



Perceptions of eating practices and physical activity among Malaysian adolescents in secondary schools: a qualitative study with multi-stakeholders

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Abstract

Objective: To conduct formative research using qualitative methods among stakeholders of secondary schools to explore their perceptions, barriers and facilitators related to healthy eating and physical activity (PA) among Malaysian adolescents.

Design: A qualitative study involving eight focus groups and twelve in-depth interviews. Focus groups and interviews were recorded and transcribed verbatim. An inductive thematic analysis approach was used to analyse the data.

Setting: Four secondary schools in Perak and Selangor states (two urban and two rural schools) in Malaysia.

Participants: Focus groups were conducted with seventy-six adolescents aged 13–14 years, and in-depth interviews were conducted with four headmasters, four PA education teachers and four food canteen operators.

Results: Stakeholders thought that adolescents' misperceptions, limited availability of healthy options, unhealthy food preferences and affordability were important challenges preventing healthy eating at school. Low-quality physical education (PE) classes, limited adolescent participation and teachers' commitment during lessons were perceived as barriers to adolescents being active at school. Affordability was the main challenge for adolescents from rural schools. Stakeholders perceived that a future school-based intervention should improve the availability and subsidies for healthy foods, provide health education/training for both adolescents and PE teachers, enhance active adolescent participation in PE and develop social support mechanisms to facilitate engagement with PA.

Conclusions: These findings provide important insights into developing school-based lifestyle interventions to improve healthy eating and strengthening PA of Malaysian adolescents.

Keywords

Diet
Physical activity
School-based
Adolescents
Malaysia

The prevalence of overweight and obesity among Malaysian adolescents has increased dramatically between 1986 and 2016 from 4 to 23 and 30% in girls and boys, respectively⁽¹⁾. The rise in the incidence of excess weight is a function of many factors consisting of raised access

to foods high in fats, added sugars and energies^(2,3), increased eating outside the home⁽⁴⁾, larger portion sizes⁽⁵⁾ and a sedentary lifestyle^(6,7). Studies in Malaysia have suggested that adolescents tend to binge on energy-dense snacks and drinks⁽⁸⁾ and follow a low-fibre,

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high-fat diet⁽⁹⁾. In addition, a recent study in Malaysia has shown that those schoolchildren who ate breakfast had a lower total LDL-cholesterol and BMI compared with those who ate breakfast irregularly⁽¹⁰⁾.

Fewer than 2% of Malaysian adolescents (mean age 12.9 years) achieve the recommended levels of moderate-to-vigorous physical activity (PA)⁽¹¹⁾, and they spend on average 4.7 h/d on media-based recreation activities, such as television viewing and electronic games⁽¹²⁾. Data from the Malaysian School-Based Nutrition Survey 2012 and Nutrition Survey of Malaysian Children (SEANUTS Malaysia) showed that more than 50% of children and adolescents were considered as having low levels of PA^(13,14) and high levels of sedentary behaviour⁽¹⁴⁾. PA in Malaysian adolescents is, therefore, important⁽¹⁵⁾.

The WHO regarded schools as a critical setting for enhancing public health nutrition and reducing the risk of unhealthy weight gain in childhood⁽¹⁶⁾. To date, school-based interventions outside of Malaysia have been found to improve PA. However, the impacts have been small, short-term and have mostly varied between interventions^(17–19). Promising policies related to the school food environment have included the provision of fresh fruits and vegetables⁽²⁰⁾, as well as restricting the sales of sugar-sweetened beverages in the school setting⁽²¹⁾. However, the effects of these programmes and their long-term sustainability are uncertain. Furthermore, despite school nutrition policies and guidelines, international research suggests that most schools fail to implement them^(22,23).

The school food environment might be a useful means of improving dietary habits and promoting more active lifestyles in Malaysian adolescents, as, for example, two main meals (breakfast and lunch) are consumed by adolescents in this setting⁽²⁴⁾. Generally, schoolchildren in Malaysia purchase food from the canteen and *koperasi* (school convenience shop). The *koperasi* sells school stationery, snacks and beverages, some of which are energy-dense. The staple foods sold at the canteen are fried rice and noodles, fried chicken and nuggets, energy-dense traditional cake and sugar-sweetened beverages. A study in Malaysia highlighted that the limited variety of food and vegetables served in school canteens may lead to deficient intakes of vitamins and minerals among adolescents⁽²⁵⁾. Besides, access to junk food sold near schools may encourage unhealthy food practices⁽²⁶⁾, such as snacking between meals and skipping main meals⁽²⁷⁾.

In Malaysia, there is a healthy food options guide for food and drink sales in school canteens and the school complex, which lists the approved or banned foods and beverages for the school canteen⁽²⁸⁾. This guideline is mandatory, but many school food canteens fail to adhere to it⁽²⁹⁾.

Two Malaysian ministries are responsible for regulating school food quality (the Ministries of Education (MoE) and Health (MoH)). They use three broad mechanisms, including (1) setting food quality standards for school canteens,

(2) providing food preparation training programmes for canteen operators and (3) monitoring canteen food quality. The deputy headmaster of a school should monitor quality standards, and a nutritionist from the MoH performs spot checks randomly throughout the year. However, canteen operators are rarely penalised for serving non-nutritious food; rather, the action is taken only in clear cases of food poisoning⁽²⁸⁾.

Internationally, governments have implemented school-based nutrition policies to restrict the sale of unhealthy foods^(30,31). Nevertheless, it also has challenges like conflicts with time for other school activities, different interests of the stakeholders (food canteen operators) (e.g. financial profit *v.* healthiness), or that the materials would not be applied as proposed⁽³²⁾. Incorporating the contribution of stakeholders throughout the development phase in combination with evidence-based knowledge, frameworks and behaviour change approaches could improve interventions to address the identified challenges⁽³³⁾.

In Malaysia, the MoE subsidised food (breakfast) programmes are limited to students with low-socio-economic backgrounds at primary schools. However, extending this subsidy to secondary schools may provide more opportunities to eat more healthily, particularly for adolescents from low socio-economic backgrounds⁽³⁴⁾.

Physical education (PE) in Malaysia is a compulsory subject taught in all primary and secondary schools. PE has the same status as other subjects in the school curriculum and is recognised as on par with other core subjects, although it is not a formally assessed subject. Tests for all physical fitness components are carried out on every student, and the results will be recorded. PE teachers in Malaysian schools comprise both PE majors and non-majors⁽³⁵⁾. PE is allocated two 40-min periods for a week in secondary schools⁽³⁵⁾. A survey among Malaysian adolescents showed that some students complained about the quality of PE classes. They also stated that PE lessons were often replaced with other lessons; the majority of PE teachers are not qualified, and PE class has been side-lined by a majority of the schools⁽³⁵⁾.

A framework for the development and evaluation of complex interventions was established by the UK Medical Research Council⁽³⁶⁾. A key stage in the development of such interventions is conducting formative research to identify the needs of the target population.

The term 'stakeholders' refers to certain groups and individuals who have a legitimate interest, or a 'stake', in the continuing effectiveness and success of an institution⁽³⁷⁾. In the school context, important stakeholders are parents, teachers, principals and canteen managers^(38,39). Stakeholders can express their experience, expected barriers or facilitators regarding the implementation of school canteen guidelines and improving the quality of PA at school⁽⁴⁰⁾. Meanwhile, numerous studies internationally have used multiple stakeholders to explore school food environments and PA among adolescents^(41–45). However, to the best of our knowledge, no studies in Malaysia have



explored concepts of healthy eating alongside PA, or discuss the barriers and facilitators for behaviour change in adolescents based on the multi-stakeholders' perceptions.

The present study was a needs assessment as a part of the MyHeART BEaT project^(34,46) to guide the development of the content and structure of future intervention. Current research focuses on the application of qualitative methods to inform the development of a school-based intervention to promote healthier eating and PA among adolescents in Malaysia. We involved a variety of stakeholders in secondary schools (adolescents, principals, PE teachers and food canteen operators) to explore: (a) stakeholders' perceptions of the provision of healthy food and PA in the school setting and (b) stakeholders' preferences and suggestions for school-based interventions to promote healthier eating and PA in Malaysia. Our findings may be relevant to other low- and middle-income settings.

Methods

Overview of the study setting

Malaysia's multilingual public school system provides free education for all Malaysians in addition to the availability of private schools and home-schooling. Education is not free in international and private schools. Secondary education lasts for 5 years, referred to as Form 1 (secondary one; grade 7; 12–13 years old) to 5 (16–17 years old; Secondary 5; grade 11). There are 5.5 million adolescents aged 10–19 years, which equates to approximately 19% of the total population; school enrolment in secondary education (% net) in Malaysia was reported at 72.2% in 2018⁽⁴⁷⁾.

Study design and participants

Semi-structured focus groups were conducted in February 2018 with Form 2 students aged 13–14 years, attending four secondary schools in Perak and Selangor states (two urban and two rural schools) in Malaysia. Convenience sampling was used to recruit adolescents. Teachers were asked to invite all Form 2 students to participate by distributing a participant information sheet and consent form to the parents of the students. During the same period, in-depth interviews, guided by structured question guides, were also conducted with multiple stakeholders (one PE teacher, one school principal and one canteen operator) at each of the four schools. All participants (and/or the adolescents' parent or legal guardians) asked to provide written informed consent before data collection commenced.

The questions were semi-structured focus groups and interview topic guides (different guides and questions) adapted from those used in previous studies but modified and developed to suit the context of the study^(48,49). Guides were pilot-tested among students and stakeholders for face

validity to confirm the feasibility for data collection. The questions explored stakeholders' perceptions of healthy eating and PA in the school setting; barriers for PA and consuming healthy foods in the school canteen; and expectations of an acceptable school-based intervention.

Data collection

Focus group discussions

A total of eight focus groups (lasting on average 40 min, range 35–45 min) were conducted by two facilitators (S.M. and H.A.M.), who were experienced and trained to conduct qualitative research (one researcher moderated the focus groups, and the other took detailed notes). Eight to ten adolescents participated in each focus group, which were conducted separately for girls and boys. Homogenous focus groups can create an atmosphere where students feel comfortable and free to speak, without having to defend their opinions. For example, females might not be able to express themselves freely in the presence of male participants. As all schools were Malay-based, focus groups were not arranged according to ethnicity (Malay, Chinese and Indian).

In-depth interviews

Twelve face-to-face in-depth interviews were conducted in four secondary schools with the headmasters, teachers and canteen operators by a trained enumerator. Open-ended questions were asked. Interviews lasted approximately 30 min (range 25–35 min).

The focus groups and interviews were conducted in Malay, digitally recorded, transcribed verbatim and anonymised. For both focus groups and interviews, the arrangement and wording of the questions were revised, if necessary, to explore emerging themes. Towards the end of the focus groups and interviews, the facilitator summarised the notes taken to participants to confirm their accuracy.

Data analysis

Data analysis was carried out in Malay, and translation of the data into English was limited to selected quotes. Analysing data in the original language prevents potential misinterpretations of participants' statements^(50–54). Two independent data analysts (F.A.B. and S.R.R.) listened to the recordings to check precision with the transcriptions. Transcripts were also compared with the facilitator's detailed notes to ascertain their credibility. The analysis of transcripts was conducted by two trained researchers (F.A.B. and S.R.R.) and subsequently verified by H.A.M./M.D./T.T.S./M.Y.J. Selected themes and quotes were translated into English by F.A.B. and S.R.R., who are native Malay speakers, and back-translated to Malay by an independent bilingual researcher (H.A.M.). Data collection and analysis were in parallel, so that data collection was

completed when saturation was reached (i.e. data had a range of perceptions and variation of replies of participants, and no new themes arose from the analysis). Data organisation and coding were facilitated by NVivo software version 10 (QRS International Pty Ltd, UK).

Data were analysed thematically⁽⁵⁵⁾, following an inductive approach by using a framework method, which included five stages⁽⁵⁶⁾. First, familiarisation with the data was conceded by reading transcripts repeatedly. Second, two trained researchers (F.A.B. and S.R.R., who are both Malay, English speakers) separately open-coded three randomly selected transcripts to start categorising data, so they could be compared with the rest of the data set. Third, coding inconsistencies (e.g. dissimilarities in terms used by the coders and whether codes were suitable to respond to the research questions) were discussed until a set of codes that made an initial framework was agreed. Based on this, the remaining transcripts were independently coded to establish any new themes and codes. Then, the coders discussed again to refine the initial framework, detect new codes and themes.

Inter-coder reliability was 95 %, as calculated by dividing the number of agreements by the sum of agreement and disagreements. Fourth, indexing (systematically applying the framework to all transcripts) was applied by one researcher using the qualitative data analysis software NVivo version 10 (QRS International Pty Ltd, UK), which simplified the comparison of similarities and differences within and between the focus groups/interviews, and the evaluation of patterns in the views of participants, according to each theme. Finally, charting data into the framework matrix was carried out by reordering the data in a chart. Themes were organised and reorganised into themes and sub-themes as described for thematic analysis⁽⁵⁵⁾. Themes and sub-themes are supported in this report by representative quotations from participants (indicated by gender, rural/urban and stakeholder). These were selected to best reflect the variety of answers.

Results

The focus groups and in-depth interviews were conducted with seventy-six adolescents (thirty-eight boys; thirty-eight girls) and multiple stakeholders ($n = 12$) from four schools, respectively. Stakeholders were principal (two female; two male), PE teacher (one female; three male) and canteen operator (three female; one male). Table 1 shows the characteristics of participants of focus groups and in-depth interviews in two urban and two rural schools. We identified several themes around the challenges faced by adolescents and stakeholders and suggestions that would need to be considered when designing future interventions to promote healthier eating and PA in secondary schools in Malaysia (Table 2). Examples of responses related to healthy eating and PA based on these themes are shown in Tables 3 and 4, respectively. In addition, the Malay version of responses is available in Supplementary material 1. The summary of the findings and their implications for the development of an intervention to promote healthier eating and PA among Malaysian adolescents is described in Table 5.

Challenges around healthy eating

Perceptions of healthy eating

Adolescents seemed to have common misconceptions of healthy eating, and most perceived fried food as being healthy. One adolescent perceived that fried rice served in the school canteen was healthy because it contains small amounts of vegetables. According to the interviews with the principals, students tended to associate healthy food with foods that are not tasty.

Some adolescents mentioned that their families' guidance helped them to change their understanding of healthy food; some stated that their mothers prepare and provide advice on food selection. Overall, adolescents thought that healthy foods were being served by the

Table 1 Participation of focus groups and in-depth interviews in two urban and two rural schools

School	Focus groups	In-depth interviews
Urban school 1	(1) 10 boys (1) 10 girls	(1) Principal (Female) (1) Physical education teacher (Male) (1) Canteen Operator (Female)
Urban school 2	(1) 8 boys (1) 8 girls	(1) Principal (Female) (1) Physical education teacher (Male) (1) Canteen Operator (Female)
Rural school 1	(1) 10 boys (1) 10 girls	(1) Principal (Male) (1) Physical education teacher (Female) (1) Canteen Operator (Female)
Rural school 2	(1) 10 boys (1) 10 girls	(1) Principal (Male) (1) Physical education teacher (Male) (1) Canteen Operator (Male)
Total	8 focus groups 38 boys (50 %); 38 girls (50 %)	12 in-depth interviews Principal (female 50 %; male 50 %) Physical education teacher (female 25 %; male 75 %) Canteen operator (female 75 %; male 25 %)

**Table 2** Challenges and opportunities for healthy eating and physical activity

Variables	Healthy eating	Physical activity
Challenges	<ul style="list-style-type: none"> • Perceptions of healthy eating • Limited healthy food options at the school canteen • Preference and affordability to buy healthy food options at the school canteen 	<ul style="list-style-type: none"> • Quality of PE classes • Students' participation in PE classes • Teachers' commitment to PE classes
Opportunities	<ul style="list-style-type: none"> • Availability of healthy food options at the school canteen • Subsidising healthy foods at the school canteen • Healthy eating education and training 	<ul style="list-style-type: none"> • PE training for temporary teachers • Encouraging students' involvement in physical activity • Parental support for adolescents' physical activities

PE, physical education.

school canteen, with fried chicken, fried rice and coconut milk rice being considered healthy foods.

Canteen operators perceived that healthy eating would not be feasible since healthy food is unpopular among adolescents and, therefore, selling healthy foods would not be a profitable practice. When asked about their comprehension of healthy food options, operators seemed to misunderstand what healthy options might be, with one giving an example that an ice cream-filled bun would be a healthy snack for adolescents.

Limited healthy food options at the school canteen

Adolescents generally agreed with each other that canteen vendors offer them limited options of food. Deep-fried and oily foods, like fried chicken and fried rice, were common options bought from the canteen. They also perceived that the school canteen provided insufficient amounts of healthy options, like fruits and vegetables, especially in rural schools.

Table 3 Challenges and opportunities around healthy eating arising in the eight focus groups discussions among adolescents (*n* 76) aged 13–14 years and twelve in-depth interviews (headmasters, physical education (PE) teachers and food canteen operators) from four secondary schools in Perak and Selangor states of Malaysia

Theme/sub-theme	Example of responses
Challenges around healthy eating	
Perceptions of healthy eating	<p>'Maybe fried rice because it contains vegetables.' (Girl, Rural school 2)</p> <p>'They (the adolescents) associated healthy food as not being tasty.' (Principal, Urban school 2, Female)</p> <p>'My mother prepares and advises me to eat more vegetables. I eat whatever she cooks.' (Girl, Urban school 1)</p> <p>'To add some afternoon snacks, we are planning to sell ice-cream filled bun.' (Canteen operator, Urban school 1, Female)</p>
Limited healthy food options at the school canteen	<p>'If we were to discuss whether the food is somewhat nutritious... balanced food is there... but maybe with extra fat (content)... or limited food like fruits.' (Principal, Urban school 2, Female)</p> <p>'We sell what the students like... when the students don't like it... then the food is not selling (well).' (Canteen operator, Urban school 1, Female)</p>
Preference and affordability to buy healthy food options at the school canteen	<p>'Students are inclined to take filling food... so, they prefer to take rice, fried vermicelli, and so forth.' (Principal, Urban school 2, Female)</p> <p>'(We) sell foods that are filling to the students.' (Canteen operator, Urban school 2, Female)</p> <p>'I do eat (at the canteen). If I do, it is because I was hungry.' (Boy, Urban school 1)</p> <p>'I don't have enough money to be able to eat well due to the low income of my father.' (Boy, Rural school 1)</p> <p>'Parental income (of the students) is very low... so, some students do not bring pocket money.' (Principal, Rural school 1, Male)</p>
Opportunities around healthy eating	
Availability of healthy food options at the school canteen	<p>'Let's say if we want to make changes... say to make a policy... the canteen is only allowed to sell healthy foods... foods that are oily will not be allowed.' (Principal, Urban school 2, Female)</p> <p>'Prepare healthier foods than unhealthy ones. We should consume fruits, vegetables, and healthy foods.' (Boy, Urban school 1)</p>
Subsidising healthy foods at the school canteen	<p>'So only healthy food choices... the healthy ones are the ones that we give subsidies to... at a (certain) price point... but sell them at a cheaper price... as an introductory move to the (healthy) foods.' (Principal, Urban school 2, Female)</p> <p>'I think in terms of (cost) of raw materials... because the price has spiked.' (Canteen operator, Urban school 2, Female)</p> <p>'Maybe reduce the (healthy) food price... like before this, some (students) could not afford to purchase them (healthy food).' (Girl, Rural school 2)</p>
Healthy eating education and training	<p>'Maybe the best approach is (having) a campaign... awareness campaign on healthy food and so forth... maybe if the University of Malaya can run a campaign together with us in school.' (Principal, Urban school 1, Female)</p> <p>'Sure if the Ministry is providing it (healthy cooking class) for us... we can follow the steps... just like the hospital canteen where the Ministry provides... so, if the Ministry provide it to us, it will not be an issue for us to follow.' (Canteen operator, Rural school 1, Female)</p>

Table 4 Challenges and opportunities around physical activity (PA) in the eight focus groups discussions among adolescents (*n* 76) aged 13–14 years and twelve in-depth interviews (headmasters, physical education (PE) teachers and food canteen operators) from four secondary schools in Perak and Selangor states of Malaysia

Theme/sub-theme	Example of responses
Challenges around PA	
Quality of PE classes	<p>'In my opinion, the physical education class is boring because we often play the same sport.' (Boy, Rural school 2)</p> <p>'For the half an hour session, physical education is very short. If the students are delayed, the time will be even shorter (for activities).' (Boy, Urban school 1)</p> <p>'So, sometimes the equipment is minimal... with many students (using it) ... students have to wait a long time for their turn to use the equipment... have to take turns... even after the teacher has split them into smaller groups... but the waiting time is still quite long, in my opinion.' (Physical education teacher, Urban School 1, Male)</p>
Students' participation in PE classes	<p>'If we were to talk about hindrance from students themselves, there are some (the students) who are not keen to do the physical activities... they will come to the field but not participate.' (Principal, Urban school 2, Female)</p> <p>'Sometimes it's not okay; some students prefer to chat and did not join (the activities).' (Girl, Rural school 1)</p> <p>'When they come, they come unprepared to do physical activities due to lack of interest... no awareness.' (Physical education teacher, Urban school 1, Male)</p>
Teachers' commitment to PE classes	<p>'Because physical education is not subject to examination.' (Principal, Urban school 1, Female)</p> <p>'The teacher is not active and often lets us decide to play (on the field) by ourselves.' (Girl, Rural school 2)</p> <p>'(Our) teacher often asked us to play by ourselves.' (Girl, Urban school 1)</p> <p>'It's just that some of the activities were not performed... where most of our teachers are temporary hence there were several activities that we are not brave enough to conduct with the students... as they are quite dangerous when not following the correct procedure.' (Physical education teacher, Rural school 2, Male)</p>
Opportunities around PA	
PE training for temporary teachers	<p>'They needed help... firstly, in terms of skills (acquisition)... especially for the temporary female teacher.' (Principal, Urban school 1, Female)</p> <p>'To provide the opportunity for specific training (programmes) for these (temporary) teachers... so, we will be utilising this opportunity to instil the required skills for them to teach.' (Physical education Teacher, Rural school 1, Female)</p>
Encouraging students' involvement in PA	<p>'Increase the activities... allocate us more time... that's all.' (Boy, Rural school 1)</p> <p>'The student will become a model... he will show (correct techniques) to his friends.' (Principal, Urban school 1, Female)</p> <p>'One request... for example, we have an hour... I would utilise 15 min to focus on track and field (activity)... meaning if you (the students) do it seriously... I (the teacher) will allow you (the student) to play football or... other activities... it seems like they (the students) are responding (positively) to this (approach).' (Physical education teacher, Urban school 2, Male)</p>
Parental support for adolescents' PA	<p>'In terms of family, they told me to be active. Play sports like running to lose weight. Make the body fit. That's all (Boy, Urban school 2)</p> <p>'I like to do... what do they call it?... fitness with my mum and my dad.' (Girl, Rural school 1)</p> <p>'Starting from 2018... The State Education Department has ordered us to implement SSDM... A warning letter will be issued under the system and first and second and third warnings are issued, and at the same time (after third warning), we will request the school counsellor to pay the student a house visit to investigate.' (Principal, Rural school 1, Male)</p>

Principals acknowledged the limited variety of foods in canteens and explained that food items are usually sold with profits and the cost of the raw materials in mind. One principal explained that the foods available could still form part of a balanced diet despite healthy options, such as fruit, is limited and other foods having a high in fat content.

Canteen operators explained that they are following the Healthy Canteen Guidelines provided by the Ministry of Health in Malaysia. They thought the limited healthy options offered in school canteens were the result of a 'supply and demand factor' by the students, whereby adolescents prefer quick and simple food options and have a low interest towards healthy foods. Operators perceived that selling healthier foods would result in fewer purchases,

which in turn would cause food waste and a financial loss to the canteen.

Preference and affordability to buy healthy food options at the school canteen

Principals perceived that adolescents preferred buying unhealthy options in the canteen, as they are more filling (energy-dense such as junk foods) than healthier foods. Canteen operators also seemed to agree with this notion, in that adolescents preferred to buy filling foods (energy-dense such as junk foods), even if they were unhealthy.

Adolescents also reported preferring to buy their meals in the canteen because the menu has filling foods, thus preventing hunger during the school period. Adolescents

Table 5 Implications of findings for the development of an intervention to promote healthier eating and physical activity among adolescents in secondary schools in Malaysia

Key components to be addressed	Desired outcome	Potential intervention content to achieve the outcome
Availability of healthy food options at school canteen	Increasing the availability of healthy food options at the school canteen.	School-based Healthy School Canteen programme can be a promising intervention to change the school food environment.
Subsidising healthy foods at the school canteen	Improving the subsidisation of healthy foods at schools.	School-based policies to improve the relative availability of healthy foods for sale at the school canteen.
Healthy eating education and training	Improving healthy eating education and training for healthy eating among adolescents and canteen operators.	Development of appropriate educational materials and training sessions for adolescents and canteen operators.
Physical education training for temporary teachers	Understanding the preferred method for training temporary teachers related to physical education classes.	The provision of an online and face-to-face training platform for temporary teachers related to physical education classes and employment of trained staffs.
Encouraging students' involvement in physical activity	Understanding the preferred method to encourage student's involvement in physical education classes.	Adopting a participant-led approach to change and providing adequate sports equipment and a wide variety of activities to account for adolescents' individual preferences.
Parental support for adolescents' physical activities	Understanding the preferred method to get the family support adolescents' physical activities.	Development of evidence-based interventions to get the family support for adolescents' physical activities.

from the rural area also stated a lack of money to buy food, mainly when asked about obstacles to healthy eating.

Principals from rural schools mentioned that adolescents at their schools came from low socio-economic backgrounds and it was common that they come to school without, or with minimal, pocket money, thus limiting their ability to buy foods in the first place. Canteen operators corroborated this. Particular to this issue, we found that students within urban schools prefer unhealthy and filling foods (to fight hunger without caring about the nutritional value) and affordability was not the primary concern.

Opportunities around healthy eating

Availability of healthy food options at the school canteen

Principals expressed the view that only healthy foods should be made available at the school canteen and the sale of unhealthy foods should be prohibited to enhance healthy eating behaviours among adolescents.

Most adolescents thought that canteen operators increasing the availability of healthy food options would facilitate them choosing healthy foods. One adolescent even suggested that foods available should form parts of a balanced diet, such as fruits and vegetable dishes. However, canteen operators explained that healthy food options were limited because some equipment for healthy cooking (e.g. utensils for roasting or steaming) are not available and often expensive for them to acquire and use when preparing meals.

Subsidising healthy foods at the school canteen

Subsidising raw ingredients and providing food coupons were some of the approaches suggested by the stakeholders to promote healthier eating. Both principals and canteen operators agreed that healthy eating could be made possible if food subsidies were provided to the

schools. Adolescents also reported that providing subsidies to reduce the burden of cost to canteen operators would allow healthy foods to be sold at lower prices. They emphasised the need for canteens to have healthy food options at lower prices, which would increase the likelihood of them opting for healthy foods.

Healthy eating education and training

All principals suggested that health education programmes should run throughout the year to change attitudes towards healthy food among adolescents. Some suggestions involved campaigns and festivals providing free healthy foods in order to encourage students to try them.

Adolescents, however, gave mixed responses when asked about the potential for health education to promote healthier eating in schools. Some adolescents were against this suggestion, explaining that educational materials, such as brochures, would not help to enhance literacy around healthy eating. However, some adolescents thought that health education might be useful, as it might help students learn to distinguish healthy from unhealthy food options.

Canteen operators seemed to like the idea of offering them the opportunity to enrol in healthy cooking classes. They would also favour receiving guidance, for example, alternatives to unhealthy foods and healthy recipes, as well as making healthy cooking tools available to aid them in preparing healthy food for students.

Challenges around physical activity

Quality of physical education classes

Adolescents often thought that the PE classes offered at school were short and boring, offering a limited variety of activities. Insufficient sports equipment and teaching materials were commonly perceived among PE teachers as challenges around PA in schools. The quality of PE



classes was an issue mentioned by adolescents; they perceived that the low teacher–student ratio hampered the efficiency of the sessions. This was particularly the case for rural schools, which have limited equipment reducing opportunities for students to participate in more activities.

Students' participation in physical education classes

In both rural and urban schools, principals, PE teachers and adolescents thought that PE classes had low participation from students. Some adolescents, in particular, reported that despite attending the classes, they preferred not to participate in the activities. PE teachers perceived that participation in classes depended on adolescents' interests and personal preferences, whereas principals thought that low participation might be because PE classes were not assessed formally.

Teachers' commitment to physical education classes

Adolescents reported that one of the challenges they faced during PE classes was that teachers were not fully committed to the class. They mentioned that teachers were not active and often instructed students to do their activity. This was highlighted in both urban and rural schools.

Principals explained that PE teachers' low commitment towards their classes was mainly due to limited skills, as many did not have a PE background and were employed as temporary staff. One of the teachers explained that they were often unable to follow the activity procedures to avoid injury to students, especially with regard to technical activities.

Opportunities around physical activity

Physical education training for temporary teachers

Principals and PE teachers felt that more training should be provided to the teachers to conduct PE classes appropriately. As the number of PE teachers is limited, both of these stakeholders largely agreed that training would aid teachers' skills and methods for delivering the classes.

Encouraging students' involvement in physical activity

In order to encourage student participation in PA, most adolescents suggested that schools should consider increasing both the frequency and duration of PE classes so that they have many opportunities to be more physically active. Students also felt that peer encouragement would help them to get involved and become more physically active. One of the principals also suggested that friends acting as a role model for specific activities would increase adolescents' involvement in classes. For example, an adolescent who plays football could help teach their friends the proper techniques to play the sport.

In addition, PE teachers suggested the implementation of a reward system for adolescents, especially those who are highly likely to not participate in PE classes. The reward system may function by engaging students to join the planned class, before giving them their reward of doing

their preferred activity. Furthermore, both principals and PE teachers suggested that sports competitions could be an outlet to help increase adolescents' interest to get involved in physical activities.

Parental support for adolescents' physical activities

Students from both rural and urban schools mentioned that they tend to be more physically active when they receive support from their parents. Examples of parental support provided by the students to facilitate this included parents dropping them off at sports facilities and joining them when engaging in PA.

Principals also addressed the importance of active parental support to promote adolescents' PA and mentioned that schools had implemented a system, called SSDM (*Sistem Sabsiab Diri Murid*) or Students' Self-Affair System, whereby a warning letter is issued to students who missed a PE class. After three absences, the school counsellor contacts the parents to discuss appropriate actions.

Discussion

In our qualitative study, Malaysian adolescents, school principals, PE teachers and canteen operators highlighted several challenges with regard to healthy eating and PA in secondary schools. Participants provided important insights on how the school environment could facilitate healthier eating and PA, including subsidising and increasing the availability of healthy foods; providing nutrition and PA training for adolescents and stakeholders; and encouraging adolescents to participate in PA via peer and parental support. These insights are essential to inform interventions to promote healthy eating and PA in secondary schools in Malaysia.

The main barriers for healthy eating at school identified by adolescents in the current sample included the lack of healthy food options, the availability of unhealthy foods and issues around preferences and affordability. In addition, there seemed to be several misconceptions regarding what constitutes healthy eating, which might have contributed to adolescents' consumption of more unhealthy foods. Our finding is in contrast to a study of Irish adolescents, who had a good understanding of what healthy eating involves⁽⁵⁷⁾. Both adolescents in the current and earlier qualitative studies^(57,58) perceived that food preferences and foods sensory qualities (i.e. texture, appearance and smell) play a more central role in their food choices. This is corroborated by a study of forty adolescents in Swiss schools, who perceived that enhancing the attractiveness of healthy choices would be the most effective approach to improving eating habits⁽⁵⁹⁾.

Families, especially mothers, were described as influencing the food habits and perceptions of healthy food of Malaysian adolescents. This was also highlighted in studies among adolescents^(60,61). Since mothers were





typically regarded as being responsible for preparing family meals^(62,63), good maternal knowledge of nutrition could improve the quality of food intake and eating behaviour of adolescents at home⁽⁶⁴⁾.

Other barriers to healthy eating in secondary schools that have been reported in earlier research included poor school meal provision, ease of access and the relatively low cost of fast food⁽⁶⁵⁾. In contrast, healthy eating has been suggested to be facilitated by parental support, broader accessibility of healthy foods, desire to look after one's appearance and will-power⁽⁶⁵⁾. Some of these findings agree with the current study's results, where adolescents suggested that increasing the availability and reducing the cost of healthy foods would help them make healthier choices in the school canteen.

School food environments are different between rural and urban areas⁽⁶⁶⁾. Identified challenges in rural schools include limited administrative capacity, difficulty in hiring and retaining qualified staffs, physical infrastructure limitations, as well as limited food supply and purchasing options^(66,67). Food habits among rural adolescents are characterised by traditional food, and a lower frequency of milk products, meat/fish/eggs, vegetables and cereals. In contrast, adolescents in urban areas eat more junk food, have a higher amount of pocket money and are engaged in less manual activities and walking than adolescents in rural areas⁽⁶⁸⁾.

Interestingly, perceptions of stakeholders in the current study did not often differ in urban or rural areas. One exception was that cost or affordability of foods offered in the school canteen, which might be a more important factor preventing healthier choices for adolescents based in rural, compared with urban, areas. Lack of money to purchase healthy food was also a barrier to healthy eating for adolescents in earlier qualitative studies^(69–71). Our findings suggest that inequalities in the foods consumed at urban and rural schools could potentially be overcome by using subsidies for healthy foods. In addition, some studies have shown that it is possible to improve food availability and increase sales of healthy items in secondary school canteens^(72,73).

All stakeholders involved in the current study perceived that the main barriers for adolescents being physically active at school were the low quality of PE classes; adolescents' low level of participation in classes; and PE teachers' limited skills and commitment. Lack of time to engage in PA during the PE class was another perceived challenge by adolescents, which is a barrier commonly observed elsewhere^(74–76). However, in these earlier reports, adolescents linked the lack of time to engage in PA due to school demands (e.g. overloaded curriculum, assignments, private lessons and prioritising academic success).

In addition, obstacles related to infrastructure and available equipment were considered as barriers to promoting high-quality PA in schools by all stakeholders, which has been reported by earlier studies as well^(77,78). However, a

Malaysian adolescent cohort study (MyHeARTs) highlighted that activities associated with higher fitness in adolescents typically took place outside of school, in the evening or at weekends⁽⁷⁹⁾, which suggests that PE may be less important than out-of-school physical activities for adolescent health.

All stakeholders highlighted that some adolescents do not engage during PE classes, potentially due to personal interests or preferences. Enjoyment of participation in PE classes is an important facilitator of adolescent PA⁽⁷⁸⁾, and offering a wider variety of activities during classes might help contribute to more active participation at school. In addition, to actively engage adolescents in PE classes, PE teachers must be trained appropriately through Initial Teacher Training. When providing PE, a teacher should carefully consider how they will adapt demonstrations and explanations of the skills being taught to meet the needs of the students in their class and the intended content⁽⁸⁰⁾. Monitoring systems need to be proven effective to ensure that PE programmes in Malaysian schools are implemented properly. PE classes are not implemented uniformly across schools and largely depend on the discretion of the school head and management. This falls short of achieving the level that is required to realise the targeted health and well-being benefits. Moreover, an effective PE system requires the collaboration of its multiple stakeholders.

Finally, all stakeholders in the current study perceived social support and encouragement as important when promoting PA. Social support, particularly from friends, family and teachers, has been consistently linked to higher levels of adolescent PA in earlier research^(81,82).

A few school-based nutritional interventions have been implemented in Malaysia^(83–86). However, most interventions to date are focused on either the prevention of obesity or disordered eating, rather than general improvements to nutrition and PA in all students. To our knowledge, Malaysia does not have a comprehensive intervention programme that promotes the components of healthy eating and an active lifestyle among adolescents.

Two previous canteen-based food nutrition intervention studies in Malaysia successfully improved healthy food knowledge among food handlers⁽²⁵⁾ and students' perception of healthy food choices⁽⁸⁷⁾. However, there was no evidence of improvement in the primary schoolchildren's preferences for fruits⁽⁸⁷⁾. The intervention between food handlers found that almost one-third of fast food and food not recommended for sale were available in the canteens because school canteens prioritised making profits⁽²⁵⁾. Meanwhile, there is still some gaps in data and demand for appropriate nutrition intervention among adolescents.

To our knowledge, this is the first study to utilise the Medical Research Council framework for the development of complex interventions for schoolchildren in Malaysia⁽³⁸⁾. We explored secondary school stakeholders' perceptions to inform the design of a future intervention to improve



dietary and PA behaviours in Malaysian adolescents. Use of the Medical Research Council framework is a strength of this study, as conducting this type of formative research before intervention development is likely to result in more feasible and acceptable interventions. A wide range of stakeholders was involved (adolescents, principals, teachers and canteen operators), who were recruited from both urban and rural areas of Malaysia, thus enabling a wide range of insights into the topics explored. Nevertheless, the generalisability of the findings to different geographical regions of Malaysia cannot be assumed and, despite thematic data saturation being reached, the sample size was relatively small. Malaysia comprises three main ethnic groups (Malay, Chinese and Indian), but we only included schools that were Malay-based and focus groups were not arranged according to ethnicity (Malay, Chinese and Indian). Students of other ethnicities could have different perceptions due to potential cultural differences. All ethnicities should participate in future studies to develop inclusive interventions. The results cannot be generalised to adolescents studying in a non-formal education programme. Furthermore, the students may have given socially desirable answers throughout the focus group discussions, mainly when they could not express their problems or if they overstated their positive perceptions.

Conclusions

The current study suggests that several challenges and opportunities to following a healthy diet and engaging in high-quality PA in Malaysian secondary schools should be addressed in a future intervention to promote these behaviours among Malaysian adolescents. Stakeholders thought that adolescents' misperceptions, limited availability of healthy options, unhealthy food preferences and affordability were important challenges preventing healthy eating at school. Low-quality PE classes, limited adolescent participation and teachers' commitment during lessons perceived as barriers to adolescents being active at school. They perceived that a future school-based intervention should ideally improve the availability and subsidies for healthy foods, provide engaging in health education/training for both adolescents and PE teachers, enhance active adolescent participation in PE classes, provide adequate sports equipment and variety of physical activities, develop role modelling, and social support mechanisms to facilitate engagement with PA. Rather than providing adolescents with only relevant knowledge related to a healthy lifestyle, they require training to deal with the obstacles. Such educational platforms should also deliver knowledge and guidance related to PA and healthy eating for their parents. Results from our study can form the basis for the development of a school-based intervention to promote healthier eating and encourage PA to Malaysian adolescents.

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Supplementary material

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References

1. NCD Risk Factor Collaboration (NCD-RisC) (2017) Child and adolescent obesity rates data in Malaysia. <http://ncdrisc.org/data-downloads-adiposity-ado.html> (accessed April 2020).
2. Vos MB, Kimmons JE, Gillespie C *et al.* (2008) Dietary fructose consumption among US children and adults: the third national health and nutrition examination survey. *Medical Science Research* **10**, 160.
3. Te Morenga L, Mallard S & Mann J (2013) Dietary sugars and body weight: systematic review and meta-analyses of randomised controlled trials and cohort studies. *BMJ* **346**, e7492.
4. Poti JM & Popkin BM (2011) Trends in energy intake among US children by eating location and food source, 1977–2006. *J Am Diet Assoc* **111**, 1156–1164.



5. Ello-Martin JA, Ledikwe JH & Rolls BJ (2005) The influence of food portion size and energy density on energy intake: implications for weight management. *Am J Clin Nutr* **82**, 236S–241S.
6. Dehghan M, Akhtar-Danesh N & Merchant AT (2005) Childhood obesity, prevalence and prevention. *Nutr J* **4**, 24.
7. Ghobadi S, Hassanzadeh-Rostami Z, Salehi-Marzjarani M *et al.* (2018) Association of eating while television viewing and overweight/obesity among children and adolescents: a systematic review and meta-analysis of observational studies. *Obes Rev* **19**, 313–320.
8. Boon TY, Sedek R & Kasim ZM (2012) Association between snacking patterns, energy and nutrient intakes, and body mass index among school adolescents in Kuala Lumpur. *Am J Food Nutr* **2**, 69–77.
9. Zalilah M, Khor G, Minalini K *et al.* (2006) Dietary intake, physical activity and energy expenditure of Malaysian adolescents. *Singapore Med J* **47**, 491–498.
10. Mustafa N, Abd Majid H, Toumpakari Z *et al.* (2019) The association of breakfast frequency and cardiovascular disease (CVD) risk factors among adolescents in Malaysia. *Nutrients* **11**, 973.
11. Su TT, Sim PY, Nahar AM *et al.* (2014) Association between self-reported physical activity and indicators of body composition in Malaysian adolescents. *Prev Med* **67**, 100–105.
12. Cheah WL, Chang CT, Rosalia S *et al.* (2011) The relationship between media use and body mass index among secondary students in Kuching South City, Sarawak, Malaysia. *MJMS* **18**, 33–42.
13. Baharudin A, Zainuddin AA, Manickam MA *et al.* (2014) Factors associated with physical inactivity among school-going adolescents: data from the Malaysian School-Based Nutrition Survey 2012. *Asia Pac J Public Health* **26**, 27S–35S.
14. Lee ST, Wong JE, Nik Shanita S *et al.* (2014) Daily physical activity and screen time, but not other sedentary activities, are associated with measures of obesity during childhood. *Int J Environ Res Public Health* **12**, 146–161.
15. Reilly JJ & Kelly J (2011) Long-term impact of overweight and obesity in childhood and adolescence on morbidity and premature mortality in adulthood: systematic review. *Int J Obes* **35**, 891–898.
16. World Health Organisation (2016) *Report of the Commission on Ending Childhood Obesity*. Geneva: WHO.
17. Hynynen ST, Van Stralen MM, Sniehotha FF *et al.* (2016) A systematic review of school-based interventions targeting physical activity and sedentary behaviour among older adolescents. *Int J Sport Exerc Psychol* **9**, 22–44.
18. Lonsdale C, Rosenkranz RR, Peralta LR *et al.* (2013) A systematic review and meta-analysis of interventions designed to increase moderate-to-vigorous physical activity in school physical education lessons. *Prev Med* **56**, 152–161.
19. Metcalf B, Henley W & Wilkin T (2012) Effectiveness of intervention on physical activity of children: systematic review and meta-analysis of controlled trials with objectively measured outcomes (EarlyBird 54). *BMJ* **345**, e5888.
20. De Sa J & Lock K (2008) Will European agricultural policy for school fruit and vegetables improve public health? A review of school fruit and vegetable programmes. *Eur J Public Health* **18**, 558–568.
21. Micha R, Karageorgou D, Bakogianni I *et al.* (2018) Effectiveness of school food environment policies on children's dietary behaviors: a systematic review and meta-analysis. *PLoS One* **13**, e0194555.
22. Downs SM, Farmer A, Quintanilha M *et al.* (2012) From paper to practice: barriers to adopting nutrition guidelines in schools. *J Nutr Educ Behav* **44**, 114–122.
23. Gabriel CG, de Vasconcelos FD, de Andrade DF *et al.* (2009) First law regulating school canteens in Brazil: evaluation after seven years of implementation. *Arch Latinoam Nutr* **59**, 128.
24. Moy FM, Ying GC, Kassim SZ *et al.* (2006) Eating patterns of school children and adolescents in Kuala Lumpur. *Malays J Nut* **12**, 1–10.
25. Rosmawati NN, Manan WW, Izani NN *et al.* (2017) Impact of food nutrition intervention on food handlers' knowledge and competitive food serving: a randomized controlled trial. *Int J Food Res* **24**, 1046.
26. Hayati Adilin MA, Holdsworth M, McCullough F *et al.* (2015) Whole school mapping to investigate the school environment's potential to promote a healthy diet and physical activity in Malaysia. *Malays J Nutr* **21**, 1–14.
27. Rezali FW, Chin YS & Yusof BNM (2012) Obesity-related behaviors of Malaysian adolescents: a sample from Kajang district of Selangor state. *Nutr Res Pract* **6**, 458–65.
28. Ministry of Education (2011) *Management Guide for Healthy School Canteen*. Putrajaya, Malaysia: MOE.
29. Ishak SI, Chin YS, Taib MN *et al.* (2020) Malaysian adolescents' perceptions of healthy eating: a qualitative study. *Public Health Nutr* **23**, 1440–1449.
30. Reilly KL, Nathan N, Wiggers J *et al.* (2018) Scale up of a multi-strategic intervention to increase implementation of a school healthy canteen policy: findings of an intervention trial. *BMC Public Health* **18**, 860.
31. Nathan N, Yoong SL, Sutherland R *et al.* (2016) Effectiveness of a multicomponent intervention to enhance implementation of a healthy canteen policy in Australian primary schools: a randomised controlled trial. *Int J Behav Nutr Phys Act* **13**, 106.
32. Evenhuis IJ, Vyth EL, Veldhuis L *et al.* (2019) Development and evaluation of the implementation of guidelines for healthier canteens in Dutch secondary schools: study protocol of a quasi-experimental trial. *Front Public Health* **7**, 254.
33. Van Nassau F, Singh AS, van Mechelen W *et al.* (2015) Implementation evaluation of school-based obesity prevention programmes in youth; how, what and why? *Public Health Nutr* **18**, 1531–1534.
34. Mohammadi S, Jalaludin MY, Su TT *et al.* (2019) Determinants of diet and physical activity in Malaysian adolescents: a systematic review. *Int J Environ Res Public Health* **16**, 603.
35. Wee EH (2013) Contemporary issues in the teaching of PE in Malaysia. *J Phys Activ Sports Exerc* **1**, 17–20.
36. Craig P, Dieppe P, Macintyre S *et al.* (2008) Developing and evaluating complex interventions: the new Medical Research Council guidance. *BMJ* **337**, a1655.
37. Mokoena S (2012) Effective participative management: does it affect trust levels of stakeholders in schools? *J Soc Sci* **30**, 43–53.
38. Uyeda K, Bogart LM, Hawes-Dawson J *et al.* (2009) Development and implementation of a school-based obesity prevention intervention: lessons learned from community-based participatory research: progress in community health partnerships. *Res Educ Action* **23**, 249–255.
39. Moore S, Murphy S, Tapper K *et al.* (2010) From policy to plate: barriers to implementing healthy eating policies in primary schools in Wales. *Health Policy* **94**, 239–245.
40. Wolfenden L, Nathan NK, Sutherland R *et al.* (2017) Strategies for enhancing the implementation of school-based policies or practices targeting risk factors for chronic disease. *Cochrane Database Syst Rev* **11**, 1–191.
41. Middleton G, Keegan R & Henderson H (2012) A qualitative exploration of stakeholder perspectives on a school-based multi-component health promotion nutrition programme. *J Hum Nutr Diet* **25**, 547–556.
42. Valaitis R, Hanning R & Orava T (2016) A qualitative evaluation of the Ontario school food and beverage policy using an implementation framework: lessons learned. *FASEB J* **30**, 897–898.



43. Rathi N, Riddell L & Worsley A (2016) What influences urban Indian secondary school students' food consumption? A qualitative study. *Appetite* **105**, 790–797.
44. Clarke J, Fletcher B, Lancashire E *et al.* (2013) The views of stakeholders on the role of the primary school in preventing childhood obesity: a qualitative systematic review. *Obes Rev* **14**, 975–988.
45. Asada Y, Hughes AG, Read M *et al.* (2017) High school students' recommendations to improve school food environments: insights from a critical stakeholder group. *J School Health* **87**, 842–849.
46. Mohammadi S, Jalaludin MY, Su TT *et al.* (2019) Dietary and physical activity patterns related to cardio-metabolic health among Malaysian adolescents: a systematic review. *BMC Public Health* **19**, 251.
47. UNESCO Institute for Statistics (UNESCO-UIS) (2018) Secondary education enrolments in Malaysia. <http://data.uis.unesco.org> (accessed April 2020).
48. Payán DD, Sloane DC, Illum J *et al.* (2017) Perceived barriers and facilitators to healthy eating and school lunch meals among adolescents: a qualitative study. *Am J Health Behav* **41**, 661–669.
49. Lewis K (2014) Pupils' and teachers' experiences of school-based physical education: a qualitative study. *BMJ Open* **4**, e005277.
50. Birbili M (2000) Translating from one language to another. *Soc Res Update* **31**, 1–7.
51. Esposito N (2001) From meaning to meaning: the influence of translation techniques on non-english focus group research. *Qual Health Res* **11**, 568–579.
52. Van Nes F, Abma T, Jonsson HB *et al.* (2010) Language differences in qualitative research: is meaning lost in translation? *Eur J Ageing* **7**, 313–316.
53. Al-Amer R, Ramjan L, Glew P *et al.* (2015) Translation of interviews from a source language to a target language: examining issues in cross-cultural health care research. *J Clin Nurs* **24**, 1151–1162.
54. Lincoln YS, González y González EM & Aroztegui Massera C (2016) "Spanish is a loving tongue..." performing qualitative research across languages and cultures. *Qual Inq* **22**, 531–540.
55. Burnard P (1991) A method of analysing interview transcripts in qualitative research. *Nurse Educ Today* **11**, 461–466.
56. Gale NK, Heath G, Cameron E *et al.* (2013) Using the framework method for the analysis of qualitative data in multi-disciplinary health research. *BMC Med Res Methodol* **13**, 117.
57. Fitzgerald A, Heary C, Nixon E *et al.* (2010) Factors influencing the food choices of Irish children and adolescents: a qualitative investigation. *Health Promot Int* **25**, 289–298.
58. Stevenson C, Doherty G, Barnett J *et al.* (2007) Adolescents' views of food and eating: identifying barriers to healthy eating. *J Adolesc* **30**, 417–434.
59. Della Torre Swiss SB, Akre C & Suris JC (2010) Obesity prevention opinions of school stakeholders: a qualitative study. *J Sch Health* **80**, 233–239.
60. Fulkerson JA, Larson N, Horning M *et al.* (2014) A review of associations between family or shared meal frequency and dietary and weight status outcomes across the lifespan. *J Nutr Educ Behav* **46**, 2–19.
61. Neumark-Sztainer D, Larson NI, Fulkerson JA *et al.* (2010) Family meals and adolescents: what have we learned from Project EAT (Eating Among Teens)? *Public Health Nutr* **13**, 1113–1121.
62. Rathi N, Riddell L & Worsley A (2018) Indian adolescents' perceptions of the home food environment. *BMC Public Health* **18**, 169.
63. Berge JM, MacLehose RF, Larson N *et al.* (2016) Family food preparation and its effects on adolescent dietary quality and eating patterns. *J Adolesc Health* **59**, 530–536.
64. van Ansem WJ, Schrijvers CT, Rodenburg G *et al.* (2014) Maternal educational level and children's healthy eating behaviour: role of the home food environment (cross-sectional results from the INPACT study). *Int J Behav Nutr Phy* **11**, 113.
65. Shepherd J, Harden A, Rees R *et al.* (2006) Young people and healthy eating: a systematic review of research on barriers and facilitators. *Health Educ Res* **21**, 239–257.
66. Hoffman V, Srinivasan M, Levin M *et al.* (2018) Operating school meal programs in rural districts: challenges and solutions. *J Child Nutr Manag* **42**, n1.
67. Yettik H, Baker R, Wickersham M *et al.* (2014) Rural districts left behind? Rural districts and the challenges of administering the elementary and secondary education. *Act J Res Rural Educ* **29**, 1–15.
68. NzezaDapi L, Nouedoui C, Janlert U *et al.* (2005) Adolescents' food habits and nutritional status in urban and rural areas in Cameroon, Africa. *Scand J Food Nutr* **49**, 151–158.
69. Melo H, de Moura AP, Aires LL *et al.* (2013) Barriers and facilitators to the promotion of healthy eating lifestyles among adolescents at school: the views of school health coordinators. *Health Educ Res* **28**, 979–992.
70. Goh YY, Bogart LM, Sipple-Asher BK *et al.* (2009) Using community-based participatory research to identify potential interventions to overcome barriers to adolescents' healthy eating and physical activity. *J Behav Med* **32**, 491–502.
71. Power TG, Bindler RC, Goetz S *et al.* (2010) Obesity prevention in early adolescence: student, parent, and teacher views. *J Sch Health* **80**, 13–19.
72. French SA, Story M, Fulkerson JA *et al.* (2004) An environmental intervention to promote lower-fat food choices in secondary schools: outcomes of the TACOS Study. *Am J Public Health* **94**, 1507–1512.
73. Hannan P, French SA, Story M *et al.* (2002) A pricing strategy to promote sales of lower fat foods in high school cafeterias: acceptability and sensitivity analysis. *Am J Health Promot* **17**, 1–6.
74. Van Royen K, Verstraeten R, Andrade S *et al.* (2015) Factors affecting physical activity in Ecuadorian adolescents: a focus group study. *J Phys Act Health* **12**, 340–348.
75. Abdelghaffar EA & Siham B (2019) Perspectives of adolescents, parents, and teachers on barriers and facilitators of physical activity among school-age adolescents: a qualitative analysis. *Environ Health Prev Med* **24**, 21.
76. Martins J, Marques A & Sarmiento H (2015) Adolescents' perspectives on the barriers and facilitators of physical activity: a systematic review of qualitative studies. *Health Educ Res* **30**, 742–755.
77. Nathan N, Elton B, Babic M *et al.* (2018) Barriers and facilitators to the implementation of physical activity policies in schools: a systematic review. *Prev Med* **107**, 45–53.
78. Morton KL, Atkin AJ, Corder K *et al.* (2016) The school environment and adolescent physical activity and sedentary behaviour: a mixed-studies systematic review. *Obes Rev* **17**, 142–158.
79. Toumpakari Z, Jago R, Howe LD *et al.* (2019) Cardiometabolic risk factors and physical activity patterns maximizing fitness and minimizing fatness variation in Malaysian adolescents: a novel application of reduced rank regression. *Int J Environ Res Public Health* **16**, 4662.
80. Makopoulou K & Armour KM (2011) Physical education teachers' career-long professional learning: getting personal. *Sport Educ Soc* **16**, 571–591.
81. Laird Y, Fawkner S, Kelly P *et al.* (2016) The role of social support on physical activity behaviour in adolescent girls:



- a systematic review and meta-analysis. *Int J Behav Nutr Phys Act* **13**, 79.
82. Mendonca G, Cheng LA, Melo EN *et al.* (2014) Physical activity and social support in adolescents: a systematic review. *Health Educ Res* **29**, 822–839.
 83. Gunasekaran DD, Sharif R, Koon PB *et al.* (2018) Juara Sihat™: study design of a school-based childhood obesity nutrition education programme in Kuala Lumpur, Malaysia. *Jurnal Sains Kesihatan Malaysia* **16**, 119–127.
 84. Selamat R, Raib J, Abdul Aziz NA *et al.* (2019) Dietary practices and meal patterns among overweight and obese school children in Malaysia: baseline data from a school-based intervention study. *Ecol Food Nutr* **24**, 1–6.
 85. Ishak SI, Chin YS, Taib MN *et al.* (2016) School-based intervention to prevent overweight and disordered eating in secondary school Malaysian adolescents: a study protocol. *BMC Public Health* **16**, 1101.
 86. Wafa SW, Talib RA, Hamzaid NH *et al.* (2011) Randomized controlled trial of a good practice approach to treatment of childhood obesity in Malaysia: Malaysian childhood obesity treatment trial (MASCOT). *Int J Pediatr Obes* **6**, e62–e69.
 87. Nik Rosmawati NH, Wan Manan WM, Noor Izani NJ *et al.* (2018) Evaluating the implementation of a canteen based food nutrition intervention among schoolchildren: a prospective intervention study. *J Health Transl Med* **21**, 21–27.