

Studying the Family Diet: An Investigation into Association Between Diet, Lifestyle and Weight Status in Malaysian Families

Yang WY^{1,2}, Burrows T¹, MacDonald-Wicks L¹, Williams LT^{1,3}, Collins CE¹ & Chee WSS²

¹ School of Health Sciences, Faculty of Health, and Priority Research Centre in Physical Activity and Nutrition, The University of Newcastle, Callaghan, New South Wales, Australia

² Division of Nutrition and Dietetics, School of Health Sciences, Faculty of Medicine and Health, International Medical University, Kuala Lumpur, Malaysia

³ Menzies Health Institute of Queensland, Griffith University, Gold Coast Campus, Australia

ABSTRACT

Introduction: The contribution of the family environment to childhood obesity in Malaysia is not well known. This paper describes the study, methodology and results of a pilot study to assess the feasibility of conducting a study on diet and lifestyle factors among Malay primary school children and their main caregiver(s) in regard to body weight status. **Methods:** The Family Diet Study used a cross-sectional design and targeted a minimum of 200 Malay families at five national primary schools in the Klang Valley, Malaysia using a multi-stage sampling method. Participants were Malay families with children aged 8 to 12 years and their main caregiver(s). Data on socio-demographic, dietary intake, parental child feeding practices, physical activity and anthropometric measures were collected predominantly at schools with follow-up 24-h dietary recalls collected by phone. Details of recruitment, inclusion criteria, assessments and statistical analyses are also discussed. **Results:** Eleven families provided data by answering questionnaires, recalling diet intake and participating in anthropometric measures. The results showed overall feasibility of the study protocol but required some modifications prior to implementation of the main study. Mothers were the main parent involved in family food procurement, preparation and mealtime supervision. Snacking was not commonly reported and fruit and vegetables intakes were generally infrequent. **Conclusion:** The most novel component of this study was the comprehensive collection of data from both children and their main caregiver(s) within the context of the family. Detailed information on dietary and lifestyle aspects will help to elucidate factors associated with obesity aetiology in Malay children.

Key words: Body weight status, child, diet, family, lifestyle

INTRODUCTION

Malaysia is currently experiencing an escalation in the prevalence of childhood obesity due to the nutrition and lifestyle transition associated with rapid economic development and urbanisation. The

transition is characterised by a shift away from high energy burning activities of daily life to sedentary lifestyles, and a traditional grain-based diet to one which is high in animal products, oils and fats (Ismail, 2002). Recent reports have

estimated that approximately 34.5% of children aged between seven to twelve years residing in urban areas in Malaysia are classified as overweight or obese (Poh *et al.*, 2013). The magnitude of childhood obesity may be greater for Malay children than other ethnicities in view of their large proportion within the population of Malaysia (Department of Statistics, 2010). Malays of all age groups make up 67.4% of the Malaysian population. The consequences of childhood obesity are significant for several reasons including physically, socially, psychologically, and economically. Also obesity has been shown to track into adulthood (Berenson, 2012). Recently, there has been a dramatic rise in the prevalence of metabolic syndrome amongst Malaysian primary school children who are obese thus increasing their risk of developing chronic diseases (Wee *et al.*, 2011).

While dietary intake is important in the aetiology of obesity, it is rarely well reported in the literature (Collins, Watson & Burrows, 2010). Little data is available on children's dietary patterns and lifestyle factors contributing to obesity in developing countries in Asia, and findings from existing studies demonstrated inconclusive dietary associations with childhood obesity (Yang *et al.*, 2012) primarily due to methodological issues relating to dietary assessment tools used (Yang *et al.*, 2014b). Dietary studies on Malaysian children are uniformly lacking in terms of exploring dietary intake and obesity relationships within the context of the family (Poh *et al.*, 2013).

The family environment is an important setting for influencing the eating and physical activity behaviours of young children. The construction and experience of a child's environment can be carried forward to the next generation via parenting styles, attitudes and lifestyle behaviours (Sleddens *et al.*, 2011). Although past research has shown a positive association between an authoritarian

parenting style and risk of children being overweight, current evidence is equivocal (Sleddens *et al.*, 2011; Pai & Contento, 2014). The traditional parenting style within the obesogenic environment in developing Asian countries may or may not be impacting on child's body weight status, highlighting the need for further research in Asian populations.

The primary aim of the Family Diet Study is to determine the associations between dietary factors, lifestyle factors, and anthropometric measures of Malay school children aged 8 to 12 years in urban areas of the Klang Valley, Malaysia. The purpose of this paper is to describe: (1) the rationale and methodology of this study including the development and selection of study measures and (2) the pilot testing of the study protocols for implementation in the Malaysian setting.

METHODS

Ethics, study design and sampling

Approval was obtained from the relevant ethics committees of the University of Newcastle (H-2013-0065) and International Medical University, Malaysia (IMU 275/2013). In Malaysia, as compulsory schooling commences at age seven, primary schools were used as recruitment sites. The Malaysian Ministry of Education and State Education Departments were approached, and permission was granted for school-based research. This study used a cross-sectional design and was conducted in urban areas in the Klang Valley, Malaysia. The location was chosen based on convenience of access to one state and one Federal Territory located in the centre of Peninsular Malaysia. The state of Selangor has a population of 5.46 million and 91.4% urbanisation (Department of Statistics, 2010). The Federal Territory of Kuala Lumpur has a population of 1.67 million and 100% urbanisation (Department of Statistics, 2010). Multi-stage sampling methods were used as shown in Figure

1. Eight national primary schools within the identified zones of Kuala Lumpur and Selangor, respectively were selected based on simple random sampling while cluster sampling was implemented to select a minimum of three primary schools from each state. The total number of participants for each school was calculated based on probability proportionate to sample size method (WHO, 2008). This probability was derived from the final estimated sample size required, total number of students per school and proportions of students with Malay ethnicity. Within primary 3, 4 and 5 levels (children aged 8 to 12 years) at each selected school, simple random sampling was undertaken and the main caregivers of Malay schoolchildren were invited to participate in this study. The sample size needed was estimated on observed prevalence of breakfast skipping (32.1%) (Ruzita, unpublished) using EPI-info™ version 5.0 statistical package (5% margin of error, and 95% confidence level). This variable was chosen as it was included in this study's questionnaire on food habits. The estimate of 283 families was increased by 28 to adjust for a non-response rate of 10%, giving a final estimate of 311 families. Two to four people per family were anticipated to participate.

Recruitment and participants

Invitations to participate were distributed by the school administrator to children in primary 3 to primary 5 classes at each school. Interested families were invited to return completed consent forms to the school. The Participant Information Sheet and Consent Form were available in both English and Malay languages to enable clear understanding of the content. Willing families were screened for eligibility by the doctoral candidate researcher (Yang) and enrolled after providing informed consent. For inclusion into this study, respondents had to be from a Malay family with the main caregiver(s) living full time with

a child who had no concurrent medical conditions. The main caregiver was defined as a parent or a person related to the family who made the main decision in terms of food purchasing, preparation and feeding the child, for example, a grandparent. The flow of recruitment and data collection is shown in Figure 2. Data collection started in August 2013 and assessments were conducted either at school or the home based on families' preferences. To obtain the main caregiver's follow-up 24-h diet recalls, a phone call was conducted within 3 to 6 months of recruitment.

Outcome measures

The study measures included family socio-demographics, dietary intake, parental attitudes, beliefs and practices about child feeding and obesity proneness, levels of physical activity, and body weight status. The main caregivers completed all study measures, while the children underwent anthropometric measurements and interviews on dietary intake and physical activity.

Family socio-demographics

Families' socio-demographics were collected using 12 items. Six items gathered data on gender, date of birth of the child, parents' employment status, parents' highest educational level, family size, and total monthly income. Six other items explored the families' food attainment including preparation and mealtime habits, pocket money provided to child, main shopping location, main food purchaser, main food preparer, mealtime(s) together, and child's main mealtime supervisor.

Dietary intake

Information on dietary intake was collected using interviewer-administered 24-h diet recalls, and supplemented with the Food Habits Questionnaire (FHQ). A search of the literature did not provide a dietary assessment tool validated

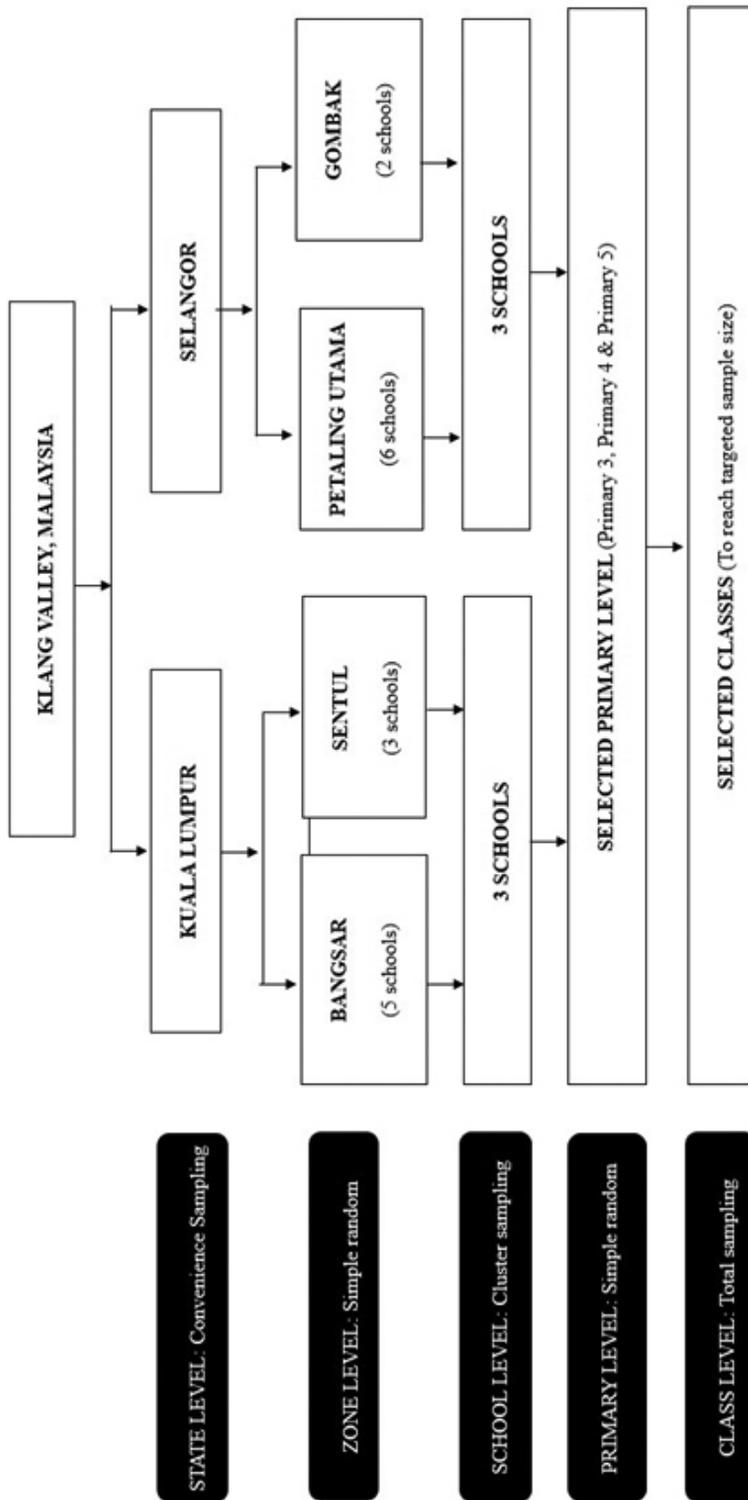


Figure 1. Multi-stage sampling for the Family Diet Study

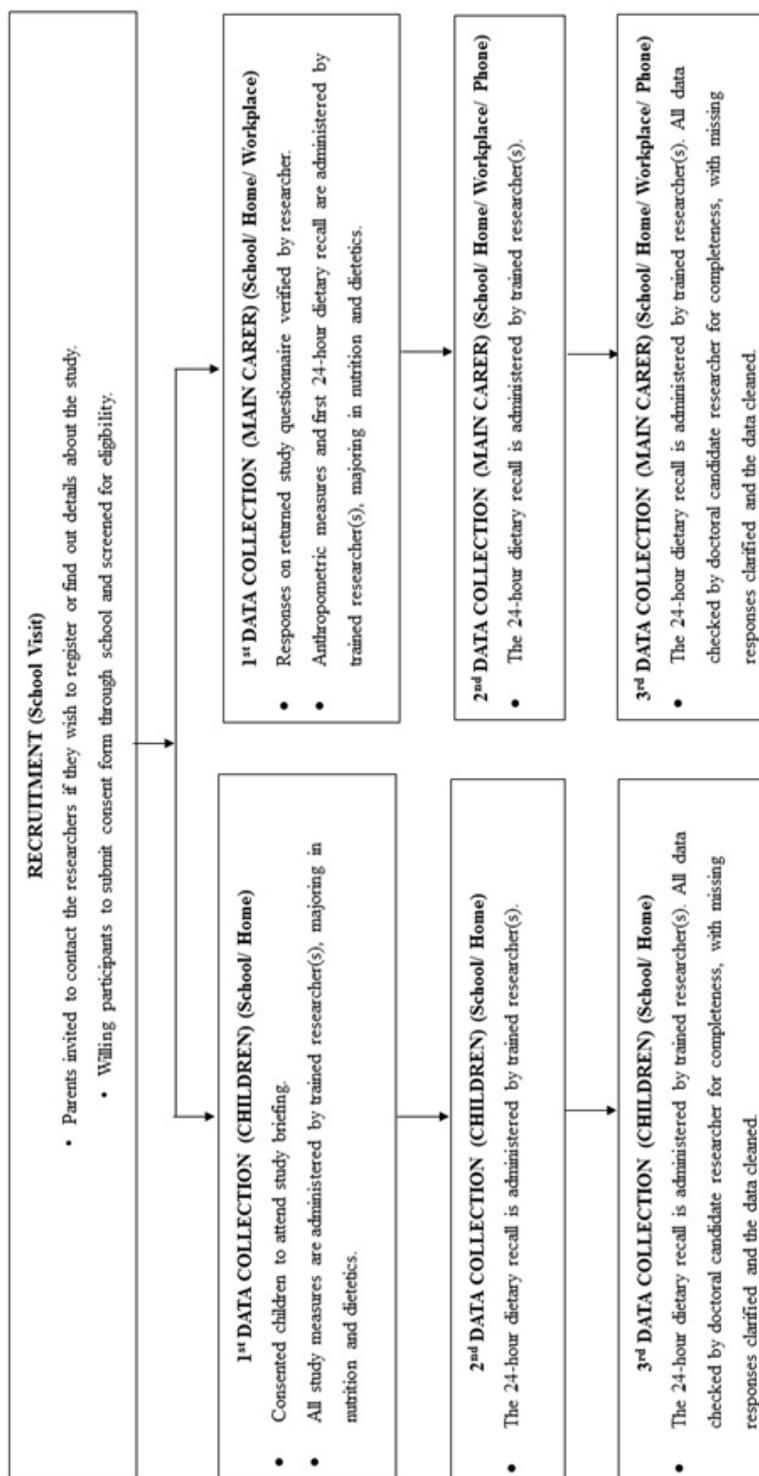


Figure 2. Flow of recruitment and data collection throughout study period

and suitable for all participants within Malaysian families. Hence this study used standardised 24-h diet recalls as the main dietary assessment method, as they are the an internationally accepted method for assessing usual dietary intake (Thompson & Subar, 2008). The repeat 24-h diet recalls followed the protocol developed based on the United States Department of Agriculture's Automated Multiple Pass Method (Thompson & Subar, 2008) and adapted the Australian National Nutrition Survey 24-h dietary recall procedures (McLennan & Podger, 1995). The adapted protocol aimed to improve the dietary intake methodological quality within the Malaysian sample population, as recommended by this study's systematic review on dietary assessment methodology and reporting in developing Asian countries (Yang *et al.*, 2014b). The 24-h diet recalls (two on weekdays and one on the weekend) collected detailed information on all food and beverage consumed on the day prior to interview, from midnight to midnight, including time of consumption, the occasion (e.g., breakfast), food descriptions detailed enough to allow for accurate food coding; the amount eaten; the source of the food, and whether the food was prepared and consumed at home. Five phases were used according to the protocol: (1) Phase One - an initial 'quick list' where participants reported all the food and beverage consumed without interruption from the researchers; (2) Phase Two - participants were provided the opportunity to report any forgotten foods from a list of food categories commonly omitted in 24-h recall reporting; (3) Phase Three - participants reported the location and time each eating occasion began and named the occasion; (4) Phase Four - research personnel probed for more detailed information about the food and the portion size, in addition to reviewing the eating occasions and times between the eating occasions; (5) Phase

Five (the final review) - participants were asked about any other item not already reported. For mixed dishes, participants were asked about the amount of each ingredient used, the number of serving sizes for each recipe, and the amount from each mixed dish they consumed. At the first interview, participants were shown food photographs and common household measures (i.e., cups, glasses, bowls, plates and spoons) to assist in the estimation of portion size. They were given a booklet containing similar photographs to be used in subsequent phone-call interviews.

The diet recalls were analysed using Nutritionist Pro™ software and nutrient data from the Malaysian Nutrient Composition of Foods (Tee *et al.*, 1997) and Singapore Nutrient Composition of Foods databases (Singapore HPB, 2003). For mixed or composite dishes, the individual ingredients were entered. For foods missing from the databases, nutrient content information was obtained from commercial packaging and entered into the database software. Methods to determine implausible energy intake were compared to reference standards as detailed elsewhere (Yang *et al.*, 2014a).

The supplementary dietary assessment method, the FHQ, specifically asked about the frequency of intake of the general food groups (e.g., fruits, vegetables, dairy products, etc.), dietary habits (e.g., drinking sweetened beverages, snacking, skipping breakfast, eating out, taking supplements, etc.) and sedentary behaviours (e.g., watching television, playing video games, etc.). This questionnaire had 13 items targeting children and 12 items targeting the main caregiver but excluded questions on pocket money provided, and was adapted from the Australian Eating Survey Food Frequency Questionnaires' supplementary questions (Watson *et al.*, 2009). The Australian survey was translated into Bahasa Malaysia with permission and local food terms were incorporated

and verified by an independent staff of a linguistic department. This tool was chosen because it is relatively straightforward to administer, has been demonstrated to be associated with lower participant burden (Thompson & Subar, 2008), and allows for comparisons to be made with existing Australian data. The tool aimed to provide information on urban Malay families' usual food behaviours over a period of 6 months. An individual response for each question was required and response categories for frequency of food groups and dietary habits were divided into daily, weekly or monthly categories. For the two questions on sedentary activities, the responses for time spent watching television included: '0 to 1 hour per day'; '2 to 3 hours per day'; '4 to 5 hours per day'; and '6 or more hours per day', whilst responses for playing computer games were: 'Never'; 'Less than once per week'; '1 to 2 per week'; '3 to 4 per week'; '5 to 6 per week'; or 'Everyday'.

Child feeding practices

The mother (or in the situation where the mother is not applicable, the other main caregiver) completed the 31-item validated Child Feeding Questionnaire (CFQ) which assessed parents' beliefs, attitudes, and practices about child feeding and obesity proneness. The English language version of the CFQ (Birch *et al.*, 2001) was used with permission from the author whilst the Bahasa Malaysia version was obtained from a local researcher who adapted and translated the original CFQ (Noor *et al.*, 2012). The Bahasa Malaysia version of the CFQ was tested for comprehension and found to have an internal reliability of 0.73 (Noor *et al.*, 2012). The questionnaire was designed to be completed by parents of children aged 2 to 11 years, and consisted of seven domains: (1) Perceived feeding responsibility (PFR); (2) Perceived parent overweight (PPO); (3) Perceived child overweight (PCO); (4) Concerns about child overweight (CCO); (5) Restriction

(REST); (6) Pressure to eat (PTE); (7) Monitoring (MONI). A 5-point Likert scale contained possible responses ranging from 'disagree' (= 1) to 'agree' (= 5) or 'never' (= 1) to 'always' (= 5) depending on the domain. Scoring was based on the mean of items under each different subscale. PFR was scored on a mean of 3 items with higher scores indicating higher levels of perceived parental feeding responsibility. The mean of PRO and PCO indicated parents' perception of their own weight status throughout life and parents' perception of their children's weight status, respectively. Higher scores of CCO represented higher levels of concern about their child's weight. REST scores indicated levels of parental restriction, higher scores of PTE indicated higher parental pressure to eat, and higher MONI scores indicated higher levels of parental monitoring (Birch *et al.*, 2001).

Physical activity

Data on physical activity were obtained from the validated short-form self-administered International Physical Activity Questionnaire-Short Form (IPAQ-SF) given to the main caregiver(s) (Chu & Moy, 2015) and the Physical Activity Questionnaire for Children (PAQ-C) given to the children (Kolwaski, Crocker & Donen, 2004). Both tools were chosen because of the lack of a single validated and appropriate questionnaire available for the local population that could be used to assess physical activity for different age groups of participants within this study. The IPAQ-SF in Bahasa Malaysia used was adapted from the Bahasa Malaysia version of IPAQ Long-Form, known as IPAQ-M. It was recently tested for its reliability and validity amongst the Malay population in Malaysia (Chu & Moy, 2015). The IPAQ-SF is a self-administered questionnaire designed for persons aged 15 to 69 years old to explore the amount of time they spent being physically active in the last

seven days. The total physical activity score is the summation of the duration (in minutes) and frequency (days) of walking, and moderate-intensity and high-intensity activities. Median values and inter-quartile ranges can be computed for walking, moderate intensity activities, high-intensity activities and a combined total physical activity score. There were three categories of physical activity: low, moderate and high (Chu & Moy, 2015). The original PAQ-C is a self-administered, 10-item, 7-day recall questionnaire assessing general levels of physical activity of children approximately 8 to 14 years old (Kolwaski *et al.*, 2004). The Bahasa Malaysia version of PAQ-C was used with permission from the Public Health Institute, Malaysia. PAQ-C assesses the level of physical activity from the last seven days. Item 1 focuses on spare time activity, Items 2 to 8 cover physical activities during physical education, recess, lunch, after school, evenings, weekends and during free time while Item 9 refers to physical activity level for all days of the week including weekend, with each item scoring on a 5-point Likert scale. An average score of 1 indicated low physical activity, scores between 1 and 5 indicated medium physical activity, and 5 indicated high physical activity.

Anthropometry

Body weight, height, waist circumference and body fat were measured by researchers according to standard protocols, either in the fasting state or at least 2-h post prandial. Participants were instructed to wear light clothing and, to remove shoes and any heavy objects prior to measurement. Each anthropometric measure was taken twice. If the second measurement was within 0.5kg for weight, or 0.5cm for height and waist circumference, or 1.5% for body fat, the mean of the first two measures was used, and if outside that range, a third measure was taken and the median value was used.

Body weight was measured to the nearest 0.1kg using a TANITA digital weighing scale. The weighing scale was calibrated with a standard weight at the beginning of the study and the scale showed zero before each measurement. Participants were required to stand on the middle of the weighing scale with minimal movement, arms by their sides and looking straight ahead for the body weight to be recorded. Height was measured to the nearest 0.1cm using a SECA Bodymeter 206 microtoise. The microtoise was placed on a flat floor, pulled up against a smooth wall, secured by the upper side and reading zero on the floor surface before each measurement. Participants were instructed to stand straight with feet together, heels, buttocks and upper part of the back touching the wall, hands by the side with the head remaining in the Frankfurt Plane position. The head of the measuring board was placed firmly down the vertex and the reading was taken from the number on the scale where the red line position touched the participant's head. For waist circumference, participants were required to stand upright in a relaxed manner, feet comfortably apart, weight evenly balanced on both feet and with their arms folded across their chest. The participant's top of the iliac crest was palpated with the researcher standing behind and the correct site was marked on the skin, followed by locating and marking the lower costal border. A non-extensible SECA 201 measuring tape was placed circulating the body, mid-way between the earlier two landmarks and the measurement was recorded to the nearest 0.1cm. Body fat percentage was measured using a Maltron BF-907 bioelectrical impedance analysis machine. The standardised protocol recommended by the manufacturer was followed and pre-preparation required was informed to the study participants. Participants laid on a flat surface in a supine position with hands and legs slightly apart.

The researcher attached four electrodes on the right side of the body, each on the hand, wrist, foot and ankle. Upon activating the instrument, pre-collected data on age, gender, body weight, height, nationality and physical activity classification were entered. The physical activity classification included 'Normal', 'Sports' or 'Athletes' and was defined by the manufacturer as follows; 'Sports: for those who train regularly (e.g., vigorous training three or four times a week)', 'Athlete: for full-time professional athletes'. Participants who were not categorised into these two categories, were classified as 'Normal'. The body fat percentage readings were recorded to the nearest 0.1%.

Body mass index (BMI) was calculated according to standardised equations and categorised using World Health Organisation (WHO) BMI-for-age growth reference (5 to 19 years old) (WHO, 2007) for children and using BMI Asian classification for ≥ 18 years (MOH *et al.*, 2004). BMI z-scores were calculated using WHO AnthroPlus software version 1.0.4 (WHO, 2009). Waist circumference of children was compared against newly developed percentile curves for Malaysian children and adolescents aged 6.0 to 16.9 years old (Poh *et al.*, 2011), whilst adult results were compared to the Malaysian standards for adult obesity (MOH *et al.*, 2004). The child's birth weight was collected at the initial interview.

Pilot testing and quality assurance

Five percent of the targeted sample size was included in a pilot study to test the protocol in terms of flow, timeline, recruitment and feasibility. The pilot study also aimed to identify any other challenges in implementing the main study. This pre-testing of procedures and instruments was designed to identify and correct poorly constructed questions, and to estimate the time needed for completion. To enhance study quality, data collection

followed a standardised procedure and all data collectors with expertise in this method (majoring in nutrition and dietetics) were trained by a doctoral candidate researcher (Yang) prior to the assessment sessions. The same assessors were used where practicable for repeat assessments for participating families. All data were checked by trained research personnel for completeness, with missing responses clarified and data cleaned. This process was designed not to influence the participants to answer questions that they may not have wanted to answer otherwise.

Statistical analyses

Normality checking and descriptive statistics were first conducted for dietary intakes and food habits, physical activity, parental child feeding practices, and body weight status. Statistical methods for testing the relationships between variables, including differences by gender and body weight status groups, and associations between the children and their main caregiver(s)' dietary and lifestyle factors (both parametric and non-parametric tests), were explored to address the aims of the main study using statistical software STATA version 11.2.

RESULTS

Sixteen families met the inclusion criteria and consented to participate in this pilot study (4 father-mother-child families, 1 father-child family and 11 mother-child families). Eleven families completed all measures (three caregivers did not complete the third follow-up 24-hour dietary recall and two families withdrew). The children were all measured at school while caregivers were measured at school, their homes or at their workplaces. Of the follow-up dietary recalls of caregivers, six were interviewed face-to-face and others were completed through phone-calls. During face-to-face sessions, all participants were able to complete the questionnaires,

Table 1. Pilot participants' anthropometric, socio-demographic and family food attainment characteristics

	Child (n=14)	Father (n=5)	Mother (n=13)	Others (n=0)
<i>Anthropometry</i>				
	<i>Mean (SD)</i>			
Age (year)	10.4 (0.6)	45.4 (6.1)	40.0 (5.5)	NA
Birth Weight (kg)	3.2 (0.5)	NA	NA	
Body Weight (kg)	37.0 (14.0)	76.5 (4.3)	67.3 (15.4)	
Height (cm)	136.9 (7.9)	167.0 (7.6)	156.2 (5.5)	
Body Mass Index (kg/m ²)	19.4 (6.2)	27.5 (2.1)	27.7 (6.8)	
Body Mass Index z-score	0.4 (2.2)	NA	NA	
Waist circumference (cm)	66.6 (16.4)	95.3 (1.5)	82.8 (12.8)	
Body Fat (%)	27.8 (9.1)	28.4 (3.1)	36.7 (6.0)	
<i>Socio-demographics</i>				
	<i>n (%)</i>			
Employment Status	Full-time NA	10 (83.3)	10 (71.4)	NA
	Self-employed	1 (8.3)	3 (21.4)	
	Others	1 (8.3)	1 (7.1)	
Highest Education Level	Secondary NA	4 (33.3)	7 (50.0)	
	College/University	8 (66.7)	7 (50.0)	NA
Family size				
5 or less			7 (50.0)	
6			5 (35.7)	
7 and above			2 (14.3)	
Family income				
< RM3500			5 (35.7)	
RM3501 - RM5000			2 (14.3)	
RM5001 and above			7 (50.0)	
Pocket money provided to child				
<RM9.99			3 (21.4)	
RM10.00 - RM14.99			6 (42.9)	
RM20 and above			5 (35.7)	
Family food attainment and living condition related to food habits				
Main shopping location				
Wet market			9 (64.3)	
Supermarket			5 (35.7)	
Hypermarket			10 (71.4)	

	Child	Father	Mother	Others
Main food purchaser	NA	4(33.3)	12 (66.7)	0
Main food preparer	NA	1(8.3)	13 (92.9)	1 (8)
Main child mealtime supervisor	NA	3(25.0)	13 (92.9)	0
Family mealtime together				
Never			1 (7.1)	
1 - 2 times			2 (14.3)	
6 - 7 times			11 (78.6)	

NA=Not Applicable

participated in anthropometric measures and reported dietary intake based on the study protocol. The participants were encouraged to seek clarification from the research personnel throughout the process.

Descriptive characteristics of the pilot study participants are presented in Tables 1 and 2. The mean (SD) BMIs for children, fathers and mothers were, 19.4(6.2)kg/m², 27.5(2.1)kg/m² and 27.7(6.8)kg/m², respectively, indicating that the majority were either in the overweight or obese category. The parents were mostly employed full-time, had tertiary education and earned an income above RM5000 per month. Mothers were the main food purchaser (67%), food preparer (93%) and mealtime supervisor (93%). Of the seven subdomains of child feeding practices, perceived feeding responsibility had highest median score of 4. Children (71%) and mothers (54%) ate breakfast at home; however, fathers mainly had breakfast while travelling to work or at work (80%). The proportion of this pilot study's participants consuming fruit and vegetables on a daily basis was generally low. The children consumed only 29% and 8% of the food as fruit or vegetables, respectively. The mothers consumed 15% and 69% of the food as fruit or vegetables, respectively. The fathers consumed 20% of food as vegetables and no fruits. Daily snacking was reported to be uncommon for half of the children and all of the parents in this sample. Less than one serve

daily of sweetened beverages was reported by 36% of children, 60% of fathers and 46% of mothers. Two-thirds of the families reported consuming Western-style fast food one to four times a month. Half of the children reported watching television for two to three hours daily while a majority of the parents reported watching less than one hour (60% fathers and 62% mothers).

As a result of this pilot study and feedback from the participants: the number of 24-h dietary recalls was reduced from three to two (one on the weekdays and one on the weekends) to reduce participant burden; the workplace was included as an alternative to home for main caregiver(s) as a venue for assessment; and the use of telephones was offered as an option for the follow-up dietary recall interview. These changes aimed to promote participation and increase participants' adherence to the protocol while reducing their burden. The prevalence of breakfast skipping observed in the children in this pilot study was found to be lower than published estimates (14%), hence the sample size was reduced from 311 to 200 families (5% margin of error, and 95% confidence level) for the main study.

DISCUSSION

The rationale and methodology behind the Family Diet Study in Malaysia have been described in detail. A literature search showed that this is the first research study exploring weight, diet and lifestyle factors affecting Malay primary school children

Table 2. Pilot participants' dietary intake, child feeding practices, food habits and physical activity characteristics

	Child (n=14)	Father (n=5)	Mother (n=13)
<i>Energy & Macronutrients</i>			
	<i>Median (IQR)</i>		
Energy (kcal)	1531 (996)	1959 (186)	1566 (746)
Carbohydrate (g)	238.2 (91.1)	256.2 (32.3)	212.3 (129.0)
Protein (g)	67.6 (27.7)	72.9 (19.4)	54.1 (32.7)
Fat (g)	48.4 (32.4)	76.0 (9.5)	53.8 (18.1)
<i>Child Feeding Practices Scores</i>			
	<i>Median (IQR)</i>		
Perceived feeding responsibility	4.0 (1.4)		
Perceived parental overweight	3.0 (0.5)		
Perceived child overweight	3.0 (0.8)		
Concern child overweight	3.2 (1.0)		
Restriction	3.9 (0.5)		
Pressure to eat	3.9 (1.0)		
Monitoring	3.9 (2.0)		
<i>Specific food habits</i>			
	<i>n (%)</i>		
<i>Vitamin and mineral supplements</i>			
Yes	10 (71.4)	2 (40.0)	6 (46.2)
No	4 (28.6)	3 (60.0)	7 (53.9)
<i>Location of breakfast</i>			
At home	10 (71.4)	1 (20.0)	7 (53.9)
At school/ On the way to work/ at work	2 (14.3)	4 (80.0)	3 (23.1)
Don't eat breakfast	2 (14.3)	0	1 (7.7)
Others	0	0	2 (15.4)
<i>Amount of fruits consumed</i>			
None/ less than 1 per week	3 (21.4)	1 (20.0)	1 (7.7)
1 to 6 per week	7 (50.0)	4 (80.0)	10 (76.9)
Once to 3 per day	4 (28.6)	0	2 (15.4)
<i>Frequency of vegetables consumed at dinner</i>			
Never	3 (23.1)	0	1 (7.7)
1 to 4 per week	9 (69.2)	4 (80.0)	3 (23.1)
5 or more per week	1 (7.7)	1 (20.0)	9 (69.2)
<i>Frequency of dairy products consumed</i>			
Never/ less than 1 per month	2 (14.3)	2 (40.0)	5 (38.5)
1 per week or less	2 (14.3)	2 (40.0)	3 (23.1)
2 to 6 per week	3 (21.4)	1 (20.0)	1 (7.7)
1 to 6 per day	7 (50.0)	0	4 (30.8)
<i>Frequency of sweetened beverages consumed</i>			
Less than 1 per day	5 (35.7)	3 (60.0)	6 (46.2)
1 to 3 per day	8 (57.1)	2 (40.0)	5 (38.5)
4 or more per day	1 (7.1)	0	2 (15.4)

Frequency of eating dinner in front of TV			
Never/ less than once a week	4 (28.6)	3 (60.0)	6 (46.2)
1 to 4 per week	8 (57.2)	2 (40.0)	4 (30.8)
5 to 7 per week	2 (14.3)	0	3 (23.1)
Frequency of snacking			
Less than once per day	7 (50.0)	5 (100.0)	13 (100.0)
1 to 2 per day	6 (42.9)	0	0
3 to 4 per day	1 (7.1)	0	0
Frequency of eating out			
Never/ less than once a week	0	2 (40.0)	4 (30.8)
1 to 6 per week	13 (92.9)	3 (60.0)	9 (69.2)
1 or more per day	1 (7.1)	0	0
Frequency of Western fast food consumed			
Never/ less than once a month	2 (14.3)	2 (40.0)	3 (23.1)
1 to 4 per month	10 (71.4)	3 (60.0)	8 (61.5)
1 to 6 per week	2 (14.3)	0	2 (15.4)

Physical Activity

Duration of watching TV			
0 to 1 hour per day	5 (35.7)	3 (60.0)	8 (61.5)
2 to 3 hours per day	7 (50.0)	2 (40.0)	4 (30.8)
4 to 5 hours per day	2 (14.3)	0	1 (7.7)
Frequency playing computer/video games			
Never/ Less than once a week	3 (21.4)	0	7 (53.8)
1 to 2 per week	6 (42.9)	2 (40.0)	3 (23.1)
3 to 7 per week	5 (35.7)	3 (60.0)	3 (23.1)

 NA=Not Applicable

and their caregiver(s) within the context of the family using the same study measures for dietary intake, physical activity and body weight status. The experience and processes involved will benefit future studies in the area of childhood obesity, particularly those conducted in the Asian region.

In Malaysia, there are limited data assessing children and adolescents' dietary intake patterns compared to those available for adults. There are few published studies from developing Asian countries investigating childhood obesity and its causative factors (Yang *et al.*, 2012) with few valid and reliable dietary assessment tools and limited reporting of children's dietary intake (Yang *et al.*, 2014b). While it is difficult to assess children's diet accurately

(Collins, Watson & Burrows, 2010), the degree of mis-reporting of energy intake among Malaysian children has rarely been investigated (Yang *et al.*, 2014a). To select the most appropriate dietary assessment tool for study participants (Thompson & Subar, 2008), the ultimate goal is to choose a method suitable for the study design and which is able to evaluate the outcome of interest with maximum validity. Despite limitations, the 24-h diet recall method has been found to be an adequate method for measuring dietary intake when compared to the gold standard of doubly labelled water (Burrows, Martin & Collins, 2010). Further, it addresses the local concerns associated with administration such as participant burden and resource constraint. Reducing dietary recalls to two days in the

current study should still be sufficient to allow for estimating the true distribution of the sample's mean intake for energy and macronutrients (Willet, 2012).

The preliminary findings of Malay children and their parents' body weight status show that the majority in this small urban sample were overweight or obese, consistent with other results amongst Malaysian populations (Khambalia & Seen, 2010; Poh *et al.*, 2013). Low fruit and vegetable intake amongst the children was similar or lower than the rates in other studies (Yngve *et al.*, 2005). However, the lack of snacking reported by these children is inconsistent with a previous local study reporting 10-year olds snacked frequently (Norimah, Poh & Ismail, 2007).

Strengths and limitations

This pilot study demonstrated that the study protocol was feasible in terms of recruitment and measurements in the Malaysian setting despite the limited ability to investigate and extrapolate the pilot results statistically due to small sample size. The processes learnt have allowed for appropriate adjustments to optimise participation and accuracy before the main study. Clear documentation and standardised measures were used for all study participants while quality assurance steps throughout the study enhanced the quality of data collection. Although the main study is cross-sectional and therefore, unable to test causal relationships, it will provide important data on the associations of diet and lifestyle factors with body weight status. Limitations include measurement bias due to self-reported food habits, physical activity and feeding practices; however, standardised protocols allow for verification of responses when required.

CONCLUSION

The Family Diet Study will be the first to identify factors associated with Malay child weight status, including weight of

caregivers, dietary intake, parenting style, physical activity and lifestyle pattern within the context of the family. The results will inform intervention research adapted to the local environment in addressing childhood obesity.

ACKNOWLEDGEMENTS

The authors would like to thank: the Ministry of Education, Malaysia; Department of Education Wilayah Persekutuan Kuala Lumpur; Department of Education Selangor; pilot study participants; research volunteer (LCY); the Children's Eating Laboratory (The Pennsylvania State University); and Malaysia's Public Health Institute for permission to use their questionnaires.

Conflicts of interest

There is no conflict of interest to be declared.

Funding

This research was funded by the International Medical University, Malaysia (IMU 275/2013).

REFERENCES

- Berenson GS (2012). Health consequences of obesity. *Pediatr Blood Cancer* 58(1): 117-121.
- Birch LL, Fisher JO, Grimm-Thomas K, Markey CN, Sawyer R & Johnson SL (2001). Confirmatory factor analysis of the Child Feeding Questionnaire: a measure of parental attitudes, beliefs and practices about child feeding and obesity proneness. *Appetite* 36(3): 201-210.
- Burrows TL, Martin RJ & Collins CE (2010). A systematic review of the validity of dietary assessment methods in children when compared with the method of doubly labeled water. *J Am Diet Assoc* 110(10): 1501-1510.
- Chu AH & Moy FM (2015). Reliability and validity of the Malay International Physical Activity Questionnaire (IPAQ-M) among a Malay population in Malaysia. *Asia Pac J Public Health* 27(2): 16.

- Collins CE, Watson J & Burrows T (2010). Measuring dietary intake in children and adolescents in the context of overweight and obesity. *Int J Obes* 34(7): 1103-1115.
- Department of Statistics M (2010). Population Distribution and Basic Demographic Characteristics Report 2010 (Updated 05/08/2011). Population and Housing Census of Malaysia 2010. Kuala Lumpur, Malaysia, Department of Statistics, Malaysia.
- Ismail MN (2002). The nutrition and health transition in Malaysia. *Public Health Nutr* 5(1A): 191-195.
- Khambalia AZ & Seen LS (2010). Trends in overweight and obese adults in Malaysia (1996-2009): a systematic review. *Obes Rev* 11(6): 403-412.
- Kolwaski KC, Crocker PRE & Donen RM (2004). Physical Activity Questionnaire for Older Children (PAQ-C). The Physical Activity Questionnaire for Older Children (PAQ-C) and Adolescents (PAQ-A) Manual. Saskatoon, SK, Canada, College of Kinesiology, University of Saskatchewan 5-10.
- McLennan W & Podger A (1995). Food and Nutrient Intake. National Nutrition Survey Users' Guide. Canberra, Australian Bureau of Statistics, pp 13-19.
- MOH, ACADMED, MASO & MEMS (2004). Clinical Practice Guidelines on Management of Obesity. Malaysia, pp 1-58.
- Noor AM, Leelavathi M, Shamsul AS, Hizlinda T, Khairani O & Fatimah A (2012). Parental concerns and control in feeding of 9 to 12-year-old children in a primary school in Kuala Lumpur, Malaysia. *Mal J Nutr* 18(1): 47-55.
- Norimah AK, Poh BK & Ismail MN (2007). Food habits and dietary intake among adolescents in Malaysia: A review. *Mal J Nutr* 13(2): S1.
- Pai HL & Contento I (2014). Parental perceptions, feeding practices, feeding styles, and level of acculturation of Chinese Americans in relation to their school-age child's weight status. *Appetite* 80: 174-182.
- Poh BK, Jannah AN, Chong LK, Ruzita AT, Ismail MN & McCarthy D (2011). Waist circumference percentile curves for Malaysian children and adolescents aged 6.0 -16.9 years. *Int J Pediatr Obes* 6(3-4): 229-235.
- Poh BK, Ng BK, Siti Haslinda MD, Nik Shanita S, Wong JE, Budin SB, Ruzita AT, Ng LO, Khouw I & Norimah AK (2013). Nutritional status and dietary intakes of children aged 6 months to 12 years: findings of the Nutrition Survey of Malaysian Children (SEANUTS Malaysia). *Br J Nutr* 110(SupplementS3): S21-S35.
- Singapore HPB. (2003). Food Composition Guide Singapore. From <http://www.hpb.gov.sg/hpb/ere/ere070101.asp>. [Retrieved May 27, 2014.]
- Sleddens EF, Gerards SM, Thijs C, de Vries NK & Kremers SP (2011). General parenting, childhood overweight and obesity-inducing behaviors: a review. *Int J Pediatr Obes* 6(2-2): e12-27.
- Tee ES, Ismail MN, Nasir MA & Khatijah I (1997). Nutrient Composition of Malaysian foods. Kuala Lumpur, Institute for Medical Research.
- Thompson FE & Subar AF (2008). Dietary assessment methodology. Nutrition in the prevention and treatment of disease. Coulston AM & Boushey CJ. San Diego, Canada, Academic Press, pp 3-39.
- Watson J, Collins C, Sibbritt D, Dibley M & Garg M (2009). Reproducibility and comparative validity of a food frequency questionnaire for Australian children and adolescents. *Int J Behav Nutr Phys Act* 6(1): 62.
- Wee BS, Poh BK, Bulgiba A, Ismail MN, Ruzita AT & Hills AP (2011). Risk of metabolic syndrome among children living in metropolitan Kuala Lumpur: a case control study. *BMC Pub Hlth* 11: 333.
- WHO (2007). Growth Chart for Children 5-19 years. Geneva, World Health Organisation.
- WHO (2008). Steps in Applying Probability Proportional to Size (PPS) and calculating Basic Probability Weights. Bierrenbach A. Geneva.

- WHO (2009). WHO AnthroPlus for Personal Computers Manual: Software for Assessing Growth of the World's Children and Adolescents. Geneva, World Health Organisation.
- Willet W (2012). Correction for the Effects of Measurement Error. *Nutritional Epidemiology*. Willet W. New York, Oxford University Press, pp 287-304.
- Yang WY, Burrows T, Collins CE, MacDonald-Wicks L, Williams LT & Chee WS (2014a). Prevalence of energy intake misreporting in Malay children varies based on application of different cut points. *J Trop Pediatr* 60(6): 472-475.
- Yang WY, Burrows T, MacDonald-Wicks L, Williams LT, Collins C & Chee WSS (2014b). Quality of dietary assessment methodology and reporting in epidemiology studies examining relationship between dietary outcome and childhood obesity in developing Asian countries: A systematic review. *Nutr & Diet* 71: 201-209.
- Yang WY, Williams LT, Collins CE & Chee WSS (2012). The relationship between dietary patterns and overweight and obesity in children of Asian developing countries: A Systematic Review. *JBI Lib System Rev* 10(58): 4568 - 4599.
- Yngve A, Wolf A, Poortvliet E, Elmadfa I, Brug J, Ehrenblad B, Franchini B, Haraldsdóttir J, Krølner R, Maes L, Pérez-Rodrigo C, Sjöström M, Thórsdóttir I & Klepp KI (2005). Fruit and vegetable intake in a sample of 11-year-old children in 9 European countries: The Pro Children Cross-Sectional Survey. *Ann Nutr Metab* 49(4): 236-245.