Validity and Reliability of Balanced Nutrition Knowledge and Eating Behavior Questionnaires among Adolescent Girls

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ABSTRACT

Background: Assessing balanced nutrition knowledge and eating behavior among adolescent girls is important because they affect health and nutritional status, thus it needs measurement instruments that have been tested for validity and reliability.

Objective: To assess the validity and reliability of balanced nutrition knowledge and eating behavior questionnaires among adolescent girls.

Method: This study involved 30 Senior High School girls aged 15-18 years. The validity of the data was tested using difficulty level analysis, differentiating power analysis, distractor analysis, Lawshe's Content Validity Ratio (CVR) analysis, and item discrimination test. The reliability of the questionnaire was tested using Cronbach's Alpha coefficient.

Results: A total of 20 items regarding balanced nutrition knowledge were considered valid and 10 items about eating behavior were declared valid. The results of the reliability test of the questionnaire on balanced nutrition knowledge and eating behavior obtained Cronbach's Alpha values of 0.822 and 0.829, thus this questionnaire is declared reliable.

Conclusion: The questionnaire on balanced nutrition knowledge and eating behavior has good validity and reliability values. The questionnaire can be used to obtain accurate and consistent data in order to assess the balanced nutrition knowledge and eating behavior among adolescent girls.

KEYWORDS: Nutritional knowledge, eating behavior, validity, reliability.

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INTRODUCTION

Assessing balanced nutrition knowledge and eating behavior in adolescent girls is important, because adolescent will experience pregnancy and it can determine the health, nutritional status, and survival of both mothers and baby [1]. Adolescence is the peak period of puberty and rapid growth which can affect physical changes [2,3]. The physical changes often cause a feeling of dissatisfaction with one's body shape. Body dissatisfaction is more common among adolescent girls than boys. In general, body dissatisfaction in adolescent girls is associated with concerns about being overweight. Body dissatisfaction influences eating behavior [4,5].

Eating behaviour which is related to feelings of body dissatisfaction is eating behavior that deviates from balanced nutrition. Forms of deviant eating behavior in adolescent girls are usually in the aspect of the amount, type, and schedule of eating, for example limiting food portions, not caring about the choice of food consumed, and skipping meals [6]. Eating behavior with balanced nutrition is actions related to food and reflected in daily life in accordance with balanced nutrition guidelines [7]. An important fundamental factor in building eating behavior is nutrition knowledge [8].

Balanced nutrition knowledge is a cognitive aspect of understanding balanced nutrition [9]. Lack of nutrition knowledge can cause reduced understanding, awareness, and practice of balanced nutrition to meet nutritional needs in daily life [10].

Lack of knowledge and deviant eating behavior regarding balanced nutrition in adolescent girls can cause nutritional problems called chronic energy deficiency. As a developing country, Indonesia still has chronic energy deficiency cases in women of childbearing age who are not pregnant with a prevalence of 14.5%. Central Java Province and Klaten District have a prevalence of chronic energy

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deficiency in women of childbearing age that exceeds the national prevalence (18.2% and 19.15%) [11]. Community and school-based nutrition education interventions have been carried out to increase on balanced nutrition knowledge and eating behavior as well as to reduce chronic energy deficiency in adolescent girls, thus the collection of such data requires standardized measuring instruments [12].

Standardized measuring instruments to obtain accurate and consistent data on balanced nutrition knowledge and eating behavior have to meet validity and reliability requirements [13]. The measuring instruments used must be adapted to the target population. A questionnaire is a measuring tool to collect data which can be in the form of questions or statements to obtain information from respondents. Questionnaires play an important role in determining the quality of a study because the questionnaire used really determined the quality of the validity and reliability of the data obtained. A good quality questionnaire will represent valid and reliable data [14]. Considering the importance of conducting this study, the researcher aims to assess the validity and reliability of balanced nutrition knowledge and eating behavior questionnaires among adolescent girls.

METHODOLOGY

This descriptive study was conducted at State Senior High School 1 Wonosari, Klaten District, it involved 30 adolescent girls aged 15-18 years who experienced chronic energy deficiency. The location for this study was chosen in Klaten District because this district has a prevalence of women of childbearing age who are not pregnant that exceeds the national and provincial prevalence, therefore, it is important to assess balanced nutrition knowledge and eating behavior among adolescent girls in this district. The sample size was based on minimum requirements for validity and reliability tests [14]. The selection of samples used a purposive sampling technique. The determination of chronic energy deficiency status in adolescent girls was based on an mid-upper arm circumference (MUAC) value of less than 23.5 cm. This measurement was done on the left arm (except for left-handed people) using a mid-upper arm circumference tape. This article has obtained research permission Sebelas Maret University Faculty of Medicine.

Data Analysis

Difficulty level analysis

Below is the equation for calculated the difficulty level of each item:

$$P= \frac{B}{Jx}$$

Notes:

P　　　= Difficulty index

B　　　= Total of respondents who answer correctly

Jx　　= Total of respondents who take the test [15,16]

The category for difficulty index are as below:

Table 1. Difficulty level categories

P-value	Category
0.70 - 1.00	Easy
0.30 - 0.69	Intermediate
0.00 – 0,29	Difficult

Differentiating power analysis

The differentiating power analysis of the test items was calculated using the following equation:

$$DP= \frac{B_A}{J_A} - \frac{B_B}{J_B}$$

Notes:

DP　　= Differentiating power index

B_A　　= Number of upper group respondents who answered correctly

B_B　　= Number of lower group respondents who answered correctly

J_A　　= Number of upper group respondents

J_B　　= Number of lower group respondents

The following are the cut-off point of the differentiating power index:

Table 2. Differentiating power categories

DP value	Category
Negative	Bad, should be eliminated
0.70 - 1.00	Excellent
0.40 – 0,69	Good
0.20 - 0.39	Fair
0.00 - 0.19	Poor

Distractor analysis

Distractor analysis is used on multiple-choice questions. Items are categorized as good if the distractor functions well where it is chosen by at least 5% of respondents [15,16].

Content validity test using Lawshe's Content Validity Ratio (CVR) analysis

In this study, the content validity test was used to assess the accuracy of the eating behavior questionnaire. This content validity test used Lawshe's CVR analysis by involving 11 community nutrition experts. The CVR value is considered valid with the $\geq$ CVR$_{critical}$ value of 0.636 [17].

Discriminatory item test

The discriminatory item test was carried out using SPSS 21 software to obtain the Pearson Product Moment correlation coefficient. Items with a correlation coefficient value of $\geq$0.30 are considered to have a high discrimination power, and vice versa, low discrimination power if the correlation coefficient value of <0.30 [18].

Reliabilty test

In this study, the Cronbach's Alpha coefficient was used to test the reliability of the questionnaire. An instrument is considered reliable if it has Cronbach's Alpha value of > 0.60-0.70 [19]. Cut-off point for the degree of reliability of an instrument

covers 0.81 <r≤ 1.00 (very reliable), 0.61 <r≤ 0.80 (reliable), 0.41 <r≤ 0.60 (fairly reliable), 0.21 <r≤ 0.40 (somewhat reliable), and 0.00 <r≤ 0.21 (less reliable) [14].

RESULTS

Analysis of the Difficulty Level of Items on the Balanced Nutrition Knowledge Questionnaire

The results of the analysis of the balanced nutrition knowledge questionnaire with 20 items, contained 2 items (10%) of the difficult category, 2 items (10%) of the intermediate category, and 16 items (80%) of the easy category (Table 3).

Table 3. Results of Analysis of Difficulty Level of the Balanced Nutrition Knowledge Questionnaire

Item	Difficulty Index	Category
Question 1.	0.70	Easy
Question 2.	0.80	Easy
Question 3.	0.90	Easy
Question 4.	0.80	Easy
Question 5.	0.57	Intermediate
Question 6.	0.70	Easy
Question 7.	0.53	Intermediate
Question 8.	0.70	Easy
Question 9.	0.20	Difficult
Question 10.	0.87	Easy
Question 11.	0.90	Easy
Question 12.	0.73	Easy
Question 13.	0.97	Easy
Question 14.	0.93	Easy
Question 15.	0.87	Easy
Question 16	0.80	Easy
Question 17	0.90	Easy
Question 18	0.90	Easy
Question 19.	0.80	Easy
Question 20.	0.20	Difficult

Source: Results of Analysis using Microsoft Excel (2022)

Differentiating Power Analysis of the Balanced Nutrition Knowledge Questionnaire

Table 4 shows the results of the analysis from 20 items, with 3 items (15%) of the poor category, 12 items (60%) of the fair category, and 5 items (25%) of the good category.

Table 4. Results of Differentiating Power Analysis of the Balanced Nutrition Knowledge Questionnaire

Item	Discrimination Index	Category
Question 1.	0.47	Good
Question 2.	0.40	Good
Question 3.	0.20	Fair
Question 4.	0.40	Good
Question 5.	0.47	Good
Question 6.	0.33	Fair
Question 7.	0.27	Fair
Question 8.	0.33	Fair
Question 9.	0.27	Fair
Question 10.	0.13	Poor
Question 11.	0.20	Fair
Question 12.	0.27	Fair
Question 13.	0.07	Poor
Question 14.	0.13	Poor
Question 15.	0.27	Fair
Question 16	0.40	Good
Question 17	0.20	Fair
Question 18.	0.20	Fair
Question 19.	0.27	Fair
Question 20.	0.27	Fair

Source: Results of Analysis using Microsoft Excel (2022)

Distractor Analysis of the Balanced Nutrition Knowledge Quaetionnaire

Table 5 shows that the balanced nutrition knowledge questionnaire has 50 distractors consisting of 38 distractors of the good category and 12 distractors of the not good enough category.

Table 5. Results of Distractor Analysis of the Balanced Nutrition Knowledge Questionnaire

Category	Number
Good	38
Not good enough	12
Total	50

Source: Results of Analysis using Microsoft Excel (2022)

Content Validity Test using Lawshe's CVR Analysis of the Eating Behavior Questionnaire

The ten (10) items on the eating behavior questionnaire were considered valid according to the results of the content validity test using Lawshe's CVR analysis, with CVR values ≥ CVRcritical values (Table 6). The valid items were further tested for discriminatory power by involving 30 respondents.

Table 6. Results of Content Validity Test using Lawshe's CVR on the Eating Behavior Questionnaire

Item	CVR$_{critical}$ Value	CVR Value	Category
Statement 1.	0.636	0.818	Valid
Statement 2.	0.636	0.636	Valid
Statement 3.	0.636	0.818	Valid
Statement 4.	0.636	0.818	Valid
Statement 5.	0.636	0.818	Valid
Statement 6.	0.636	0.818	Valid
Statement 7.	0.636	1.000	Valid
Statement 8.	0.636	0.636	Valid
Statement 9.	0.636	0.636	Valid
Statement 10.	0.636	1.000	Valid

Source: Results of Analysis using Microsoft Excel (2022)

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Discriminatory Item Test of the Eating Behavior Questionnaire

The results of the discriminatory item test of the questionnaire showed that 10 items were considered to have high discriminatory power with the correlation coefficient value ranging from 0.404-0.655 (Table 7).

Table 7. Results of the Discriminatory Item Test of the Eating Behavior Questionnaire

Item	Coefficient Correlation	Category
Statement 1.	0.428	High
Statement 2.	0.625	High
Statement 3.	0.404	High
Statement 4.	0.430	High
Statement 5.	0.579	High
Statement 6.	0.554	High
Statement 7.	0.550	High
Statement 8.	0.655	High
Statement 9.	0.618	High
Statement 10.	0.457	High

Source: Results of Analysis using SPSS 21 (2022)

Reliability Test of the Balanced Nutrition Knowledge and Eating Behavior Questionnaire

Table 8 shows the results of the reliability test of the balanced nutrition knowledge and eating behavior questionnaires, it was found that both questionnaires were declared reliable with a Cronbach's Alpha count (r_{count}) > Cronbach's Alpha standard ($r_{critical}$).

Table 8. Results of the Reliability Test of the Balanced Nutrition Knowledge and Eating Behavior Questionnaires

Questionnaire	Number of Item	Cronbach's Alpha Count	Criteria
Balanced Nutrition Knowledge	20	0.822	Reliable
Eating Behavior	10	0.829	Reliable

Source: Results of Analysis using SPSS 21 (2022)

DISCUSSION

This study assesses the accuracy and reliability of balanced nutrition knowledge and eating behavior questionnaires among adolescent girls. This study begins with preparing question items and statements that will be used. This study questionnaire consisted of 20 question items regarding balanced nutrition knowledge by selecting answers in the form of multiple-choice and 10 statement items regarding eating behavior using a Likert scale. The implementation of validity and reliability tests can help researchers determine which items can be accepted, improved, or eliminated [13].

The validity test is a testing step to determine the accuracy of instruments in carrying out their functions and showing measurement results that are in accordance with the purpose of a study in order to obtain the true conditions (facts) of what is measured [14]. The validity of the balanced nutrition knowledge questionnaire was tested using difficulty level analysis, differentiating power analysis, and distractor analysis, involving 30 respondents. Difficulty level analysis is used to identify the ease or difficulty of each question item [20]. The difficulty level index for the balanced nutrition knowledge questionnaire ranges from 0.20-0.97. The greater the difficulty index value, the easier the question item [21].

Differentiating power analysis is used to determine the ability of questions to differentiate between respondents with high and low ability [16]. The differentiating power index of the balanced nutrition knowledge questionnaire ranges from 0.07-0.47. Question items with a differentiating power index below 0.2 must be deleted [22]. Poor and negative differentiating power analysis can be due to inappropriate selection of words, writing errors, or poor respondent preparation before answering the question [21]. The analysis showed that 3 questions have a poor differentiating power index. These questions are considered easy but cannot differentiate between respondents with high and low ability. However, these questions are needed to represent the content and objectives of the study, so they are maintained. These question items are useful for identifying respondents who lack a basic understanding of balanced nutrition. Deleting items with a poor differentiating power index can interfere with the validity test [23]. Other studies revealed that a poor differentiating power index is not an exclusion [23,24]. The higher the differentiating power index, the better the item [23].

Distractor analysis is used to find out how the choices deceive respondents who are unable to choose the right answer. The multiple-choice questions in the balanced nutrition knowledge questionnaire have 4 alternative answers. The distractor analysis referring to the distribution of answers or options chosen by respondents, however, the answer key was not included in the distractor calculation [15,16]. The majority (38) of the distractors on this questionnaire have a good category.

The eating behavior questionnaire was tested for content validity through Lawshe's CVR analysis and item discrimination test. The content validity test is used to determine the relevance of the instrument content based on expert judgment through rational analysis [18,25]. Expert opinion can be used to produce the required information.[26] This CVR analysis involved 11 public nutrition experts. The CVR value of the eating behavior questionnaire ranges from 0.636-1.000. The greater the CVR value, the better the content validity. The item discrimination test was carried out after testing the content validity.

The item discrimination test is used to test the item's ability to differentiate individuals or groups that have the measured attribute from individuals or groups that do not have

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the measured attribute. The discriminatory power of the eating behavior questionnaire was based on the Pearson Product Moment correlation coefficient value. All items obtained a correlation coefficient value of ≥0.30, it means that they all have high discriminatory power [18]. This test involved 30 respondents.

Then, question items or statements that are declared valid were tested for reliability using the Cronbach's Alpha coefficient. Reliability testing is a measurement process that is carried out several times on the same subject, thus obtained the measurement results are relatively consistent. The reliability assessment of the balanced nutrition knowledge and eating behavior questionnaires refers to the Cronbach's Alpha coefficient value. The higher the Cronbach's Alpha value, the more reliable the questionnaire [14]. The r-count value of the balanced nutrition knowledge questionnaire and eating behavior questionnaire is 0.822 and 0.829 respectively. Both questionnaires meet the reliability test criteria so they are reliable.

CONCLUSION

All 20 items of balanced nutrition knowledge questions are valid and 10 statements of eating behavior questionnaire are also declared valid. Both questionnaires are reliable referring to the Cronbach's Alpha coefficient value. The Cronbach's Alpha value of the balanced nutrition questionnaire and eating behavior questionnaire is 0.822 and 0.829 respectively. The results of this study prove that the validity and reliability values of both questionnaires meet the criteria for use as a measuring tool, thus the questionnaire can be used to obtain accurate and consistent data in order to assess the balanced nutrition knowledge and eating behavior among adolescent girls.

CONFLICT OF INTEREST
No conflicts of interest have been declared.

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APPENDIX

A. Balanced Nutrition Knowledge Questionnaire

No.	Multiple choice questions, please cross the correct answer.
1.	What does balanced nutrition mean? a. Foods that are not exposed to germs or substances that can harm health. b. A nutritional intake that contains nutrients in the types and amounts according to individual needs, with an emphasis on the principles of food diversity. c. Foods such as fish, eggs, chicken, beef, tempeh, and tofu. d. Everything that comes from biological sources and water, whether processed or intended for human consumption.
2.	Which of the following are the four pillars of balanced nutrition? a. Consuming varied foods, getting used to clean and healthy living, drinking 8 glasses of water a day, and maintaining a normal body weight. b. Consuming varied foods, reducing consumption of sugar, salt, and oil, doing physical activity, and losing weight. c. Consuming varied foods, getting used to clean and healthy living, doing physical activity, and maintaining a normal body weight. d. Consuming varied foods, reducing consumption of sugar, salt, and oil, getting used to clean and healthy living, and doing physical activity.
3.	Which of the following is not a balanced nutrition massage? a. Consuming foods with high sugar level b. Eating lots of vegetables and fruit c. Being grateful and enjoying a variety of foods d. Getting used to consuming a variety of staple foods
4.	Which of the following is the correct balanced nutrition message for adolescent girls? a. Getting used to washing hands with soap b. Getting used to drinking enough water c. Getting used to consuming a variety of foods and eating more green vegetables and fruits d. Getting used to eating 3 times a day
5.	Which of the following is consuming a variety of foods in one meal? a. Rice, water spinach, and snapper b. Rice, spinach, fried tempeh, milkfish, and fruit c. Brown rice, spinach, and fried tofu d. Rice, beef, and tea
6.	What is the recommended frequency of having breakfast in a week? a. No need b. 3x/week c. 4x/week d. Every day
7.	Based on 'Isi Piringku' (balanced nutrition guidelines that show the proportion of types of food that should be consumed to have a balanced and healthy diet), how much does a person need to consume staple foods? a. $\frac{1}{2}$ part of $\frac{1}{2}$ plate b. $\frac{1}{3}$ part of $\frac{1}{2}$ plate c. $\frac{2}{3}$ part of $\frac{1}{2}$ plate d. At will
8.	Which of the following indicators is used to determine the nutritional status of adolescents? a. Body weight-for-age b. Height-for-age c. Body weight-for-height d. Body mass index-for-age
9.	Which of the following is an indicator of good nutritional status in adolescents? a. ≥ 3 SD b. ≥ 1 until 2 SD

No.	
	c. -2 until 1 SD
	d. < -2 SD
No.	**Multiple choice questions, please cross the correct answer.**
10.	What is healthy food? a. Foods containing balanced nutrition b. Clean foods c. Foods that are easy to prepare d. Foods with delicious taste
11.	What is the main benefit of food for our body? a. Eliminates hunger b. Fills the stomach c. As an energy substance, building agent, and regulating agent d. Eliminates thirst
12.	Which nutrient is the main source of energy? a. Fat b. Carbohydrate c. Vitamin d. Protein
13.	Which of the following are foods that are sources of carbohydrates? a. Duck meat, chicken meat, beef b. Noodles, potatoes, corn, sweet potatoes, cassava c. Tofu, tempeh, fish, eggs d. Spinach, water spinach, mustard greens, apples, oranges
14.	Which of the following are foods that are sources of protein? a. Tofu, tempeh, fish, eggs b. Duck meat, chicken meat, mango c. Noodles, potatoes, corn, sweet potatoes and cassava d. Spinach, water spinach, mustard greens, apples, oranges
15.	What is the benefit of protein for the body? a. Maintains body temperature b. Protects body organs c. Dissolves nutrients d. Growth, and maintenance of cells, tissues, and organs
16.	Which of the following is a sign that someone is experiencing a chronic energy deficiency? a. Mid-upper arm circumference equal to or greater than 23.5 cm b. Mid-upper arm circumference less than 23.5 cm c. Head circumference equal to or greater than 32.5 cm d. Head circumference between 30-32.49 cm
17.	What can be done to prevent and overcome chronic energy deficiency? a. Smoking b. Reducing fiber consumption c. Skipping breakfast d. Eating foods with a balanced and varied diet
18.	Which of the following is the cause of chronic energy deficiency? a. Consuming excessive and fatty foods b. Having breakfast every day c. Doing exercise every day d. Skipping meals and not consuming a balanced and varied diet
19.	Which of the following is not the impact of suffering from chronic energy deficiency? a. Giving birth to a baby with normal weight and having a low risk of miscarriage b. Giving birth to a baby with low birth weight c. Increase maternal and infant mortality rates d. Premature birth

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No.	Multiple choice questions, please cross the correct answer.
20.	Referring to the Regulation of the Minister of Health of the Republic of Indonesia Number 28 of 2019, how much are the energy, protein, fat, and carbohydrate needs of adolescent girls aged 16-18 years? a. 2125 kcal, 69 g protein, 83 g fat and 340 g carbohydrates b. 2125 kcal, 59 g protein, 71 g fat and 292 g carbohydrates c. 2100 kcal, 65 g protein, 70 g fat and 300 g carbohydrates a. 2250 kcal, 56 g protein, 75 g fat and 309 g carbohydrates

B. Eating Behavior Questionnaire

Put a checkmark on one of the answers that correspond to your behavior.

No.	Statement	Never	Rarely	Sometimes	Often	Always
1.	Having breakfast before 9 o'clock every day					
2.	Having lunch on time every day					
3.	Having dinner on time every day					
4.	Consuming more than one type of staple food a day (replacing rice with bread, corn, sweet potatoes, potatoes, noodles, cassava, etc.)					
5.	Consuming more than one type of animal protein a day (eggs, meat, fish, seafood, etc.)					
6.	Consuming more than one type of vegetable protein a day (tofu, tempeh, etc.)					
7.	Consuming staple foods, side dishes (animal and vegetable), vegetables, fruit, and water at every meal					
8.	Consuming at least two portions of animal and vegetable side dishes every day					
9.	Consuming at least two portions of fruit every day					
10.	Consuming at least 8 glasses or 2 liters of water every day					