DEVELOPMENT OF A NEW COMPUTER PROGRAM TO ASSESS DIETARY INTAKE IN PORTUGUESE SCHOOL-AGE CHILDREN: A QUALITATIVE APPROACH

DESENVOLVIMENTO DE UM NOVO INSTRUMENTO ONLINE DE AVALIAÇÃO DO CONSUMO ALIMENTAR PARA CRIANÇAS PORTUGUESAS EM IDADE ESCOLAR: ABORDAGEM QUALITATIVA

Maria Ana Carvalho[1], Osvaldo Santos[1], Ana Rito[2], Emma Foster[3], Helen J Moore[4], José Pereira Miguel[1,2]
1. Institute of Preventive Medicine, Faculty of Medicine, University of Lisbon, Portugal
2. National Institute of Health Doutor Ricardo Jorge, IP, Portugal
3. Human Nutrition Research Centre, Institute of Health and Society, University of Newcastle, UK
4. Wolfson Research Institute, Durham University, UK

Acta Pediatr Port 2014;45:116-123

ABSTRACT

Introduction: Twenty-four-hour dietary recall is the method of choice for assessing food intake among school-age children. Because they require highly trained interviewers, recalls are expensive and impractical for large-scale nutrition research. A new method for assessing dietary intake in children is being developed: the Portuguese self-administered computerized 24-hour dietary recall (PAC24). The objectives of this study were to identify and select food items for inclusion in PAC24; to better understand the way children report their previous day's food consumption; and to identify the different meanings and labels children give to certain food items.

Methods: Data were collected through 21 focus groups (FGs), conducted in seven primary schools from the seven regions of Portugal in 2011. A total of 204 children in second to fourth grades participated. The FGs were homogeneous for school grade and area of residence and heterogeneous for gender and socioeconomic status. Children participated in FGs after their parents' written informed consent was obtained. Topics for discussion were the previous day's food consumption and individual meanings and labelling of certain food items. Content analysis followed a thematic coding process.

Results: A total of 3959 food items were identified and classified into 12 food groups. Children generally reported foods chronologically, organized into the three main meals (breakfast, lunch and dinner). Consumption of snacks and sweets were reported after prompting for snacks and forgotten foods. Not all children were able to record foods successfully; both descriptions and quantities of food posed problems. Different regional- or culture-specific terms were identified for some of the food items.

Conclusions: This qualitative approach enriched the pool of food items that had been developed based on a literature review and revealed the main points that should be taken into account in developing PAC24.

Keywords: children; computerized dietary recall; dietary intake; focus groups; 24-hour dietary recall.

RESUMO

Introdução: O questionário às últimas 24 horas é o método de eleição para avaliar o consumo alimentar em crianças em idade escolar. Contudo, requer entrevistadores treinados, é dispendioso e inadequado para estudos de grandes dimensões. Está atualmente em desenvolvimento um novo instrumento de avaliação do consumo alimentar para crianças portuguesas: o questionário às últimas 24 horas, *online* e de auto-preenchimento (PAC24).

O objetivo do presente estudo foi identificar e selecionar os itens alimentares para inclusão no PAC24, compreender melhor a forma como as crianças reportam o consumo alimentar do dia anterior e conhecer a forma como as crianças verbalizam e interpretam alguns itens alimentares.

Métodos: Foram conduzidas 21 sessões de Focus Groups (FGs) em sete escolas do primeiro ciclo do ensino básico nas sete regiões de Portugal, em 2011. Participaram 204 crianças do segundo ao quarto ano. Os FGs foram homogéneos para o ano de escolaridade e área de residência e heterogéneos para o género e estado socioeconómico. A participação nos FG foi feita após autorização das escolas e preenchimento do termo de consentimento informado pelos pais das crianças. Os tópicos para discussão foram: consumo alimentar do dia anterior e verbalização e interpretação de alguns itens alimentares. A análise de conteúdo seguiu um processo de codificação temática, identificando todos os termos e expressões associadas a itens alimentares.

Resultados: Foram identificados 3959 itens alimentares, agrupados posteriormente em 12 grupos de alimentos. O relato espontâneo das crianças relativamente ao consumo alimentar do dia anterior foi feito de forma cronológica e organizado em três refeições principais (pequeno-almoço, almoço e jantar), tendo sido necessário colocar questões específicas para obter informação referente ao consumo dos lanches e de bolos. Muitas crianças revelaram ser difícil, para elas, descrever e quantificar os alimentos. Foram ainda identificados termos com especificidade regional para alguns itens alimentares.

Conclusões: Esta abordagem qualitativa enriqueceu a lista de itens alimentares inicialmente criada a partir da

revisão da literatura e revelou aspetos fundamentais a incluir no desenvolvimento do PAC24.
Palavras-chave: crianças; questionário online; consumo alimentar; focus groups; questionário às últimas 24 horas.

INTRODUCTION

The burden of chronic diseases is rapidly increasing worldwide[1]. Non-communicable diseases (NCDs), including cardiovascular disease, cancer, chronic respiratory disease and diabetes, are the leading cause of death in the world, responsible for 63% of the 57 million deaths that occurred in 2008[2]. Almost half of chronic disease-related deaths are attributable to cardiovascular disease[2]. Obesity, and particularly childhood obesity, is also showing worrying trends, not only because it affects a large proportion of children – 19.3-49.0% of boys and 18.4-42.5% of girls in Europe are overweight[3] – but also because it is established earlier in life. These wide variations in overweight and obesity prevalence estimates, among primary school children from twelve European countries, suggest the presence of a north-south gradient, with the highest prevalence values found in southern European countries[3]. In Portugal, data from the COSI-Portugal study showed that 37.9% of children were overweight and 15.3% were obese[4].

Food and nutrition are important determinants of NCDs[5-7]. Furthermore, children's diets must be suitable to support normal, and sometimes very rapid, growth and development [8]. What makes food intake an NCD risk factor instead of a health protecting factor is imbalances in variety, quality and quantity. This distinction is often very subtle and so difficult to assess. Therefore, for both clinical and research purposes, reliable ways of assessing dietary intake (including reliable and valid data collection instruments) are required so that children's dietary intake can be effectively monitored[9]. This is especially difficult to achieve for children of primary school age. A cognitive model of children's reporting of food intake was proposed by Baranowski and Domel[10]. This model includes three structural components: sensory register, short-term memory, and long-term memory. In the 7–8 year age group, there seems to be a fairly rapid increase in children's ability to participate in unassisted recalls for foods eaten in the immediate past[11]. However, children between 7 and 10 years old often need some help from parents or other adults, especially for providing details about types and quantities of consumed food[11]. Twenty-four-hour dietary recalls (24hDR) are logistically simple, applicable for cross-cultural surveys and not too burdensome for respondents, and would be the method of choice (especially when assisted by parents) for assessing food intake among school-age children[12, 13]. Furthermore, computers appear to be useful for this task since they (a) are seen as enjoyable devices for children, (b) reduce the costs of both collecting and processing dietary intake information due to the quantity and complexity of data usually involved, (c) enhance consistency of interviewing, due to standardization of the probes used to query details of consumed foods and respective portions, and (d) minimize the burden of respondents compared to other diet assessment systems[14,15].

In Portugal, data on food consumption are scarce for all age levels, and especially for children. There are few reliable data sources. The Food Balance Sheets[16] and the few national monitoring surveys[17], conducted on representative population samples, do not provide reliable estimates at the individual level, which are essential for identifying groups at risk and studying causal relationships between diet and disease[18].

A new method for assessing food and nutrition intake of Portuguese school-age children is currently being developed: the Portuguese self-administered computerized 24hDR (PAC24). In order to design this web-based questionnaire, it would be helpful to (a) identify and select an extensive list of food items for PAC24, (b) better understand how children organize their previous day's food intake when trying to report this information, and (c) identify different meanings and labels children give to certain food items. To obtain such information, we followed a qualitative approach with a sample of second, third and fourth-grade Portuguese school-age children.

METHODS

This study follows a qualitative approach, with data collection carried out using focus groups (FGs) between March and September 2011. FGs allow more abstract and in-depth exploration of food and nutrition issues than is possible with less interactive data collection tools such as structured questionnaires. They also enable the gathering of a considerable amount of information in a short data-collection timeframe, and of several individuals' perspectives as well. This data-collection methodology thus maximizes the opportunity of gaining insight into how children refer to and speak about food-related habits and consumption[19, 20].

Study population and design

The study included students from the second to the fourth grade. They were selected from seven schools

in the seven regions of Portugal (including the islands): North, Centre, Lisbon and Tagus Valley (LTV), Alentejo, Algarve, Madeira and the Azores. Schools were selected on the basis of a convenience sampling process, with the authorization and active collaboration of the Portuguese Ministry of Education. The criteria for the inclusion of schools were: regional location, presence of second to fourth grades, and willingness to participate. Within each school, participants were selected from class lists according to theoretical criteria (purposive sampling). In accordance with these purposive criteria, FGs were constructed to ensure homogeneity for school grade and area of residence, and heterogeneity of gender and social-economic status. The study was approved by the Ethics Committee of the Faculty of Medicine of Lisbon. Parents completed informed consent forms, and assent was obtained from children before they participated.

All FGs were conducted at school, in private classrooms. In each school, three FG sessions were conducted, one each with children from the second, third and fourth grade (a mean of 10 children per FG). Most FGs were conducted during the morning (90.5%). This was because greater accuracy has been reported with interviews conducted in the morning when the target period is the previous day [21]. The FGs, each lasting between 40 and 60 minutes, were conducted and moderated by nutritionists and one psychologist. The same nutritionist conducted the FGs in all regions, except in Madeira and Azores, where the FGs were conducted by local nutritionists. Each nutritionist was trained in administering the same standardized questions and was also informed of the objectives of the study. The psychologist conducted the first three sessions with the nutritionist and gave assistance with methodological issues concerning qualitative approaches for child subjects.

Focus group questions

FG questions were developed by the research team on the basis of a previous review of the literature. The discussion followed an enjoyable game format. Topics for discussion were:

a) Previous day's food consumption

Data on the previous day's food consumption were obtained by simulating a multiple pass 24hDR, developed by the US Department of Agriculture[22]. The multiple pass method guides the respondent through a 24-hour reference period of food intake, providing different opportunities for the respondent to remember food details and also additional foods (Table 1). It has been validated and shown to accurately estimate mean total energy and protein intakes. In the US, it has been used in the National Health and Nutrition Examination Survey (NHANES), and in Europe, a similar program, EPIC-SOFT, has been developed for use in the European Prospective Investigation into Cancer and Nutrition.

Children were asked to verbally report intake in any order they wished in response to the initial instruction "Tell me everything you had to eat and drink yesterday, from when you woke up until when you went to bed" *("Diz-me tudo aquilo que comeste e tudo aquilo que bebeste ontem, desde que acordaste até ao momento em que foste dormir.")*. They were then asked about items that might have been forgotten, including water, soft drinks, biscuits, sweets and ice cream. These forgotten food items were based on commonly forgotten categories of foods described previously[22]. After that, the children were asked about the time and occasion of each food, and for further information (details, amounts and place where each food was eaten). They were asked to report quantities of food in terms of units (e.g. number of biscuits, number of slices of toast, number of slices of pizza) and/or household measures (e.g. spoons of sugar, glasses of water). In a final review, the children were asked if they had consumed anything else (the moderator repeated what they had reported and gave a prompt like "Did you eat anything yesterday that I didn't mention?"*)*. Responses were obtained from each child during FGs. But interaction between children frequently prompted additional food items to be recalled (e.g., one child reminding another that she/he also ate a birthday cake). This possible bias was useful and informative for the main purpose of the data collection (i.e., recording food items as they are remembered and reported by children of this age).

b) Individual meanings and labelling of food items

We asked children if they could identify and differentiate wholegrain from white bread, commonly consumed low fat or reduced fat foods (e.g. milk), and also if they knew what ice tea is made from (Table 2). The reason for these questions for meaning assessment was that in the first FGs it became clear that the meanings for such items were not universal among these age-groups.

Data analysis

The FGs were audiotaped and transcribed to ensure proper thematic content analysis. Each FG was transcribed by the researchers who participated as FG moderators. The recorded content of all the FGs (full corpus) was merged and included in the analysis. Content analysis followed a thematic coding process. Each unit of meaning was considered as important as any other, no matter the frequency of its verbalization. This was because the main goal was to gather terms and meaning about food items. The analysis was performed entirely by one of the researchers, and was

subsequently validated by the other researcher. After the coding process, the coded transcripts were sorted, each piece of material relevant to a particular issue or theme being cut and pasted so that all material relevant to a particular topic was placed in the same category. As the data were qualitative in nature, only frequencies are used for food item selection purposes (Table 1) and no formal statistical tests were applied in the study.

RESULTS

A total of 21 FGs were conducted. Overall, 204 children participated in the study. The age distribution was: 7-8 years (second grade; n=70); 8-9 years (third grade; n=61), and 9-10 years (fourth grade; n=73). With respect to geographical distribution, 29 children lived in the North region, 37 in the Centre region, 19 in LTV, 34 in the Alentejo, 29 in the Algarve, 27 in the Azores, and 29 in Madeira.

Analyses of the data were based on three key themes: 1) the previous day's food consumption; 2) the way children reported on the previous day's food consumption; and 3) meaning and labelling of specific food items.

Previous day's food consumption

Overall, 3959 food items were identified by children when asked about their previous day's food intake. These food items were classified by researchers (rather than by the children themselves) into the following food groups (Table 1): 1) cereals, cereal products and potatoes (920 items);

Table 1. Food items included in the 12 food categories

Food Groups	Description	Food items reported	
		n	%
1) Cereals, cereal products and potatoes	All types of bread made with different types of flour (wheat, whole wheat, rye) including toasted bread; all types of pasta; baby cereals; all types of rice; potatoes; sweet potatoes; potato crisps; mashed potatoes; breakfast cereals; crackers; biscuits without cream or chocolate; sweet corn	920	23.2
2) Fruit	Fresh fruit; 100% fruit juice; nuts; seeds; olives	326	8.2
3) Vegetables	Raw and cooked vegetables; vegetable soup	376	9.5
4) Milk and dairy products	All types of milk (whole, semi-skimmed, skimmed, flavoured); yoghurt; cheese	591	14.9
5) Meat, fish and eggs	Beef; pork; hamburgers; chicken; poultry; raw, canned and cooked fish; fish products; crustaceans and molluscs; eggs (fried, boiled, scrambled, omelettes); ham; sausage; snails	546	13.8
6) Pulses, fresh and processed	All types of beans; lentils; peas; lupin seeds	30	0.8
7) Oils and fats	Butter; olive oil and other vegetable oils; margarine; cream; mayonnaise; peanut butter	150	3.8
8) Beverages	Tap water; bottled water; fruit juice with added sugar; soft drinks; black coffee; tea; alcohol; other hot drinks (cocoa or chocolate beverages; white coffee), fruit drinks	449	11.3
9) Sweet products	Chocolate and chocolate products; ice cream; biscuits (chocolate biscuits, butter biscuits); cakes; sweet snacks; sugar; jelly; milk-based desserts; sweets; jam; marmalade; honey; sweet breakfast cereals; sweet cereal-based snacks (e.g. bars); pancakes; waffles; brioches; milk bread rolls; croissants; croissants with chocolate filling	445	11.2
10) Snacks and fast food	Pizza; hot dogs; quiches; savoury pies; pastry	35	0.9
11) Mixed dishes	Meat-based dishes; fish-based dishes; pasta-based dishes	84	2.1
12) Miscellaneous	Vinegar, ketchup, mustard sauce	7	0.2

2) fruit (326 items); 3) vegetables (376 items); 4) milk and dairy products (591 items); 5) meat, fish and eggs (546 items); 6) pulses (30 items); 7) oils and fats (150 items); 8) beverages (449 items); 9) sweet food (445 items); 10) snacks (non-sweet) and fast food (35 items); 11) mixed dishes (84 items); and 12) miscellaneous (7 items). The FGs were run during spring and summer, which may explain the high reported consumption of ice cream.

The most popular breakfast choices were: chocolate cereals, honey cereals, toast, milk and bread with butter, cheese, ham or jam. Common to all children was the fact that their parents prepared breakfast for them whether they (the parents) were present at the meal or not (e.g., when breakfast was taken out of home). A wide variety of foods were reported as being eaten as snacks, such as sandwiches, biscuits, cakes, yoghurt, flavoured milk, fruit and ice cream. Snacks were most commonly eaten during school break-time and at home, straight after school. Snacks in school were typically brought from home, with the exception of the flavoured milk (usually with chocolate) that was offered by the school.

The majority of children had lunch in the school canteen and the reporting of lunch food consumption was more collective (involving all participants of each FG) than individual. All the lunches included vegetable soup, meat or fish with potatoes, pasta or rice. Salad and fruit were optional, and so some children did not report the consumption of those food items.

There were considerable differences in food composition of dinner between children. By contrast, the consumption of beverages was common during dinner, particularly soft drinks, especially ice tea. Of the total consumption of beverages reported by children, 56.6% were soft drinks. Finally, few children reported an additional snack before going to bed. When they did, it consisted of cake, sweets, milk or tea.

How children reported on the previous day's food consumption

In general terms, children reported foods chronologically (from the first item eaten in the morning to the last item at night), but some foods, such as beverages (e.g. water) were routinely reported non-chronologically. Most children reported three main meals (breakfast, lunch and dinner). Without prompts for snacks (Table 2) participants did not spontaneously report the consumption of foods between breakfast and lunch, lunch and dinner, and/or after dinner. They reported food items using the time of day and other contexts, such as where they were, who they were with, and what they were doing as methods of remembering which foods they had consumed. Individual children differed in the effort they made trying to remember what they ate during the previous day. A number verbalized having difficulties reporting what they ate and in reporting the quantities of those foods remembered. This was more evident among children in the second grade (7-8 years old), and was also more evident when children were asked about quantities of sugar, chocolate, honey or coffee added to beverages (Table 2). Regarding water consumption, children reported different sources, including glasses of water, bottled water and drinking fountains. Most children reported the consumption of sweets and cakes that other pupils brought to school (especially on birthdays to share with their peers), after they were asked for forgotten foods (Table 2).

Meaning and labelling of specific food items

With regard to wholegrain bread, some children thought that it was a special type of bread for people who are trying to lose weight; other children understood it to be toasted bread (Table 2). Most children differentiated whole, semi-skimmed and skimmed milk on the basis of the colour of the bottle (Table 2).

When children were asked "What is ice tea made from?", a considerable percentage (15.8%) who reported consuming this soft drink said that it is made from water with a small quantity of sugar (Table 2).

Regional or culture-specific terms were also identified for some of the food items.

DISCUSSION

There is a need to develop tools for assessing food intake among Portuguese children. This study was undertaken in order to identify and select food items that will comprise a computer-based, self-administered 24hDR for second-fourth grade Portuguese children. It also aimed to gain a better understanding of the way that children of this age report their previous day's food consumption, through FG methodology that enabled a more in-depth exploration of food consumption issues than is possible with less interactive data collection tools such as structured questionnaires. The results could also be used to better understand how to ask children about their recent food intake through a computerized food recall, such as PAC24.

Usually, qualitative methods aim to capture the ways and processes in which people think and behave. In this study, the main goal was to gather an extensive list of words, terms and expressions used by Portuguese second to fourth grade children to refer to food items. So, rather than conducting a phenomenological or interpretative analysis of the content, analysis of the

corpus (i.e., transcripts of the FGs) was mainly targeted at identifying those food words and terms.

Although the FG technique has significant advantages in gathering data, it also has some limitations. For instance, the results cannot be used quantitatively, and the quality of the data obtained relies to a large extent on the skills of the researcher(s) in charge of the FGs. This should be taken into account when reviewing the results of qualitative research such as this and when considering how they can, and should, be used. Another limitation is that we have no way of knowing whether what children said was really what they had eaten on the previous day, because the

Table 2. Major reporting issues regarding previous day's food consumption and individual meanings and labelling of some food items

Food reporting issues	Typical comments
Children reported the three main meals first (breakfast, lunch and dinner) and then snacks, after specific prompting for snacks.	**Moderator** I'd like to know what you ate yesterday from when you woke up until you went to bed. **Child** I ate bread with butter and a glass of milk with Nesquik[1]. **Moderator** And then? **Child** I ate cabbage soup and cod with potato. **Moderator** And that was your lunch? **Child** Yes. **Moderator** And then what? **Child** Pizza. **Moderator** And then? **Child** Then is the next day. **Moderator** You told me that in the morning, you ate bread with butter and milk with Nesquik[1]. And between breakfast and lunch, did you eat or drink anything? **Child** Ah, I drank milk and I ate a *chipicao*[2].
Description of food quantities was difficult for some children, especially for sugar, chocolate, honey or coffee added to beverages.	**Moderator** Ok. And if I ask you about how much sugar was in your milk, can you tell me? **Child** No. **Moderator** How many spoons of chocolate did you add to milk? **Child** I don't know. My mother puts sugar in my milk every day.
The majority of children reported sweets and cakes that children brought to school on birthdays after prompting for forgotten food items.	**Moderator** One thing that surprises me is that nobody besides these two girls ate chocolate or sweets yesterday. **Child** I did. **Child** I think I did the day before yesterday. **Child** I had a croissant. **Child** Yesterday I drank a juice. **Child** I only have them on birthdays. **Child** Every day I eat at least two chocolate biscuits. **Child** I eat more on Sundays, that's the day I go to my grandmother's house and she gives me pastries. **Child** Yesterday I ate a *pastel de nata*[3]. **Moderator** So, I think that's better, at the end of the game that I'm developing, to add a question like this: "Did you eat sweets yesterday?" What do you think about that? **Children** Good.
Individual meanings and labelling of some food items	**Typical comments**
Some children thought that wholegrain bread was a special type of bread for people who are trying to lose weight; for other children it was like toast.	**Moderator** That bread *[you said you ate yesterday]*... was it very white or rather dark? **Child** Dark. **Moderator** Who eats white bread? **Children** Me. **Moderator** And dark? **Child** Just him. **Moderator** Ok, but before the bread went to the toaster, what colour was it? **Child** White. It was normal bread. It was dark outside but inside it was white. **Moderator** Who can say what "wholegrain bread"is? **Child** Wholegrain bread is for people who are trying to lose weight. (...) **Child** It's something that helps you lose weight and it also has little brown dots.
The majority of children classified ice tea as flavoured water with no or little added sugar.	**Moderator** And you? Tell me what do you think what ice tea is. **Child** It's a bit like tea. **Moderator** It's a bit like tea. And do you think it has a little or a lot of added sugar? **Child** A little.

[1]Nesquik: chocolate powder for milk; [2]Chipicao: a sweet filled 'croissant', [3]Pastel de nata: a traditional portuguese cake.

data were not validated with a method such as face-to-face 24hDR or direct meal observations. Furthermore, since the objective of this study was not to analyze children's dietary reporting accuracy, the results should not be interpreted as such. Another potential limitation of this study is the generic nature of the authors' questions in the FGs regarding quantities of food consumed. Future research should use more appropriate tools for assisting children in this estimation, such as food photographs. Finally, it is also possible that some children were unwilling to talk about their food consumption in a group setting because of the sensitivity of these issues.

In this study, children from second to fourth grade (7 to 10-year-olds) were asked to report their previous day's food consumption, without assistance from parents or teachers. This is important, because literature suggests that parents lack first-hand knowledge of their children's intake at school and also because there is evidence that children of this age are able to respond adequately to self-report methods such as dietary recalls[11]. Answers regarding food items were grouped by researchers (when analyzing the collected data) into 12 food groups. The categorization of these groups was based on a combination of findings from international dietary surveys[23-27].

When asked about what they had eaten the previous day, children generally reported foods chronologically (from the first item eaten in the morning to the last item at night). But some foods, such as beverages (e.g. water) were routinely reported non-chronologically. Subar *et al*[28] found the same results in formative research on a 'quick list' for a computerized dietary recall. Regarding the interview format (open or structured by main meals), Baxter *et al*[29] found that although more items were reported as being eaten in a structured meal interview format than in an open interview format, accuracy was better with open format interviews, with lower intrusion and total inaccuracy rates. We found that children did not report the consumption of snacks spontaneously, but in the majority of cases only when specific meal/snack name prompts were used. Subar *et al* [28] and Foster *et al*[30], after testing two versions of a 'quick list' for remembering foods consumed on the previous day (open format versus meal format), found that participants showed a strong preference for the meal-based format. Further studies should be carried out before deciding on the interview format for PAC24.

Students used a wide variety of retrieval categories when reporting consumption[31]. FG participants from this study used the time of day and other contexts as cues for remembering which foods they had consumed. According to Baxter *et al*[32], food category prompting slightly improves recall accuracy among fourth graders, but only in half of the children who received it. We found that most children reported the consumption of sweets only after specific prompting for forgotten foods. This suggests that asking children about easily forgotten foods (e.g., foods that are usually taken outside main meals) may have an important role in increasing the accuracy of self-administered automated recalls. Further research should thus be conducted in order to validate the food prompts that will be included in PAC24.

Furthermore, not all children were able to report foods without a significant effort; both descriptions and quantities of food were difficult for some children to recall. Research indicates that children have considerable difficulties in accurately estimating quantities eaten[33].

We identified some regional or culture-specific names attributed by children to some food items that will be taken into account for the software development. The FGs also showed that the majority of children did not understand the nutritional composition of some food items (e.g., ice tea and wholegrain bread). This highlights the need to increase the nutritional literacy of this age-group.

In summary, a new method for assessing food and nutrition intake of Portuguese school-age children is currently being developed: PAC24. In order to design this web-based questionnaire, a qualitative approach was followed, with data collection carried out using FGs. This study enriched the pool of food items that had been developed based on a literature review and also revealed the main ways in which children report their previous day's food consumption, as well as different meanings and labelling of some specific food items, that should be taken into account in the development of PAC24. Future research, particularly content validation by experts, usability tests and criteria validation, should be carried out in order to validate PAC24 for use in Portuguese school-age children.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

FUNDING

This research received no specific grant from any funding agency from the public, commercial or not-for-profit sectors.

ACKNOWLEDGEMENTS

The authors thank Carla Jardim, Marta Perro Domingues and Sara Ferreira for their assistance in the development of the focus groups in schools. The authors especially thank the schools and children who participated in the study.

CORRESPONDENCE

Maria Ana Carvalho
mariaanacarvalho@gmail.com

Recebido: 02/01/2014
Aceite: 24/04/2014

REFERENCES

1. World Health Organization. Diet, nutrition and the prevention of chronic diseases. Report of a Joint WHO/FAO Expert Consultation. Geneva: WHO; 2003.
2. Alwan A, MacLean D, Riley LM, d'Espaignet ET, Mathers CD, Stevens GA, *et al*. Monitoring and surveillance of chronic non-communicable diseases: progress and capacity in high-burden countries. *The Lancet* 2010;376:1861-1868.
3. Wijnhoven TMA, van Raaij JMA, Spinelli A, Rito AI, Hovengen R, Kunesova M, *et al*. WHO European Childhood Obesity Surveillance Initiative 2008: weight, height and body mass index in 6–9-year-old children. *Pediatr Obes* 2013;8:79-97.
4. Rito A, Wijnhoven TMA, Rutter H, Carvalho MA, Paixão EL, Ramos C, *et al*. Prevalence of overweight and obesity among Portuguese children (6-8 years old) using three definition criteria: COSI Portugal, 2008. *Pediatr Obes* 2012;7:413-422.
5. Nestle M. Nutrition in Public Health and Preventive Medicine. In: *Public Health & Preventive Medicine*. 15th ed. Iowa City: McGraw-Hill; 2007:1195-1203.
6. Shetty PS. Food and nutrition. In: *Oxford Textbook of Public Health*. 5th ed. USA: Oxford University Press; 2009:177-196.
7. Political Declaration of the High-level Meeting of the General Assembly on the Prevention and Control of Non-communicable Diseases. Document A/66/L.1. New York: United Nations; 2011.
8. Michaelsen KF. Child Growth. In: *Pediatric Nutrition in Practice*. Basel: Karger; 2008:1-5.
9. Foster E. Assessing dietary intake in primary school children. [PhD thesis]. Tyne and Wear: University of Newcastle upon Tyne; 2003.
10. Baranowski T, Domel SB. A cognitive model of children's reporting of food intake. *J Clin Nutr* 1994;59:212S-217S.
11. Livingstone MBE, Robson PJ, Wallace JMW. Issues in dietary intake assessment of children and adolescents. *Br J Nutr* 2004; 92:S213-S222.
12. Andersen LF, Lioret S, Brants H, Kaic-Rak A, de Boer EJ, Amiano P, *et al*. Recommendations for a trans-European dietary assessment method in children between 4 and 14 years. *Eur J Clin Nutr* 2011; 65:S58-S64.
13. Moore HJ, Ells LJ, McLure SA, Crooks S, Cumbor D, Summerbell CD, *et al*. The development and evaluation of a novel computer program to assess previous-day dietary and physical activity behaviours in school children: The Synchronised Nutrition and Activity Program™ (SNAP™). *Br J Nutr* 2008;99:1266-1274.
14. Weber Cullen K, Baranowski T, Baranowski J. Computer Software Design for Children's Recording of Food Intake. *JNA* 1998;30:405-409.
15. Thompson FE, Subar AF, Loria CM, Reedy JL, Baranowski T. Need for Technological Innovation in Dietary Assessment. *J Am Diet Assoc* 2010;110:48–50.
16. Instituto Nacional de Estatística. Balança Alimentar Portuguesa 2003-2008: dieta portuguesa afasta-se das boas práticas nutricionais. Lisboa: INE; 2010.
17. Instituto Nacional de Estatística & Instituto Nacional de Saúde Doutor Ricardo Jorge, eds. Inquérito Nacional de Saúde 2005/2006. Lisboa: Instituto Nacional de Estatística, Instituto Nacional de Saúde; 2009.
18. Slimani N, Valsta L. Perspectives of using the EPIC-SOFT programme in the context of pan-European nutritional monitoring surveys: methodological and practical implications. *Eur J Clin Nutr* 2002;56:S63-S74.
19. Puchta C, Potter J. *Focus Group Practice*. London: Sage Publications;2004.
20. Ritchie J, Lewis J. *Qualitative Research Practice – A Guide for Social Science Students and Researchers*. London: Sage Publications; 2011.
21. Baxter SD, Hardin JW, Guinn CH, Royer JA, Mackelprang AJ, Smith AF, *et al*. Fourth-grade children's dietary recall accuracy is influenced by retention-interval (target period and interview time). *J Am Diet Assoc* 2009;109:846-856.
22. Raper N, Perloff B, Ingwersen L, Steinfeldt L, Anand J. An overview of USDA's dietary intake data system. *J Food Compost Anal* 2004;17:545-555.
23. United States Department of Agriculture, Agriculture Research Sevice: What we eat in America. http://www.ars.usda.gov/Services/docs.htm?docid=13793. Accessed in October 31st 2012.
24. Bates B, Lennox A, Bates C, Swan G, eds. *National Diet and Nutrition Survey: headline results from year 1 and 2 (combined) of the Rolling Programme* (2008/2009-2009/2010). London: Department of Health, Food Standards Agency; 2011.
25. Stahl A, Vohmann C, Richter A, Heseker H, Mensink GB. Changes in food and nutrient intake of 6- to 17-year-old Germans between the 1980s and 2006. *Public Health Nutr* 2009;12:1912-1923.
26. Leclercq C, Arcella D, Piccinelli R, Le Donne C, Turrini A. The Italian National Food Consumption Survey INRAN-SCAI 2005-06: main results in terms of food consumption. *Public Health Nutr* 2009;12:2504-2532.
27. Lioret S, Dubuisson C, Dufour A, Touvier M, Calamassi-Tran G, Maire B, *et al*. Trends in food intake in French children from 1999 to 2007: results from the INCA (étude Individuelle Nationale des Consommations Alimentaires) dietary surveys. *Br J Nutr* 2010; 103:585-601.
28. Subar AF, Thompson FE, Potischman N, Forsyth BH, Buday R, Richards D, *et al*. Formative research of a quick list for an automated self-administered 24-hour dietary recall. *J Am Diet Assoc* 2007;107:1002-1007.
29. Baxter SD, Smith AF, Guinn CH, Thompson WO, Litaker MS, Baglio ML, *et al*. Interview format influences the accuracy of children's dietary recalls validated with observations. *Nutr Res* 2003; 23:1537-1546.
30. Foster E, Hawkins A, Delve J, Adamson AJ. Reducing the cost of dietary assessment: self-completed recall and analysis of nutrition for use with children (SCRAN24). *J Hum Nutr Diet* 2014; 27:26-35.
31. Baxter SD, Thompson WO, Davis HC, Johnson MH. 'How do you remember you ate…?': A Delphi technique study to identify retrieval categories from fourth-grade children. *J Am Diet Assoc* 1997; 97: 31-36.
32. Baxter SD, Thompson WO, Davis HC. Prompting methods affect the accuracy of children's school lunch recalls. *J Am Diet Assoc* 2000;100:911-918.
33. Goodwin RA, Brulé D, Junkins EA, Dubois S, Beer-Borst S. Development of a food and activity record and portion-size model booklet for use by 6- to 17-year olds: a review of focus-group testing. *J Am Diet Assoc* 2001;101:926-928.