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Nutritional Knowledge, Attitudes, and Food Practices among Competitive Athletes, Recreational Athletes and Non-Participants*

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ABSTRACT

The objective of the study was to compare nutritional knowledge, attitudes and food practices of competitive athletes, recreational athletes and non-participants. All students enrolled at the University of Nebraska in an Introductory Nutrition course in which sports nutrition was stressed, were asked to participate in the study. The course was typical of many introductory nutrition courses; about two thirds of the students were from the Department of Health, Physical Education and Recreation, and most of the students were encouraged to take this course by their advisers. The students were divided into three groups: 20 competitive athletes (mostly runners, swimmers, basketball players and football players for the University), 14 recreational athletes (who were involved in a planned exercise program at least 2 hours per week), and 19 non-participants. At the beginning of the semester, students completed a food frequency questionnaire, and a 24-hour food record based on the Food Guide Pyramid. A nutrition knowledge and attitude questionnaire was formulated specifically for this study, covering normal nutrition and sports nutrition. The results showed that consumption of foods from all Food Guide Pyramid food groups except the fats/oils/sweets group was not significantly different among the three student groups. Regarding the fats/oils/sweets group, competitive athletes consumed significantly more numbers of servings than recreational athletes, while the recreational athletes consumed significantly more than non-participants ($p < 0.01$). The total mean scores from the nutrition attitude and knowledge questionnaire were not significantly different among the three student groups. However, combined athletes (competitive athletes and recreational athletes) obtained significantly higher scores on some of the nutrition attitude questions and had significantly lower scores on some of the nutrition knowledge questions ($p < 0.05$). The results of the study indicate that athletes, whether competitive or recreational, had a very positive attitude regarding the effects of nutrition on their sports performance and health; however, these athletes did not appear to apply scientific principles of sports nutrition to their diet. In conclusion, advising athletes to simply increase or decrease their intakes of certain foods is too simplistic an approach for maintenance of good health and for better sporting performance. Athletes and non-athletes need continuous nutrition education to help with improving their competitive edge and food choices.

KEY WORDS: nutritional knowledge, attitude, practice, competitive athletes, recreational athletes.

INTRODUCTION

The attitude of a person towards a specific concept is affected by many factors; education is only one of these factors. Knowledge of nutrition has been related to attitudes towards nutrition of several professional and non-professional groups.[1,2] College students are an appropriate target audience for nutrition education because their dietary practices are often poor and their lives are in transition. Change of dietary behavior often occurs at such transition points, so the potential for positive planned change is greater for this group.[3,4]

Peak performance and good health involve proper nutrition and physical fitness. There are no magic diets that will make an athlete win. Good genes, good conditioning and a proper diet are needed to build a fit body or an elite athlete.[5] There is too much misinformation in the field of sports nutrition and too many sales of super wonder pills. Misinformation spreads through electronic and printed media to the players, their coaches and trainers.[6-13] Nutrition has been one of the most neglected areas in sports medicine.[14,15] Too few involved in sports and fitness know that there are qualified sports nutritionists/dietitians. Although coaches, trainers and athletes usually understand the principles of physical training, they often neglect the equally well-developed principles of nutrition.[16-18]

It is important for coaches to have sufficient knowledge of nutrition concepts and also to have a sports nutritionist help with the team, especially for the sports which have weight restrictions. Weight control leads to tension between the coaches and their athletes, especially women ath-

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letes.[14][19-25] In order to best serve elite athletes, it is necessary to know something about what the coaches are telling the players, what the athletes know about nutrition, and what the athletes are actually eating.[24-29]

Although much is known about the nutrition knowledge, attitudes, and dietary practices of college students in general, little is known about those of college athletes *and athletes alike*. Because of the sharp increase in the number of people involved in vigorous exercise programs, it is very important to evaluate the nutritional needs of athletes. Erroneous interpretations of nutritional messages have caused many athletes to decrease, eliminate, or increase intakes of certain types of foods, supplements or sports drinks.[30-35]

The objective of the study was to compare nutrition knowledge, attitudes, and practices of competitive athletes, recreational athletes, and non-participants.

METHODS

1. Sample selection

All students enrolled in an Introductory Nutrition course, in which the sports nutrition component was stressed, were asked to participate in the research study. This course was typical of many introductory nutrition courses in that it had no prerequisites and was taken by students from all colleges within the University of Nebraska, Lincoln. However, about two thirds of the students were from the Department of Health, Physical Education and Recreation, and most of them were encouraged to take this course by their advisers. Participation in the study was one of several activities in which enrollees could use to fulfill requirements of the course. The subjects for the study were 53 apparently healthy young adults. They were divided into three groups: 20 competitive athletes (mostly runners, swimmers, basketball players, and football players), 14 recreation athletes (who were involved in a planned exercise program at least 2 hours per week), and 19 non-participants. Classification of the individuals was in part determined by the subjects themselves and in part by the investigator on the basis of examination of the subjects' physical activity records. Individuals who did not clearly fall into one of these categories were not included in the final calculation of the data.

2. Data collection

Demographic data were collected from the students who had signed written agreements to participate in the study. At the beginning of the semester, students completed a food frequency questionnaire and a 24-hour food record based on the Food Guide Pyramid. A nutrition knowledge and attitude questionnaire was written specifically for this study, covering normal nutrition and sports nutrition. The questionnaire contained 28 questions (10 attitude questions and 18 knowledge questions) presented in the form of the statements to be answered: *Strongly agree, Agree, Don't know, Disagree, or Strongly disagree.* In scoring the questionnaire, subjects received varying points for degree of agreement or disagreement with the value statement. Responses for the value statement were scored from 1 to 5: +5 for Strongly agree, +4 for Agree, +3 for Don't know, +2 for Disagree, and +1 for Strongly disagree. For negatively worded statements, the opposite scoring system was used: +5 for strongly disagree, +4 for Disagree, +3 for Don't know, +2 for agree, and +1 for strongly agree.

3. Data analysis

The Statistical Analysis System (SAS) program was used to analyze nutritional knowledge, attitudes and food practices of the three different groups: analysis of variance, least square means, frequency distribution, and orthogonal contrasts were used.

RESULTS AND DISCUSSION

As shown in Table 1, the mean age of subjects was 21 years old. Subjects included both males and females. The mean weight of competitive athletes was the highest among the three student groups, at 168 lbs, compared to 147 lbs for recreational athletes, and 144 lbs for nonparticipants.

Table 2 shows the subjects' preference for using salt and pepper at the table according to the 24-hour recall. Typically, salt and pepper are added at the table to the food served in America. In order to find out how much sodium was consumed, subjects were asked if they added salt and pepper at the table. Forty-three percent of the non-participants added salt to the food at the table, while competitive athletes and recreational athletes added less additional salt (35% and 28%, respectively). Non-participants also preferred additional pepper, compared to com-

Table 1. Demographic profile of subjects

	Competitive athletes	Recreational athletes	Non-participants
Age (years)	20.8	21.2	21.5
Gender: Female	11	7	12
Male	9	7	4
Weight (lbs)	168	147	144

Table 2. Salt and pepper preferences of competitive athletes, recreational athletes, and non-participants during their meal (using 24-hour recall)

	Competitive athletes	Recreational athletes	Non-participants
Adding salt	35%	28%	43%
Adding pepper	45%	35%	56%

Table 3. Food group consumption of competitive athletes, recreational athletes and non-participants assessed by a 24-hour food record using the Food Guide Pyramid[a)]

Food group	Recommended intake[a)]	Competitive athletes	Recreational athletes	Non-participants
Grain/cereal/bread	6 – 11	5.79 ± 0.64	5.57 ± 0.71	5.45 ± 0.76
Vegetable	3 – 5	2.00 ± 0.32	1.85 ± 0.35	1.41 ± 0.38
Fruit	2 – 4	1.44 ± 0.31	1.42 ± 0.31	1.83 ± 0.37
Dairy	2 – 3	2.91 ± 0.46	2.85 ± 0.50	2.75 ± 0.54
Meat	2 – 3	2.71 ± 0.29	2.07 ± 0.32	1.83 ± 0.35
Fat, oil, & sweet	use sparingly	4.82 ± 0.45	3.14 ± 0.49*	2.04 ± 0.53**

a) Number of servings
*: Indicates significant difference between competitive athletes and recreational athletes ($p < 0.01$)
**: Indicates significant difference between combined athletes and non-participants ($p < 0.01$)

petitive athletes and recreational athletes (56%, 45% and 35%, respectively). In summary, salt and pepper were less used at the table by recreational athletes, compared to competitive athletes and non-participants.

The food consumption results (Table 3), based on the Food Guide Pyramid, indicated that there were no significant differences among the three student groups regarding the number of servings consumed in the grain/bread/cereal group, the vegetable group, the fruit group, the dairy group and the meat group. However, the most numbers of servings from each food group, except the fruit group, were consumed by competitive athletes, and the least by non-participants. Non-participants consumed more fruits than other groups (non-participants, 1.83 servings/day; competitive athletes, 1.44 servings/day; and recreational athletes, 1.42 servings/day), while both competitive athletes and recreational athletes consumed more vegetables than the non-participants (competitive athletes, 2.00 servings/day; recreational athletes, 1.85 servings/day; non-participants, 1.41 servings/day). The average amounts from each food group consumed by competitive athletes, recreational athletes and non-participants (except for fats/oils/sweets) were within the recommended range (in the case of dairy and meat products) or less than the recommended range (grain/cereal/bread, vegetables and fruits). Fat/oil/sweet consumption levels were significantly different between competitive and recreational athletes

Table 4. Frequencies of consumption of selected food items of competitive athletes, recreational athletes and non-participants assessed by food frequency questionnaire

Food items	Competitive athletes	Recreational athletes	Non-participants
Milk	1.65 ± 0.20	1.92 ± 0.25	1.93 ± 0.24
Ice cream	3.75 ± 0.24	3.64 ± 0.29	4.20 ± 0.28
Cheese	2.25 ± 0.20	2.14 ± 0.24	3.46 ± 0.23*
Ham, cured sausage	3.80 ± 0.23	3.92 ± 0.27	4.06 ± 0.26
Bacon	4.05 ± 0.22	4.21 ± 0.26	4.20 ± 0.25
Beef stew, pot roast	4.15 ± 0.21	4.14 ± 0.25	4.20 ± 0.24
Hamburger, steak	2.75 ± 0.27	2.71 ± 0.32	2.66 ± 0.31
Chicken, poultry	2.70 ± 0.20	2.71 ± 0.24	2.93 ± 0.24
Frankfurter, bologna	4.05 ± 0.31	4.07 ± 0.37	3.93 ± 0.36
Fish	4.20 ± 0.24	4.28 ± 0.29	4.26 ± 0.28
Whole wheat bread	2.50 ± 0.32	2.71 ± 0.38	2.40 ± 0.41
White bread/roll	2.35 ± 0.35	2.71 ± 0.42	2.40 ± 0.41
Egg	3.35 ± 0.23	3.28 ± 0.27	3.86 ± 0.26
Potatoes	2.45 ± 0.18	2.21 ± 0.21	3.73 ± 0.20
Dark leafy greens	3.50 ± 0.28	3.35 ± 0.34	4.33 ± 0.32*
Broccoli	3.95 ± 0.28	3.71 ± 0.34	4.33 ± 0.32
Carrots	3.70 ± 0.32	3.71 ± 0.38	3.73 ± 0.37
Tomatoes, juice	3.95 ± 0.35	3.78 ± 0.42	3.73 ± 0.41
Apple, juice	3.35 ± 0.27	3.07 ± 0.32	2.86 ± 0.31
Orange, juice	2.50 ± 0.25	2.28 ± 0.30	2.06 ± 0.29
Vit. C fortified drink	3.70 ± 0.38	3.28 ± 0.45	3.46 ± 0.44
Potato or corn chips	2.55 ± 0.30	2.92 ± 0.36	2.80 ± 0.35
Kool aid	4.15 ± 0.39	3.85 ± 0.47	4.00 ± 0.45
Soda pop (regular)	2.20 ± 0.44	3.28 ± 0.53	3.13 ± 0.51
Soda pop (low sugar)	3.50 ± 0.44	4.07 ± 0.53	2.86 ± 0.51
Dougnuts	3.80 ± 0.26	3.78 ± 0.31	4.00 ± 0.30
Sweet pastries	3.90 ± 0.28	3.64 ± 0.34	3.60 ± 0.33
Cakes	3.95 ± 0.26	3.85 ± 0.31	4.00 ± 0.30
Candy	3.00 ± 0.30	2.64 ± 0.36	2.93 ± 0.34
Cookies	3.55 ± 0.25	3.21 ± 0.30	3.20 ± 0.29
Alcoholic beverages	3.60 ± 0.32	4.07 ± 0.38	3.46 ± 0.37
Tobacco products	5.40 ± 0.38	5.21 ± 0.45	3.26 ± 0.44*
Tea	4.05 ± 0.33	4.71 ± 0.40	3.60 ± 0.38
Coffee	5.10 ± 0.39	5.07 ± 0.46	3.46 ± 0.45*
Sports drinks	4.75 ± 0.31	4.78 ± 0.38	5.13 ± 0.36

*: Indicates significant differences between combined athletes and non-participants ($p < 0.01$)
1) Once a day or more
2) Several times/week
3) Once/week
4) Once/month
5) Rarely
6) Never

($p < 0.01$), and between combined athletes and non-participants ($p < 0.01$); competitive athletes consumed 4.82 servings per day, recreational athletes consumed 3.14 servings per day, and non-participants consumed 2.04 servings per day.

The average frequencies of consumption of cheese, dark green leafy vegetables, coffee, and tobacco (Table 4) were found to be significantly different between combined athletes and non-participants ($p < 0.01$). Cheese consumption of non-participants was significantly lower than competitive athletes and recreational athletes (non-partici-

pants, once/week; competitive athletes and recreational athletes, several times/week, $p < 0.01$). Less dark green leafy vegetables were consumed by non-participants than competitive athletes and recreational athletes (non-participants, once/month; competitive athletes, several times/week, $p < 0.01$). Non-participants consumed more coffee and tobacco than competitive athletes and recreational athletes, while the consumption of alcoholic beverages and tea were not significantly different between the student groups. The preference for sports drinks was not found to be significantly different among the three student groups; competitive athletes and recreational athletes consumed sports drinks once a month or rarely, while non-participants consumed sports drinks rarely or never.

As shown in Table 5 and Table 6, the total mean scores for nutrition attitudes and nutrition knowledge were not significantly different among the three groups. However, combined athletes scored significantly higher from the questions that "*learning nutrition facts is the best way to achieve favorable changes in food*", and lower scores from the question that "appearance is the strongest motivator for most people to try to achieve and maintain ideal weight" (competitive athletes, 4.00; recreational athletes, 4.00; and non-participants, 4.56) than non-participants.

Competitive athletes generated significantly higher scores ($p < 0.05$) than recreational athletes from the question that "*very poorly-fed people are much more likely to revolt than are those who are marginally fed*" (which is false); competitive athletes scored 3.30, while recreational athletes scored 2.57, and this might be due to combined athletes' experiences.

Combined athletes received significantly lower scores ($p < 0.05$) from the question "*male and female athletes participating in running sports are prone to develop iron deficiency anemia*" (which is true); competitive athletes scored 3.15, recreational athletes scored 3.07, and non-participants scored 3.56. Combined athletes received significantly lower scores ($p < 0.05$) from the question "*the most reliable food sources of calcium is milk and milk products such as cheese and yogurt*" (which is true); competitive athletes scored 3.95, recreational athletes 4.07, and non-participants 4.56. Combined athletes also received significantly lower scores ($p < 0.05$) from the question "*athletes need to consume a heavy meal shortly before an athletic event in order to maintain energy needs*" (which is false); competitive athletes scored 3.75, recreational athletes 4.00, non-participants 4.43. Recreational athletes had higher scores than competitive athletes ($p < 0.05$) from the question that "*alcohol contains more calories than does carbohydrate*"; recreational athletes scored 3.71, while competitive athletes scored 3.05.

A former study of the nutrition knowledge and food practices of 115 college athletes, compared to 55 non-athletes, found that non-athletes and females had signifi-

Table 5. Nutrition attitude responses of competitive athletes, recreational athletes and non-participants[a)]

Questions	Competitive athletes	Recreational athletes	Non-participants
1. Learning nutrition facts is the best way to achieve favorable changes in food habits. (False)	1.80 ± 0.19	2.00 ± 0.23	1.31 ± 0.22**
2. Good eating habits are more easily achieved when children are very young. (True)	4.05 ± 0.18	4.50 ± 0.22	4.25 ± 0.21
3. High school and college athletic coaches can influence the eating practices of athletes under their supervision. (T)	3.80 ± 0.22	3.78 ± 0.27	3.93 ± 0.25
4. School food service (school lunch) and dormitory food service programs generally serve meals which are nutritionally well balanced. (T)	3.20 ± 0.22	3.50 ± 0.27	3.62 ± 0.25
5. Governmental programs to provide meals to special groups such as children, pregnant women, the elderly, or the poor are really a waste of tax dollars. (F)	4.15 ± 0.20	4.00 ± 0.24	4.00 ± 0.23
6. Very poorly-fed people are much more likely to revolt than are those who are marginally fed. (F)	3.30 ± 0.19	2.57 ± 0.23*	2.68 ± 0.21
7. In general, athletic coaches are excellent sources of accurate nutrition information. (F)	3.20 ± 0.22	3.50 ± 0.26	3.25 ± 0.25
8. Most foods that are really good for you do not taste very good. (F)	3.75 ± 0.21	3.92 ± 0.25	3.75 ± 0.23
9. People really have to think a lot about what to eat in order to achieve a good diet. (F)	2.50 ± 0.23	2.42 ± 0.27	2.12 ± 0.25
10. Appearance is the strongest motivator for most people to try to achieve and maintain ideal weight. (T)	4.00 ± 0.16	4.00 ± 0.19	4.56 ± 0.18**
Means of total score	33.75 ± 0.66	34.21 ± 0.79	33.50 ± 0.74

a) Total possible score = 50
*: Indicates significant difference between competitive athletes and recreational athletes ($p < 0.05$)
**: Indicates significant difference between combined athletes and non-participants ($p < 0.05$)
T = True statement F = False statement
When the statement is true, 1 = Strongly disagree, 2 = Disagree, 3 = Don't know, 4 = Agree, 5 = Strongly agree
When the statement is false, 1 = Strongly agree, 2 = Agree, 3 = Don't know, 4 = Disagree, 5 = Strongly disagree

Table 6. Nutrition knowledge of competitive athletes, recreational athletes and non-participants[a)]

Questions	Competitive athletes	Recreational athletes	Non-participants
11. Gelatin is a good source of high quality of protein. (F)	3.05 ± 0.23	3.35 ± 0.28	3.06 ± 0.26
12. Athletes who are trying to increase their muscle mass need to consume special protein and amino acid supplements in addition to ordinary food. (F)	2.90 ± 0.25	3.14 ± 0.30	2.75 ± 0.28
13. Male and female athletes participating in running sports are prone to develop iron deficiency anemia. (T)	3.15 ± 0.15	3.07 ± 0.18	3.56 ± 0.17**
14. The very low body fat levels found in athletes may make them prone to brittle bone disease. (T)	3.20 ± 0.19	3.28 ± 0.22	3.50 ± 0.21
15. Salt tablet consumption is recommended for athletes who participate in activities involving excess sweating. (F)	3.25 ± 0.27	3.07 ± 0.33	2.81 ± 0.31
16. Carbohydrate loading works better for untrained than for trained athletes. (F)	3.35 ± 0.18	3.42 ± 0.21	3.60 ± 0.20
17. Tobacco smoking increases the body's need for vitamin C. (T)	3.10 ± 0.19	3.28 ± 0.23	3.62 ± 0.22
18. The most reliable food source of calcium is milk and milk products such as cheese and yogurt. (T)	3.95 ± 0.20	4.07 ± 0.24	4.56 ± 0.23**
19. Fat from plant sources is cholesterol free. (T)	3.05 ± 0.17	2.78 ± 0.20	3.18 ± 0.19
20. Some plant fats are more saturated than are animal fats. (T)	2.90 ± 0.18	3.07 ± 0.22	3.06 ± 0.21
21. Iron from meat is more bioavailable than is iron from bread. (T)	3.35 ± 0.17	3.14 ± 0.21	3.43 ± 0.20
22. People may become dehydrated without becoming thirsty first. (T)	4.05 ± 0.19	3.92 ± 0.23	4.00 ± 0.21
23. Infants seem to be born with a liking for sweet flavors. (T)	3.05 ± 0.19	3.21 ± 0.23	3.56 ± 0.22
24. Under all circumstances, breast feeding of babies is more preferable than is bottle feeding. (F)	2.30 ± 0.27	2.57 ± 0.32	2.12 ± 0.30
25. Athletes need to consume a heavy meal shortly before an athletic event in order to maintain energy needs. (F)	3.75 ± 0.18	4.00 ± 0.21	4.43 ± 0.20**
26. Alcohol contains more calories than does carbohydrate. (T)	3.05 ± 0.21	3.71 ± 0.25*	3.93 ± 0.23
27. Stopping smoking usually results in substantial weight gain. (F)	2.50 ± 0.23	2.78 ± 0.28	2.25 ± 0.26
28. Special sports drinks are needed for peak sports performance. (F)	4.25 ± 0.21	4.21 ± 0.26	3.81 ± 0.24
Means of total score	58.20 ± 1.18	60.14 ± 1.41	61.31 ± 1.32

a) Total possible score = 90
*: Indicates significant difference between competitive athletes and recreational athletes ($p < 0.05$)
**: Indicates significant difference between combined athletes and non-participants ($p < 0.05$)
T = True statement F = False statement
When the statement is true, 1 = Strongly disagree, 2 = Disagree, 3 = Don't know, 4 = Agree, 5 = Strongly agree
When the statement is false, 1 = Strongly agree, 2 = Agree, 3 = Don't know, 4 = Disagree, 5 = Strongly disagree

cantly higher nutrition knowledge scores and lower nutrient intakes (from a 24-recall) than athletes and male subjects.[19] In the present study, nutrition knowledge scores of non-athletes (non-participants) were not significantly higher than those of the athletes. However, non-athletes showed significantly higher scores than athletes for some nutrition knowledge questions. Non-participants had lower intakes of food groups than competitive athletes and recreational athletes, although they appeared well aware of the importance of lowering fat, oil, and sweet consumption. Athletes should be counseled to increase the consumption of foods from the grain/bread/cereal and dairy groups while decreasing foods high in fats, oils, and sweets.

Gollman and Carlyle[29] investigated whether exercising adult members of a university wellness center had greater nutrition knowledge and better eating habits than non-exercisers, by administering questionnaires to 240 subjects by mail. It was found that exercisers were significantly better informed and had better eating patterns than non-exercisers. In the present study, mean scores of nutrition attitudes indicated that combined athletes had somewhat more positive attitudes than non-participants, and the mean scores of nutrition knowledge were somewhat higher for non-participants than recreational athletes and competitive athletes.

From the results of the study, it can be concluded that athletes, whether competitive or recreational, had very positive attitudes towards the effects of nutrition on their exercise performance and health; however, they were found to be not actually applying scientific principles of sports nutrition to their diets.

Since the relationship between nutrition and sports has become of increasing interest to athletes as well as to people in general,[36-41] most dietetic programs need to include more information on sports nutrition. Also, it is necessary to include nutrition course work in athletic programs, to achieve improved eating patterns for improved performance.

In conclusion, advising athletes to simply increase or decrease their intakes of certain foods is perhaps too simplistic an approach for maintenance of good health status

and better physical performance. Athletes and non-athletes should be offered and would benefit from continuous nutrition education.

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