

NUTRITIONAL KNOWLEDGE AND STATUS OF COACHES IN VARIOUS SPORTING CODES

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ABSTRACT

Coaches have an important responsibility in the lives of athletes since athletes often use them as a source of advice for various performance-related issues, such as the nutritional regime. This descriptive study set out to identify the nutritional knowledge and nutritional status of coaches from various sport codes, as well as their nutrition recommendations for their athletes. The study included 165 individuals from different sporting codes i.e. team, strength, explosive power and endurance sports. Coaches were given a self-administered questionnaire with 76 questions. Most coaches had poor diet choices. For instance, the number of coaches who regularly consume vegetables, fruits and fish was low and most skipped meals attributable to limited opportunities and/or not feeling hungry. 76% of the 165 coaches alleged that they had sufficient knowledge about nutrition and 82% of the coaches provided knowledge about nutrition to their athletes. There was a significant difference among coaches of different sport codes in their recommendations concerning nutritional ergogenic supplements ($p < 0.01$). The coaches of strength sport mostly recommended proteins/amino acid supplements. Coaches predominantly gave the correct or expected answer to both general nutritional knowledge and sport nutritional knowledge questions. However, the suggestions that coaches made to their athletes about training nutrition was inadequate.

Key words: Coaches; Nutritional knowledge; Nutritional status.

INTRODUCTION

Sports nutrition can be defined as the translation of nutritional knowledge into a practical daily eating plan focused on providing the energy for physical activity, facilitating the repair process following physical work and optimising athletic performance in competitive events, while promoting overall health and wellness (Fink *et al.*, 2006). Research on the role of nutrition in exercise and sport has increased dramatically and, therefore, the scientific information in the field of sport nutrition is expanding rapidly. Today there is no doubt that nutrition plays a vital role in exercise performance and training (Manore & Thompson, 2000; Benardot, 2012).

Competitive athletes not only concentrate on their training to enhance their athletic performances but also place importance on their nutrition (Ersoy, 2011). It is known that insufficient and unbalanced nutrition may result in some health problems and poor performance and that athletes with a well-designed nutritional plan are more advantageous vis-a-vis those having an insufficient nutritional regime (Dobbe, 2005; Ersoy & Hasbay, 2008). The aim of optimal nutrition is to meet metabolic requirements and to provide the necessary energy and nutrients for the body (Yücecan, 2008). Optimising nutritional intake has been demonstrated to elicit peak performance levels from subsequent enhanced recovery, body mass control, effective hydration and reductions in illness and injury, which coincide with increased confidence because of a more prepared mental state for competition (Cockburn *et al.*, 2014). Consuming carbohydrate-rich food before, during and after training contributes to athletes' performance by helping to refresh the storages, which decrease during training or competition (Insel *et al.*, 2004). It was also found that when carbohydrates and proteins (CHO/PRO: 3-4/1) were consumed together in the first three hours after competition, that the muscle protein synthesis rate was high (Fink *et al.*, 2006; Howarth *et al.*, 2009), which contributed to recovery (Nybo *et al.*, 2013). Inadequate energy and nutrient intake may result in fatigue during the next training session if no effort is made in replacing the needed sources of nutrients (Dunford & Doyle, 2008).

To determine nutritional knowledge, daily food consumption records together with nutrition habit and status, sport dieticians/nutritionists may administer the questionnaires (Insel *et al.*, 2012). Insufficient knowledge about nutrition and inadequate dietary practices could be limiting factors for sport, as well as exercise performance and recovery (Kruseman *et al.*, 2008). It is, therefore, of utmost importance for elite athletes to have a reliable source of nutritional knowledge (Dobbe, 2005). In addition to the reliability of nutritional knowledge, athletes should also have easy access to reliable sources of nutritional knowledge. According to Torres-McGehee *et al.* (2012), coaches, fitness instructors and dieticians are the first sources of nutritional knowledge for athletes. As mentioned before, sufficient energy, food and fluid intake of elite athletes has a great impact on their competition performance and post-competition/exercise recovery (Dobbe, 2005). Therefore, the wide misinformation about nutrition among athletes makes it more and more crucial for sport instructors and coaches to be knowledgeable about nutritional regimes for athletes (Graves, 1991).

Athletes have sought advice from strength and conditioning coaches, dieticians, peers, family, media and independent research. However, Cockburn *et al.* (2014) found that coaches are the predominant source. Coaches have an important responsibility in the lives of athletes and athletes often use them as source of advice for different issues. Thus, coaches may influence athletes' energy and nutrient intake directly and should, therefore, acquire knowledge from reliable sources (Juzwiak & Ancona-Lopez, 2004; Zinn *et al.*, 2006; Cockburn *et al.*, 2014), and show that they possess adequate nutritional knowledge. Consequently, the aim of this study was to assess the level of nutritional knowledge and nutritional status of coaches from various sporting codes, as well as the dietary recommendations of coaches to athletes.

METHODOLOGY

Participants

Coaches (N=165) attending coaching courses throughout Turkey volunteered to take part in the study. The coaches coached different sporting codes (team, strength, explosive power and endurance sports), at different coaching levels (specifically levels 1 to 5). The first level is the beginner or entry level for nutritional education and nutritional topics include general nutritional knowledge, whereas the 5th level was the highest level for sport nutrition knowledge. The number of participants, which was originally 187, was reduced to 165 because some participants did not complete all the questions in the questionnaire. Of the 165 coaches that volunteered, 84.8% (n=140) were male, while 15.2% (n=25) were female. The average age of the males and females were 36±10 years and 32±9 years respectively, with coaching experience of about 8±7 years.

Procedure

The researcher interviewed coaches during the coaching courses. Erciyes University Medical Faculty Clinical Research Review Board in Turkey approved this study and all the participants provided written informed consent (2014/105). All participants took part on a voluntary basis with the option to withdraw at any time. The purpose of the questionnaires was thoroughly explained to the coaches by the researcher. Participants had the freedom to ask any questions during the completion of the questionnaire. Furthermore, any word or question that they did not understand was explained to them.

Sports Nutrition Knowledge Questionnaire

The questionnaire consists of 76 items. It was applied to individuals who coached in various sport codes with a view to identifying their nutritional knowledge, habits and nutritional status. The questionnaire contained 2 main sections.

A qualified dietician prepared the first section. The first section evaluated the demographics of coaches including age, education levels, whether they used to participate and/or whether they currently participate in any sport, the sport codes they coach, how many meals they personally have a day, the reasons why they might skip a meal, their fluid intake and their knowledge about nutritional ergogenic supplements.

The second part of the questionnaire comprised 20 sport nutrition knowledge questions about nutrition and diet (adapted from Güven *et al.*, 2009), divided into 3 sub-categories: general nutrition (2 questions); nutrients (5 questions); and sports nutrition (13 questions). Each question could be answered 'TRUE' or 'FALSE', to discourage coaches from guessing answers and to allow differentiation between those possessing accurate and incorrect knowledge.

Statistical analysis

Statistical analyses were performed using the Statistical Package for Social Sciences (SPSS 15 Inc., Japan) for Windows. The level of significance was set at $p < 0.05$. Descriptive statistics were used to summarise continuous variables using mean, standard deviations (SD) and frequencies. Chi-square (χ^2) tests were used to indicate differences among the sporting codes (specifically team, strength, explosive power and endurance sports).

RESULTS

Table 1 shows the distribution of coaches according to the 4 sporting codes. Of them, 72% (119) were university graduates and 27.9% (46) were high school graduates. The graduates from a School of Physical Education and Sport constituted 65.5% (108), while 8.4% (14) were in other professions. In terms of their current occupations, 87.3% (144) of the participants left this question unanswered. Some (8.5%; 14) were teachers and others stated that they worked in various fields. Of all the participants, 21% (34) were in the 1st coaching level, 31.5% (52) in the 2nd level, 29% (48) in the 3rd level, 10.3% (17) in the 4th level and 8.5% (14) in the 5th level.

TABLE 1. COACHES ACCORDING TO VARIOUS SPORT CODES

Sport codes	n	%
Team sports (football, basketball, volleyball, handball)	66	40.0
Strength sports (wrestling, boxing, taekwondo, weightlifting, judo)	34	20.6
Explosive power sports (gymnastics, table tennis, swimming, badminton)	29	17.6
Endurance sports (skiing, athletics)	36	21.8
Total	165	100

TABLE 2. EXERCISE DURATION AND FLUID INTAKE OF COACHES

Questions	Sport codes	n	Mean±SD	F	p
How many <i>DAYS</i> per week do you exercise? (only 127 exercised)	Team sports	#52	4.15±1.32	1.655	0.180
	Strength sports	#27	4.56±1.15		
	Explosive power sports	#17	3.65±1.22		
	Endurance sports	#31	3.97±1.76		
How many <i>HOURS</i> per week do you exercise? (only 127 exercised)	Team sports	#52	1.91±0.61	8.697	0.000*
	Strength sports	#27	2.28±0.88		
	Explosive power sports	#17	1.74±0.44		
	Endurance sports	#31	2.66±0.93		
How much <i>FLUID</i> (in litres) do you drink in a day?	Team sports	66	2.16±0.78	0.359	0.782
	Strength sports	34	2.07±0.87		
	Explosive power sports	29	2.22±0.88		
	Endurance sports	36	2.26±0.77		

* p<0.05

#= Only those who partake in exercise answered these questions (n=127)

TABLE 3. COMPARISON OF COACHES IN VARIOUS CODES ACCORDING TO THEIR NUTRITIONAL HABITS

Questions	Answer	Sport Codes				Total	χ^2 -value	p-value
		Team n (%)	Strength n (%)	Expl. power n (%)	Endurance n (%)			
1. Do you eat vegetables and fruits regularly 5 times a day?	Yes	19(45.2)	10(23.8)	6(14.3)	7(16.7)	42	1.699	0.637
	No	47(38.2)	24(19.5)	23(18.7)	29(23.6)	123		
2. Do you eat fish regularly at least 2-3 times a week?	Yes	18(35.3)	9 (17.6)	9 (17.6)	15(29.4)	51	2.673	0.445
	No	48(42.1)	25(21.9)	20(17.5)	21(18.4)	114		
3. Do you eat more than 2-3 portions of red meat a week?	Yes	46(45.5)	14(13.9)	13(12.9)	28(27.7)	101	15.190	0.002*
	No	20(31.3)	20(31.3)	16(25.0)	8(12.5)	64		
4. Do you go to a fast food restaurant (hamburger) more than once a week?	Yes	19(52.8)	4(11.1)	4(11.1)	9(25.0)	36	5.203	0.158
	No	47(36.4)	30(23.3)	25(19.4)	27(20.9)	129		
5. Do you eat dry legumes (dry beans, chickpeas, etc.) more than once a week?	Yes	51(36.7)	33(23.7)	22(15.8)	33(23.7)	139	9.651	0.022*
	No	15(57.7)	1(03.8)	7(26.9)	3(11.5)	26		
6. Do you eat rice and pasta more than 5 times a week?	Yes	32(38.6)	15(18.1)	15(18.1)	21(25.3)	83	1.560	0.669
	No	34(41.5)	19(23.2)	14(17.1)	15(18.3)	82		
7. Do you eat oily nuts (pistachio, hazelnut, walnut) at least 2-3 times a week?	Yes	43(36.8)	27(23.1)	21(17.9)	26(22.2)	117	2.314	0.510
	No	23(47.9)	7(14.6)	8(16.7)	10(20.8)	48		
8. Do you use olive oil at home?	Yes	57(39.3)	31(21.4)	25(17.2)	32(22.1)	145	0.600	0.896
	No	09(45.0)	3(15.0)	4(20.0)	4(20.0)	20		
9. Do you consume 2 glasses of milk/yoghurt and/or 2 matchboxes (60g) of cheese a day?	Yes	51(37.2)	32(23.4)	25(18.2)	29(21.2)	137	4.883	0.181
	No	15(53.6)	2(07.1)	4(14.3)	7(25.0)	28		
10. Do you consume desserts/candy a couple of times every day?	Yes	32(38.6)	16(19.3)	15(18.1)	20(24.1)	83	0.651	0.885
	No	34(41.5)	18(22.0)	14(17.1)	16(19.5)	82		

*p<0.05

Table 2 shows the coaches' status of exercise durations and their fluid intake. When participants were asked: "Do you ever skip meals?", 37.4% (37) of 99 participants who responded 'YES' to the question were the coaches of team sports, while 21.2% (21) were the coaches of strength and endurance sports. Lunch was in the first place (58%) and breakfast in the second (34%) in the ranking of the meal skipped. The 2 main reasons why they skipped meals were explained as not finding any opportunity and not feeling hungry.

The comparison of coaches in various sport codes according to their nutritional habits is summarised in Table 3. It was found that the percentage distribution of those who regularly ate vegetables and fruits every day and fish at least 2 or 3 times a week was low, whereas the number of those who consumed desserts/candies a couple of times every day was equal to those who did not. Similarly, the percentage of those who ate rice or pasta more than 5 times a week was equal to those who did not.

A significant difference was found among the groups in the answers they presented to the questions: "Do you eat more than 2 to 3 portions of red meat a week?" ($p=0.002$). When participants were asked: "Do you eat more than 2 to 3 portions of red meat a week?", 31.3% (20) of 64 participants who responded 'NO' to the question were coaches of team sports and strength sports, 25.0% (16) were coaches of explosive power sports, 12.5% (8) were coaches of endurance sports. Of the 101 participants who responded 'YES' to the question, 45.5% (46) were coaches of team sports, 27.7% (28) were coaches of endurance sports, 13.9% (14) were coaches of strength sports and 12.9% (13) were coaches of explosive power sports.

A significant difference was also found among the groups regarding their answer to the question: "Do you eat dry legumes (dry beans, chickpeas, red beans, etc.) more than once a week?" ($p=0.02$). When participants were asked: "Do you eat dry legumes (dry beans, chickpeas, red beans, etc.) more than once a week?", 36.7% (51) of 139 participants who responded 'YES' to the question were coaches of team sports, 23.7% (33) were coaches of strength sports and endurance sports and 15.8% (22) were coaches of explosive power sports.

When participants were asked "Do you eat dry legumes (dry beans, chickpeas, red beans, etc.) more than once a week?", 57.7% (15) of 26 participants who responded 'NO' to the question were coaches of team sports, 26.9% (7) were coaches of explosive power sports, 11.5% (3) were coaches of endurance sports and 3.8% (1) was a coach of strength sports.

Only 13.3% (22) of the coaches stated that they used nutritional ergogenic supplements themselves, mostly multivitamins (15) and proteins (7). 59% of those who used ergogenic supplement stated that they used them on their own initiative, whereas 18.2% used them on the advice of a physician and 13.6% on the advice of another coach.

In response to the question, "Do you have any knowledge about sport nutrition?", 76.3% (126) of participants said 'YES', while 23% (38) responded "not at a sufficient level". There was no significant difference among the sporting codes ($p>0.05$). The top 3 sources of knowledge were listed as school (48.4%), coaching training seminars (36.3%) and books (9.1%). 82% (135) of coaches stated that they provided their athletes with knowledge about nutrition. There was a significant difference between the coaches of the various sport codes

recommending nutritional ergogenic supplements ($p < 0.01$) (Table 4). The coaches of strength sports mostly recommend proteins/amino acid supplements.

TABLE 4. COMPARISON: RECOMMENDATIONS ABOUT NUTRITIONAL ERGOGENIC SUPPLEMENTS BY COACHES OF VARIOUS SPORT CODES

Question: <i>Do you recommend nutritional ergogenic supplements to athletes?</i>							
Answer	Sport codes					χ^2 -Value	p-Value
	Team n (%)	Strength n (%)	Expl. power n (%)	Endurance n (%)	Total N		
Yes	10 (21.7)	21 (45.7)	4(08.7)	11(23.9)	46	27.724	0.000*
No	56 (47.1)	13 (10.9)	25(21.0)	25(21.0)	119		
Total	66 (40.0)	34 (20.6)	29(17.6)	36(21.8)	165	* $p < 0.05$	

In response to the questions, "What do you recommend your athletes to eat as the last main meal before the exercise" and "What do you recommend to them for their nutrition during and after the exercise?", the most common answers were a meal that contains complex carbohydrates and carbohydrates and proteins together for the pre-exercise period, water and sport drinks during the exercise and plenty of water and fruits for the post-exercise period. No significant difference was observed among the groups in terms of the answers to the questions ($p > 0.05$).

An analysis of the percentage distribution in terms of giving the expected answer to the nutrition knowledge questions revealed that most of them gave the expected answers. Among the groups, significant differences were observed only in the response to the statement, "Food that are rich in carbohydrate should be eaten in the recovery period" ($p = 0.04$), and to the statement, "Fluid intake should stop 1 hour before the competition" ($p = 0.03$) (Table 5). There were significant differences between the groups in their response to the statement, "Fats are the most important nutrients to boost the performance", according to the coaching levels.

It was found that the percentage of expected answers given by the coaches in levels 1 to 3 was higher than that of the others. However, the different coaching levels did not lead to any significant difference in their answers to the questions about nutritional knowledge in this study.

TABLE 5. COMPARISON OF COACHES OF VARIOUS SPORT CODES REGARDING KNOWLEDGE OF NUTRITION

Questions	Answer	Sport Codes					Total N	χ^2 -value	p-value
		Team n (%)	Strength n (%)	Expl. power n (%)	Endurance n (%)	Total N			
1. A sufficient and balanced diet is fundamental to a healthy life.	True	61(38.6)	34(21.5)	27(17.1)	36(22.8)	158	5.409 ^a	0.144	
	False	5(71.4)	0(00.0)	2(28.6)	0(00.0)	7			
2. 4 basic nutrient groups are the meat group, milk group, cereals and fruits & vegetables.	True	58(39.2)	29(19.6)	28(18.9)	33(22.3)	148	2.575 ^a	0.462	
	False	8(47.1)	5(29.4)	1(05.9)	3(17.6)	17			
3. Bread, rice and pasta are rich in carbohydrates.	True	62(39.7)	34(21.8)	25(16.0)	35(22.4)	156	6.419 ^a	0.093	
	False	4(44.4)	0(00.0)	4(44.4)	1(11.1)	9			
4. Vegetables and fruits are rich in proteins.	True	25(46.3)	6(11.1)	11(20.4)	12(22.2)	54	4.670	0.198	
	False	41(36.9)	28(25.2)	18(16.2)	24(21.6)	111			
5. Liver and meat are a good source of vitamin C.	True	9(50.0)	4(22.2)	4(22.2)	1(05.6)	18	3.228 ^a	0.358	
	False	57(38.8)	30(20.4)	25(17.0)	35(23.8)	147			
6. Iron is a nutrient that causes anaemia.	True	45(37.8)	24(20.2)	24(20.2)	26(21.8)	119	2.181	0.536	
	False	21(45.7)	10(21.7)	5(10.9)	10(21.7)	46			
7. Calcium is necessary for bones and dental health.	True	61(38.6)	33(20.9)	28(17.7)	36(22.8)	158	3.587 ^a	0.310	
	False	5(71.4)	1(14.3)	1(14.3)	0(00.0)	7			
8. Vitamins and minerals are the basic nutrients that provide the body with energy.	True	41(42.3)	17(17.5)	14(14.4)	25(25.8)	97	4.397	0.222	
	False	25(36.8)	17(25.0)	15(22.1)	11(16.2)	68			
9. Fats are the energy source that the body uses primarily.	True	27(48.2)	13(23.2)	9(16.1)	7(12.5)	56	5.193	0.158	
	False	39(35.8)	21(19.3)	20(18.3)	29(26.6)	109			
10. Carbohydrates are the most convenient energy source for athletes.	True	55(39.0)	29(20.6)	25(17.7)	32(22.7)	141	0.594 ^a	0.898	
	False	11(45.8)	5(20.8)	4(16.7)	4(16.7)	24			
11. The last main meal should be eaten at least 3 hours before the exercise/competition.	True	55(37.9)	32(22.1)	26(17.9)	32(22.1)	145	2.643 ^a	0.450	
	False	11(55.0)	2(10.0)	3(15.0)	4(20.0)	20			

Continued on next page

TABLE 5. COMPARISON OF COACHES OF VARIOUS SPORT CODES REGARDING KNOWLEDGE OF NUTRITION (cont.)

Questions	Answer	Sport Codes				Total	χ^2 -value	p-value
		Team n (%)	Strength n (%)	Expl. power n (%)	Endurance n (%)			
12. Dry beans, rice and yoghurt are a convenient menu before an exercise or a competition.	True	18(42.9)	10(23.8)	7(16.7)	7(16.7)	42	1.107	0.775
	False	48(39.0)	24(19.5)	22(17.9)	29(23.6)	123		
13. Food rich in carbohydrate should be eaten during the recovery period.	True	45(36.0)	23(18.4)	26(20.8)	31(24.8)	125	8.431	0.038*
	False	21(52.5)	11(27.5)	3(07.5)	5(12.5)	40		
14. It would be a good choice to consume chocolate bars, cakes and coke right after an exercise or a competition in order to accommodate the need for energy.	True	15(53.6)	6(21.4)	4(14.3)	3(10.7)	28	3.677	0.298
	False	51(37.2)	28(20.4)	25(18.2)	33(24.1)	137		
15. Fluid intake should stop in one hour before the competition.	True	15(26.8)	14(25.0)	9(16.1)	18(32.1)	56	8.746	0.033*
	False	51(46.8)	20(18.3)	20(18.3)	18(16.5)	109		
16. Having sports drinks would be an advantage in long-term exercise.	True	40(37.4)	23(21.5)	21(19.6)	23(21.5)	107	1.381	0.710
	False	26(44.8)	11(19.0)	8(13.8)	13(22.4)	58		
17. When the fluid loss due to perspiration reaches 2% of the body weight, performance is adversely impacted.	True	45(38.1)	24(20.3)	25(21.2)	24(20.3)	118	3.863	0.277
	False	21(44.7)	10(21.3)	4(08.5)	12(25.5)	47		
18. Fats are the most important nutrients to boost the performance.	True	23(53.5)	10(23.39)	6(14.0)	4(09.3)	43	7.453	0.059
	False	43(35.2)	24(19.7)	23(18.9)	32(26.2)	122		
19. Vitamin and mineral tablets are ergogenic elements athletes use to increase their performance.	True	41(35.7)	23(20.0)	22(19.1)	29(25.2)	115	4.393	0.222
	False	25(50.0)	11(22.0)	7(14.0)	7(14.0)	50		
20. In order to increase the muscle mass, one should take proteins more than the amount actually needed.	True	40(41.2)	18(18.6)	18(18.6)	21(21.6)	97	0.702	0.873
	False	26(38.2)	16(23.5)	11(16.2)	15(22.1)	68		

^a Proportion of the number of cells less than 5 to total cell number is more than 20%

^b Expected answer

*p<0.05

DISCUSSION

The study revealed that 65.5% (n=108) of the participants were graduates from a School of Physical Education and Sport and the sport codes they used to participate in were mainly team sports (40%). There was no significant relationship between the sporting codes they coach currently and those they participated in previously. Overall nutritional knowledge of most coaches were sufficient, however, their own nutritional habits were not appropriate.

A linear relationship was expected between coaching levels and healthy nutritional habits. However, the different coaching levels did not lead to any significant difference in their answers to the questions about nutritional habits in this study. These results can be deduced because, despite the increased nutrition education of coaches in this study, they may not change the present nutrition habits. Bayraktar and Yaman (2002) found some significant difference in nutritional habits among different coaching levels in different sporting codes. It was found that the percentage of expected answers given by the coaches about healthy nutritional habits was higher for third level coaches than first and second level coaches.

It was seen that the percentage distribution of those who regularly consume vegetables and fruits every day and those who eat fish at least two to three times a week was low. However, the number of those who ate desserts and candies for a couple of times every day was equal to the number of those who did not. The percentage of those who ate rice and pasta five times a week was nearly the same as the number of those who did not. A significant difference was observed among the groups in the answers to the questions "Do you eat red meat more than two to three times a week?" and "Do you eat dry legumes (dry beans, chickpeas, red beans, etc.) more than once a week?". Coaches of team sports and endurance sports ate red meat more than two to three times a week. Coaches who ate dry legumes (dry beans, chickpeas, red beans, etc.) more than once a week were 84.2% (139) of 165 participants.

These results indicated poor diet choices of most coaches, even though they perceived themselves as having adequate nutritional knowledge (Table 5). A study by Bayraktar and Yaman (2002), found that there was no significant difference in nutritional status of the coaches (handball-taekwondo and handball-gymnastics). In another study, it was found that nutritional behaviours of gymnastic coaches were different from those of some other sporting code coaches (swimming, basketball, volleyball). Because gymnastic coaches generally want to be lean, they especially pay attention to body weight. Therefore, their nutritional behaviours may be different from other sport codes (Heffner *et al.*, 2003). However, there were no differences among coaches of different sport codes in the current study.

Most of the coaches indicated that they think they have knowledge about sport nutrition. Schools (48.4%), coaching training seminars (36.3%) and books (9.1%), were listed as the top three sources of nutritional knowledge. The first ranking of the school in this list can be explained by the fact that most of the participants were graduates from the School of Physical Education and Sport, where they took a compulsory course in sport nutrition. Yıldırım and Bayraktar (2002) state that the top three sources of knowledge for coaches were books (18.9%), schools (18.9%), nutrition experts and dieticians (14.2%), and coaching courses

(14.2%) (Yıldıran & Bayraktar, 2000). Another study revealed similar results (seminars, schools and coaching courses) (Çınar *et al.*, 2009).

Dobbe (2005) found that most coaches were interested in learning about sport nutrition. In addition, other research with similar findings also report that the primary source of nutritional knowledge for athletes was mostly coaches (Burns *et al.*, 2004; Sajber *et al.*, 2013). Dobbe (2005) suggests that the source of nutritional knowledge for sportsmen was mostly the coaches, whereas it was dieticians and school courses for sportswomen. In the current study, 81.8% (n=135) of the participants said they provided their athletes with knowledge about nutrition. Training topics mostly included a sufficient and balanced diet, ergogenic supplements and nutrition during the exercise/competition periods. Yıldırım *et al.* (2008) found that 58.1% (250) of 430 coaches made nutritional recommendations to their athletes and the recommendations were mostly on sufficient and balanced diets (54.8%), and nutrition before and after exercise/competition (17.6%). Another study revealed that the most common problem coaches identified, regarding their athletes, was an insufficient and unbalanced diet based mainly on fast food (Corley *et al.*, 1990).

Body weight and composition are important factors for performance not only in sport codes that are subject to weight classifications, such as boxing, wrestling and weight-lifting, but also in other codes such as gymnastics, running and cycling. It is, therefore, of great importance for coaches to be knowledgeable on this issue (Turocy *et al.*, 2011). Many athletes often need knowledge about prevention of fatigue (Şenel *et al.*, 2004), increasing their performance, ergogenic supplements and weight control (Burns *et al.*, 2004). Consequently, coaches could influence the nutritional behaviours of athletes directly. It is, therefore, important that coaches have correct nutritional knowledge from reliable sources such as registered dieticians, nutritionists and exercise physiologist.

In this study, there was a significant difference among coaches of different sport codes providing knowledge about nutritional ergogenic supplements. Coaches of strength sports mostly recommended protein and amino acid supplements. Another study supports the fact that coaches (58%) recommend nutritional supplements (Kruseman *et al.*, 2008). In a study on strength sport coaches (63 males, 30 females), it was found that all of the males and 47% of the female coaches stated that they gave a diet program to those whom they were coaching. However, only male coaches (62%) recommended anabolic steroids (Jazayeri & Amani, 2004).

It is a basic objective for an athlete to sustain his or her energy balance. Carbohydrates are the main nutrients that provide the energy needs, and have a critical role particularly in high intensity long-term exercises. Especially, before an exercise, it is recommended to consume some food containing low fat and fibre, proteins at medium levels and rich in carbohydrates but with a low Glycaemic Index. As the duration and intensity of exercise increases minerals are lost. Sport drinks may be useful in long duration exercises since the sport drink replace mineral loss. Even if it is known that carbohydrates with a high Glycaemic Index ensure better saturation in glycogen storage, it is useful to consume 3 to 6g essential amino acids in order to increase the protein synthesis after the exercise (Fink *et al.*, 2006). In the current study, in response to the question, "What do you recommend your athletes as the last main meal before, during and after the exercise?", the two most common answers for the pre-

exercise period was: a meal that contains complex carbohydrates and a meal that contains carbohydrates and proteins together; during exercise, water and sport drinks; and for the post-exercise period, plenty of water and fruits. No significant difference was observed among the groups in the answers to the questions. Carbohydrate and protein should be recommended by coaches especially after training. Other researchers state that coaches make recommendations mostly before the competition and recommend food rich in protein but poor in fat, whereas they do not make any special recommendation for the exercise period (Juzwiak & Ancona-Lopez; 2004). Although the main source of energy for athletes is carbohydrates, Juzwiak and Ancona-Lopez (2004) report that coaches recommend food rich in protein for gymnastics, tennis, swimming and judo.

Most of the participants knew what the four main nutrient groups were (89.7%), and that food such as rice, pasta and bread were rich in carbohydrates (94.5%). The percentage was high for those who gave the expected answers to questions about nutrition before, during and after a competition and knowledge about fluid and sport drink intake. The percentage who gave the answer, 'TRUE', to the question, "In order to increase the muscle mass, one should take proteins more than the amount actually needed" was high (58.8%), which suggest that there is limited nutritional knowledge. Although a previous study has shown that 96.8% of coaches did not know that minerals are essential nutrients and 88.2% of coaches did not know that water is an essential nutrient (Jazayeri & Amani, 2004). Another study has shown that the coaches emphasised that carbohydrates are the primary energy sources and food rich in protein should not be consumed in the last main meal right before a competition (Yıldiran & Bayraktar, 2000). This indicate the limited knowledge of coaches and that each coach had different nutritional knowledge.

Most coaches gave the expected answers to both general nutritional questions (excluding the eighth question), and sport nutrition questions (excluding the twentieth question). There were significant differences between the groups only in the answers given to the questions, "Food rich in carbohydrates should be consumed in the recovery period" and "Fluid intake should stop one hour before the competition". The rate of the answer 'TRUE' of coaches of team and endurance sports was higher on the question, "Food rich in carbohydrates should be consumed in the recovery period" than coaches of strength and explosive power sports. Most of the coaches of strength and explosive power sports answered "protein" to this question. This could be because these coaches believed that protein was more effective for muscle mass and muscle tissue repair than carbohydrates for strength and explosive power athletes. The rate of the answer, 'FALSE' of team sport's coaches was higher for the question, "Fluid intake should stop one hour before the competition", than the other coaches.

There was a significant difference between the groups in their response to the statement, "Fats are the most important nutrient to increase the performance", according to the level of coaching. It was found that the coaches in the first three levels tended to give the expected answer more than the others did. However, the levels of coaches did not lead to any significant difference in their answers to the questions about nutritional knowledge in this study.

Various studies conducted previously with the aim to determine coach's nutritional knowledge level found that the coaches had insufficient knowledge about nutrition (Sossin *et*

al., 1997; Yıldıran & Bayraktar, 2000; Shifflett *et al.*, 2002; Çongar & Özdemir, 2004; Zinn 2004; Kruseman *et al.*, 2008). Some other studies showed that they gave correct answers to the nutritional knowledge questions and, therefore, they had a sufficient knowledge level (Bedgood & Tuck, 1983; Pantano, 2006; Smith-Rockwell *et al.*, 2011; Torres-McGehee *et al.*, 2012).

CONCLUSIONS

This study aimed to assess the nutritional knowledge levels and nutritional habits/status of coaches who play an important part in the lives of athletes and the recommendations they gave to their athletes. Nutritional knowledge of most coaches was sufficient since most coaches gave the correct answers to both general nutritional knowledge questions and sport nutritional knowledge questions. Nevertheless, nutritional habits of most coaches were insufficient. Coaches provided their athletes with knowledge about nutrition specifically about sufficient and balanced diet, ergogenic supplements and nutrition during the exercise/competition periods. Coaches of strength sports mostly recommend proteins/amino acid supplements compared to the other sporting codes. Although coaches said they had knowledge on sport nutrition and they gave the expected answers to sport nutrition questions, they did not recommend accurate knowledge about training session nutrition to their athletes. It is important that coaches have correct knowledge. Therefore, the knowledge sources of coaches must be reliable, such as registered dieticians, nutritionists and exercise physiologists. The coaches should be properly educated in nutrition by sport dieticians, nutritionists and exercise physiologists. More nutritional knowledge questions can be researched in future studies.

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