Original Article

nutrition and health

Nutrition and Health
1–11

DOI: 10.1177/0260106020982356
journals.sagepub.com/home/nah
SAGE

Development and validation of a questionnaire measuring knowledge, attitudes, and practices (KAP) to healthy eating and activity patterns in school children (HEAPS)

Panchali Moitra[1], Preeti Verma[2] and Jagmeet Madan[3]

Abstract

Background: Development of culturally appropriate and psychometrically sound instruments that measure knowledge and health behaviors of children will help to inform appropriate interventions. **Aim:** To develop and test the validity and reliability of a questionnaire measuring knowledge, attitudes, and practices to healthy eating and activity patterns in school children in India. **Methods:** Review of literature, focus-group discussions, and theoretical constructs of the Health Belief Model guided the development of an item pool. Face and content validity were assessed by children and a panel of experts and the item content validity, item difficulty, and discrimination indices were calculated. Construct validity was determined using the principal axis method of exploratory factor analysis among a cross-sectional sample of children (n=252). Internal consistency (Cronbach α values >0.7) and test-retest reliability (intraclass correlation coefficient values >0.75) were estimated. **Results:** Item content validity index for clarity and relevance were satisfactory (>0.80) and internal consistency for knowledge (Kuder-Richardson 20 = 0.832), attitude (Cronbach's α = 0.912), and practice items (Cronbach's α = 0.769) were good. Four factors (children's eating habits, family dietary practices, and consumption of healthy and unhealthy foods) and two factors (moderate to vigorous activities and sedentary activities) explained 67.7% and 48.2% of the total variance in practice items. Intraclass correlation coefficient estimates ranged from good to excellent (0.72–0.99). **Conclusions:** The results of the validity and reliability of the 84-item knowledge, attitudes, and practices to healthy eating and activity patterns in schoolchildren questionnaire were promising. The detailed description of the methodology employed may prove useful to researchers conducting similar studies in children.

Keywords

Knowledge attitude practice, KAP survey, healthy eating, activity, patterns, development and validation, school children, eating habits, India, validity and reliability, health belief model

Introduction

Unhealthy dietary habits of children (Beena et al., 2013; Mehta et al., 2014; Shaikh et al., 2016; Rathi, Riddell, and Worsley, 2018), inadequate levels of physical activity (Qidwai et al., 2010; Esht et al., 2018), and excessive sedentary behaviors (Biddle et al., 2010; Gupta et al., 2012; Esht et al., 2018) pose public health challenges in India as elsewhere (Shridhar et al., 2016; Karki, Shrestha, and Subedi, 2019). Recent studies indicate an increase in obesity rates not just among children belonging to higher socio-economic backgrounds but also in lower-income groups where being underweight remains a major problem (Ranjani et al., 2016; Kumar and Kelly, 2017; Meharda et al., 2017). Adiposity during childhood is associated with impaired

[1] Department of Food, Nutrition & Dietetics, Sir Vithaldas Thackersey College of Home Science (Autonomous), Shreemati Nathibai Damodar Thackersey Women's University, Mumbai, India
[2] Department of Special Education, Associate Dean, Interdisciplinary Studies, Shreemati Nathibai Damodar Thackersey Women's University, Mumbai, India
[3] Department of Food, Nutrition & Dietetics, Sir Vithaldas Thackersey College of Home Science (Autonomous), Shreemati Nathibai Damodar Thackersey Women's University, Mumbai, India

Corresponding author:
Ms. Panchali Moitra, Department of Food, Nutrition & Dietetics, Sir Vithaldas Thackersey College of Home Science (Autonomous), Shreemati Nathibai Damodar Thackersey Women's University, Santacruz West, Mumbai 400049, India.
Email: panchali2511@yahoo.co.in

glucose tolerance (Misra et al., 2011; Musaiger and Al-Hazzaa, 2012; Ranjani et al., 2016; Kumar and Kelly, 2017), and cardiovascular risk clustering (Boutayeb, 2006; Kao and Sabin, 2016; Branca et al., 2019), thus triggering adverse health consequences tracking into adulthood.

To address these challenges, effective interventions are needed (Sivagurunathan et al., 2015; Vaz et al., 2016) and to design these interventions, the determinants of diet and activity-related behaviors among children, such as the knowledge and attitudes to healthy eating and activity levels and motivations or readiness to change unhealthy practices, must be better understood (Murang, Tuah, and Naing, 2017). Assessment of these attributes will require the development of age and culturally appropriate instruments with sound psychometric properties; such instruments will also provide suitable formats to monitor the impact of relevant interventions (Trakman et al., 2017). Studies exploring the knowledge, attitudes, and practices (KAP) of children to healthy eating and physical activity patterns are limited in India, and fewer studies have evaluated the psychometric properties of the instruments used to measure knowledge or health-related behaviors among children.

Health behavior theories are useful to examine the factors influencing health behaviors in any population (Glanz and Bishop, 2010; Teixeira and Marques, 2017). The Health Belief Model (HBM) is one of the most widely recognized theoretical frameworks used to assess health and nutrition-related behaviors (Kim, Ahn, and No, 2012; Naghashpour et al., 2014; Tavassoli et al., 2017). The key constructs of HBM include perceived susceptibility and perceived severity (people's belief that they are susceptible to the negative consequences of their unhealthy behaviors), perceived benefits and barriers (the perception that benefits associated with desired behaviors outweigh the barriers involved), cues to action and self-efficacy (the belief that they are capable of adopting the change to achieve desired results). Understanding these specific perceptions can help to predict attitudes and motivations of behavior change and develop key messages aimed at encouraging healthy eating habits and adequate activity-related practices in children.

The purpose of this paper is to describe the development and evaluation of the psychometric properties of a questionnaire that measures knowledge regarding healthy eating and activity levels, attitudes and perceptions related to nutrition and activity patterns (perceived susceptibility, benefits, barriers, readiness to change, and self-efficacy) and practices associated with eating habits such as consumption of breakfast, fruits, vegetables, and energy-dense snacks, and specific physical activity and sedentary behaviors among 10-12 years old children in Mumbai, India.

Methods

The development and validation of the questionnaire assessing the KAP to healthy eating and activity patterns in school children (HEAPS) were conducted in two phases. First, we developed a test plan and generated an item pool, and then conducted a cross-sectional study to test the validity and reliability of the developed instrument. The steps involved are provided in Figure 1.

Study sites and participants

The study was carried out at four purposively selected coeducational aided and private schools in Mumbai, India. Aided schools are financially supported by the state government and are typically attended by children of low and low-middle socioeconomic status (SES) and the private schools are run by private managements, usually catering to children belonging to upper-middle and upper SES families. These schools cater to children aged 6–15 years, studying in grades 1–10. In this study, children were selected from both aided and private schools (used as a proxy for SES) to ensure proportional representation across socioeconomic backgrounds. We randomly selected eight classes (a class each from grades six and seven of the four selected schools), each comprising approximately 35–45 students, as the participating classes. All children attending these classes (n=323) were verbally explained the study protocol, and the information sheets and consent forms were sent home for parental consent. A total of 295 children, aged 10–12 years, provided written parental consent and were selected as the study sample. Of these, 28 children participated in the face validity exercise, 15 were not present on the survey day, 252 completed the KAP-HEAPS questionnaire for testing validity and internal consistency reliability, and a subsample (n=132) participated in the test-retest reliability exercise. Ethics approval was obtained and written and informed assent was received from children before data collection.

Phase 1: Development of the KAP-HEAPS questionnaire

Item Development: The item pool was generated after a detailed review of relevant literature and existing instruments. Computerized searches of scholarly databases, Google Scholar and PubMed, were conducted using the keywords, "eating habits" and "activity patterns" in combination with search terms, "knowledge in children," "attitudes," "perceptions to health," "barriers and facilitators," "children in India," "Health Belief Model," and "sedentary activity in children." The results were carefully evaluated by the authors and subjected to eligibility criteria—relevance to the study objectives, year of publication (<5 years), access to the full article, the inclusion of children or middle-school students as the sample, and discussion on the methodological description of validity and reliability of the instruments. After evaluation, six studies (Strauss and Smith, 2009; Glanz and Bishop, 2010; Hiew et al., 2015; Kigaru et al., 2015; Amiri et al., 2017; Oli et al., 2018) were selected as references for item

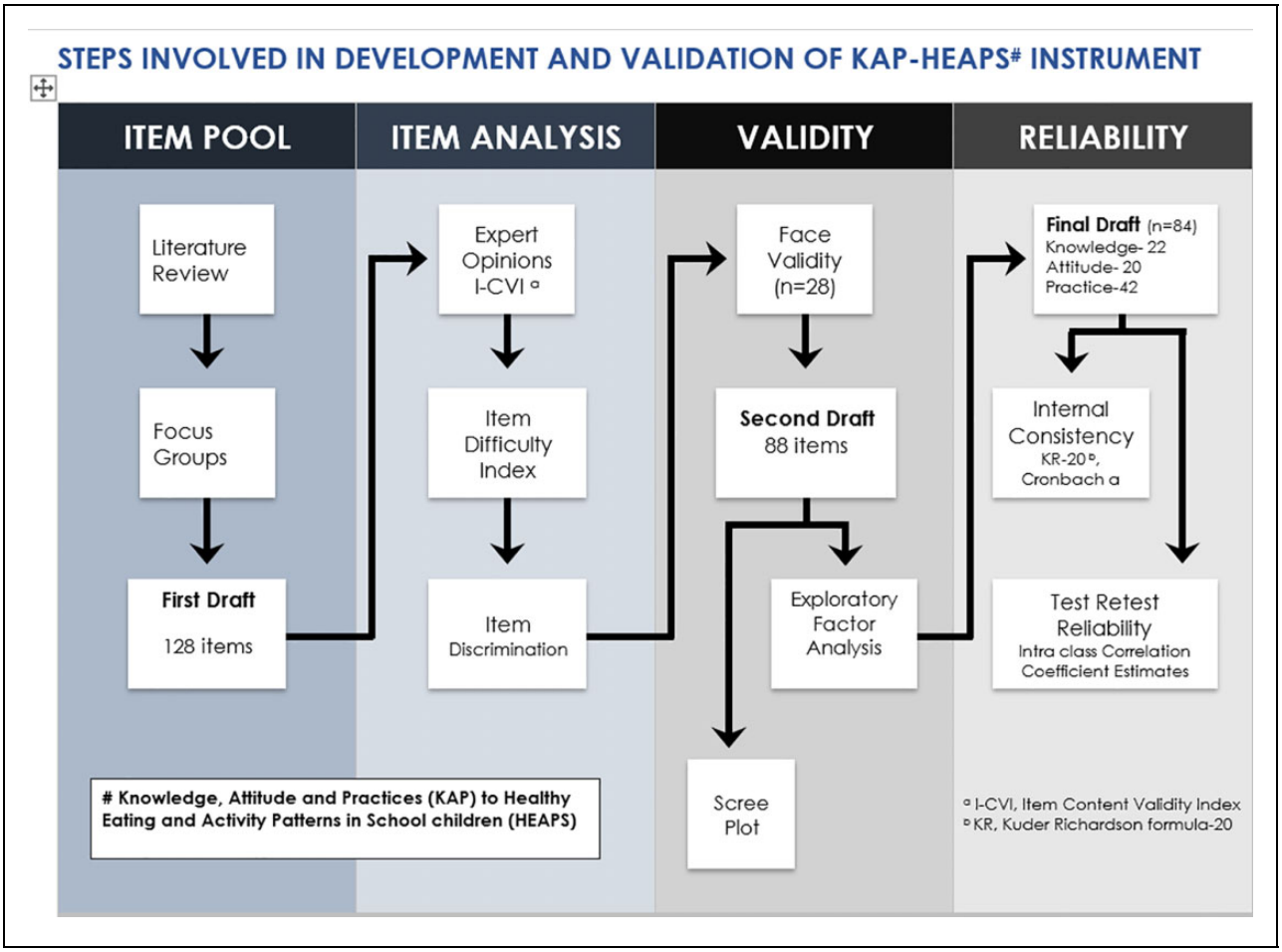

Figure 1. Steps involved in development and validation of knowledge, attitudes, and practice (KAP) to healthy eating and activity patterns in schoolchildren (HEAPS) questionnaire.

development. Any disagreements between authors were resolved via consensus.

To explore attitudes and diet and activity-related practices of children, 14 focus group discussions were conducted with children (n=42), parents (n=22), and teachers (n=9). Participants were selected from six aided and private coeducational schools in Mumbai. Thematic analysis was performed and the recurrent themes and quotes were reviewed to develop statements measuring attitudes and practices related to healthy eating and activity levels in children. The detailed results of these discussions are described elsewhere (Moitra and Madan, 2020).

Based on the initial analysis, the draft instrument was developed, including participant demographic characteristics such as sex, date of birth, type of school attended (private school or aided school), class, and division of studying and questions assessing the KAP related to healthy eating and activity levels.

Initial draft of the instrument: In the first draft, the knowledge items included 48 multiple-choice questions assessing children's knowledge of food groups, balanced diet and food pyramids, macronutrients and specific micronutrients, healthy and unhealthy eating habits, risk factors of non-communicable diseases such as obesity, diabetes, and heart diseases, and the recommended daily activity levels. Each correct response was given one point and incorrect responses, "do not know," and "not sure" received zero points. The attitude statements were developed based on the focus group results and HBM constructs of perceived susceptibility, severity, benefits, barriers, readiness to change, and self-efficacy. All items were rated on a four-point Likert scale from "strongly agree" to "strongly disagree," with numeric scores zero to three. For negatively phrased statements (such as perceived barrier items), the scores were re-coded as three, two, one, and zero with the response "strongly disagree" receiving a score of three.

Practice items evaluated children's eating habits and food consumption patterns and their physical activity levels and sedentary behaviors. Dietary practice questions included children's weekly frequency of consuming breakfast, skipping meals, and bringing healthy snacks to school, family dietary habits such as frequency of eating out in restaurants, ordering takeaways, having family

meals together, and watching television while eating food at home, and a 35-item food frequency questionnaire that measured children's weekly consumption of fruit, vegetables, and energy-dense snacks. Activity-related practices were assessed by asking "In the last 7 days, how many days did you perform the following activities?" The listed moderate to vigorous physical activities (MVPA) were sports such as football and basketball, cycling, dancing, jogging or running, swimming, martial arts, and skipping or jumping rope, and sedentary activities (SA) included watching television, playing or studying on the computer, chatting with friends on the phone, listening to music or reading, playing board games with friends, and sitting in class.

The list of food items and the MVPAand SA-related practices included in the first draft was based on the results of focus group discussions and previous studies in Indian children (Mehta et al., 2014; Bailey et al., 2018; Esht et al., 2018; Griffiths and Bentley, 2018; Rathi, Riddell, and Worsley, 2018). Responses for all practice items were assessed on a five-point Likert scale, scored zero to four (from "never" to "more than once a day"). Reverse scoring was done for the consumption of unhealthy snacks and performing SA to ensure that the higher scores indicated healthier practices.

At the end of this phase, the 128-item KAP instrument included 48 knowledge, 25 attitude, 35 dietary practice, 12 MVPA, and eight SA-related questions. The next step was to evaluate the psychometric properties of the instrument.

Phase II: Validity and reliability of the questionnaire

Face validity: A sample of 28 children (aided schools $n=12$ and private schools $n=16$) evaluated the face validity. Children were encouraged to ask for clarification, to provide remarks, and identify questions or instructions they found difficult to understand. The remarks obtained were evaluated and appropriate modifications related to language, the order of questions, and wording of items were made. Response latency to identify questions requiring further explanations and the approximate time needed to complete the questionnaire were noted.

Content validity: Content validity was tested by a team of professionals (two dietitians, an educationist, and a researcher who had previous experience of conducting a validation study) and experiential experts (two parents with children aged 10 and 11 years, a teacher supervisor of grade six in a private school, and a science teacher of grade seven in an aided school). These experts ($n=8$) reviewed the questionnaire individually, and rated each item for relevancy and clarity on a four-point ordinal scale (0, not relevant/unclear; 1, item needs revision; 2, relevant/clear with minor revisions; and 3, very relevant/very clear). The item-wise content validity index (I-CVI) was calculated by dividing the number of experts (who gave a score of two or three to each item for relevancy and clarity) by the total number of experts (Zamanzadeh et al., 2015). Based on the I-CVI, the items were retained, revised, or deleted. To further establish content validity, we assessed item difficulty by reviewing the proportion of children ($n=252$) who responded correctly to the knowledge items and calculating the item discrimination index to determine whether a specific item was an indicator of good knowledge. Items that were correctly answered by more than 80% or less than 20% of participants were reviewed, and decisions related to the retention of these items were taken. (Trakman et al., 2017)

Construct validity: The underlying constructs of attitude and practice items were determined using the principal-axis method of exploratory factor analysis. Varimax rotation with Kaiser normalizations presented each factor in a more meaningful manner and factor loadings were estimated. The number of factors to remain was determined by considering the eigenvalues >1 and factor loadings >0.4 (Hiew et al., 2015). Bartlett's test of sphericity and the Kaiser-Meyer-Olkin (KMO) measure established sample adequacy for performing factor analysis (Strauss and Smith, 2009; Lachat et al., 2012; Ratti et al., 2017).

***Reliability*:** Internal consistency of the items in attitude and practice scale (interval scale) was evaluated using the Cronbach α value >0.7 (Hiew et al., 2015; Amiri et al., 2017) and for the dichotomous items in the knowledge scale (scored as zero or one) using Kuder-Richardson 20 (KR-20) >0.7 (Salkind, 2012). As suggested in previous studies, we used the intraclass correlation coefficient (ICC) to determine the correlation and degree of agreement between the variables measured in the test and retest of the survey instrument (Cullen, Watson, and Zakeri, 2008; Koo and Li, 2016).

Statistical analyses

Data were analyzed using SPSS version 22 (SPSS, Chicago, USA); frequency and percentages for categorical variables and mean and standard deviation values for continuous variables were calculated. Variables were compared according to sex and the type of school attended by the participants using chi-square and *t*-tests; the level of significance was set at $p<0.05$. As suggested in similar studies, we used I-CVIs of 0.7 or higher to determine the content validity, an item difficulty index range 0.2–0.8 for retention of items based on item difficulty, and point-biserial correlation coefficient values of 0.2–0.3 to discriminate items in the knowledge scale (Zamanzadeh et al., 2015; Trakman et al., 2017; Kovacic, 2018). Exploratory factor analysis using the principal axis factoring method and varimax rotation determined the construct validity.

Internal consistency of the knowledge scale was evaluated using KR-20 >0.7 (Amiri et al., 2017) and for attitude and practice items, we used Cronbach's α values >0.7 (Glanz and Steffen, 2008). Test-retest reliability was analyzed using a single-measurement, absolute-agreement, two-way mixed-effects model and interpreted based on 95% confidence interval (CI) estimates of ICC values

Table 1. Demographic characteristics of participants in the knowledge, attitudes, and practices (KAP) to healthy eating and activity patterns in schoolchildren (HEAPS) study (n=252).

Characteristics	Number	Percentage
Sex		
Boys	121	48.0
Girls	131	52.0
Type of school		
Aided	122	48.4
Private	130	51.6
Sixth grade	128	50.8
Seventh grade	124	49.2
Religion		
Hindu	179	71.1
Muslim	46	18.3
Christian	10	3.9
Parsi	12	4.8
Other	5	1.9
Father's occupation		
Service	89	35.3
Business	68	26.9
Professional (doctor/lawyer/CA)	32	12.7
Menial jobs (driver/plumber/painter)	43	17.1
Self employed	9	3.6
No response/does not know	11	4.4
Mother's working status		
Does not work	140	55.5
Part time	38	15.1
Full time	74	29.4

CA, chartered accountant.

>0.75 as good and with > 0.9 as excellent reliability (Cullen, Watson, and Zakeri, 2008; Koo and Li, 2016).

Results

Overall, 252 children completed the survey to determine the construct validity, internal consistency, and test-retest reliability. The mean age of participants was 11.5 (1.2) years, 48% were boys, 52% were studying in private schools, 56% reported that their mothers were not working outside the home, and more than three quarters ascribed to the Hindu religion. The demographic characteristics of the participants are provided in Table 1.

The overall I-CVI scores for clarity and relevance in the instrument were 0.910 and 0.828, respectively, whereas it ranged from 0.812 to 1.00 for knowledge items, from 0.866 to 0.987 for items in the attitude scale, and from 0.782 to 0.856 for practice items. Out of 48 knowledge items in the first draft, 18 questions were removed based on I-CVI <0.7, four questions were reworded post face validity to improve clarity and comprehension, and an additional eight items were excluded based on item difficulty index <0.2 or >0.8. Similar revisions were made for attitude and practice items. At the end of the content and face validity exercise, the 88-item KAP-HEAPS instrument comprised 22 knowledge, 22 attitude, and 44 practice questions (32 dietary practice and 12 MVPA and SA practice). The average time to complete the survey was 25–40 minutes.

To conduct exploratory factor analysis, we tested the assumptions using Bartlett's test of sphericity and KMO measures of sampling adequacy; Bartlett's test of sphericity was observed to be significant at <0.0001, and KMO was adequate for attitude items (KMO 0.890) and practice items (KMO 0.730). Next, the principal axis-factoring method was used to extract factors keeping the minimum eigenvalue as 1; this method extracted four dimensions in the attitude scale with the first, second, and third dimensions explaining 15.3%, 11.3%, and 8.6% of the variance in the scores, respectively. All items in this analysis had primary loadings over 0.5. Dimension 1 of the attitude scale included five items that measured "perceived susceptibility and severity" to adverse health consequences of unhealthy eating habits and activity levels. Dimension 2 was named "perceived benefits" and included six items measuring the perceived benefits of indulging in healthy eating practices and being active, whereas dimension 3 and dimension 4 assessed "perceived barriers" (six items) and "readiness to change and self-efficacy" (three items), respectively.

From the factor analysis and scree plot, four factors (individual eating habits, family eating habits, and consumption of healthy and unhealthy foods) explained 67.7% variance in dietary practice and two factors explained 48.2% of the total variance in the activity practice items. In the final analysis model, 22 knowledge, 20 attitude, 30 dietary practice, and 12 activity (six MVPA and six SA) practice items were retained (Table 2).

Supplementary Table 1 and 2 provide the results of the exploratory factor analysis.

The total KR-20 for the knowledge subscale was 0.832 and Cronbach's α values for the attitude and practice scales were 0.892 and 0.810, respectively. As all items had Cronbach α values >0.7, the instrument was considered to have good internal consistency. The final 84-item KAP-HEAPS survey was administered twice to a sub-sample of children (n=132), with the median duration between tests as 19 days. Out of these children, 54.2% were from a private school, 52.2% were girls, and 48.5% studied in grade six. For knowledge items, ICC estimates ranged from 0.72 (unhealthy eating habits) to 0.99 (food groups and nutrients, mean = 0.87). ICC estimates were excellent for majority of the attitude items (range 0.92–0.99), except for perceived susceptibility (ICC, 0.78; 95% CI, 0.60–0.88); the levels of reliability in practice items were good (fruit consumption, ICC, 0.83; 95% CI, 0.78–0.87) to excellent (SA, ICC, 0.95; 95% CI, 0.91–0.99), except in dietary practice related to unhealthy food consumption (ICC, 0.68; 95% CI, 0.62–0.73).

The number of items and examples of questions in each subscale of the KAP-HEAPS questionnaire and the mean and SD values for KAP scales, KR-20, and Cronbach α values for internal consistency and ICC values with 95% CI

Table 2. Summary of dimensions, eigen values, percentage variance, and range of factor loadings extracted using principal axis-factoring method for attitude and practice items in knowledge, attitude, and practice (KAP) to healthy eating and activity patterns in school children (HEAPS) study.

	Initial eigenvalues			Extraction sums of squared loadings			
Factors/dimensions	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %	**Range of factor loadings**
Attitude items							
1 Perceived susceptibility and severity	3.042	15.290	15.290	3.042	15.209	15.209	0.519–0.646
2 Perceived benefits	2.249	11.287	26.577	2.249	11.247	26.456	0.525–0.675
3 Perceived barriers	1.721	8.604	35.181	1.721	8.604	35.060	0.519– 0.632
4 Readiness to change and self-efficacy	1.567	7.837	43.018	1.567	7.837	42.897	0.584–0.767
Dietary and activity practice items							
1 Personal eating habits	6.130	21.322	23.322	8.130	21.322	23.322	0.695–0.761
2 Family dietary habits	4.643	18.525	41.847	6.643	18.525	41.847	0.526– 0.757
3 Consumption of healthy foods	3.011	14.486	56.334	4.011	14.486	56.334	0.552–0.675
4 Consumption of unhealthy foods	2.664	11.367	67.701	2.664	11.367	67.701	0.507–0.691
Activity 1. Moderate to vigorous physical activity	7.834	28.282	28.282	7.834	28.282	28.282	0.519–0.724
Activity 2. Sedentary activity	4.547	19.891	48.173	4.547	19.891	48.173	0.489– 0.706

Extraction Method: Principal Axis Factoring. Rotation Method: Varimax with Kaiser Normalization.

of ICC estimates for test-retest reliability are presented in Table 3.

KAP related to healthy eating and activity levels

The mean knowledge, attitude, dietary practice, and physical activity scores were 16.62 (2.2), 36.54 (6.2), 73.64 (28.7), and 28.86 (4.5), respectively. There were no significant differences in the mean knowledge, attitude, and dietary practice scores between girls and boys, although the mean physical activity scores were significantly higher among boys (33.30 vs 24.42 in girls; $p=0.032$). Participants from private schools reported significantly higher mean knowledge (17.55 vs 14.06 in aided schools, $p<0.001$), attitude (40.07 vs 34.31 in aided schools, $p<0.001$), and dietary practice scores (78.90 vs 71.33 in aided schools, p value <0.001).

Most children (>70%) reported "good" knowledge (scores above 50%) about healthy and unhealthy eating habits and the benefits of being active but "poor" knowledge about the healthy eating plate (29%), portions and serving sizes (33%), risk factors of non-communicable diseases (38%), and examples of moderate to vigorous activity (42%). Participants disagreed with the statements "*I am worried about becoming obese"* (32%), "*I am worried about getting diabetes*" (37%), and "*I am worried about getting heart disease*" (42%). Less than one third (28%) agreed that "*I will get diseases if I don't eat healthily*" and only 22% strongly agreed to the statement "*I will feel tired if I am physically inactive*." These results indicated low perceived susceptibility and perceived severity of the adverse consequences of unhealthy eating habits and physical inactivity in the sample. Only 61%, 48%, and 39% reported having breakfast, carrying healthy snacks to school, and consuming fruits more than thrice a week, respectively.

Discussion

In this study, several measures of validity such as the face, content, and construct validity and measures of reliability such as internal consistency and test-retest reliability were employed to develop the KAP-HEAPS questionnaire. Although we could not find any similar studies that had described the methods of validating KAP instruments among school children in India, several studies conducted outside India used similar methods to evaluate the psychometric properties of questionnaires. A study conducted to develop and determine the reliability of KAP towards wholegrains among Malaysian primary school children assessed construct validity using exploratory factor analysis (Hiew et al., 2015), another study reported the use of internal consistency α values and test-retest reliability coefficient values to examine the reliability of the instrument (Vereecken et al., 2009), and another assessed the psychosocial constructs associated with calcium intake in adolescent girls based on the key constructs of a health-behavior theory (Glanz and Steffen, 2008). The attitude items in our study were based on the constructs of the HBM, a theoretical framework that is often used to understand health-related behaviors (Ghaffari et al., 2012; Rahmati-Najarkolaei et al., 2015; Tavassoli et al., 2017).

Similar to previous studies (Murang, Tuah, and Naing, 2017; Scherr et al., 2017; Mamba, Napoles, and Mwaka, 2019), we observed inadequate knowledge regarding

Table 3. Description of the items, mean scores, internal consistency, and intraclass correlation coefficient values of items in knowledge, attitudes, and practices (KAP) to healthy eating and activity patterns in school children (HEAPS) survey in Mumbai (n=252).

Scale/ subscale	Items	Questions	Response scoring	Mean (SD)	KR-20 or α	ICC (95% CI)
Knowledge					0.832	
Food groups and nutrients	6	Food group that should take most space on your plate. Recommended daily servings of fruit and vegetables for children. Food items at the top of the food pyramid. Sources of simple carbohydrates in diet. Sources of healthy fats in diet. Foods high in fiber content.	Each correct response = 1 Incorrect response/ don't know/ not sure = 0 Maximum possible scores = 25	4.18 (1.2)		0.961** (0.92–0.99)
Eating habits	6	Components of healthy eating plan. Healthy breakfast choices. Identify nutritious afterschool snack. Allowed daily consumption of sugar. Identify unhealthy eating habits.[a] Effect of consuming too many junk foods. Healthy alternatives to SSBs.		5.44 (2.3)		0.782* (0.70–0.82)
NCDs	5	Modifiable risk factors of NCDs.[a] Symptoms related to diabetes. Foods for healthy heart. Ways to prevent NCDs. Health problems associated with obesity.		3.10 (1.8)		0.875** (0.84–0.91)
Activity patterns	5	Identify moderate to vigorous activities.[a] Benefits of being active. How often should you indulge in MVPA? How long should you watch TV or play on a computer every day? Consequences of physical inactivity.		3.82 (2.1)		0.821** (0.79– 0.85)
Attitude						
Perceived susceptibility and severity	5	I will get diseases if I don't eat healthily. I will feel tired if I am physically inactive. I am worried about getting diabetes. I am worried about getting heart diseases. I am worried about overweight/obesity.	For all items except perceived barriers Strongly agree = 3 Agree = 2 Disagree = 1 Strongly disagree = 0	7.23 (3.4)	0.892	0.752* (0.687–0.826)
Perceived benefits	6	Healthy eating can reduce risk of diseases. Fruit can fight infections. Eating vegetables can help you lose weight. Regular breakfast helps improve alertness. Exercising is good for my muscles and bones. Being physically active will increase my energy levels and improve my moods.	For perceived barrier items Strongly agree = 0 Agree = 1 Disagree = 2 Strongly disagree = 3 Maximum possible scores = 60	12.28 (6.2)		0.942** (0.91– 0.96)
Perceived barriers	6	It is difficult to eat two pieces of fruit a day. I am not sure what and how much should I eat. I have trouble choosing healthy foods when eating out or with friends. I find exercise boring. I don't get time to exercise. Playing on the computer is more fun than playing outside with friends.		8.69 (2.8)		0.922** (0.91–0.94)
Readiness to change and self-efficacy	3	I try to eat breakfast every day. I try to eat fruit every day. I want to improve my eating habits.		7.38 (4.7)		0.953 ** (0.92– 0.98)

(continued)

Table 3. (continued)

Scale/ subscale	Items	Questions	Response scoring	Mean (SD)	KR-20 or α	ICC (95% CI)
Dietary practice						
Personal eating habits	3	How often do you have breakfast? How often do you carry tiffin to school? How often do you skip a meal?	For healthy eating habits and consumption of healthy foods Never = 0	8.54 (3.6)	0.768	0.923** (0.89–0.95)
Family dietary habits	3	How often did your family eat a meal together, eat a meal in front of TV, eat out at restaurants/ order takeaways?	1–2 times = 1 3–4 times = 2	9.10 (4.1)		0.956** (0.92– 0.98)
Consumption of fruits and vegetables (healthy foods)	12	How often did you consume bananas, citrus fruits, apples, grapes, other fruits, 100% fruit juice? How often did you consume potatoes, carrots, tomatoes, cauliflower, cabbage, green leafy vegetables, salad, other vegetables?	Every day = 3 > once/day = 4 For unhealthy eating habits and consumption of unhealthy foods Never = 4	19.42 (12.0)		Fruits 0.838* (0.78–0.87) Vegetables 0.88* (0.86–0.91)
Consumption of foods high in fat, sugar and salt (unhealthy foods)	12	How often did you consume biscuits, chocolates, cakes/pastries, Cola-Cola/ Pepsi? How often did you consume vada pav, samosa, burger/pizza, pav bhaji? How often did you consume wafers, Frankie, fried rice/noodles, Maggi noodles?	1–2 times = 3 3–4 times = 2 6–7 times = 1 >once /day = 0 Maximum possible scores = 120	36.45 (14.6)		0.682* (0.62–0.73)
Activity						
MVPA	6	In the last 7 days, how often did you play football/basketball, martial arts, cycling/dancing, cricket/badminton, running/jogging, jumping rope?	Never = 0 1–2 times = 1 3–4 times = 2 6–7 times = 3 >once a day = 4 Maximum possible scores = 24	15.5 (8.3)	0.881	0.968** (0.94–0.99)
Sedentary activity	6	In the last 7 days, how often did you watch TV, play/study on computers, chat with friends/social media, read/listen to music, sit in lessons?	Never = 4 1–2 times = 3 3–4 times = 2 6–7 times = 1 >once/day = 0 Maximum possible score = 24	12.8 (4.5)	0.920	0.954** (0.91–0.99)

α, Cronbach alpha; 95% CI, 95% confidence interval; ICC, intraclass correlation coefficient; KR-20, Kuder-Richardson 20; MVPA, moderate to vigorous physical activity; NCD, non-communicable diseases; SSB, sugar-sweetened beverages.

*Correlation is significant at $p<0.05$ level; ** $p<0.001$ (one tailed).

recommended daily servings of fruit and vegetables, guidelines related to the required duration of physical activity and daily limits of SAs. Poor perceived susceptibility and severity of adverse health consequences of noncommunicable diseases were also observed. These findings suggest that efforts are necessary to improve the nutritional knowledge of children, but an acknowledgment of the interplay between perceptions and attitudinal variables, such as perceived susceptibility to diseases and perceived benefits and barriers to adopting healthy lifestyle habits, and practices related to diet and activity patterns of children is also needed.

There are several strengths to this study—first, a valid and reliable instrument was developed to measure KAP related to healthy eating and activity levels in Indian children. Second, this study was conducted in Mumbai city, an economic hub that is undergoing rapid urbanization (Yedla, 2003) and associated changes in lifestyle practices and food accessibility and consumption patterns (Cuevas García-Dorado et al., 2019). Considering that children are often at the forefront of these sociocultural changes (Jayawardena et al., 2016; Bailey et al., 2018) and are more likely to be tempted to adopt unhealthy food choices and lifestyle practices (Popkin, Adair, and Ng, 2012; Griffiths and Bentley, 2018), the brief 84-item KAP instrument developed in this study can be used as a pre-intervention assessment tool to examine possible mediating attributes of knowledge and attitudes to healthy-eating habits and activity patterns in urban children. This instrument can also be used to evaluate before and after comparisons of intervention programs, designed to improve awareness and foster positive attitudes among school children in India. Third, the selection of participants from aided and private schools (using the type of school attended as a proxy for socioeconomic status) ensured representation across socioeconomic backgrounds. Finally, the participants in this study were in the stage of early adolescence (10–12 years), an impressionable age when autonomy in decisions over lifestyle habits, including diet and activity patterns, is being formed and an understanding of their knowledge and attitude to healthy eating and activity levels may prove to be a future investment.

However, it must be noted that our study has the limitations of generalizability due to the use of a purposive-sampling method and selection of an urban setting to evaluate the psychometric properties of the instrument. Further studies with larger samples and diverse settings are needed for validation of this instrument and to understand how children learn and use health-related knowledge and translate them into better lifestyle practices.

Conclusions

The results of this study are promising. The measures of validity determined the extent to which the KAP-HEAPS instrument measured what it intended to, and the reliability testing established the temporal ability. The detailed description of the methodology employed to develop and evaluate the psychometric properties of the questionnaire may prove useful to researchers who are developing nutritional knowledge and health behavior-related instruments or conducting similar measurement studies in children. Considering that studies evaluating the reliability and validity of instruments measuring KAP to healthy eating and activity levels among children in India are limited, conducting descriptive methodological studies in the future is warranted. Measuring these attributes is crucial to provide further direction to address nutrition and physical inactivity-related health issues among children.

Acknowledgments

The authors would like to acknowledge Mr. Jagdish Sharma for his assistance with statistical analysis, the field research team for their hard work, and the heads of the institutes who provided permission to conduct the study. The authors appreciate the valuable inputs and cooperation provided by the study participants.

Author contributions

PM and JM formulated the research questions and designed the study. PM and PV supervised fieldwork and PM was responsible for data analysis and management. PM drafted the manuscript and JM and PV critically reviewed the manuscript; the final draft was approved by all authors.

Data accessibility

Research data included in Supplementary files are the authors' content. Additional datasets used and/or analyzed during the present study are available from the corresponding author on reasonable request.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical statement

This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving research study participants were approved by the Intersystem Biomedica Ethics Committee, Mumbai, India (version 2, dated 19 February 2019). Written informed consent was obtained from parents and written informed assent was obtained from the participants.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

ORCID iD

Panchali Moitra https://orcid.org/0000-0002-3630-2794

Supplemental material

Supplemental material for this article is available online.

References

Amiri P, Asghari G, Sadrosadat H, et al. (2017) Psychometric properties of a developed questionnaire to assess knowledge, attitude and practice regarding vitamin D (D-KAP-38). *Nutrients* 9(5): 1–13. DOI: 10.3390/nu9050471.

Bailey C, Garg V, Kapoor D, et al. (2018) Food choice drivers in the context of the nutrition transition in Delhi, India. *Journal of Nutrition Education and Behavior*. DOI: 10.1016/j.jneb.2018.03.013.

Beena S, et al. (2013) Nutrient intake among school going adolescent girls in Lucknow district, India. *Journal of Biomedical and Pharmaceutical Research*.

Biddle SJH, et al. (2010) Tracking of sedentary behaviours of young people: A systematic review. *Preventive Medicine* 345–351.

Boutayeb A (2006) The double burden of communicable and non-communicable diseases in developing countries. *Transactions of the Royal Society of Tropical Medicine and Hygiene*.

Branca F, et al. (2019) Transforming the food system to fight non-communicable diseases. *BMJ (Online)* 364.

Cullen KW, Watson K, and Zakeri I (2008) Relative reliability and validity of the block kids questionnaire among youth aged 10 to 17 years. *Journal of the American Dietetic Association* 108(5): 862–866.

Dorado S, Cornselsen L, Smith R, et al. (2019) Economic globalization, nutrition and health: a review of quantitative evidence. *Globalization and Health* 15(1): 15. DOI: 10.1186/s12992-019-0456-z.

Esht V, et al. (2018) A preliminary report on physical activity patterns among children aged 8–14 years to predict risk of cardiovascular diseases in Malwa region of Punjab. *Indian Heart Journal* 70(6): 777–782.

Ghaffari M, et al. (2012) Effect of Health Belief Model based intervention on promoting nutritional behaviors about osteoporosis prevention among students of female middle schools in Isfahan, Iran. *Journal of Education and Health Promotion* 1(1): 14.

Glanz K and Bishop DB (2010) The role of behavioral science theory in development and implementation of public health interventions. *Annual Review of Public Health* 31(1): 399–418.

Glanz K and Steffen A (2008) Development and reliability testing for measures of psychosocial constructs associated with adolescent girls' calcium intake. *Journal of the American Dietetic Association* 108(5): 857–861.

Griffiths PL and Bentley ME (2018) The nutrition transition is underway in India. *The Journal of Nutrition*.

Gupta N, et al. (2012) Childhood obesity in developing countries: Epidemiology, determinants, and prevention. *Endocrine Reviews* 48–70.

Hiew CC, et al. (2015) Development and validation of knowledge, attitude and practice on healthy lifestyle questionnaire (KAP-HLQ) for Malaysian adolescents. *Journal of Nutrition and Health Sciences* 2(4).

Jayawardena R, et al. (2016) Nutrition transition and obesity among teenagers and young adults in South Asia. *Current Diabetes Reviews*.

Kao KT and Sabin MA (2016) Type 2 diabetes mellitus in children and adolescents. *Australian Family Physician*.

Karki A, Shrestha A, and Subedi N (2019) Prevalence and associated factors of childhood overweight/obesity among primary school children in urban Nepal. *BMC Public Health* 19(1): 1055.

Kigaru DMD, et al. (2015) Nutrition knowledge, attitude and practices among urban primary school children in Nairobi City, Kenya: A KAP study. *BMC Nutrition* 1(1): 44.

Kim HS, Ahn J and No JK (2012) Applying the health belief model to college students' health behavior. *Nutrition Research and Practice* 6(6): 551–558.

Koo TK and Li MY (2016) A guideline of selecting and reporting intraclass correlation coefficients for reliability research. *Journal of Chiropractic Medicine* 15(2): 155–163.

Kovacic D (2018) Using the content validity index to determine content validity of an instrument assessing health care providers' general knowledge of human trafficking. *Journal of Human Trafficking* 4(4): 327–335.

Kumar S and Kelly AS (2017) Review of childhood obesity: From epidemiology, etiology, and comorbidities to clinical assessment and treatment. *Mayo Clinic Proceedings*.

Lachat C, et al. (2012) Eating out of home and its association with dietary intake: A systematic review of the evidence. *Obesity Reviews*.

Mamba NPS, Napoles L, and Mwaka NM (2019) Nutrition knowledge, attitudes and practices of primary school children in Tshwane Metropole, South Africa. *African Journal of Primary Health Care and Family Medicine* 11(1).

Meharda B, et al. (2017) Overweight and obesity: A rising problem in India. *International Journal of Community Medicine And Public Health*.

Mehta K, et al. (2014) Dietary pattern of schoolgoing adolescents in Urban Baroda, India. *Journal of Health, Population and Nutrition*.

Misra A, et al. (2011) Nutrition transition in India: Secular trends in dietary intake and their relationship to diet-related non-communicable diseases. *Journal of Diabetes*.

Moitra P and Madan J (2020) Perceived barriers and facilitators of healthy eating and physical activity: Focus groups with children, parents and teachers in Mumbai, India. *International Journal of Community Medicine And Public Health* 7(6): 2363.

Murang ZR, Tuah N, and Naing L (2017) Knowledge, attitude and practice towards eating and physical activity among primary school children in Brunei: A cross-sectional study. *International Journal of Adolescent Medicine and Health*.

Musaiger AO and Al-Hazzaa HM (2012) Prevalence and risk factors associated with nutrition-related noncommunicable diseases in the Eastern Mediterranean region. *International Journal of General Medicine*.

Naghashpour M, et al. (2014) Nutrition education based on health belief model improves dietary calcium intake among female students of junior high schools. *Journal of Health, Population and Nutrition*. 32(3): 420–429.

Oli N, et al. (2018) Knowledge, attitude and practice on diet and physical activity among mothers with young children in the Jhaukhel-Duwakot Health Demographic Surveillance Site, Nepal. *PLoS ONE* 13(7).

Popkin BM, Adair LS, and Ng SW (2012) Global nutrition transition and the pandemic of obesity in developing countries. *Nutrition Reviews* 70(1): 3–21.

Qidwai W, et al. (2010) Adolescent lifestyle and behaviour: A survey from a developing country. *PLoS ONE*.

Rahmati-Najarkolaei F, et al. (2015) Factors predicting nutrition and physical activity behaviors due to cardiovascular disease in Tehran university students: Application of health belief model. *Iranian Red Crescent Medical Journal* 17(3): 1–6.

Ranjani H, et al. (2016) Epidemiology of childhood overweight & obesity in India: A systematic review. *Indian Journal of Medical Research*.

Rathi N, Riddell L and Worsley A (2018) Urban Indian adolescents practise unhealthy dietary behaviours. *British Food Journal*.

Ratti V, et al. (2017) An exploratory factor analysis and construct validity of the resident choice assessment scale with paid carers of adults with intellectual disabilities and challenging behavior in community settings. *Journal of Mental Health Research in Intellectual Disabilities* 10(3): 198–216.

Salkind N. (2012) 'KR-20'. In *Encyclopedia of Research Design*. SAGE Publications, Inc. DOI: 10.4135/9781412961288.n205.

Scherr RE, et al. (2017) A multicomponent, school-based intervention, the shaping healthy choices program, improves nutrition-related outcomes. *Journal of Nutrition Education and Behavior* 49(5): 368–379.e1.

Shaikh NI, et al. (2016) Going global: Indian adolescents' eating patterns. *Public Health Nutrition* 19(15): 2799–2807.

Shridhar K, et al. (2016) Prevalence and correlates of achieving recommended physical activity levels among children living in rural South Asia: A multi-centre study. *BMC Public Health* 16(1).

Sivagurunathan C, et al. (2015) Adolescent health: Present status and its related programmes in India. Are we in the right direction? *Journal of Clinical and Diagnostic Research*.

Strauss ME and Smith GT (2009) Construct validity: Advances in theory and methodology. *Annual Review of Clinical Psychology* 5(1): 1–25.

Tavassoli E, Reisi M, Javadzad SH, et al. (2013) The effect of the health belief model-based education & improvement of consumption of fruits and vegetables: An interventional study. *Journal of Health in the Field* 1(2).

Teixeira PJ and Marques MM (2017) Health behavior change for obesity management. *Obesity Facts* 10(6): 666–673.

Trakman GL, et al. (2017) Developing and validating a nutrition knowledge questionnaire: Key methods and considerations. *Public Health Nutrition* (15): 2670–2679.

Vaz M, et al. (2016) The nutrition transition in India. *South African Journal of Clinical Nutrition*.

Vereecken C, et al. (2009) Reliability and validity of a healthy diet determinants questionnaire for adolescents. *Public Health Nutrition* 12(10): 1830–1838.

Yedla S. (2003) *Urban environmental evolution: The case of Mumbai*. Report prepared for Institute for Global Environmental Strategy(IGES), Japan.

Zamanzadeh V, et al. (2015) Design and implementation content validity study: Development of an instrument for measuring patient-centered communication. *Journal of Caring Sciences* 4(2): 165–178.