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## Developing a knowledge, attitude, and practice questionnaire on nutrition, physical activity, and body image for 13–14-year-old female adolescents



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### المخلص

**أهداف البحث:** كان الهدف من هذه الدراسة هو تطوير والتحقق من صحة استبانة المعرفة والسلوك والممارسة حول التغذية والنشاط البدني وصورة الجسم للمراهقات من سن 13-14 سنة.

**طريقة البحث:** تتكون استبانة المعرفة والسلوك والممارسة في البداية من 73 عنصرا ، تغطي المعرفة (30) والسلوك (22) والممارسة (21) المتعلقة بالتغذية والنشاط البدني وصورة الجسم. تم اختبار المحتوى وصلاحيته لوجه لتحديد صلة عناصر الاستبانة بالمحتوى وصلتها بالتغذية والنشاط البدني وصورة الجسم. تم تقييم صحة البناء باستخدام تحليل عامل استكشافي. تم تحديد الاتساق الداخلي من خلال قيمة ألفا كرونباخ، وتم تحديد الثبات بناء على موثوقية الاختبار وإعادة الاختبار.

**النتائج:** بناء على تحليل العامل الاستكشافي، كان لكل مقياس أبعاد متعددة. تراوحت قيمة ألفا كرونباخ بين 0.977 و 0.888 للمعرفة ، و 0.902 و 0.977 للسلوك و 0.949 و 0.950 للممارسة. أوضحت موثوقية الاختبار-إعادة الاختبار أن كبا المعرفة كانت 0.773-1، بينما كانت قيم الارتباط داخل الصف للسلوك 0.682-1 و للممارسة 0.778-1.

**الاستنتاجات:** كانت الاستبانة النهائية للمعرفة والسلوك والممارسة، والتي تضمنت 72 عنصرا، صالحا وموثوقا لاستخدامه في تقييم مستويات استبانة

المعرفة والسلوك والممارسة للتغذية والنشاط البدني وصورة الجسم للطالبات اللاتي تتراوح أعمارهن بين 13 و 14 عاما في المملكة العربية السعودية.

**الكلمات المفتاحية:** التغذية؛ النشاط البدني؛ شكل الجسم؛ استبانة المعرفة والسلوك والممارسة؛ تصديق؛ السعودية؛ الإناث المراهقات

### Abstract

**Objectives:** The objective of this study was to develop and validate a Knowledge, Attitude, and Practice Questionnaire (KAPQ) on nutrition, physical activity, and body image for 13–14-year-old female adolescents.

**Method:** The KAPQ initially consisted of 73 items, covering knowledge (30), attitude (22), and practice (21) related to nutrition, physical activity (PA), and body image (BI). The content and face validity were tested to identify the relevance of the questionnaire items to the content and their relevance to nutrition, PA, and BI. Construct validity was assessed using an exploratory factor analysis (EFA). Internal consistency was determined by Cronbach's  $\alpha$  value, and stability was determined based on test–retest reliability.

**Results:** Based on the EFA, each scale had several dimensions. The Cronbach's  $\alpha$  ranged between 0.977 and 0.888 for knowledge, 0.902 and 0.977 for attitude, and 0.949 and 0.950 for practice. The test–retest reliability revealed that the kappa of knowledge was 0.773–1.000, while the intraclass correlation (ICC) values for attitude and practice were 0.682–1.000 and 0.778–1.000, respectively.

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**Conclusion:** The final KAPQ, which included 72 items, was valid and reliable for assessing the KAP levels for nutrition, PA, and BI of 13–14-year-old female students in KSA.

**Keywords:** Attitude and practice questionnaire; Body image; Knowledge; Nutrition; Physical activity; Saudi and adolescent females; Validation

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## Introduction

Adolescence is the stage from childhood to adulthood, occurring between the ages of 10 and 19 years.<sup>1</sup> Diet and weight influence physiological changes during this period of growth. Therefore, adolescents should eat healthy foods, such as fruits, vegetables, whole grains, proteins, and low-fat dairy products.<sup>2</sup> Some adolescents will suffer from poor health in adulthood if they follow an unhealthy diet and consume more calories than needed,<sup>1</sup> which will lead to weight gain.<sup>3</sup>

Adolescence is linked to a higher risk of obesity, which could result in increased body fat and body mass index (BMI), iron deficiency, anorexia, bulimia nervosa,<sup>4</sup> high blood pressure, high triglyceride and cholesterol levels, and diseases such as ischemic stroke, insulin resistance, type 2 diabetes, and coronary heart disease.<sup>5</sup> A study in 2011 found that 29.4% and 23.2% of Saudi girls and boys were obese and overweight, respectively.<sup>6</sup> In 2020 among adolescents and adults (18–26) years old, 14.9% of Saudis were obese, and 20.4% were overweight,<sup>7</sup> indicating that the prevalence of obesity among Saudis has not gone down substantially in recent years.

A healthy body can be achieved by maintaining a healthy diet and engaging in physical activity (PA).<sup>8</sup> Knowledge can be defined as an individual's understanding,<sup>9</sup> while attitude refers to the belief in benefits and confidence in one's abilities. Attitude helps to explain how a person's behaviour is affected by feelings and thoughts.<sup>9</sup> Attitude and practice can be changed gradually as a person gains specific knowledge about health.<sup>10</sup> Similarly, knowledge about good nutrition will result in better nutritional practices.<sup>11</sup> Generally, surveys are needed to evaluate the effectiveness of various studies and intervention programmes.<sup>12</sup> A self-report questionnaire has commonly been used to assess knowledge, attitude, and practice related to nutrition, PA, and body image (BI) in many countries, including Egypt, Iran, Lebanon, the United States, Kenya, Malaysia,<sup>13–19</sup> and KSA.<sup>20,21</sup>

However, sometimes the available questionnaires cannot be used. For example, they might be specific to particular cultures or unsuitable for the age of the target respondents.<sup>20</sup> Therefore, researchers have developed Knowledge, Attitude, and Practice Questionnaires (KAPQs), which are suitable for their target populations and specific objectives and have good reliability and validation scores.<sup>22</sup> Currently, there is

a lack of KAPQs on nutrition, PA, and BI to evaluate variables related to nutrition, PA, BI, and nutritional interventions. Therefore, this study sought to develop and validate a KAPQ on nutrition, PA, and BI for 13–14-year-old female adolescents.

## Materials and Methods

### *Study design and population*

A cross-sectional study was conducted in a government intermediate school in Arar City (North region), KSA, between November 2020 and December 2020 on 13–14-year-old Saudi female adolescents. Since males in KSA attend school separated from females, males were excluded from the sample. Moreover, it has been found that the best time to assimilate and understand nutrition and PA is when adolescents are between 12 and 14 years old.<sup>23</sup> Accordingly, the current study involved 13–14-year-old adolescents who were attending intermediate school, whereas 11–12-year-old students were excluded because they were attending primary school.

Based on simple random sampling using Excel software, one school was selected randomly from 18 schools in Arar to examine the validity and reliability of the proposed KAPQ on nutrition, PA, and BI. The school has three classrooms for 13-year-old students and three classrooms for 14-year-old students. The respondents were selected randomly from the six classrooms using Excel.

### *Sample size*

As suggested by Hutcheson and Sofroniou,<sup>24</sup> a minimum number of 150 respondents was considered adequate for an exploratory factor analysis (EFA) in this study. An adolescent without medical conditions, such as cardiovascular diseases, cancer, fractures, asthma, or diabetes, whose health condition made it possible to engage in PA was considered a healthy adolescent eligible for this study. All the respondents met the criteria for eligibility. Meanwhile, adolescents with chronic diseases or physical disabilities were excluded. The adolescent participants and at least one of their parents, who consented to their participation, were given the opportunity to engage in the study.

### *Data collection*

The first author performed this study. Initially, all the respondents were interviewed directly during school hours and asked to complete the KAPQ within 20 min. The first section of the questionnaire focused on sociodemographic characteristics, while the rest comprised the KAPQ sections.

### *Sociodemographic characteristics*

The sociodemographic section on the questionnaire was related to the participant's age, number of siblings, number of household members, education level of the mother and father, and monthly household income.<sup>25,26</sup>

### *Development of the questionnaire items*

The self-report KAPQ was adapted based on previous studies, focusing on KAPQs associated with nutrition, PA, or BI.<sup>15,20,27</sup> The new questionnaire developed for the Saudi female adolescent population covered three dimensions—nutrition, PA, and BI—not just one or two, as in previous studies. Furthermore, this KAPQ was targeted to 13- and 14-year-old adolescents, as there have been few studies on this age group. The KAPQ dimensions were knowledge, attitude, and practice.

First, the first author reviewed the curricula and daily schedules of the 13- and 14-year-old adolescents in Arar. It has been reported that those adolescents do not have curricula associated with nutrition, PA, or BI.<sup>28</sup> However, some information was found related to soup recipes, and food labels are included in the family education curriculum. Moreover, in the school canteens in Arar, there are no major differences in the prices of healthy and unhealthy foods, such as chocolates, sweets, chips, cakes, and cheese sandwiches. In addition, sugary beverages are sold for the same price as healthy drinks, such as milk, in most school canteens.

Second, the nutrition education programme was developed with a focus on eating healthy foods, being physically active, and having a positive BI, based on the needs of this population. The needs of this population were determined in a cross-sectional study by Ahmad Bahathig et al.<sup>29</sup> The main contents of the nutrition education programme and the present KAPQ are the importance of food groups, food serving sizes, variety, and energy balance, with a focus on how to prevent obesity and type 2 diabetes, body weight status, BI satisfaction (the importance and consequences), growth, tips to reduce the consumption of unhealthy foods and replace them with healthy eating habits, and the importance of food labels. The programme also emphasises replacing sedentary behaviour and screen time with PA. Moreover, consideration was given to the recommended amount of PA (60 min/day),<sup>30</sup> classification levels of PA, warm-up exercises, walking as a form of PA, and the drawbacks of physical inactivity.

The research team adapted the KAPQ following the development of the nutrition education programme. All the items were presented in Arabic, the national language of KSA, for the convenience of the respondents and to ensure that they would be easily understood by most of them.

### *Development of the knowledge section of the KAPQ*

The knowledge section included 30 questions for determining the respondents' level of knowledge about nutrition, PA, and BI. The total number of items was based on the average number of 26 knowledge items in previous studies on nutrition and PA.<sup>27,31</sup> However, it was rounded up to 30 items based on a needs assessment<sup>29</sup> and previous studies.<sup>20,27,32</sup> The knowledge items included the Saudi food guide pyramid, food planning, eating habits, main meals, replacing sedentary time with activities, food choices, the importance of food labels, energy balance, body weight status, PA recommendations, benefits of PA, warming up, walking activities, sedentary behaviour, and

BI. Close-ended questions were used for all the items in this section, with answer options of true, false, and 'I do not know.' Each wrong answer was given a score of 0, and each correct answer was given a score of 1. The scores varied from 0 to 30 points. A score above the mean indicated a good level of knowledge, and the highest knowledge score indicated the best level of knowledge among the target population.<sup>15</sup>

### *Development of the attitude section of the KAPQ*

This section comprised 22 items for determining the respondents' attitudes toward nutrition, PA, and BI. The total number of questions was based on the average number of attitude items on nutrition, PA, and BI reported in previous studies.<sup>27,31</sup> The attitude items for adolescents were focused on healthy/unhealthy food, the importance of nutrition, PA, BI, daily recommendations for nutrition and PA, PA choices, and levels and sedentary behaviour. The items were answered on a five-point Likert scale, with options including strongly agree (5), agree (4), sometimes (3), disagree (2), and strongly disagree (1) for the 11 positive statements,<sup>10,33</sup> and ranging from strongly disagree (5) to strongly agree (1) for the 11 negative statements.<sup>10,34</sup> A higher attitude score indicated a more positive attitude, and the scores varied from 22 to 110.

### *Development of the practice section of the KAPQ*

This section included 21 questions based on the average number of items on nutrition, PA, and BI practices in previous studies. In addition, the respondents were asked how frequently they practiced nutrition, PA, and BI.<sup>27,31</sup> Individual answers were given for all the items about daily practices related to the consumption and selection of healthy and unhealthy food, dietary intake planning, reducing sedentary behaviour, increasing PA, and having a positive BI. A five-point Likert scale was used, with answers including very frequent (5), often (4), sometimes (3), rarely (2), and never (1) for the 12 positive statements; reverse scores were assigned to the nine negative statements.<sup>10,27</sup> The scores varied between 21 and 105, with higher scores indicating more positive practices.

### *Translation*

The KAPQ was translated into English and reviewed by a Ph.D. student from the Universiti Putra Malaysia, who is bilingual in English and Arabic and familiar with the study terms. The KAPQ was then translated from English to Arabic by two certified translation offices in KSA, after which backward translation was done in two different offices in KSA to check the grammar and understanding. Finally, the first researcher compared the Arabic and English versions, while a Ph.D. lecturer at Al-Iraqiya University in Baghdad, Iraq, reviewed the Arabic version.

### *Validity*

The validity of an instrument refers to its ability to measure what it is supposed to measure.<sup>35,36</sup> This KAPQ

was examined for its content, face validity, and construct validity.

#### *Content validity*

Content validity estimates the importance and relevance of the questionnaire items to the content.<sup>37</sup> The content validity of the KAPQ was determined by a panel of six experts, who were professionals in the fields of PA and nutrition (1), public health medicine and non-communicable diseases (1), nutrition and food science (3), and clinical nutrition (1). Each item was rated for appropriateness and accuracy as essential, useful but not necessary, or not essential.<sup>10</sup> Lawshe's formula was used to calculate the content validity ratio (CVR):  $(ne - (N/2)) / (N/2)$ , where *ne* is the number of experts who stated the item was essential, and *N* is the total number of experts.<sup>38</sup> According to Lawshe,<sup>38</sup> a CVR rating of at least 0.99 from six or more experts is required for an item to be accepted or retained.

#### *Face validity*

Face validity can be defined as the degree to which the KAPQ effectively assesses the relevance of the items on nutrition, PA, and BI.<sup>35,36</sup> The face validity of the KAPQ was tested after the items had been modified based on the content validity. Of the 150 respondents who tested the construct validity in this study, 40 were randomly selected and tested the face validity, which was conducted through discussion with the first author. The first author provided standardised instructions. The respondents were asked to complete the KAPQ and to indicate whether the items could be clearly understood during the discussion with the first author. The respondents' comments highlighted any items that required adjustment. Furthermore, time was considered to ensure that the items were not too long and were understandable and appropriate for the respondents.

#### *Construct validity*

Construct validity refers to the underlying concept that a test was developed to measure.<sup>37</sup> An EFA was performed on the 150 respondents who answered the KAPQ and participated in construct validity to identify the underlying constructs for knowledge, attitude, and practice. A parallel analysis was performed to identify the factor structure of the items in each section. In contrast, a principal component analysis (PCA) was carried out to analyse the polychoric correlation matrix. Promin rotation was used to determine how many factors should be retained. Bartlett's test was conducted to determine sphericity (significant at  $<0.05$ ),<sup>39</sup> and a Kaiser–Meyer–Olkin test was used to determine the sampling adequacy (of  $>0.6$ ).<sup>40</sup> Community values greater than 0.3 indicated that the variables fit the factor solution.<sup>41</sup>

#### *Reliability*

Reliability is an indication of the stability of the results.<sup>37</sup> Internal consistency and test–retest reliability were tested.

#### *Internal consistency reliability*

The similarity between items or sets of items is evaluated to determine internal consistency reliability.<sup>42</sup> This involves measuring the inter-correlation of the elements in a questionnaire and determining whether they concur in measuring the same construct. It was important to check the reliability of the KAPQ among the 150 respondents before conducting the actual study with a larger population. Cronbach's alpha value, ranging from 0 to 1, was used to determine the degree of replication in the results, where a value of 1 indicated ideal internal consistency, a value of 0.70 indicated adequate internal consistency, and lower values indicated low internal consistency.<sup>37</sup>

#### *Test–retest reliability*

To determine the stability of the results, test–retest reliability was measured with 40 respondents,<sup>37</sup> randomly selected from the 150 total respondents, with an interval of 2 weeks between the tests.<sup>43</sup>

#### *Statistical analysis*

SPSS (US) version 25 software was used for the data analysis. An EFA was conducted on the items in each section of the KAPQ to evaluate construct validity. A parallel analysis scale determined the number of factors to be retained. Bartlett's test values were acceptable if  $<0.05$ .<sup>39</sup> A Kaiser–Meyer–Olkin test was used to measure the sampling adequacy, with a value of  $>0.6$  indicating that the data were adequate and suitable for the EFA.<sup>40</sup> An oblimin rotation was performed to identify the factors that could be correlated, and the required eigenvalues were  $>1.0$ . Communality is the variance accounted for by all the components of each variable, and a value of  $>0.3$  indicates that the variable is acceptable.<sup>41</sup> According to Fabrigar et al.,<sup>44</sup> acceptable loading factors can be above 0.5, 0.4, or 0.3. In this study, the acceptable loading factor was  $>0.5$ , although loading factors  $>0.3$  were retained and item loaded onto the factor if the reliability (Cronbach's alpha) was  $>0.7$ , indicating internal consistency.<sup>37</sup>

## **Results**

#### *Sociodemographic characteristics*

The response rate for this study was 90.9% ( $n = 150$ ). There were no missing data during the data cleaning process. The mean age was  $13.4 \pm 0.49$ ; 55.3% of the respondents had 5–10 siblings, and 66% had 5–10 household members. Furthermore, 63.3% and 80% of the adolescent respondents had mothers and fathers who had completed university studies, respectively. In addition, 60% of their monthly household incomes were between Saudi Riyal (SAR) 5000 and 14,999. Their sociodemographic characteristics are presented in [Table 1](#).

**Table 1: Sociodemographic characteristics numbers and percentage of respondents.**

Variables	Frequency (n)	Percentage (%)
<b>Age (years) (Mean ± SD)</b>	13.4 ± 0.49	
13 years	80	53.3%
14 years	70	46.7%
<b>Siblings (n)</b>		
<5	31	20.7%
5–10	83	55.3%
>10	36	24.0%
<b>Households (n)</b>		
<5	19	12.7%
5–10	99	66.0%
>10	32	21.3%
<b>Mother's education level</b>		
Intermediate school or lower	21	14.0%
High school	34	22.7%
Undergraduate or higher	95	63.3%
<b>Father's education level</b>		
Intermediate school or lower	4	2.7%
High school	26	17.3%
Undergraduate or higher	120	80.0%
<b>Family monthly income *</b>		
<5000	16	10.7%
5000–14,999	90	60.0%
≥15 000	44	29.3%

Sample size n = 150. \*1 USD = 3.75 KSA Riyal (SAR).

### Content validity

Eleven knowledge items, four attitude items, and two practice items did not meet the recommended CVR value (<0.99 of what the panel of experts considered useful). However, these items were modified, based on the experts' recommendations, and retained because the panel of experts considered them necessary for the respondents and related to the intervention programme. In addition, three items were deemed non-essential by only one expert on the panel, but because the remaining experts identified them as essential, these items were retained. Therefore, there were 73 items in total: 30 for the knowledge section, 22 for the attitude section, and 21 for the practice section of the KAPQ.

### Face validity

All the items in the three sections of the KAPQ were clear and completely understood by the respondents. In addition, the researcher defined terms such as moderate PA and sedentary activities using simple words and provided examples that could be easily understood, as requested by the respondents.

### Construct validity

The results of the EFA for knowledge revealed four components (Table 2). Based on the promin rotation results

**Table 2: Factor loadings related to knowledge.**

Variable	C1 PA & sedentary behaviour	C2 Nutrition	C3 General PA	C4 Nutrition and PA
Q8; Adolescents (13–14) years can spend 4 h per day on screen time such as iPad, mobile phone, or other devices	0.826			
Q9; One of the activities which are not considered sedentary behaviour is sitting while playing music	0.806			
Q19; The time of sedentary activities should be 4 h per day	0.744			
Q21; Fatima can replace sedentary lifestyle by playing computer games	0.676			
Q23; Chatting with friends while sitting in a living room for an hour or more every day can improve your body fitness	0.65			
Q28; Physical inactivity increases the risk of type 2 diabetes	0.584			
Q27*; Physical activity reduces stress	0.342		0.421	
Q2; Vegetables and fruits are the best sources of fibre		0.878		
Q6; Food labels can show less information about calories		0.821		
Q10; Adolescents (13–14) years can skip one of the main meals each day		0.722		
Q12; Body Mass Index (BMI) = weight (kg)/length (m <sup>2</sup> )		0.702		
Q15; You need to measure weight and height, and body mass index (BMI) to monitor your growth		0.678		
Q16; Fat food can increase obesity		0.590		
Q17; Soft drinks have a large amount of minerals		0.590		
Q18; Obesity is not increasing risks of diabetes type 2		0.508		
Q22; Unsaturated fat is good if it presents in food		0.507		
Q24; Based on the Saudi Healthy Food Palm, taking 2–3 serving sizes of vegetables every day will make you healthy		0.371		
Q3; Everyone can practice physical activity regularly regardless of health status			0.862	
Q5; Regular physical activity is essential for all ages			0.823	
Q4; Skipping is classified as low physical activity			0.805	
Q20; It is better to practice one type of physical activity every day			0.755	
Q25; Warm-up exercises are essential before any other exercise			0.642	

**Table 2** (continued)

Variable	C1 PA & sedentary behaviour	C2 Nutrition	C3 General PA	C4 Nutrition and PA
Q11; Cycling is classified as an aerobic physical activity			0.585	
Q26; Walking has a vital role in achieving longevity of life			0.541	
Q14; Physical activity is a movement produced by big muscles contractions that require energy consumption			0.540	
Q7; Adolescents (13–14) years need to eat healthy food regardless of practicing physical activity				0.849
Q13; When the amount of food calories taken is 2000, and energy expenditure is 1800 calories. In this situation, weight is loss				0.739
Q30; Drinking water before, during, and after walking is essential for your body health				0.634
Q29; Ordering big size food because of sale promotions is not a healthy eating practice				0.301
Eigenvalues	3.947	4.812	4.713	2.871
%Total of Variance	13.6	16.6	16.3	9.90
Reliability	0.920	0.928	0.927	0.888

Note: \*Removed because of factor cross-loading. C1: Component 1 (Physical activity and sedentary behaviour). C2: Component 2 (Nutrition). C3: Component 3 (General physical activity). C4: Component 4 (Nutrition and physical activity).

of the knowledge items, the seven items related to PA and sedentary behaviour (component 1) accounted for 13.6% of the variance. Question 27 was removed because it was cross-loading with component 2 (nutrition). The ten items

related to nutrition (component 2) accounted for 16.6% of the total variance. The third component was general PA, which included eight items that accounted for 16.3% of the variance. Finally, the component on nutrition and PA (4

**Table 3: Factor loadings related to attitude.**

Variable	C1 Physical activity & nutrition	C2 Nutrition	C3 General physical activity
Q1; I think eating healthy food is more critical than doing physical activity for our bodies' health	0.808		
Q7; I like to spend more than 3 h using a mobile phone every day	0.793		
Q13; I think sedentary behaviour does not affect body weight	0.765		
Q14; I believe body health is affected by an imbalance between the quantity of food energy taken and the amount of food energy consumption	0.723		
Q2; I think the way of cooking will not affect my choice of food outside		0.953	
Q11; I should follow the Healthy Food Plan to help me eat healthy food		0.91	
Q4; I think eating healthy food is not essential for the growth		0.884	
AQ12; I think there is a relationship between healthy food and academic achievement		0.874	
Q3; For my body health, I think skipping breakfast is not good		0.872	
Q15; I believe what I eat every day will not affect my future body health		0.864	
Q9; I think obesity is not related to eating a high amount of calories		0.837	
Q16; Starchy foods should be recommended in every main meal		0.593	0.303
Q20; I think that doing more physical activity can help me to prevent type 2 diabetes			0.955
Q17; I think recommendations of physical activity help me to be an active student			0.943
Q18; I think I can do moderate physical activity at least 60 min every day			0.939
Q21; The amount of calories on food's label does not influence my choice of food			0.892
Q8; I should practice physical activity every day, such as walking not more than 10 min			0.868
Q6; I think helping my family with household chores is necessary to increase physical activity			0.862
Q22; I think doing physical activity can help me to control my body weight			0.86
Q5; I think I can increase my physical activity gradually to get health benefits			0.857
Q10; I think doing physical activity should be done outdoor			0.765
Eigenvalues	2.604	5.980	7.299
% Total of Variance	12.4	28.5	34.8
Reliability	0.902	0.966	0.977

Note: C1: Component 1 (Physical activity and nutrition). C2: Component 2 (Nutrition). C3: Component 3 (General physical activity).

**Table 4: Factor loadings related to practice.**

Variable	C1 Physical activity	C2 Nutrition
Q4; Order fried food instead of grilled food	0.882	
Q5; Skip drinking water when you practice moderate physical activity for 60 min or more	0.882	
Q6; Skip reading the nutritional value of food labels when buying food	0.845	
Q14; Avoid eating increasing fat food when you are eating outside to prevent obesity	0.819	
Q19; Check your body weight to maintain or to reach a normal weight	0.805	
Q21; Skip drinking milk or dairy products in your dish every day	0.768	
Q12; Include a variety of vegetables and fruits in your meals every day	0.758	
Q8; Skip main meals time to reduce your weight	0.680	
Q16; Order soft drinks when you eat outside	0.668	
Q1; Practice any type of physical activity in a suitable place and time		0.894
Q2; Skip walking as a physical activity without your family or friends		0.874
Q3; Get 4 h or more in sedentary behaviour such as watching TV or chatting with friends every day		0.863
Q7; Replace your time spend in front of a screen such as your mobile phone or iPad with physical activity		0.814
Q9; Increase physical activity in every opportunity, such as helping your mother with chores		0.764
Q10; Practice moderate physical activity for 60 min every day		0.75
Q11; Skip daily physical activity		0.742
Q13; Walk as a physical activity every day		0.673
Q17; Practice physical activity to maintain your health body		0.654
Q18; Practice warm-up before any exercise		0.649
Q20; Replace low physical activity with moderate physical activity		0.359
Eigenvalues	5.738	6.196
% Total of Variance	28.7	31.0
Reliability	0.949	0.950

Note: C1: Component 1 (Physical activity). C2: Component 2 (Nutrition).

items) explained 9.9% of the variance. The total variance explained by the four components was 56.4%, which exceeded the general recommendation of 50%.<sup>45</sup>

Based on a parallel analysis, the EFA results showed three components regarding attitude. According to the promin

rotation, the first component had four PA and nutrition items, accounting for 12.4% of the variance. Moreover, the second component includes eight items on nutrition that explained 28.5% of the total variance. The factor analysis results indicated nine items in the third component of general

**Table 5: The Cronbach's  $\alpha$  for each component and the test-retest reliability analysis results for knowledge, attitude, and practice.**

Internal consistency reliability			
Variable	Eigenvalues	% Total of Variance	Reliability Cronbach's alpha
<b>Knowledge</b>			
Component 1; PA & sedentary behaviour (7 items)	3.947	13.6	0.920
Component 2; Nutrition (10 items)	4.812	16.6	0.928
Component 3; General PA (8 items)	4.713	16.3	0.927
Component 4; Nutrition and PA (4 items)	2.871	9.90	0.888
<b>Attitude</b>			
Component 1; Physical activity & nutrition (4 items)	2.604	12.4	0.902
Component 2; Nutrition (8 items)	5.980	28.5	0.966
Component 3; General physical activity (9 items)	7.299	34.8	0.977
<b>Practice</b>			
Component 1; Physical activity (9 items)	5.738	28.7	0.949
Component 2; Nutrition (11 items)	6.196	31	0.950

Table 5 (continued)

Internal consistency reliability					
Variable	Eigenvalues	% Total of Variance		Reliability Cronbach's alpha	
<b>Test-retest reliability</b>					
<b>Knowledge</b>		<b>Attitude</b>		<b>Practice</b>	
Item	Kappa	Item	ICC	Item	ICC
KNW1	1	At1	0.891	PR1	0.965
KNW2	0.886	At2	0.715	PR2	0.857
KNW3	1	At3	0.843	PR3	0.895
KNW4	0.947	At4	0.958	PR4	1
KNW5	0.89	At5	1	PR5	1
KNW6	0.918	At6	0.835	PR6	0.923
KNW7	0.946	At7	0.961	PR7	0.849
KNW8	1	At8	0.968	PR8	0.897
KNW9	1	At9	0.921	PR9	0.851
KNW10	1	At10	0.96	PR10	1
KNW11	1	At11	0.886	PR11	0.86
KNW12	1	At12	0.775	PR12	0.931
KNW13	0.942	At13	0.932	PR13	0.926
KNW14	0.805	At14	0.897	PR14	0.953
KNW15	0.773	At15	0.963	PR15	0.927
KNW16	0.762	At16	1	PR16	0.828
KNW17	0.827	At17	0.791	PR17	1
KNW18	0.946	At18	0.932	PR18	1
KNW19	1	At19	0.853	PR19	0.937
KNW20	0.776	At20	0.848	PR20	0.862
KNW21	0.844	At21	0.872	PR21	0.778
KNW22	0.895	At22	0.682		
KNW23	1				
KNW24	0.875				
KNW25	0.875				
KNW26	0.875				
KNW27	0.875				
KNW28	1				
KNW29	1				
KNW30	1				

At= Attitude. ICC= Intraclass correlation. KNW= Knowledge. PR= Practice.

PA, which explained 34.8% of the variance. All three components explained 75.7% of the total variance, which exceeded the general recommendation of 50%<sup>45</sup> (Table 3).

Based on a parallel analysis, the EFA results indicated two factors regarding practice. The promin rotation showed nine items (component 1) regarding PA, which accounted for 28.7% of the variance of the first factor, while 11 items of component 2 on nutrition explained 31% of the variance. The total variance for the two components was 59.7%, which exceeded the general recommendation of 50%<sup>45</sup> (Table 4). The final KAPQ consisted of 29 items for knowledge, 22 for attitude, and 21 for practice.

#### Internal consistency reliability

The reliability coefficients for all the knowledge components ranged between 0.888 and 0.928, which were good values. The reliability coefficients were between 0.902 and 0.977 for all the components of attitude, indicating good reliability. For practice, the coefficient was 0.949 for the first component and 0.950 for the second component, indicating acceptable reliability. The Cronbach's  $\alpha$  for each component is shown below in Table 5.

#### Test-retest reliability

Stability was checked with a test-retest reliability test. The correlated reliability agreement was measured twice using Cohen's unweighted kappa coefficient for knowledge and the ICCs for attitude and practice. The kappa coefficients were between 0.773 and 1 for the knowledge scale. The items for attitude had ICCs between 0.682 and 1.000, and the practice items had ICCs between 0.778 and 1.000, indicating acceptable agreement between the two tests (Table 5).

#### Discussion

To date, this is the first KAPQ developed for nutrition, PA, and BI that assessed content validity, face validity, and construct validity through EFA. The Cronbach's alpha coefficient and test-retest reliability test were used to determine the stability of the KAPQ. The final KAPQ had 72 items, covering knowledge (29), attitude (22), and practice (21). The current KAPQ is different from previous KAPQs for many reasons. It is the first KAPQ to be administered in Arar to female Saudi adolescents, specifically those aged 13



and 14 years. In contrast, previous KAPQs in KSA were administered to adolescents with a wider age range and were shorter<sup>20,21</sup> Additionally, unlike previous KAPQs, this KAPQ covers nutrition, PA, and BI rather than only nutrition. Furthermore, this KAPQ was administered to Saudi adolescents, while Fetohy et al. focused on foreign adolescents.<sup>21</sup>

Saudi society may differ from other societies regarding the lack of opportunities for young adolescent females to practise outdoor PA compared to males. In addition, the hot weather may also prevent Saudi females from practicing PA, and they generally lack knowledge regarding nutrition and PA.<sup>46</sup> Therefore, more attention should be paid to KAP assessments to determine Saudi females' health requirements regarding PA, nutrition, and BI. Accordingly, the present KAPQ was developed to suit Saudi females. Unlike previous studies,<sup>13–18</sup> which focused on one or two factors regarding knowledge, attitude, or practice levels, this KAPQ added the BI factor to emphasise its importance to human health. Although BI was included in the KAPQ by Sharif Ishak et al.,<sup>27</sup> it was intended for Malaysians only and included both males and females. As such, it does not fit this population group.

Although some of the CVR results were less than 0.99, which was unacceptable to the six experts assessing the questionnaire,<sup>38</sup> the panel of experts assured the first researcher that 14 of these items could be considered necessary and acceptable after modifications were made based on their recommendations. Moreover, although three items were rated unnecessary by one expert, they were still included because the five other experts deemed them necessary. The content validity result was excellent. This indicated that the KAPQ had appropriate items on each scale (72 in total). Other researchers have applied similar procedures to determine the content validity of health.<sup>47</sup> Face validity is not the strongest validity test, but it is important for understanding the content and judging whether or not items are valid for the respondents. In this study, the respondents understood most of the KAPQ items and considered them representative of the study's objectives.<sup>37</sup> The questionnaire was delivered in Arabic after editing and proofreading, and the translation was based on the understanding of the text rather than a literal translation. It is recommended that the researchers initially start with many items during the development of the KAPQ,<sup>48</sup> as they would eventually have to remove cross-loading items.<sup>49</sup> To ensure the construct validity of the KAPQ, as shown by the EFA, the items with cross-loadings were removed (Q27 in knowledge), and all commonalities (factor loadings) in this KAPQ were above 0.5.<sup>41</sup> Thus, a good correlation was found between the items in the factor analysis in the present study. The knowledge scale measured the understanding of nutrition, healthy and unhealthy foods, nutrients, energy balance, and awareness about PA, SB, BI, and diet-associated diseases. The attitude scale measured the respondents' beliefs about increasing the intake of healthy foods, PA, having a positive BI, reducing unhealthy food intake, SB, BI dissatisfaction, and adherence to guidelines. The practice scale measured the

respondents' consistency in healthy food intake, such as milk and dairy products, vegetables, and fruits, and their minimisation of unhealthy food intake, such as fast foods containing high amounts of oil and sugar. It also measured their daily practice of PA ( $\geq 60$  min) and whether they were happy with their BI.

Internal consistency was measured by Cronbach's alpha coefficient. The questionnaire had an acceptable level of reliability. In general, values of 0.5–0.6 reflect poor internal consistency, values of 0.6–0.7 are questionable, values of 0.7–0.8 are acceptable, values of 0.8–0.9 are good, and values  $>0.9$  are excellent.<sup>50</sup> The Cronbach's alpha values in this study ranged between 0.888 and 0.977 for knowledge, 0.902 and 0.977 for attitude, and 0.949 and 0.950 for practice, indicating good to excellent internal consistency reliability. When a scale has more than ten items, the coefficient can be higher due to the magnitude of the effect of a large number of items.<sup>51,52</sup> Furthermore, the answers were far from extreme, which increased the prevalence of the respondents' answers to each subscale item, thus increasing the magnitude of the associations within the sub-items and increasing the value of Cronbach's alpha.<sup>51,53</sup> These findings were consistent with those of Hiew et al.,<sup>10</sup> who reported a Cronbach's alpha of 0.845 for attitude towards nutrition and PA in their healthy lifestyle questionnaire for young adolescents. In addition, the results of this study agreed with those of Andrés García et al.,<sup>54</sup> who reported that the internal consistency of their questionnaire dimensions, including food and habits, PA, and sedentary behaviours, was  $>0.9$ . Moreover, the test–retest reliability of the current findings showed good to excellent stability in knowledge, as measured by the kappa (0.773–1.000) and ICC for practice (0.778–1.000), while the stability of attitude was 0.682–1.000, as measured by the ICC. When developing a new measuring instrument, the test–retest reliability should be greater than 0.7. However, the results still showed good to excellent stability, as only one item was  $<0.7$  (0.682), and the rest were  $>0.7$ . The adolescents might have been sure about their nutrition, PA, and BI; thus, their responses to the questionnaire were the same at different times.<sup>10</sup> Finally, the present study results were also consistent with those of Itani et al.,<sup>51</sup> whose test–retest reliability indicated good stability regarding eating behaviour (ICC  $>0.7$ ).

This study is unique because it is the first to validate a KAPQ about nutrition, PA, and BI targeting female Saudi adolescents between the ages of 13 and 14. Furthermore, this instrument used a five-point Likert scale in some domains, which may have prevented these items from being excluded. The current study was limited in that it only included Saudi females in Arar, as it could not be expanded due to the lack of time and workers. Thus, the present KAPQ cannot be applied to males. As the KAPQ contained 72 items, patience was needed for the adolescents to complete it in less than 20 min. However, researchers could perform an analysis to reduce the number of KAPQ items for intermediate school students. Since this instrument was validated for 13–14-year-old female Saudi adolescents from Arar, the questionnaire should be validated in future

research to assess the needs of specific target groups based on their communities.

## Conclusion

This KAPQ was valid and reliable for measuring the knowledge, attitude, and practice of 13–14-year-old Saudi female adolescents in Arar regarding nutrition, PA, and BI. Accordingly, it can serve as a template for future studies to identify KAP levels in adolescents and inform effective control or prevention strategies related to nutrition, PA, and BI.

**Abbreviations:** At, Attitude; BI, body image; ICC, Intraclass correlation; KAPQ, Knowledge, Attitude, and Practice Questionnaire; PA, physical activity; PR, Practice; SAR, Saudi Arabia Riyal; SD, Standard deviation.

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## Conflicts of interest

The authors have no conflict of interest to declare.

## Ethical approval

This study was approved by the Deanship of Scientific Research from the Local Committee of Bio-Ethics: Deanship (HAP-09-A-043) at The Northern Border University in Arar, KSA (Ref No. 13/40/H), the Human Study Ethics Committee of University Putra Malaysia (JKEUPM; Ref No. UPM/TNCPI/RMC/JKEUPM/1.4.18.2), and the Ministry of Education in Arar, KSA.

## Consent

Students included in this study and their parents provided informed consent to participate. They had the opportunity to ask questions in relation to the present research before obtaining approval. The study was conducted after the consent forms had been received from the respondents and their parents. The respondents were asked to complete the questionnaire concerning their sociodemographic characteristics and the KAPQ.

## Authors' contributions

A.A.B. conceptualized and designed the study, contributed to validation, resources, data collection, and the writing of the original draft and final version of the manuscript; H.A.S. conceptualized, designed, and supervised the study, assisted in drafting the manuscript, and reviewed the manuscript. N.B.M.Y. supervised the study and reviewed the manuscript. N.H.M.S. supervised the study and reviewed the manuscript. All authors have critically reviewed and approved the final draft and are responsible for the content and similarity index of the manuscript.

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