight and academic performance in children and adolescents. *J Am Diet Assoc* 105: 743-760.
- Redondo MR, Ortega RM, Zamora MJ, Quintas ME, Lopez-Sobaler AM, Andres P & Gaspar MJ (1997). Influence of the number of meals taken per day on cardiovascular risk factors and the energy and nutrient intakes of a group of elderly people. *Int J Vitam Nutr Res* 67: 176-182
- Singapore Ministry of Health (2001). National Nutrition Survey, Singapore, 1998. Department of Nutrition, Ministry of Health, Singapore.
- Siega-Riz AM, Carson T & Popkin B (1998). Three squares or mostly snacks: what do teens really eat? *J Adolesc Health* 22: 29-36
- Song WO, Chun OK, Obayashi S, Cho S & Chung CE (2005). Is consumption of breakfast associated with body mass index in US adults? *J Am Diet Assoc* 105: 1373-1382
- Titan SM, Bingham S, Welch A, Luben R, Oakes S, Day N & Khaw KT (2001). Frequency of eating and concentrations of serum cholesterol in the Norfolk population of the European prospective investigation into cancer: cross sectional study. *Br Med J* 323: 1286-1288
- World Health Organization (WHO) (1995). Physical status: The Use and Interpretation of Anthropometry. Report of a WHO Expert Committee. Technical Report Series 854. WHO, Geneva.