










Nutritional knowledge, practices and habits of elite female soccer players according to the playing position

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Abstract: The aim of this study was to investigate the level of nutritional knowledge, practices and habits (NKPH) among Jordanian female football players. Furthermore, it explores the differences in the level of NKPH according to their playing position. Seventy healthy and uninjured elite female soccer players participated in this study. The height, body mass, and body mass index (BMI) of the participants (mean \pm SD) were 162 ± 0.045 cm, 57.25 ± 5.30 kg, and 21.75 ± 1.89 kg/m², respectively, and were assessed during the 2023-2024 competitive seasons. The researchers used the following anthropometric measurements (height, body mass, body mass index (BMI) and (NKPH) level. The objectives of the study were achieved by applying means, standard deviations and one-way ANOVA analysis to examine the effect of playing position on the dependent variables, and Pearson's correlation coefficient using SPSS version 29, with a confidence level of 95%. The results of the study showed no statistically significant differences in anthropometric variables according to playing position. Also, the general level of nutritional habits was low, ranging between (18.42 and 21.90 points), with a clear superiority of the average of the midfielders (21.90 points) and at a reasonable level. As for nutritional knowledge, it ranged between (59-66.15 %) with a good level, as midfielders obtained the highest percentage (66.15 %). On the other hand, there were statistically significant differences in nutritional practices in favour of the midfielder position. However, there were statistically significant relationships between nutritional knowledge, habits ($r=0.49$) and practices ($r=0.28$). Therefore, further research linking dietary habits, knowledge and practices with physiological variables is recommended.

Keywords: Anthropometric, Nutrition knowledge, Practices, Soccer, Playing Position

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INTRODUCTION

Soccer is a sport that has been played by both males and females in various countries worldwide. In recent years, there has been a significant increase in the number of women's tournaments. This observation is evidenced by a 37% surge in the number of participants compared to the year 2000, as reported by the International Federation of Association Football (FIFA). Moreover, the global female player population has exhibited a substantial increase from 13.3 million in 2019 to an estimated 60 million by 2026, underscoring a more general upward trend in the participation of women in sports. Concurrent with this growth is an increasing recognition of the pivotal role of physical conditioning and nutritional practices in optimizing female soccer players' performance. Nutrition plays a foundational role in soccer performance by supplying essential nutrients, energy, recovery, and injury prevention [2, 3]. Soccer is an intermittent aerobic sport characterized by high-intensity activities [4]. Consequently, the repeated execution of high-intensity exercises, such as running, jumping, and kicking the ball, can lead to the depletion of the body's fuel reserves, resulting in fatigue and a decline in performance [5]. This underscores the importance of ensuring that players consume additional nutrients to maintain optimal growth and development [6].

In light of the preceding discourse, extant research suggests a direct correlation between the interplay among knowledge, habits, and dietary behaviors on the health and performance of athletes. Nutritional knowledge empowers athletes to meet their energy and healthy food requirements [7]. Insufficient sports nutritional knowledge, as posited by Hasanpouri et al. [8], has been demonstrated to result in reduced strength and endurance, as well as an elevated risk of injuries. Additionally, incorrect nutritional information obtained from internet sources or media has been identified as a contributing factor to dietary inadequacies. Consequently, a dearth of nutritional knowledge is a primary factor contributing to suboptimal dietary behaviors among athletes [9].

Conversely, positive dietary habits among athletes have been shown to promote and consistently adopt healthy eating practices [10]. In contrast, negative dietary habits have been demonstrated to contribute to decreased athletic performance [10]. Studies have also indicated a positive correlation between knowledge, practice, and dietary habits [8]. Erroneous assumptions about nutrition have been demonstrated to have a detrimental effect on food choices among athletes [11]. Additionally, a positive correlation has been observed between nutritional knowledge and dietary habits, which, in turn, positively influences dietary practices among soccer players [12].

Therefore, nutritional education is a critical factor in promoting positive behaviors and improving dietary habits among female football players. A comprehensive understanding of the players' nutritional knowledge is instrumental for nutritionists in designing effective educational programs and implementing targeted nutritional interventions. The cornerstones of sports nutrition are threefold: adequate fluid intake, preservation of energy reserves, and the consumption of appropriate and sufficient sustenance following training and competition [14]. Moreover, the energy requirements of female soccer players range from approximately 352 ± 10.58 kcal/day, with these demands varying according to factors such as body weight and playing position [15].

In light of the paucity of scientific studies in this field and the critical importance of nutrition for female soccer players, this study aims to assess the knowledge, practice, and dietary habits of professional female soccer players in Jordan. The study will also examine the differences in knowledge, practice, and dietary habits based on the playing position variable. The study will also seek to explore the correlations between knowledge, practice, and dietary habits. The findings of this study will contribute to a comprehensive understanding of how nutrition influences the performance of female soccer players. The findings of this study will be disseminated to nutritionists, thereby assisting them in designing educational nutrition programs and implementing nutritional interventions for female soccer players. The study's findings will offer insights into the areas where female

soccer players may lack sufficient nutritional knowledge. These insights will guide nutritionists in developing tailored educational interventions and strategies to promote healthier eating behaviors among athletes.

MATERIAL AND METHODS

Participants

The present research employed a descriptive-analytical study design to assess female soccer players' nutritional knowledge, practice, and habits (NKPH) in Jordan. The study population comprised 70 healthy and uninjured elite female soccer players, as confirmed by the medical records of the teams. The mean \pm SD of the participants' height, body mass, and body mass index (BMI) were 162 ± 0.045 cm, 57.25 ± 5.30 kg, and 21.75 ± 1.89 kg/m², respectively. The assessment of the participants' height, body mass, and BMI was conducted during the 2023-2024 competitive season. Additionally, all participants had accumulated a minimum of eight years of experience in local competitions, including the national league. The participants were then categorized based on their specific playing positions: Fourteen goalkeepers (Gs), twenty-four defenders (Ds), ten midfielders (Ms), and twenty-two forwards (Fs), as illustrated in Table 1.

Procedure

In the course of developing the study instrument, the researchers conducted a comprehensive review of scientific studies [2,8,16-19].

Anthropometric Measurements

The subjects' height was measured in meters, with the subjects standing erect and barefoot (to the nearest 0.1m). Body mass was measured with an electronic scale of high sensitivity, with the subjects in bare feet and wearing only bathing suits. It is noteworthy that all measurements were performed in duplicate, and the mean values were documented. The body mass index (BMI), a common anthropometric indicator in studies involving athlete populations, was calculated using the following formula: $BMI = BW/h^2$. $BMI (kg/m^2) = \text{Body Mass (BW) (kg)} / \text{Height (h) (m)}$. The categorization of BMI is determined by the World Health Organization (WHO) cut-off points.

The nutritional knowledge domain

The resulting nutritional knowledge scale consists of 20 items, and the score for this domain was assessed using the attribution method. Each item was scored on a binary scale, with correct responses receiving a value of one point, and incorrect responses receiving a value of zero. It is imperative to note that the maximum attainable score for this domain is 20 points, and the raw scores are subsequently converted into percentages. Table 2 presents the items of this domain, along with the points allocated for each question. The level of nutritional knowledge was classified into four categories: 1. Very poor: 0-less than 25%; 2. Poor: 25- less than 50%; 3. Good: 50- less than 75%; 4. Very good: >75%.

Table 1. The anthropometric characteristics of the study sample (n=70)

Variables	Goalkeepers (n=14)		Defenders (n=24)		Midfielders (n=10)		Forwards (n=22)		Total (n=70)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Height (m)	1.62	0.036	1.62	0.054	1.62	0.055	1.61	0.038	1.62	0.045
Body mass (kg)	61.00	11.20	59.5	8.36	53.2	7.34	54.45	4.30	57.25	5.30
BMI (kg/ m ²)	23.32	4.86	22.36	2.05	20.2	1.85	20.8	1.61	21.8	1.89

SD – standard deviation

Table 2. The items of the nutritional knowledge scale

No.	Items*	Points	
		T	F
1	Protein is the primary energy source for the muscle	1	0
2	Fats have essential roles in the body	1	0
3	During the activity, feeling thirsty is a sufficient indicator of the need for fluids	1	0
4	Vitamin consumption can supply the body with significant amounts of energy	1	0
5	Dehydration can minimize athletic performance	1	0
6	The last meal before a competition should be consumed directly before the competition	1	0
7	Athletes need to consume the exact amounts of energy-dense foods as not physically active individuals	1	0
8	Salt has a significant role in a healthy diet	1	0
9	An athlete must consume more salt and salty foods than other physically active individuals, especially during an intensive training session.	1	0
10	The body can store excess amounts of proteins in the muscles	1	0
11	Consuming more significant amounts of meat and eggs will increase muscle size	1	0
12	Equal amounts of carbohydrate and protein have approximately the same caloric value	1	0
13	The body can store limited amounts of excess sugar in the body as glycogen	1	0
14	Caffeine-containing beverages can increase the body's ability to bear fatigue during a training session	1	0
15	Insufficient intake of fluids and energy drinks can result in dehydration, which, in turn, can affect the ability to train and endurance	1	0
16	During the day and training session, climate temperature plays an important role in determining the quantity of fluids needed by the body	1	0
17	Dietary supplements are recommended for all athletes aiming to enhance their performance	1	0
18	Zinc and other vitamins are needed for all physically active individuals to boost immunity	1	0
19	Underweight athletes have a more remarkable ability to bear fatigue and training sessions	1	0
20	Consuming small amounts of carbohydrates has unfavorable effects on health, and it can also minimize the level of athletic performance	1	0

T - true, F - false.

Table 3. The items of the nutritional practices scale

Items	Points		
	always	sometimes	never
Drink water only when you feel thirsty	2	1	0
Drink fluids during exercise without encouragement or reminders	2	1	0
Regular weight measurement	2	1	0
Weight measurement before and after exercises	2	1	0
Eat 3 meals/day	2	1	0
Eat between meals	2	1	0
My feelings control the amount and type of food I eat	2	1	0
I determine my food intake depending on the intensity of exercise	2	1	0
I care about the quality and type of my food	2	1	0
Eat a meal immediately after an exercise session	2	1	0
Follow a special diet before the competition	2	1	0

Poor: Less than 7, Good: 7- Less than 15 and very good: 15≤

Table 4. The items of the nutritional habits scale

No	Items	Options	points	No	Items	Options	points
1	Number of main meals	2	0	9	Based on the previous question, when should snacks is eaten after exercise?	Immediately after an exercise session	2
		3	3			Within 30 minutes	2
		4	2			Within 2 hours	1
		More 4	1			More than 2 hours	0
2	Number of snack meals	None	0	10	Drink water during exercise session	None	0
		1	1			1-2	1
		2	2			3-5	2
		3	3			More 5	3
3	What type of snacks do you eat?	Biscuits, sweets	0	11	When to drink water after exercise?	Immediately after an exercise session	2
		Crisps, pretzels	1			Within 30 minutes	2
		Fresh fruit	3			Within 2 hours	1
		Scone, bread	2			More than 2 hours	0
		Other	1	12	Do you eat vegetables and salads with your meals?	Yes	2
None	3	No	0				
4	Number of Skipping main meals	1-2	2	13	Based on the previous question, how many times?	Sometimes	1
		3-5	1			None	0
		More 5	0			1-2	1
		5	What type of breakfast do you usually eat?			Bread with cheese	1
Vegetables	1			More 5	3		
Breakfast cereal with milk	2			Yes	0		
Bread with eggs/beans/hummus	3			No	2		
6	Based on the previous question, how many times take it?	None	0	15	How many times a week do you drink high-sugar drinks?	Sometimes	1
		1-2	1			1-2	2
		3-5	2			3-5	1
		More 5	3			More 5	0
7	Eat outside your home	None	3	16	What supplements do you take?	Proteins	1
		1-2	2			Herbs	0
		3-5	1			Vitamins	1
		More 5	0			Minerals	1
8	Eat a snack immediately after an exercise session	None	0			I don't take	0
		1-2	1				
		3-5	2				
		More 5	3				

Poor: less than 21, Good: 21– less than 31, and very good: 31-42

The nutritional practices domain

The nutritional practices scale consisted of 11 items. Responses were evaluated using a three-point Likert scale, with (2) indicating "always," (1) indicating "sometimes," and (0) indicating "never." To derive the opposite of this measure in items (1, 7), the following conversion was employed: (0) always, (1) sometimes, and (2) never. The total scores ranged from 0 to 22. Table 3 presents the items constituting this domain, along with the points allocated for each question. The classification of overall nutritional practice scores was conducted into three categories: 1. Poor: Less than 7; 2. Good: 7- Less than 15; 3. Very good: 15≤.

The nutritional habits domain

The nutritional habits scale consisted of 16 items. The maximum attainable score for this domain is 41 points. Table 4 presents the items of this field and the points due for each question. The classification of nutritional habits was conducted into three categories: 1. Poor: less than 21; 2. Good: 21- less than 31; 3. Very good: 31-42.

Following the construction of the study instrument, its paragraphs were translated into Arabic by three Nutrition and English language specialists, who then reviewed them to ensure their linguistic and scientific integrity. The study sample was also required to complete the tool under the supervision of a nutrition specialist and team administrator. This was done to explain the study objectives and answer any inquiries to ensure complete clarity of the study tool paragraphs.

Ethical Considerations

This intervention does not modify standard football training regimens or entail motor actions that diverge from the conventional practices employed during training sessions and competitive matches. Furthermore, all participants underwent a medical examination prior to the commencement of the season. Additionally, written consent was obtained from each female soccer player and their respective families.

Statistical analysis

The statistical analysis was conducted using SPSS 29.0.1.1 for Windows (SPSS Inc., Chicago, USA). Means and standard deviations were calculated for all parameters. The One-Way ANOVA analysis was utilized to examine the impact of playing position on the dependent variables. Pearson's correlation coefficient was also employed to detect relationships between (NKPH). The Kolmogorov-Smirnov test was employed to verify data normality, and the statistical significance values of all study variables ranged between 0.862 and 1.54 and were more significant than 0.05. For all analyses, a statistical significance was set at $p < 0.05$.

RESULTS

The primary objective of this study was to assess the level of knowledge, practice, and dietary habits among professional female soccer players in Jordan. The investigation further sought to elucidate potential disparities in knowledge, practice, and dietary habits, with respect to the playing position variable. Additionally, the study probed the correlation between knowledge, practice, and dietary habits. Table 5 presents the differences in anthropometric measurements according to the playing position variable. Table 6 presents a comprehensive overview of nutritional knowledge, habits, and practices among female soccer players across diverse playing positions. Table 7 presents the differences in nutritional knowledge, habits, and practices among female soccer players according to the playing position variable. Finally, Table 8 presents the correlations between knowledge, habits, and nutritional practices among female soccer players in different playing positions.

Table 5. The One-Way ANOVA test results for anthropometric measurements according to the playing position (n=70)

Variables		Sum of Squares	df	Mean Square	F	p
Height (m)	Between Groups	0.001	3	0.000	0.086	0.967
	Within Groups	0.142	66	0.002		
	Total	0.143	69	-		
Body mass (kg)	Between Groups	636.984	3	212.328	3.404	0.023
	Within Groups	4116.388	66	62.370		
	Total	4753.371	69	-		
Body mass index (kg/ m ²)	Between Groups	87.708	3	29.236	3.931	0.112
	Within Groups	490.834	66	7.437		
	Total	578.542	69	-		

Effect size between groups: Treatment Sum of Squares/Total Sum of Squares (0.006, 0.134, 0.151) respectively

Table 6. The nutritional knowledge, habits, and practices means (n=70)

Domains	Playing position	Mean	SD	Percentage (%)	Categories
*Nutritional habits	Goalkeepers (n=14)	21.76	0.91		Good
	Defenders(n=24)	18.42	0.78		Poor
	Midfielders(n=10)	21.90	0.40		Good
	Forwards(n=22)	20.36	0.74		Poor
	Total (n=70)	20.61	0.70		Poor
**Nutritional knowledge	Goalkeepers (n=14)	13.23	0.88	59.00	Good
	Defenders(n=24)	12.00	0.53	60.00	Good
	Midfielders(n=10)	11.80	0.93	66.15	Good
	Forwards(n=22)	12.27	0.62	61.35	Good
	Total (n=70)	12.33	0.74	61.65	Good
***Nutritional practices	Goalkeepers (n=14)	8.71	0.79		Good
	Defenders(n=24)	6.95	0.88		Poor
	Midfielders(n=10)	9.60	0.85		Good
	Forwards(n=22)	9.31	0.75		Good
	Total (n=70)	8.64	0.82		Good

*Poor: less than 21, Good: 21- less than 31, and very good: 31-42; **Very poor: 0-less than 25%, Poor: 25- less than 50%, Good: 50- less than 75%, and very good: >75%; ***Poor: Less than 7, Good: 7- Less than 15 and very good: 15≤

Table 7. The Results of the One-Way ANOVA test for nutritional knowledge, habits, and practices variables according to the playing position (n=70)

Domains		Sum of Squares	df	Mean Square	F	p
Nutritional habits	Between Groups	3.213	19	0.169	1.57	0.102
	Within Groups	5.377	50	0.108		
	Total	8.590	69	-		
Nutritional knowledge	Between Groups	0.292	19	0.015	1.35	0.193
	Within Groups	0.566	50	0.011		
	Total	0.858	69	-		
Nutritional practices	Between Groups	16.098	19	0.847	1.66	<0.001*
	Within Groups	0.000	50	0.000		
	Total	16.098	69	-		

Effect size between groups ANOVA Treatment Sum of Squares/Total Sum of Squares (0.37, 0.34, 1) respectively

Table 8. Pearson test results for correlations between nutritional knowledge, habits, and practice among female soccer (n=70)

Predictor	Habits	Knowledge	Practices
Habits	-	0.49**	0.31**
Knowledge	0.49**	-	0.28*
Practices	0.31**	0.28*	-

** p<0.01; * p<0.05

DISCUSSION

A thorough review of the values in Table 5 reveals that there are no statistically significant differences in the anthropometric variables according to the playing position. This finding is supported by the levels of statistical significance, which were more significant than $p > 0.05$. These outcomes align with the findings of the study [7]. However, these findings contradict the results reported in Study [20], which indicated no statistically significant differences in the anthropometric indicators according to the playing position.

The results indicated that the overall nutritional habits level was suboptimal, ranging from 18.42 to 21.90 points, with midfielders exhibiting the highest mean score (21.90), suggesting a satisfactory level of adherence to nutritional guidelines. With regard to nutritional knowledge, the players scored between 59% and 66.15%, with midfielders again leading at 66.15%. The overall nutritional knowledge level was found to be 61.65%, which is notably higher than the 54.6% reported by Danilo et al. [21]. It is noteworthy that female soccer players require approximately 352 ± 10.58 kcal/day, with energy demands varying according to body weight and playing position [15]. Concurrently, the overall average of nutritional practices attained a commendable level of 8.64. The values in this field ranged from 6.95 to 9.60, with midfielders demonstrating the highest mean of 9.60. Conversely, defenders demonstrated the lowest mean in this field (6.95), indicating a substandard level of performance.

A subsequent review of the differences in the means of habits and nutrition knowledge revealed that these differences were not statistically significant, despite the clear superiority of female midfielders in all fields. Conversely, a statistically significant disparity emerged concerning nutritional practices, with the midfielder position demonstrating a significance level less than $p < 0.05$. The researchers concluded that the possession of adequate nutritional knowledge by female players is associated with positive nutritional behaviors. Song et al. [12] also indicate that good nutritional knowledge indirectly affects positive nutritional practices and habits among soccer players.

The researchers contend that the positive correlation between habits, knowledge, and nutritional practices manifested distinctly in the data presented in Table 8. The findings indicated a statistically significant relationship between nutritional knowledge, habits, and practices, with correlation coefficients of 0.49 and 0.28, respectively, both of which are significant at the $p < 0.05$ level. According to Hasanpouri et al. [22], correlation coefficients below 0.30 indicate a weak relationship, while those between 0.30 and 0.60 indicate a moderate relationship. Bakhtiar et al. [11] also indicate that positive nutritional habits among athletes promote healthy nutritional practices and continuous maintenance. It is evident that a lack of nutritional knowledge impedes an athlete's capacity to meet the demands of playing football [8].

CONCLUSION

Nutrition plays a pivotal role in the performance of female football players by supplying the requisite nutrients to meet the demands of the sport. The study's findings indicated that the nutritional habits exhibited by the participants were suboptimal, while their nutritional knowledge and practices were satisfactory. The responses exhibited statistically significant variations in nutritional practices based on playing position, with midfielders demonstrating the highest levels. Furthermore, the study identified significant correlations between nutritional habits, knowledge, and practices. The researchers believe that the findings of this study can help challenge incorrect nutritional concepts and guide nutritionists' development of nutritional education programs. The implementation of evidence-based nutritional interventions can be facilitated by such programs. It is imperative for female football players to acquire nutritional information from credible and certified sources, as this can profoundly influence their comprehension of nutrition and, consequently, their performance. The implementation of nutrition education programs is imperative to optimize players' performance, health, and overall well-being. These programs should enhance players' nutritional knowledge and encourage positive dietary changes through personalized nutrition plans. By tailoring advice to the specific needs of the players, including their training schedules and positions, such programs can foster better nutrition and improved performance in the field. Future studies should explore the relationship between nutritional habits and physiological variables, such as vitamins and minerals, to deepen the understanding of the specific nutritional needs of female football players.

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