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Nutritional Status and Dietary Practices of Female Athletes

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Abstract: The aim of this study was to assess the nutritional status and the feeding practices of female athletes practicing sport at the first class level. The sample of was taken from three sports clubs in Alexandria and included 124 athletes practicing handball, basketball or volleyball. Each athlete was privately interviewed using a pre-coded questionnaire to collect data on her educational level and her source of advice regarding athletic nutrition. Data was collected on the exact composition of the diet consumed before competition which were analyzed using the Egyptian food composition table. The diet was classified into balanced diet, unbalanced diet, high carbohydrate or high protein diets. Athletes were questioned about the time of consuming diet before competition and about fluid intake before, during and after the sport event. The athletes were also requested to provide information on the type of supplement frequently consumed. The nutritional status of the athletes was assessed using a set of anthropometric measurements including body weight, height, waist and hip circumferences. BMI was calculated. The results show that anthropometric measurements were within normal range. The team coach and older players were the main sources of nutrition advice. Only 22.6% of the athletes consumed a balanced diet and a similar proportion consumed a high carbohydrate diet. Meals were consumed by 42.8% of the players less than 3 hours before competition. Fluids were omitted by 33.1% and 50.8% of the athletes before and during competition. Nutritional supplements were taken by 73.4% of the players, performance enhancing supplement was most commonly used particularly by university graduates. The results confirm that poor dietary practices are quite prevalent and necessitate the inclusion of a nutritionist in the training team.

INTRODUCTION

The composition and timing of food intake of athletes can dramatically affect exercise performance, recovery rate, body weight and health. Sports nutrition has grown over the past two decades linking how an athletic eats with how they perform during practice and competition events.(1) Young athletes are either misinformed or have misconceptions about sports nutrition. Proper nutrition for young athletes is critical not only to promote performance, but more importantly to their growth, development and overall health.(2)

Female athletes are susceptible to

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what is known as the female athlete triad of disordered eating, amenorrhea and osteoporosis.[3] In addition, female athletes have excessive concern over body weight and resort to severe food restriction which may impair their nutrition.[4]More importantly, female athletes stand a greater chance of developing complications or injuries associated with an increased level of exercise and poor dietary practices.[5]

Female athletes need to understand good nutritional practices. The limited information they learn in secondary school is slightly increased during college years. The kind of information learned and the importance young people place on this knowledge affect both their nutrition and performance.[6]

Ronsen et al [7] found that despite of differences between sports groups, many female athletes report unsatisfactory nutritional habits. Micronutrient supplementation was prevalent but varied between both groups of sports. *Nichols et al* [8] reported that 88% of female endurance athletes were consuming less than the minimum amount of energy needed for training. This may represent a chronic low level stressor instigating cortisol release. Such disorder occur more frequently in women with high level of cognitive and dietary restrain.[9]

When energy intake of female athletes is less than might be anticipated based on their training load, the intakes of iron calcium, vitamin B_{12} and Zinc and other nutrients are often below the recommended daily allowances.[10] In addition, athletes involved in heavy training may need more of some vitamins such as thiamin, riboflavin and B_6 because they are involved in energy production but the amount needed may be obtained by increasing food intake.[11] However, if the athlete consume a low calorie diet with limited food intake, she will never cover her daily requirements from several nutrients

such as minerals and vitamins.

Hydration status and fluid consumption have a profound effect on performance during endurance activities lasting more than 60 minutes.[12] Water lost from the body via urine, gastrointestinal tract, evaporation from skin and respiration is exacerbated by heat , humidity or fluid restriction during exercise.[13] Those conditions are quite prevalent in Egyptian stadiums. It is very critical to pay special attention to fluid intake and hydration strategies of female athletes particularly during the hot weather which prevails over 6 months in Egypt.

Sound nutritional practices is essential to athletic success by maximizing performance and speeding recovery time.[14] However, female athletes have poor grasp of sound nutritional information which is mostly provided by trainers or coaches.[15] Coaches can help to enhance the performance of their athletes by promoting good nutrition, however, they need to have the nutritional knowledge in order to encourage healthy food choices.[16] Coaches of Egyptian teams are usually retired player without proper experience or training in physical education or nutrition. In fact, some trainers and coaches may recommended old food habits and taboos followed while they were practicing sports. This would be negatively reflected on the information they pass to their players who can not gain from recent development in sports nutrition.

Although the nutrition and feeding practices of athletes received considerable world wide attention and have been extensively used in upgrading the performance of athletes, this subject was not properly investigated in Egypt. Literature review revealed little information about the nutritional status of female athletes. Such activities in sports clubs are concentrated on the regulation of body weight of athletes. Therefore, this study was initiated to investigate the nutritional

status and feeding practices of female athletes in Alexandria.

Subjects and methods

The subjects of this study were female athletes competing at the first class level. The study was implemented in three leading sports clubs in Alexandria Governorate. The administration of every club was met to obtain their permission to interview the athletes and to carry out the study. The aim of the study was explained to all athletes from teams in the three clubs and were invited to participate in the study. The total sample included 124 female athletes practicing either handball (42), basketball (36) or volleyball (46) .

Each player was privately interviewed using a pre-coded questionnaire to collect data on her level of education, the sources of information and advice concerning their nutrition. Athletes were requested to provide detailed information regarding their dietary practices including the composition of the diet consumed before competition and the timing of consuming such diet. The components of the diet were analyzed using the food composition table of Egyptian foods issued by the National Nutrition Institute[17]. The diets were classified into balanced diet providing all nutrients in the recommended quantities, a diet rich in carbohydrates in which carbohydrates provide more than 75% of the calories, a diet rich in proteins in which proteins provide more than 20% of the calories and unbalanced diet deficient in one or more nutrients. The athletes were questioned about the exact quantities of water consumed before, during and after competition. They were also requested to provide information on the type of supplement frequently used while practicing sports. The supplements were either multivitamin preparation, minerals or performance enhancing supplement such as sports drinks, antioxidants, creatine or caffeine.

The nutritional status of the athletes

was assessed by using a set of anthropometric measurements including body weight which was measured to the nearest 0.5 Kg, height recorded to the nearest 0.5 cm. waist and hip circumferences recorded to the nearest 0.5 cm. All measurements were made using standard techniques[18]. Body weight and height were used in the calculation of the Body Mass Index (BMI; weight in kilograms divided by the square of height in meters).

Statistical analysis was performed using the statistical package for social sciences version 12.0. Descriptive data were calculated as frequencies. The association between variables was assessed using Chi-square test. Data on anthropometric measurements are presented in the form of means and standard deviation. Comparison between means was made using a one way analysis of variance. P values less than 0.05 were considered statistically significant.

RESULTS

The mean anthropometric measurements of female athletes practicing different sports is presented in Table (1). The mean height of basketball players (178.2 cm) was statistically higher than that of volleyball or handball players , 173.1 cm and 171.6 cm respectively. On the contrary, handball players had the heaviest body weight (66.1 kg) while basket ball players recorded the least body weight (63.8 kg). As a result, the body mass index of athletes from the latter group was least (20.1) and was significantly lower than that calculated for both volleyball and handball players, 21.4 and 22.6 respectively. Waist circumference was significantly lower (63.8 cm) for basketball players and was highest for athletes practicing handball (72.8 cm). Hip circumference was significantly higher (93.8 cm) for volleyball players, decreased to 91.6 cm for handball players and was least for basketball players. Analysis of variance revealed that anthropometric

measurements varied significantly in athletes practicing different sports.

The sources of advice about athletic nutrition for female athletes practicing different sports are illustrated in Table (2). The results show that coaches were the main source of nutrition advice (33.9%) followed by older players (27.4%) while physicians were the source for only 20.2% of the athletes. The source of nutrition information varied significantly with the level of education of the athletes ($\chi 2$ = 14.05, p< 0.05). Older players were the main source of nutrition advice for students and athletes with secondary school education, 43.3%, and 37.9% respectively. On the other hand, university graduates relied mostly on coaches (37.9%) and physicians (22.4%) to get the nutrition information. Mass media were the least important source of information for female athletes (18.5%).

The nature of the diet consumed before competition by female athletes was not significantly affected by the source of information regarding athletic nutrition (Table 3). The results show that 29.8% of the athletes consumed a high protein diet, 22.6% consumed either a high carbohydrate or balanced diet while 25% of the athletes consumed an unbalanced diet. The data show that when the advice was given by the coach or older players, the athletes consumed a high protein diet, 33.3% and 32.4% respectively. When the information was drawn from mass media, 39.1% of the players consumed unbalanced diets. Balanced diets were mostly consumed when physicians were the source of nutrition advice (32.0%).

The timing of meal consumption before competition was significantly modified by the source of nutrition advice (Table 4). The data show that 20.2% of the athletes consumed their diet less than two hours before competition, another 22.6% between two and three hours before competition and the majority (33.0%)

consumed their diet more than four hours before competition. When the coach was the source of advice, 59.5% of the athletes had their diet more than four hours before competing . when older players and physicians gave the advice, the majority of the athletes had their diets three to four hours before competition, when mass media were the source of information , the majority of the players (34.8%) had their diet less than two hours before competing. The differences were statistically significant ($\chi 2 = 24.05$, $p < 0.001$).

The mean fluid consumption by female athletes before, during and after competition is presented in Table 5. The mean fluid consumption was 0.85 liter before competition , decreased to 0.46 liter during competition and was highest (1.17 liter) after the sports events were completed. The data also show that while 50.8% of the athletes omitted fluid intake while competing, 33.1% did so during competition and only 16.9% did not take any fluids after competition. The results also show that 29.0% of the female athletes consumed less than one liter before competition , such percent increased to 35.5% while competing and declined to 21.8% when the sport event was completed. The majority of the players (47.6%) consumed between 1-2 liters after competition and another 13.7% consumed more than 2 liters.

The results presented in Table 6 show that the level of education of the female athletes had a significant effect on the intake of nutritional supplement ($\chi 2 = 16.16$, $p < 0.05$). The data show that 26.6% of the female athletes did not take any supplement, 23.4% used multivitamin preparations, 21.8% consumed mineral supplement and 28.2 % used performance enhancer supplements. Students and athletes with secondary school education were more likely to consume mineral supplement (29.8% and 24.1% respectively). Performance enhancer

supplements were mostly consumed by female athletes with university education (41.4%), this was significantly higher than that reported among students and athletes with middle level of education (16.2% and 17.2% respectively)

Discussion

Marinating a strong and healthy athletic performance is more than just a matter of training, practice and keeping in shape. The body of the athlete needs support in the form of sound nutrition, proper hydration and rest in order to keep performing and responding at peak level.

Female athletes tend to have nutritionally inadequate diet and thus may be at risk when taxing their bodies in heavy training schedule. Poor nutrition in female athletes is often associated with performance plateau and repeated injuries.

The results of this study show that Anthropometric measurements of female athletes were within normal range. However, significant variations were evident between athletes practicing different sports. Basketball player were taller and had a lighter body weight when compared with handball or volleyball players. (Table 1). It is evident that the nature of the sport requires the selection of athletes with special body measurements. Tall athletes are naturally selected for basketball, while shorter but heavier athletes are better suited to practice the more violent handball.

Young female athletes' concern about weight and body image strongly influence their eating practice. Knowledge alone is not enough to ensure good dietary habits. Coaches and others who work with athletes must teach young people how to select foods that will promote good health and upgrade their athletic performance. The results of the present study (Table 2) show that coaches are the main source of nutrition advice to female athletes, however, older players who might have inadequate knowledge had a strong

influence on young female athletes. University educated athletes were more keen to follow physicians' advice while students were more responsive to their older team mates. *Georgiou et al* [19] reported that both athletes and coaches have limited nutritional knowledge and indicated that nutrition education is needed for those who influence young athletes.

More than 20 years ago, *Barr* reported that nutrition information sources were positively associated with nutritional knowledge of athletes. The most frequent sources were magazine, coaches and team mate, fewer athletes cited physicians as the source of advice.[20] This is quite comparable to that reported in the present study. The problem facing female athletes is that coaches and physicians do not have adequate knowledge about sports nutrition and may give the athletes wrong advice. It is essential to have a nutritionist in the training team to plan the meals for the athletes , follow the change in their body weight, select the diet that should be consumed before competition and to apply the recent concepts in athletic nutrition such as glycogen loading . This is not the case in almost all Egyptian teams competing at the national or international levels. The role of the nutritionist is usually assumed by the coach, the physician or some times older players. *Clark et al* (2003), expressed the importance a sport dietitian has in improving adequate nutrition education and improving performance during the competition seasons.[21]

The results presented in table 3 show that female athletes did not receive proper nutrition advice as 25% consumed unbalanced diet and 29.8% received a high protein diet. Active athletes often think they need to consume high protein diets to cover the building and repair of their tissue. A diet providing 15% of energy from protein would cover all the requirements and there is little need to recommend that athletes

consume more protein.[22]

Despite of the importance of carbohydrates in the diet consumed before competition, only 22.6% of the female athletes consumed a high carbohydrate diet providing more than 75% of the calories. (Table 3) Athletes benefit the most from the amount of carbohydrates stored in the body. Carbohydrates yield more energy per unit oxygen consumed than fats. Because oxygen is the limiting factors in long duration events, it is beneficial to the athlete to use the energy source requiring the least amount of oxygen per kilocalorie produced. Consumption of carbohydrate fluids is also recommended to increase carbohydrate intake which is the primary fuel substrate during exercise and to help the players to remain in energy balance.[23]

Timing of food intake is very important for athletes. Eating sensibly before exercise assure that there is enough energy to fuel exercise and at the same time does not impose additional burden induced by the digestion and absorption of ingested food. It was surprising to note that 42.8% of the players consumed their meal less than 3 hours before competition, this would definitely have a negative effect on the level of athletic performance and indicate that such players did not receive proper nutrition advice not only on the type of diet they consume but also on the timing of such diet (Table 4).

Water is an important nutrient for the athlete. Athletes should start any event hydrated and replace as much lost fluid as possible by drinking chilled liquids at frequent intervals during the event. Chilled liquids are absorbed faster and help lower body temperature. In violation of all scientific recommendations, the results show that fluid was omitted by 33.1% of the players before competition, 50.8% during competition and another 16.9% did not drink any fluids at least for one hour after competition. Female athletes mentioned

that after competition, their body temperature is high and water intake would harm them. This behavior indicates that, the athletes were poorly informed about their water and fluid requirements.

Fluid restriction will cause dehydration particularly in endurance events performed in hot environment as it always the case in Egypt. A hot environment can complicate the ability of the body to regulate temperature during exercise.[24] It is extremely essential that appropriate quantities of fluids should be taken at regular intervals during exercise and proper hydration should be secured at the end of the sport event.[25]

Nutritional supplements are taken to meat the dietary needs of high performance athletes to enhance and improve exercise performance and training adaptation, prevention of nutritional deficiencies, increase muscle mass and improved recovery.[26] The results presented in table 6 show that 73.4% of the female athletes take nutritional supplement. Performance enhancing supplements such as sport drinks, caffeine, creatine and antioxidants were more popular and were consumed by University graduate at a high rate (41.4%). Mineral supplements particularly iron may be needed for female athlete suffering from iron deficiency anemia. However, it was reported that mineral supplementation does not enhance performance in well nourished athletes.[27]

Multivitamin preparation was consumed by 21.8% of the athletes and was more common among university graduates (29.3%). Some athletes may be at risk of vitamin deficiency such as those who do not eat a well balanced diet, or those following a calorie restricted diet. Such athletes should take a multivitamin preparations. However, Increased caloric intake through a varied diet ensures a sufficient amount of vitamins and minerals. There is no evidence that taking more

vitamins than is obtained by eating a variety of foods will improve performance.

Table 1: Mean anthropometric measurements of female athletes practicing different sports

Anthropometric measurements	Number examined			ANOVA (F)
	Handball (42)	Basketball (36)	Volleyball (46)	
Height (cm)	171.6±4.3	178.2±7.3	173.1±8.1	69.41*
Body weight (kg)	66.1±5.9	63.8±5.7	64.6±5.4	9.56*
Body mass index (kg/m2)	22.6±1.99	20.1±2.4	21.4±2.2	27.42*
Waist circumference (cm)	72.8±5.8	63.8±7.0	69.6±6.3	126.04*
Hip circumference (cm)	91.6±5.2	88.2±6.3	93.8±5.9	54.96*

Difference significant at $p<0.001$

Table 2: Sources of advice about athletic nutrition for female athletes from different educational levels

Source of advice	Educational level						Total	
	Students		Middle		University			
	No.	%	No.	%	No.	%	No.	%
Coaches	11	29.7	9	31.0	22	37.9	42	33.9
Older players	16	43.3	11	37.9	7	12.1	34	27.4
Mass media	5	13.5	5	17.3	13	22.4	23	18.5
Physicians	5	13.5	4	13.8	16	27.6	25	20.2
Total	**37**	**100**	**29**	**100**	**58**	**100**	**124**	**100**

$X^2= 14.05$, $p<0.001$

Table 3: Effect of the source of nutrition advice on the nature of diet consumed before competition

Nature of diet	Source of nutritional advice								Total	
	Coaches		Older players		Mass media		Physicians			
	No.	%	No.	%	No.	%	No.	%	No.	%
Balanced	7	16.7	8	23.5	5	21.7	8	32.0	28	22.6
High carbohydrate	11	26.2	8	23.5	4	17.4	5	20.0	28	22.6
High protein	14	33.3	11	32.4	5	21.7	7	28.0	37	29.8
Unbalanced	10	23.8	7	20.6	9	39.1	5	20.0	31	25.0
Total	**42**	**100**	**34**	**100**	**23**	**100**	**25**	**100**	**124**	**100**

X^2= 5.41, difference not significant.

Table 4: Impact of source of nutrition advice on the timing of diet consumption before competition

Time of diet consumption before competition (hours)	Source of nutritional advice								Total	
	Coaches		Older players		Mass media		Physicians			
	No.	%	No.	%	No.	%	No.	%	No.	%
<2	5	11.9	6	17.7	8	34.8	6	24.0	25	20.2
2-	6	14.3	8	23.5	7	30.4	7	28.0	28	22.6
3-	6	14.3	11	32.5	5	21.8	8	32.0	30	24.2
>4	25	59.5	9	26.5	3	13.0	4	16.0	41	33.0
Total	**42**	**100**	**34**	**100**	**23**	**100**	**25**	**100**	**124**	**100**

X^2=24.05, p<0.001

Table 5: Fluid consumption by females athletes before, during and after competition.

Fluid consumption (liters)	Timing of consumption					
	Before		During		After	
	No.	%	No.	%	No.	%
Omitted	41	33.1	63	50.8	21	16.9
<1	36	29.0	44	35.5	27	21.8
1-	32	25.8	8	6.5	59	47.6
2+	15	12.1	9	7.2	17	13.7
Total	124	100	124	100	124	100
$\bar{x}$ ±S.D	0.85±0.8		0.46±0.7		1.17±0.8	

Table 6: Nutritional supplements frequently consumed by female athletes from different educational levels

Type of supplement	Educational level						Total	
	Students		Middle		University			
	No.	%	No.	%	No.	%	No.	%
None	13	35.1	12	41.4	8	13.8	33	26.6
Multivitamins	7	18.9	5	17.3	17	29.3	29	23.4
Mineral	11	29.8	7	24.1	9	15.5	27	21.8
Performance enhancers	6	16.2	5	17.2	24	41.4	35	28.2
Total	**37**	**100**	**29**	**100**	**58**	**100**	**124**	**100**

X^2= 16.6, p<0.05

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