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Nutritional knowledge and food choice in relation with nutritional status among adolescent athletes of sport special class student

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Abstract
Nutritional knowledge is useful in optimizing performance and as a basic knowledge. Nutritional knowledge is one of several determining factors for eating behavior. The purpose of this paper is to analyze the relationship between nutritional knowledge, food choices with nutritional status of adolescent athletes. The research design used was descriptive quantitative with a total of 133 participants with simple random sampling. The research instrument consisted of the NUKYA (Nutritional Knowledge for Young and Adult Athletes) questionnaire and Food choice questionnaire. The results of the study showed nutritional knowledge was not related to nutritional status (p = 0.188) while the selection of eating has been associated to nutritional status (p = 0.042). In multivariate terms of knowledge and selection of eating contributed only 5.1% to nutritional status. Accordingly, an educational nutrition program is needed as well as an evaluation in monitoring the nutritional and health status of students to have good physical quality along with knowledge and eating selection.

Keywords: Adolescent athletes, nutritional knowledge, food selection

Introduction
Nutritional knowledge becomes part of several determinants of eating behavior that can be modified (Jauhari, 2020) [1]. It contains basic information related to energy, proportions, types of nutrients, and eating habits that are applied by individuals in daily habits. (Kesztyüs *et al*., 2017) [2]. In adolescence, problems related to nutrition are mostly caused by improper eating behavior which results in nutritional imbalance from their food intake to the recommended nutritional adequacy rate. Adolescence is a period of transition from childhood to adulthood. Nutrition fulfillment in adolescents must be very concerning, many adolescents need special nutrition, such as teenagers who are active in sports, as well as carrying out other physical activities (Firmansyah & Muhammad RAP, 2021) [3]. Adolescents who are involved in sports activities have an increased need for nutritional consumption during the growth period, but many of them do not meet adequate daily nutritional intake recommendations (Bingham *et al*., 2015) [4]. The level of knowledge is one of the factors that can influence the choice of food. Meanwhile, according to a nutritional knowledge survey study conducted on athletes, many athletes have sub-optimal food intake and inadequate dietary knowledge, which can turn into poor food choices (Hitendre *et al*., 2022) [5]. Good nutritional knowledge is in line with good nutritional behavior as evidenced by healthy eating choices (Noronha *et al*., 2020) [6].
The selection of proper food has been one of the important aspects of eating behavior (Ratih *et al*., 2022) [7]. A person's level of nutritional knowledge influences attitudes, behavior, and eating habits in choosing foods related to the focus of a person's nutritional condition. According to research conducted by (Jauhari, 2020) (Trakman *et al*., 2016) [1, 8] generally, neither athletes nor trainers have sufficient knowledge about sports nutrition to create an environment that can produce a good performance and optimal health. Researchers want to conduct research on nutritional knowledge and food choices with nutritional status in Special Sports Class at Surakarta Junior High school.

Sport special class students are students in their early teens who have high physical activity, therefore knowledge as an essential part of becoming professional athletes cannot be neglected. This study is intended to analyze the association between nutritional knowledge and food choices with the nutritional status of students in the Special Sports Class. It is expected that this research could provide an evaluation in monitoring the nutritional and health status of the Special Sports Class so that students in the Special Sports Class have good physical quality along with proper knowledge of nutrition and food choices.

2. Materials and Methods

This type of research was observational analytic with a cross-sectional research design and was conducted in December-January 2023. The research population was adolescent athletes in the Special Sports Class. There are 3 classes in sport special class in each grade has a total of 64 students, thus resulting in the total population of KKO students being 192 students. Calculation of sample size using OpenEpi software, which is an application for calculating sample size in cross-sectional studies with Margin of error (α) = 5%, Confidence Level (CI) = 95%, Population size (N) = 192 and Response distribution = 50%, accordingly the minimum sample size is 129.

The sampling technique in this study was carried out by simple random sampling. The inclusion criteria in this study were Special Sports Class Students who actively participated in school activities academically and routine training and were willing to participate and complete the research, while the Exclusion criteria were students who did not fill in the required data thoroughly. The instrument used is the NUKYA (Nutrition Knowledge for a young and adult athlete) questionnaire, which is a questionnaire for assessing nutritional knowledge. The NUKYA questionnaire has been adapted and translated by a sworn translator and through a series of questionnaire validity and reliability tests. The questionnaire consisted of 24 questions with 57 items covering four different sections, such as macronutrients (27 items), micronutrients (19 items), hydration (8 items), and periodicity of food intake (3 items). The interpretation of the nutritional knowledge assessment using NUKYA is classified into 2 categories which explain a score of ≤60% and above as adequate knowledge, and a score of ≥ 60% when nutritional knowledge is inadequate (Nor Azizam, 2022) [9]. The questionnaire for test–retests reliability (R = 0.895, $p< 0.001$) and internal consistency (Cronbach's α = 0.849) (Vázquez-espino & Rodas-font, 2022) (Trakman *et al*., 2018) [8]. Whereas the food selection questionnaire was developed based on the latest athlete dietary guidelines and was accurately reviewed by experts. The Food Choice Questionnaire (FCQ) was originally developed and tested in the United Kingdom (UK) by Steptoe and Pollard (1995) where it has been used extensively to assess food choice motives. The food choice questionnaire consists of 36 items consisting of 9 dimensions: health, mood, convenience, sensory appeal, natural content, price; weight control; familiarity; and, ethical concerns (Cunha *et al*., 2018) [12]. BMI/Age nutritional status data use anthropometry by measuring students' weight and height. BMI calculation results are included in the Z-Score formula, with a body mass index compared to the BMI/Age index of children aged 5-18 years. The calculation of the Z score formula will generate a value that can be used to see the interpretation of the categories and nutritional status by category. In this study, respondents filled out a series of questionnaires provided by researchers, while anthropometric data measuring height and weight were measured by researchers. This type of research is an observational analysis with a cross-sectional research design. Data retrieval is carried out once on each subject and at the same time to provide an overview and situation. Analysis with Chi-Square statistical test on bivariate analysis while ordinal logistic regression analysis for multivariate analysis. This research has been approved by the Health Research Ethics Committee, Faculty of Medicine, Sebelas Maret University (No: 04/UN27.06.11/KEP/EC/2023).

3. Results & Discussion

3.1 Respondent Characteristics

After obtaining approval from the Health Research Ethics Committee, Faculty of Medicine, 143 participants were recruited but only 133 completed the study. Ten participants were excluded from the study as they did not fill out the questionnaires completely. The respondents of the study were students in the early adolescent category, ranging from the age of 12-16 years with a distribution of 12 years old 12 people (9%), 13 years old 42 people (31.6%), 14 years old 48 people (36.1%), 15 years old 29 people (21.8%) and 16 years old 2 people (1.5%). Based on gender, the total of male respondents was 82 people (61.7%) and 51 people (38.3%) for female respondents. The percentage of nutritional status of respondents was categorized into three based on the findings of the z-score calculation with the category of underweight 4 respondents (3%), normal 104 respondents (78%), and overweight 25 respondents (19%).

Table 1: Characteristics of participants (n=133)

Variables	n	
	f	%
Gender		
Male	82	61.7%
Female	51	38.3%
Age		
12	12	9%
13	42	31.6%
14	48	36.1%
15	29	21.8%
16	2	1.5%
Nutritional Status		
Underweight	4	3%
Normal	104	78%
Overweight	25	19%

Table 1 shows that the majority of respondents are male (61.7%) and dominated by the age group of 14 years (36.1%) and 13 years (31.6%) as well as the nutritional status data presents that most of respondents have good nutritional status (78%) with a total of 104.

3.2 Nutritional Knowledge of Sport Special Class students

Based on nutritional knowledge analysis data, the majority of respondents have inadequate nutritional knowledge (35%). Education related to nutrition has never been carried out programmatically in either schools or training centers. The results of the survey show that students of special sports classes are not yet aware of sports nutrition knowledge, as evidenced by the survey results that 65% of students do not have adequate sports nutrition knowledge.

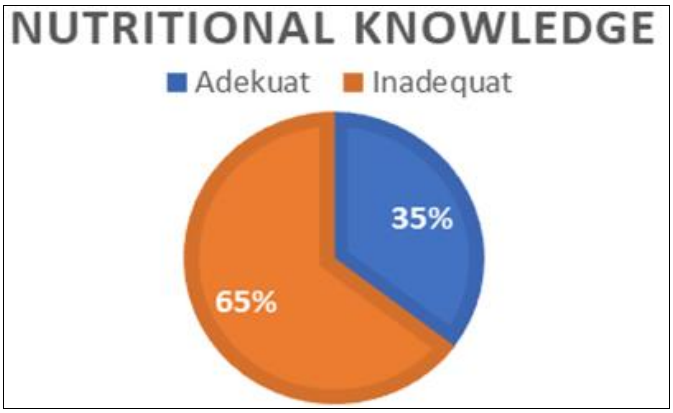

Fig 1: Nutritional Knowledge percentage

3.3 Nutritional Knowledge of adolescent athlete with nutritional status

Nutritional knowledge from analysis of the NUKYA instrument shows that the majority of respondents have inadequate nutritional knowledge (35%). A respondent with adequate knowledge should answer ≥ 60% correctly answer. Meanwhile, if the answer is ≤ 60% correct then nutritional knowledge is categorized as inadequate. The distribution of nutritional knowledge based on nutritional status categories is in table 2. It is explained
that the distribution of adequate nutritional knowledge is dominated by respondents in the good nutrition category as many as 39 respondents, even though respondents with inadequate nutritional knowledge more than respondents who have adequate nutritional knowledge accompanied by good nutritional status, so it can be concluded that adequate nutritional knowledge is not always followed by good nutritional status. In the nutrition category, more than 19 respondents out of a total of 25 respondents had inadequate nutritional knowledge. Meanwhile, it is distributed to two people in the underweight category of adequate and inadequate nutrition.

Table 2: Relation of nutritional knowledge with nutritional status of sport special class student

Variabel		Nutritional Status						df	p
		Underweight		Normal		Overweight			
		N	%	N	%	N	%		
Nutritional Knowledge	Adequate	2	1.5%	39	29.3%	6	4.5%	1	0,188
	Inadequate	2	1.5%	65	48.9%	19	22.1%		

Bivariate analysis was conducted to rule out the relationship between nutritional knowledge with nutritional status. In this study, the test was carried out using the chi-square test, in which if the test results obtained $p<0.05$ then it can be concluded that there is a relationship between variables, but if $p>0.05$ it means that there is no relationship between variables in the study. The statistical analysis result in the table 2 shows that there is no relationship between nutritional knowledge with nutritional status ($p = 0.188$).

3.4 Food choices of sport special class student

Feeding choices factors are grouped into three determinants, i.e., individual characteristics, food, and environment (Syahroni *et al*., 2021) [13]. The individual characteristics consist of age, gender, level of education and psychological condition, food preferences, senses, and mood. Meanwhile, food characteristics include organoleptic properties of food, ease of digestibility, food preparation methods, and food content) and environmental characteristics related to the price, ethnicity, and ease/access to food). (Ratih *et al*., 2022)[7] In this study, the researcher divided 3 selection factors and obtained the percentage of the reason for eating with the classification of questions.

Table 3: Total Variance Explaned

Food Selection Factors	Total Variance Explaned	Question Code
Individual Characteristics	27,18%	P9, P12, P18, P20, P23, P26, P2,P10, P13, P19
Food content	18,24%	P5, P6, P16, P22, P3, P17
Environment	29,99%	P1, P7, P11, P21, P27, P8, P28, P4, P15, P25, P14, P24

Analysis of each question item was carried out to describe the variation of respondents' answers, as a whole from the primary data in Table 3. The total variation of answers to the reason for choosing food with the highest percentage is in environmental factors. Statistical tests on the analysis of the relationship between eating selection and nutritional status were using the chi-square test. The data of each respondent will be grouped categorically by flagging the category of reasons for food selection in each respondent. From the categorization of reasons for eating selection, 38 respondents had reasoned by individual characteristic factors and 95 respondents had reasons for eating choices by environmental factors.

3.5 Food Choices of Sport Special Class student in Relation with Nutritional Status:

From the analysis of primary data, it is known that none of the respondents had food content factors as the main reason in food selection. The dominance of reasons for eating selection is environmental factors. Based on the results of the bivariate test with the Chi-Square test in table 4, it was found that the choice of eating was related to nutritional status in Sports Special Class students with a p-value = 0.042.

Table 4: Relationship of feeding selection with nutritional status

Variable		Nutritional Status						df	p
		Malnutrition		Good Nutrition		Overweight			
		N	%	N	%	N	%		
Food Choice Factor	Individual Characteristic	1	0.8%	34	25.6%	3	2.3%	1	0,042*
	Environmental factors	3	2.3%	70	52.6%	22	16.5%		

3.6 Correlation of Nutritional knowledge and food choices with nutritional status of sport special class student

Multivariate analysis was carried out to determine the relationship between nutritional knowledge, and eating selection to the nutritional status of p<0.25 requirements. In this study, nutritional knowledge and eating selection had a value of p<0.25 so that nutritional knowledge and eating selection could be tested multivariate which used an ordinal logistic regression test.

Table 6: Logistic Regression of Ordinal Knowledge of Nutrition and Selection of meals with nutritional status

Variable	CI 95% Upper Limit – Lower Limit	p	Negelkerke R Square
Pengetahuan Gizi	-1.546 – 0.484	0.245	0.051
Pemilihan Makan	-2.262 – 0.1	0.113	

Table 6. provides result that nutritional knowledge and eating selection are not related to nutritional status in adolescent athlete at sport specific class. Negelkerke R Square's value on ordinal logistic regression was 0.051 which means that nutritional knowledge and the reason for eating only affected 5.1% of nutritional status in the adolescent athlete, while 94.9% were influenced by other factors that were not studied in this research. Other factors that affect the nutritional status of adolescent athletes need to be studied in order to control and minimize the prevalence of undernutrition and overnutrition so that at a young age good health quality and productivity are formed.

4. Discussion

This study represents that most adolescent athletes have good nutritional status. From the primary data of the study, nutritional status is not related to nutritional knowledge. Nutritional knowledge is basic information related to energy, proportions, types of nutrients, and eating habits applied by individuals based on the source of information received until it is adopted into a daily habit(Wulandari *et al*., 2019) [14]. Good nutritional status or optimal nutritional status occurs when the body obtains enough nutrients needed by the body. Malnutrition status occurs when the body is deficient in one or more essential nutrients. In line with research conducted by (Wulandari *et al*., 2019) [14], the results of this study show that the correlation of nutritional knowledge with nutritional status is very weak (r = 0.124), with a p-value of 0.319 (p>0.05), so there is no relationship between nutritional knowledge and nutritional status. This means that the higher the level of nutritional knowledge, it has no meaning in showing the better the nutritional status (Wulandari *et al*., 2019) [14] Factors involved and influencing the formation of nutritional status in addition to nutritional knowledge, in a study conducted by (Rahayu, 2020) [15] in adolescents are diet, physical activity, and body image. according to (Noronha *et al*., 2020) [6] stated that there is no significant relationship between knowledge about nutrition and nutritional status because knowledge has an indirect influence on nutritional status, while the direct influence that affects nutritional status is nutritional intake and infectious diseases.

Nutritional knowledge in the adolescent athlete in this study tended to be inadequate with a percentage of 64.7%. One of the causes of the lack of nutritional knowledge in adolescent athletes is exposure to insufficient nutritional information, and inapplicable nutritional knowledge (adolescents have not been able to apply nutritional knowledge directly) (Valliant *et al*., 2012) [16]. Environmental influences are more influential on adolescent food choices environmental influences are like (the influence of food trends and the influence of peers) (Birkenhead & Slater, 2015) [17]. Choosing food is very important for us because the impact caused is very influential for us. Whether the food is beneficial for our body or just the opposite. Everyone has different food choices, especially in adolescence (Faradila *et al*., 2020) [18]. In this study, the most instrumental factor in eating selection is environmental factors. Adolescence is a period of transition from childhood to adulthood. According to (Ratih *et al*., 2022) [7], in the selection of food, 3 factors determine and influence among them individual characteristics consisting of age, gender, level of education and psychological condition, and food preferences (sensory and mood) (Furst *et al*., 1996) [19]. Food characteristics include organoleptic properties of food, ease of digestibility, food preparation methods, and food content. Meanwhile, environmental characteristics are price, ethnicity, and ease/access to food (Santoso, Sela O, Azalia J, 2018) [20]. Among teenagers, the consumption of fast food, soft drinks, and sugar is more in demand than consuming vegetables and fruits to meet the nutritional needs of their bodies (Rahayu, 2020) [15]. (Ratih *et al*., 2022) (Syahroni *et al*., 2021) [7, 13] This is evident from the results of the study that none of the adolescents had the main selection reason in the food content factor, 28.6% of the reasons for eating selection were influenced by individual characteristics and 71.4% were influenced by environmental factors.

In research conducted by (Wulandari *et al*., 2019) [14] Among adolescents, the consumption of fast food, soft drinks, and sugar is more in demand than consuming vegetables and fruits to meet the nutritional needs of their bodies, this is also supported by the results of research where adolescents are more likely to choose food based on environmental factors. Environmental factors referred to food trends, the influence of peers, ease of access to food, and price (Birkenhead & Slater, 2015) [17]. Consumption behavior in adolescents has changed, both changes in healthy and unhealthy consumption behavior (Philippou *et al*., 2017) [21]. Changes in consumption behavior can affect eating choices in adolescents (Valliant *et al*., 2012) [16]. One aspect of environmental factors is the influence of mass media or social media, Teenagers who spend a lot of time playing on social media and watching television tend to eat unhealthy foods because the content or advertisements displayed are mostly about food such as junk food (Folasire *et al*., 2015). The consumption of nutrients in a person can determine the achievement of a degree of health that can be

called nutritional status, the correct diet greatly affects the growth and development of adolescents (Spronk *et al*., 2014) [23].

According to the research by (Rahayu, 2020) a fairly dominant factor that causes a state of malnutrition status is food selection behavior. In this study in the bivariate analysis, the variable of eating selection with nutritional status has a value (p = 0.042) which means that there is a relationship between eating selection and nutritional status. Adequate nutrition knowledge is needed to understand the importance of daily food choices for performance, health, and recovery (Heikkilä *et al*., 2019) [24]. Based on research conducted by (Heikkilä *et al*., 2019) [24] The mean knowledge scores were at a satisfactory level already before the intervention thus leaving less room for improvement. In other words, many of the athletes already knew at baseline how to eat it's important because knowledge is only one of the factors affecting what we eat (Valliant *et al*., 2012) [16]. Another factor that influences food choice is psychological, social, and economic factors and those related to lifestyle and beliefs, or determinants of food choice (Philippou *et al*., 2017) [21]. Nutrition education can be cost-effective and lead to considerable improvements in nutrition knowledge (Grabia *et al*., 2022) [25]. Promoting such education interventions can help to reduce the amount of one-on-one nutritional counseling and save the resources of athletes and sports organizations (Iwasa-Madge & Sesbreno, 2022) [26]. Therefore, based on the lack of healthy food selection in the category of adolescent athletes in this study, regular monitoring and evaluation are needed to support and change behavior in eating selection to be healthier (Wulandari *et al*., 2019). By identifying basic nutritional knowledge nutrition interventions can focus on groups that need more nutrition education (Kettunen *et al*., 2021) [27]. In other words, even the use of a relatively small amount of time and other resources for structured, motivating, science-based nutrition education can drive positive changes in nutrition knowledge that athletes can benefit from in their training.

This study coincides with previous research (Kettunen *et al*., 2021) [27] that nutritional knowledge is not related to nutritional status, and feeding selection in adolescents is dominated by environmental factors. Although nutritional knowledge and eating choices do not have a direct impact on nutritional status, for adolescent athletes knowledge and eating choices are one of important aspects that must be understood. Therefore, in the optimization program for breeding professional athletes through special sports classes, nutrition education is needed to provide nutritional understanding for athletes in choosing food. The limitation of this study is that data collection was only carried out in the Special Sports Class in one junior high school. So it is hoped that in subsequent studies an analysis of eating behavior will be carried out on Special Sports Class students in the wider area so that the results of the study can be generalized in general and can be an integrated program as an effort to improve achievement and performance for adolescent athletes.

5. Conclusion

Based on the results of the nutrition knowledge survey research, shows that the majority of nutritional knowledge in KKO students is inadequate, namely 64.7%. Although statistically nutritional knowledge is not related to nutritional status in KKO students, the lack of nutritional knowledge, especially in athletes in adolescence, can affect performance and eating habits. Meanwhile, in the eating selection variable, 71.4% of KKO students have a basis for eating selection to be influenced by environmental factors, environmental factors such as trends in foods with high sugar content, and fast food can have a bad impact on health status. Therefore, the results of this study can be used as a development of nutrition education and screening of students' eating habits to optimize the exercise process and shape students into healthy and outstanding students.

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