

Athletes with Physical and Visual Impairment and Coaches of Para Sports: What do They Know about Sports Nutrition?

Atletas com Deficiência Física e Visual e Treinadores de Desporto Adaptado: O que Sabem sobre Nutrição no Desporto?

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Abstract and Keywords

Understanding the nutritional knowledge of para-athletes is crucial to notice the improvements needed and to create better and individualised nutrition education programmes, in order to improve the health and performance of athletes. The purpose of this study is to assess the nutrition knowledge of athletes with physical and visual impairments and their coaches. Thirty-six athletes (n=27) and coaches (n=9) participated in this study, and the Abridged Nutrition for Sports Knowledge Questionnaire (ANSKQ) was used to assess the nutrition knowledge. In average, they scored lower (38%) in the overall score than the majority of the current literature (40-70%). Coaches scored higher than athletes in all categories, in total (coaches=47% vs. athletes=35%, $p=0.010$), in sports nutrition (coaches=41% vs. athletes=30%, $p=0.029$) and in general nutrition (coaches=61% vs. athletes=46%, $p=0.036$). It is necessary to increase athletes' and coaches' nutrition knowledge. Moreover, coaches might be able to assist the nutritionists in this task of transmitting nutrition information to para-athletes, as they are emotionally and physically closer to them.

Keywords: para-athletes; nutrition knowledge; coaches; para-sports; sports nutrition

Resumo e Palavras-chave

Compreender o conhecimento nutricional dos atletas de desporto adaptado é crucial para perceber as melhorias necessárias e para criar melhores programas de educação alimentar e individualizados, com o intuito de melhorar a saúde e o desempenho desportivo dos atletas. O objetivo deste estudo é avaliar o conhecimento de nutrição de atletas com deficiência física e visual e dos seus treinadores. Trinta e seis atletas (n=27) e treinadores (n=9) participaram neste estudo, e foi usado o *Abridged Nutrition for Sports Knowledge Questionnaire* (ANSKQ) para avaliar o conhecimento em nutrição. Em média, eles pontuaram menos (38%) do que a maioria da literatura atual (40-70%). Os treinadores tiveram uma pontuação maior do que os atletas em todas as categorias, no total (treinadores=47% vs. atletas=35%, $p=0.010$), em nutrição no desporto (treinadores=41% vs. atletas=30%, $p=0.029$) e em nutrição geral (treinadores=61% vs. atletas=46%, $p=0.036$). É necessário melhorar o conhecimento dos atletas e dos treinadores em nutrição. Para além disso, os treinadores pode ter a capacidade de auxiliar os nutricionistas nesta tarefa de transmitir informação sobre nutrição a atletas de desporto adaptado, uma vez que estão emocional e fisicamente mais próximos dos mesmos.

Palavras-chave: atleta de desporto adaptado; conhecimento em nutrição; treinadores; desporto adaptado; nutrição no desporto

List of abbreviations

ANSKQ - Abridged Nutrition for Sport Knowledge Questionnaire

NSKQ - Nutrition for Sport Knowledge Questionnaire

SD - Standard Deviation

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Introduction

Para-sports have been around for more than one hundred years, starting essentially as a rehabilitation therapy for war veterans, at the present time, they have begun to reach highly competitive levels⁽¹⁾. As for the last Paralympic Games in Tokyo 2021, 4393 para-athletes from 162 countries participated in the games, whereas in the first Paralympic Games in Rome in 1960 counted only with 400 athletes from 23 countries^(1, 2).

Alongside with this growth, there is the constant need to improve performance of para-athletes to correspond with the demands of the current competitive level. However, when working with para-athletes, there are several factors that could affect the athletes' dietary intakes, such as sleep disturbances, drug-nutrient interactions due to the use of medications, swallowing difficulty, abnormal sweating, decreased thermoregulation, low muscle mass and gastrointestinal discomfort, body image and others⁽³⁻⁵⁾.

Furthermore, due to their impairments, the risk of having decreased nutrient status, low bone mineral density and be more susceptible to illness and injuries is higher in para-athletes⁽³⁾. Therefore, sports nutrition plays an important role in the health and the performance of para-athletes^(3, 6).

The lack of nutrition knowledge is a possible factor that could affect the achievement of the required dietary intake⁽⁷⁾. In fact, nutritional knowledge can influence the athlete's healthy eating choices and behaviours^(5, 8, 9). More knowledgeable athletes might have a more adequate uptake of overall energy, carbohydrates, fibre and calcium. It also has been associated with greater

ingestion of protein, fruits and vegetables and lower uptake of fat and sweetened drinks^(10, 11).

In order to increase nutrition knowledge, an effective approach is nutrition education. This can consist in in person or online lectures, activities, workshops, individual or group counselling, handouts and booklets⁽¹⁰⁾. However, even though there are various methods of nutrition education, it is important that the information transmitted to the athletes is from a reliable academic source. Therefore, incorporating a certified nutritionist in sports clubs could increase the knowledge of the athletes⁽¹²⁾.

The emotional and physical relationships between the athletes and coaches are close, hence why coaches have an important role in providing information to the athletes. Thus, it is essential to focus the nutrition education for the coaches as well⁽¹³⁾. For the development of nutrition educational programs, it is mandatory to recognise and understand the nutrition knowledge of athletes and their coaches and to be conscious of the improvements needed⁽⁷⁾.

Objectives

This study has the main purpose of assessing the nutrition knowledge of athletes with physical and visual impairments and their coaches.

Materials and Methods

1. Participants

This study included male and female athletes with physical and visual impairments, with the minimum age of sixteen years old, and coaches of para-

sports who work daily with these athletes. The participants were chosen from different para-sports, Boccia, Goalball, Para Swimming and Para Table Tennis, of Porto Football Club, excluding the athletes that had some type of intellectual impairment. The participants were then recruited via email.

2. Instrument

The instrument used was a self-administered questionnaire, that the athletes and coaches filled in under the main researcher supervision in person in the club. The questionnaire chosen for this study was the Abridged Nutrition for Sport Knowledge Questionnaire (ASNKQ)^(14, 15), which has been previously validated. It was used a Portuguese translation, approved by the original author of this questionnaire. The questionnaire is composed of thirty-five questions divided in two main categories: general nutrition knowledge (n=11) and sports nutrition knowledge (n=24). The answers were all multiple choice, and in order to prevent the participants from guessing, there was a “not sure” option for every question. The scores were made by giving one or zero points for correct or incorrect and “not sure” answers, respectively, which was then used to determinate the overall and the subsections scores.

There were also demographic and para-sports related questions added to the questionnaire, such as gender (male or female), age, position in the club (athlete or coach), para-sport (boccia, goalball, para table tennis or para swimming) and type of impairment (physical, visual or none). The participants were also asked whether they have had any nutrition appointment previously (yes or no) and if they have ever attended any nutrition related lecture (yes or no). Both athletes

and coaches were asked how important they think that it is to receive correct information about nutrition (not so important, important or very important) and how they classify their health status (not so healthy, healthy or very healthy).

The questionnaire responses were collected between the months of May and June of 2024, using the Google Forms platform.

3. Statistical Analysis

All analysis were performed using the version 29.0 of the IBM Statistical Package for Social Sciences (SPSS®) for Windows.

Descriptive statistical data, such as gender, position in the club, para sports and impairment were analysed based on absolute and relative frequencies. There were also assessed the mean and standard deviations (SD) of the age. The questions about health, nutrition appointment, nutrition lecture and importance of nutrition knowledge were analysed with descriptive statistic as well.

The statistical tests, such as correlation of Spearman, independent t-test and oneway ANOVA, were used to compare ANSQK overall, general nutrition and sports nutrition scores with the other variables.

4. Ethical Considerations

All the participants were volunteers and both athletes and coaches were provided with and signed a written informed consent form. The study was approved by the Health Department of the club, and it was sent to the Faculty of Nutrition and Food Sciences of the University of Porto's ethical committee.

Results

1. Participants Characteristics

A total of thirty-six athletes (n=27) and coaches (n=9) filled in the questionnaire. The mean of ages of the athletes and coaches were, respectively, 27.9 ± 11.0 and 35.4 ± 16.3 years. There are 82% of athletes who were male (n=22) and 19% females (n=5), the coaches were 44% males and 56% females (n=4 and n=5, respectively). The participants were athletes and coaches of four different para-sports, 47% of boccia (n=17), 19% of goalball and para swimming (n=7, n=7) and 14% of para table tennis (n=5). Most of the athletes had physical impairment, a total of 81% (n=22). The characteristics of the participants are described in the tables below.

Table 1 - Participants Descriptive Characteristics

	Athletes			Coaches			Total
	All	Male	Female	All	Male	Female	
Demographic Characteristics, n (%)							
Participants	27 (75)	22 (81.5)	5 (18.5)	9 (25)	4 (44.4)	5 (55.6)	36
Age, years, mean $\pm$ SD	27.9 $\pm$ 11.0	28.6 $\pm$ 3.2	24.6 $\pm$ 9.2	35.4 $\pm$ 16.3	43.0 $\pm$ 23.6	29.4 $\pm$ 3.2	29.8 $\pm$ 12.7
Para-sports Information, n (%)							
Boccia	14 (51.9)	9 (40.9)	5 (100)	3 (33.3)	1 (25)	2 (40)	17 (47)
Goalball	5 (18.5)	5 (22.7)	0	2 (22.2)	2 (50)	0	7 (19)
Para Swimming	5 (18.5)	5 (22.7)	0	2 (22.2)	0	2 (40)	7 (19)
Para Table Tennis	3 (11.1)	3 (13.6)	0	2 (22.2)	1 (25)	1 (20)	5 (14)
Impairment Information, n (%)							
Physical	22 (81.5)	17 (77.3)	5 (100)	0 (0)	0 (0)	0 (0)	22 (61)
Visual	4 (14.8)	4 (18.2)	0 (0)	0 (0)	0 (0)	0 (0)	4 (11)
None	1 (3.7)	1 (4.5)	0 (0)	9 (100)	4 (100)	5 (100)	10 (22)

When asked about their health status, 6% of the participants ranked it as “not very healthy” (n=2), 83% said it was “healthy” (n=30) and 11% ranked their health as

“very healthy” (n=4). Moreover, only one athlete (4%) and one coach (11%) categorised their health as “not very healthy”, and, respectively, twenty-three and three athletes (85%, 11%) and seven and one coaches (78%, 11%) ranked it as “healthy” and “not very healthy”.

2. Nutrition Knowledge Assessment

The ANSKQ score was made of a total of thirty-five points, in which eleven points were for the general nutrition questions and twenty-four points for sports nutrition ones. The total ANSKQ mean score was 13.4 ± 4.2 points (38%), less than half of the full score. The lowest score was five and the highest was twenty-three. The scores are described in the Table 2.

Table 2 - Total ANSKQ and Subcategories Mean Scores

	Mean $\pm$ SD	Range
ANSKQ Score		
General Nutrition	5.5 ± 1.9	1-10
Sports Nutrition	7.9 ± 3.1	3-14
Overall ANSKQ Score	13.4 ± 4.2	5-23

When looking for the age, there seemed to be a positive correlation between the ages and the general nutrition, sports nutrition and total scores, which means the older the participant, better the scores. However, no significant differences were found (Table 3). As for comparing the three scores with both genders, no statically differences could be found either (Table 4).

Table 3 - Total ANSKQ and Subcategories Scores Correlation to Age

	Correlation Coefficient	p
ANSKQ Score		
General Nutrition	0.245	0.150
Sports Nutrition	0.162	0.345
Overall ANSKQ Score	0.255	0.133

Table 4 - Total ANSKQ and Subcategories Mean Scores Separated by Gender

	Male (n=26) Mean $\pm$ SD	Female (n=10) Mean $\pm$ SD	p
ANSKQ Score			
General Nutrition	5.5 $\pm$ 1.9	5.5 $\pm$ 2.0	0.958
Sports Nutrition	8.0 $\pm$ 3.0	7.4 $\pm$ 3.5	0.586
Overall ANSKQ Score	13.6 $\pm$ 4.0	12.9 $\pm$ 4.9	0.672

Scores separated by athletes and coaches showed that in all three categories, ANSKQ total, general and sports nutrition, coaches had a higher score when compared to the athletes, all with statistical differences ($p=0.036$; $p=0.029$ $p=0.029$). In the overall score, athletes scored 12.4 ± 4.1 points (35%) and coaches 16.4 ± 3.0 points (47%) ($p=0.036$). The scores separated by position in the club can be read below in Table 5.

Table 5 - Athletes' and Coaches' Total ANSKQ and Subcategories Mean Scores

	Athletes (n=27) Mean $\pm$ SD	Coaches (n=9) Mean $\pm$ SD	p
ANSKQ Score			
General Nutrition	5.1 $\pm$ 1.9	6.7 $\pm$ 1.4	0.036
Sports Nutrition	7.2 $\pm$ 3.0	9.8 $\pm$ 2.6	0.029
Overall ANSKQ Score	12.4 $\pm$ 4.1	16.4 $\pm$ 3.0	0.010

Practicing or coaching different types of para-sport did not seem to have statistically significant differences nor did the different types of impairment. The scores for these two variables are shown in the Tables 6 and 7, respectively. Moreover, as it can be seen in the Table 8, the health status looked like it could have positive correlation with the scores, but there were no significant differences between them.

Table 6 - Total ANSKQ and Subcategories Mean Scores Separated by Para-sport

	Boccia (n=17) <i>Mean ± SD</i>	Goalball (n=7) <i>Mean ± SD</i>	Para Swimming (n=7) <i>Mean ± SD</i>	Para Table Tennis (n=5) <i>Mean ± SD</i>	p
ANSKQ Score					
General Nutrition	5.5 ± 2.5	5.9 ± 1.1	5.3 ± 1.5	5.6 ± 0.9	0.956
Sports Nutrition	7.5 ± 3.2	8.9 ± 3.1	7.9 ± 3.8	7.8 ± 1.8	0.815
Overall ANSKQ Score	12.9 ± 4.7	14.7 ± 3.9	13.1 ± 4.7	13.4 ± 2.5	0.836

Table 7 - Total ANSKQ and Subcategories Mean Scores Separated by Impairment

	Physical (n=22) <i>Mean ± SD</i>	Visual (n=4) <i>Mean ± SD</i>	p
ANSKQ Score			
General Nutrition	5.0 ± 2.1	6.0 ± 0.9	0.376
Sports Nutrition	7.1 ± 3.1	9.0 ± 1.4	0.240
Overall ANSKQ Score	12.1 ± 4.2	15.0 ± 1.4	0.198

Table 8 - Total ANSKQ and Subcategories Scores Correlation to Health Status

	Correlation Coefficient	p
ANSKQ Score		
General Nutrition	0.222	0.194
Sports Nutrition	0.145	0.399
Overall ANSKQ Score	0.223	0.191

3. Importance of Nutritional Knowledge

When questioned “how much do you think is important to receive correct information about nutrition?”, 19% of the participants said it was “important” (n=7) and 81% answered “very important”, none of them ranked it as “not so important”. No significant differences were found when analysing this variable with the three scores.

Table 9 - Total ANSKQ and Subcategories Scores Correlation to Nutrition Importance

	Correlation Coefficient	p
ANSKQ Score		
General Nutrition	0.172	0.316
Sports Nutrition	0.208	0.225
Overall ANSKQ Score	0.224	0.189

Furthermore, when asked about their background, at most four of the participants (11%), one athlete (4%) and three coaches (33%), had never had a nutrition appointment, and similarly only four athletes (15%) and one coach (11%), a total of 14% of the participants (n=5), had never attended lecture about nutrition. Comparing whether the participants had had a nutrition appointment before or not and whether they have attended a nutrition lecture or not to their overall and subcategorised scores, it is possible to observe that no significant difference was found.

Table 10 - Total ANSKQ and Subcategories Mean Scores Separated by Nutrition Appointment

	Yes (n=32) Mean $\pm$ SD	No (n=4) Mean $\pm$ SD	p
ANSKQ Score			
General Nutrition	5.6 $\pm$ 2.0	5.0 $\pm$ 1.2	0.564
Sports Nutrition	7.8 $\pm$ 3.0	8.8 $\pm$ 3.8	0.549
Overall ANSKQ Score	13.4 $\pm$ 4.8	13.7 $\pm$ 4.8	0.859

Table 11 - Total ANSKQ and Subcategories Mean Scores Separated by Nutrition Lecture

	Yes (n=31) Mean $\pm$ SD	No (n=5) Mean $\pm$ SD	p
ANSKQ Score			
General Nutrition	5.5 $\pm$ 1.9	6.0 $\pm$ 1.9	0.558
Sports Nutrition	8.2 $\pm$ 3.1	5.8 $\pm$ 1.9	0.109
Overall ANSKQ Score	12.7 $\pm$ 4.3	11.8 $\pm$ 3.4	0.371

Discussion

1. Overall ANSKQ Scores

The goal of this study was to assess the nutritional knowledge of para-athletes with physical and visual impairment and of their coaches. The overall ANSKQ mean score revealed that the participants had an inadequate nutrition knowledge (approximately 38%), para-athletes scored 35% and coaches 47%. In average, the

participants answered correctly to less than half of the questions. The score of the para-athletes is lower than the majority of studies done with abled body athletes^(6, 10). According to the systematic review by Janiczak⁽¹⁰⁾, the overall mean range of the studies used is 40% to 70%, higher than the results from our study.

In the study by Deguchi⁽⁵⁾, it is reported that the para-athletes with physical disability between the ages of seventeen and seventy-two scored in average a total of 43% in the overall score, which was slightly lower than collegiate student athletes, who scored as a mean 54%. In another study done internationally⁽⁷⁾, with participants from five continents, showed that the para-athletes with spinal cord injury scored 52% and coaches of para-sports 57%. However, the authors suggest that this high score, which is even higher than in some other studies with similar populations, could be due to the fact that the participants could be more aware of nutrition as they were the ones who took the initiative to fill in the questionnaire⁽⁷⁾.

Several other studies conducted to abled body athletes, have shown as well that our study's scores are lower when compared to non-disabled athletes^(9, 11, 17-20). A study from 2015⁽⁹⁾, reported that the professional rugby players' mean score was 73%, and in the study by Andrews⁽¹⁷⁾ the mean score of student-athletes was 57%. Another study conducted to young athletes using the same questionnaire as the current study (ANSKQ)⁽¹¹⁾, indicated that the high school and college athletes' mean score was, respectively, 46% and 49%. Moreover, a study done to Malaysian university students⁽¹⁸⁾, also presented a higher score than this study, the athletes scored 59%. Heikkilä⁽²⁰⁾ showed that Finnish endurance athletes scored in average 73% and their coaches 81%. Furthermore, a study from 2019 conducted to Australian team sports athletes⁽¹⁹⁾, using two different nutrition knowledge

questionnaires, the Nutrition for Sports Knowledge Questionnaire (NSKQ) and Abridged Nutrition for Sports Knowledge Questionnaire (ANSKQ), revealed that the athletes scored a mean of, respectively, 48% and 49% in both questionnaires. However, there is a study, which was published in 2021⁽²¹⁾, using the ANSKQ questionnaire, the average score for athletes was equal to the one in this current study (35%) and the coaches continued to score higher (52%).

Even though, the knowledge of these participants is shallowed, para-athletes have scored lower than coaches (35% vs. 47%). This can as well be observed in other studies⁽²⁰⁻²²⁾, for example, in the study by Torres-McGehee⁽²²⁾, coaches had a mean score of 66% and athletes a score of 55% ($p < 0.001$). The study from 2021⁽²¹⁾ and another one from 2018⁽²⁰⁾ also showed that coaches scored higher than athletes ($p < 0.001$). However, it is also important to notice that coaches' higher level of knowledge could be a co-variable of being a coach⁽²¹⁾, such as the level of education they have, the need to be updated so they could transmit useful information to the athletes, or even their attendance to nutrition related lectures. These low scores in nutrition knowledge is associated with inadequate food choices and dietary ingestions, which are related to suboptimal health status and performance⁽⁸⁾. Hence, it indicates that there is a need to increase athletes', as well as coaches', knowledge.

2. General versus Sports Nutrition Knowledge

The mean score of the general nutrition subcategory was higher than the one for sports nutrition (50% vs. 33%), which can be as well noticed in other studies^(5, 11, 23). Deguchi showed that for para-athletes the mean score for general nutrition is

46%, whereas the sports nutrition score is 36%, and for college student athletes, the scores were slightly higher, with 55% for the general nutrition score and 49% for the other. In the study from 2016⁽²³⁾, half of the participants could answer correctly the general nutrition questions, however, when it came to the sports nutrition ones, less than 50% of them was able to answer them right. This suggests that there is a higher need to focus on sports nutrition education for para-athletes and coaches. Furthermore, Madden⁽⁷⁾ found that lower sports nutrition mean scores are associated with those athletes who did not attend sports nutrition workshops in comparison with the ones who did.

The difference between the general and sports nutrition mean scores could be due to diverse factors. General nutrition tends to consist in simpler nutrition concepts in comparison to sports nutrition, which makes it is easier to understand and to retain the information. Another reason could be that the nutrition lectures and activities presented to people have a tendency to be more focused on practicalities from the day-to-day life rather than the theoretical knowledge of sports nutrition, which results in athletes having lower knowledge in this area.

3. Importance of Nutrition Knowledge

Our study did not find any relationship between the participants' perceived importance of receiving correct nutrition and the scores. When it comes to nutrition appointments, we could not find any significant difference between those who had previously had a nutrition appointment and those who had not. These findings are similar to the studies conducted by Elshoryi⁽²¹⁾ and Tarkman^(6, 14, 15). The second author suggests that nutrition appointments might not lead directly to better nutrition knowledge as it is a complex topic, and that the

education in this context may focus of practical knowledge rather than the theory of sports nutrition.

Furthermore, nutritional knowledge is an important factor in athletes' health status, performance and recovery, as it is positively associated with adequate dietary intake, better food choices, optimal energy uptake and, consequently, health status and increased performance⁽⁸⁾.

An effective way to increase the nutrition knowledge of athletes is through nutrition education programs, it ensures that the correct information is transmitted as they should be conducted by knowledge nutritionists. This can consist in various types of events, such as in person or online lectures, activities, workshops, individual or group counselling, handouts and booklets⁽¹⁰⁾.

According to a study done with Iranian athletes⁽¹³⁾, there is a positive relationship between the nutrition education and nutrition knowledge. After a nutritional education programme that consisted of booklet, basic information about nutrition and four different three-hour courses, the knowledge of the athletes had almost duplicated. Moreover, coaches are ranked as one of the main sources of information of athletes, due their emotional and physical closeness to athletes and for being almost all the time with them⁽¹³⁾. This could suggest that due to this close relationship and the higher score of coaches' knowledge when compared to para-athletes' score found in our study in all the scores of nutrition, it could be beneficial to invest as well in the nutrition education for coaches, as they can be an aid to the nutritionist when it comes to transmit correct nutritional information to the para-athletes.

4. Limitations

The main limitation of this study was that it did not assess the sources of information of these participants, which would have been interesting doing it to understand where the lack of nutrition knowledges comes from. Hence, it is not possible to know if the low scores are due to the lack of knowledge or incorrect one. Furthermore, it is not possible to know whether the information about nutrition of these athletes and coaches received previously was reliable and if it corresponds with the information interrogated in the questionnaire. There could also be an interaction with their personal experience and their perception of correct and incorrect nutrition information.

Moreover, the number of visually impaired athletes was scarce, which has influenced some of the statistical tests. Even though the questionnaire form was filled in person to prevent cheating, the fact that the main investigator was in the room with the athletes and coaches might have influence their answers as they could feel the pressure of her presence.

Conclusion

It is mandatory that para-athletes are equipped with the correct nutrition information as a way to guarantee the ideal nutrition status, which is crucial for an optimal health, performance and recovery. This study suggests that there is still a great lack of knowledge among para-athletes and coaches of para-sports. The athletes have significant lower knowledge in nutrition, which can indicate that the correct information is not reaching them or even that only a few information is being transmitted effectively. Hence, there is a higher need to seek for nutrition educational programmes as a way of increasing their knowledge. Even

though coaches show a better understanding of nutrition, they still could take advantage of educational programmes, and, consequently, assist nutritionist in the task of transmitting the correct information to para-athletes, as they have a strong emotional bond with them and are more present in the day-to-day life. Future investigations should study the effects of nutrition education programmes for athletes and coaches in their knowledge, and how the coaches' knowledge can affect in the long term the diet choices, and consequentially, the performance and health of athletes.

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