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Correlation of Consumption Vegetables, Fruit, and Nuts with Body Mass Index and Fat Deposition in Saudi Elite Male Soccer Players

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Abstract **Background**: The nutrition of elite soccer players is crucial to optimize performance and improve body composition. Currently, little is known about the correlations between the consumption of fruit, vegetables, and nuts with body mass index (BMI) and fat deposition among Saudi soccer elite players. To address this gap in the literature, the current study aimed to evaluate the effect of the consumption of fruit, vegetables, and nuts on BMI and fat percentage in elite Saudi soccer players. **Methods**: The Saudi Food Frequency Questionnaire (FFQ) was used alongside a cross-sectional research design to gather data from a sample of young Saudi soccer players (N = 81; aged 17–21 years old) to assess participants' food intake; body fat percentage was measured using skinfold thickness and BMI was calculated. **Results**: It showed that the participants' consumption of fruit, vegetables, and nuts was low (mean intake: 63.80 (SD = 28.54), 60.65 (SD = 32.97), 31.58 (SD = 18.94), respectively). Moreover, the relationship between the indexes for the consumption of fruit, vegetables, and nuts with BMI was not significant ($r = -0.037$, $p = 0.742$; $r = 0.143$, $p = 0.203$; $r = 0.080$, $p = 0.477$, respectively). Also, there was no significant relationship between the indexes for the consumption of fruit, vegetables, and nuts with fat percentage ($r = -0.066$, $p = 0.560$; $r = 0.119$, $p = 0.292$; $r = 0.012$, $p = 0.913$, respectively). Furthermore, fat percentage was significantly predicted by BMI ($p < 0.001$). **Conclusions**: Our results indicated that the consumption of vegetables and nuts was associated with better BMI values. Thus, athletes should adopt a strict dietary regime that focuses on an adequate amount of high-quality fruit, vegetables, and nuts to enhance performance. The significance of this research stems from being the first to evaluate the association between vegetables, fruits, and nuts intake and body composition among Saudi soccer elite athletes, giving a rise in understanding regarding athletes' nutrition to achieve better and improved body composition.

Keywords Soccer, Body Mass Index, Vegetables, Performance, Vitamin

1. Introduction

Soccer is a contact sport that requires intermittent bursts of speed and power; its high intensity means that the training load and competitive games can affect players' performance [1,2]. Year on year, the physical intensity required in competitive games has increased; nowadays, it has reached a general average intensity of 70–75% of the maximum rate of oxygen consumption [3]. Also, the intensive physical demands on soccer players may vary due to differences in training status, positions on the field, and specific tactical roles [4]. Moreover, the long-term tensions imposed on players by enormous daily training routines can lead to consequences such as a reduction in immune function, which can also result from short-term, intense workouts [5]. Meanwhile, inadequate diet among high-performance athletes, especially soccer players, might diminish immune function, which may increase their susceptibility to infection as well as compromise their athletic performance [6].

The importance of optimal nutrition and dietary intake strategies to maximize performance among soccer players is well known [7,8]. The energy balance status plays an important role in soccer players' performance throughout games and helps prevent possible health problems and injuries [9]. The proportions of required nutritional intake and energy expenditure vary depending on the type of physical activity, especially in high-endurance sports like soccer. Meeting these demands requires a more balanced diet to perform at the highest level [8].

High concentrations of free radicals can be harmful to many cellular tissues [10]. Athletes should avoid foods that may increase oxidative stress and increase their consumption of foods that are higher in antioxidants. An example of the latter is a diet rich in fruit and vegetables, which raises the plasma levels of antioxidants and protects against many chronic diseases [10]. Interestingly, the potential effects of the consumption of vegetables as a protector against oxidative damage, which can cause coronary heart disease, is well known; indeed, all vegetables are considered high-antioxidant items [5]. Fruits such as pomegranates, blackcurrants, oranges, kiwi fruit, berries, and sour cherries contain very high levels of antioxidants; likewise, pistachio nuts and seeds such as unhulled sesame seeds (especially black sesame seeds) are rich sources of antioxidants and vitamin E [5].

The assessment of dietary intake in athletes has been studied to estimate the extent to which it meets the required energy balance [11]. The Food Frequency Questionnaire (FFQ) has been commonly used to evaluate individual dietary intake [11,12]. A large study conducted in Tehran province, investigating the dietary intake of Iranian soccer players, found that those consuming fruit and vegetables two to three times per day were 15.4 and 33.5%, respectively [13]. However, in the same study, about 70 % of soccer players reported consuming fruit 4–7 times per week while only 35.1% reported consuming vegetables 2–3 three times per week [13]. Meanwhile, a study that assessed the dietary intake of elite soccer players in the Italian National Football Championship Serie A Tim found that the consumption of fruit and vegetables was very low, which may have affected vitamin and antioxidant levels during the season [14]. Also, other studies found that the intake of fruit and vegetables by athletes failed to meet dietary intake recommendations; in some studies, the intake of fruit and vegetables was much lower than recommended [3,14,15]. Hence, the current study aimed to examine the association between the consumption of fruit, vegetables, and nuts with BMI and fat composition among Saudi soccer elite players. Also, we hypothesize that consuming more of fruits, vegetables, and nuts is associated with lower BMI and fat percentage values. In addition, to the best of our knowledge, there is a lack of studies on the assessment of dietary intake among soccer players in Saudi Arabia; it is hoped that the current study will support a better understanding of the dietary habits of this group and lead to the development of better nutrition regimes.

2. Materials and Methods

A cross-sectional research design was employed to examine the association between the consumption of vegetables, fruit, and nuts with BMI and fat composition in young, professional Saudi soccer players from Riyadh. This study was approved by the ethical committee at King Saud University (E-21-5659) and conducted as per the guidelines of the Declaration of Helsinki. Written consent was obtained from all participants.

Participants:

A sample of young Saudi soccer players (N = 81; 18–25 years old) was recruited for this study. Participants were recruited from three football clubs in Riyadh, Saudi Arabia, during the Saudi Arabia league 2020–2021. The participants normally trained daily and competed once or twice per week. In addition, these clubs are registered in the Saudi Football Federation as professional clubs. Participation in the study was based on specific criteria as (none injured player, healthy, and not suffering from digestive disorders). The participants normally attended clubs for training sessions daily and competed once or twice per week. Training sessions consist of warm-up, technical, tactical (small sided games) and cool down.

Anthropometric Measurements

The participants' body weight was measured before beginning the study using a digital scale to the nearest 0.1 kg (Seca813, Germany); height was measured to the nearest 0.01 cm (Seca213 Germany). For all participants, the Siri equation (Siri, 1961; 495/body density – 450) was utilized to convert body density into per cent body fat. Body fat percentage was measured using skinfold thickness at seven sites (subscapular, triceps, chest, midaxillary, suprailiac, abdomen, and thigh) using a Holtain skinfold caliper (Holtain Ltd., Crymych, UK). The skinfold measurements were taken by a well-trained expert in the technique. The sum of these four skinfold measurements was used to calculate total body fat percentage using the following equation: body density = 1.112 - (0.00043499 x sum of skinfolds) + (0.00000055 x square of the sum of skinfold sites) - (0.00028826 x age) [16,17].

Food Frequency Questionnaire:

The FFQ by [18] was used to assess participants' food intake. The questionnaire consists of 14 categories including the following items: dairy products, fruit, vegetables, meat, fish, eggs, mixed dishes, sandwiches and snacks, bread, cereal, and starches, beverages, juices, and drinks, sweets, seeds and nuts, fast and non-fast food, artificial sweeteners, vitamins and minerals, and fats, oils, and sugar. In line with the study's aim, the authors included the items relating to fruit, vegetables, and nuts only for analysis.

The Saudi Food Frequency Questionnaire (FFQ) was validated and reliable for Saudi Arabia population [18]. As nutrition and body composition are risk factors of non-communicable diseases in Saudi Arabia (Doctoral dissertation, University of Glasgow).

Statistical analysis:

The variables were described using central tendency measures (frequencies, percentages, means, and medians) and dispersion measures (standard deviation and ranges). A total score for each food group (fruits, vegetables, and nuts) was calculated to determine the food index for each participant. A Pearson correlation test was performed to examine the correlation between the selected health indicators (years of experience in playing soccer, weight, BMI, and fat percentage) and each food group index (fruits, vegetables, and nuts). In addition, multiple linear regression was used to examine the prediction of BMI and fat percentage based on the food group indexes (fruits, vegetables, and nuts). Alpha was set to 0.05 for a two-tailed level of significance and a power of 0.80 was used.

Descriptive statistics (central tendency (mean), and dispersion (standard deviation)) were use to describe continuous variables, while frequencies and percentages were used to describe categorical variables.

All parametric tests were conducted setting significant point at alpha < 0.05. And after testing and assuring all parametric test assumptions, sample observations were random; all variables assure normal distribution (Skewness values were within the range -2 to +2. Kurtosis values were within range -7 to +7); all variables assure equality of variances. We used pearson r collelation to examine the relationship between two linear continuous variables.

Regression was conducted setting significant point at alpha < 0.05. Tests to see if the data met the assumption of collinearity indicated that multi-collinearity was not a concern. Also, the data met the assumption of independent errors (Durbin-Watson value = 1.606). In addition, the histogram of standardized residuals indicated that the data contained approximately normally distributed errors, as did the normal P-P plot of standardized residuals, which showed points that were not completely on the line, but close. In addition, the scatterplot of standardized predicted values showed that the data met the assumptions of homogeneity of variance and linearity. The data also met the assumption of non-zero variances.

3. Results

The total sample included 81 soccer players aged from 17–21 years old (19±1). The length of the participants' experience in playing soccer ranged from 1–14 years with a mean of 6 years (SD = 3). BMI scores ranged from 17–31 (22±2); fat percentages ranged from 4–17 with a mean of 9 (SD 3) (See Table 1).

Table 1. Characteristics of soccer players (n = 81)

Variables	M ± SD	MIN	MAX
Age (year)	19 ± 1	17	21
Experience (year)	6 ± 3	1	14
Weight (kg)	66 ± 8	52	85
Height (cm)	2 ± 0	2	2
Body mass index (BMI) (kg/m^2)	22 ± 2	17	31
Body fat percent (%)	9 ± 3	4	17

Table 2. Fruit, vegetable, and nut consumption among the participants (n= 81)

Items	<1/month n (%)	1-3 / month n (%)	1/ wk. n (%)	2-4/ wk. n (%)	5-6/ wk. n (%)	1/day n (%)	2-3/day n (%)	4-5/day n (%)	> 6/day n (%)
Fruits									
Fruit salad	4 (5)	11 (13.8)	14 (17.5)	12 (15)	3 (3.8)	15 (18.8)	9 (11.3)	7 (8.8)	5 (6.3)
Apple	5 (6.7)	9 (12)	12 (16)	12 (16)	5 (6.7)	12 (16)	8 (10.7)	6 (8)	6 (8)
Banana	4 (5.1)	6 (7.7)	10 (12.8)	14 (17.9)	8 (10.3)	14 (17.9)	8 (10.3)	6 (7)	8 (10.3)
Berries	23 (31.9)	14 (19.4)	8 (11.1)	2 (2.8)	3 (4.2)	12 (16.7)	5 (6.9)	3 (4.2)	2 (2.8)
Orange	7 (9.7)	10 (13.9)	9 (12.5)	6 (8.3)	8 (11.1)	14 (19.4)	9 (12.5)	5 (6.9)	4 (5.6)
Grapefruit	42 (64.6)	6 (9.2)	2 (3.1)	1 (1.5)	0 (0)	8 (12.3)	1 (1.5)	3 (4.6)	2 (3.1)
Peaches	23 (32.9)	10 (14.3)	11 (15.7)	2 (2.9)	1 (1.4)	9 (12.9)	5 (7.1)	3 (4.3)	6 (8.6)
Date	11 (13.6)	10 (12.3)	21 (25.9)	8(9.9)	7 (8.6)	13 (16)	4 (4.9)	3 (3.7)	4(4.9)
Kiwi	25 (3.8)	12 (16.2)	10 (13.5)	7 (9.5)	2 (2.7)	7 (9.7)	5 (6.8)	3 (4.1)	3 (4.1)
Grapes	20 (26.7)	11 (14.7)	15 (20)	7 (9.3)	1 (1.3)	12 (16)	4 (5.3)	4 (5.3)	1 (1.3)
Olives	28 (40)	7 (10)	15 (21.4)	4 (5.7)	2 (2.9)	10 (14.3)	2 (2.9)	2 (2.9)	0 (0)
Watermelon	17 (23)	9 (12.2)	10 (13.5)	11 (14.9)	3 (4.1)	9 (12.2)	8 (10.8)	3 (4.1)	4 (5.4)
Melon	25 (35.2)	9 (12.7)	11 (15.5)	5 (7)	2 (2.8)	9 (12.7)	2 (2.8)	4 (5.6)	4 (5.6)
Mango	22 (29.7)	13 (17.6)	10 (13.5)	6 (8.1)	3 (4.1)	8 (10.8)	7 (9.7)	4 (5.4)	1 (1.4)
Vegetables									
Cabbage	47 (58)	9 (11.1)	6 (7.4)	5 (6.2)	4 (4.9)	5 (6.2)	2 (2.5)	2(2.5)	1 (1.2)
salad	20 (30.3)	9 (13.6)	9 (13.6)	6 (9.1)	2 (3)	11 (16.7)	5 (7.6)	2 (3)	2 (3)
Mix veg. cooked	25 (37.3)	5 (7.5)	11 (16.40	5 (7.5)	4 (6)	9 (13.4)	6 (9)	0 (0)	2 (3)
cauliflower	43 (62.3)	4 (5.8)	7 (10.1)	2 (2.9)	0 (0)	5 (7.2)	2 (2.9)	3 (4.3)	3 (4.3)
tabouleh	22 (31.4)	11 (15.7)	11 (15.7)	5 (7.1)	3 (4.3)	9 (12.9)	5 (7.1)	1 (1.4)	3 (4.3)
Green leaves	17 (23.6)	14 (19.4)	11 (15.3)	11 (15.3)	2 (2.8)	7 (9.7)	5 (6.9)	2 (2.8)	3 (4.2)
okra	25 (36.2)	13 (18.8)	13 (18.8)	3 (4.3)	1 (1.4)	8 (11.6)	2 (2.9)	1 (1.4)	3 (4.3)
Peas cooked	30 (44.8)	8 (11.9)	6 (9)	7 (10.4)	2 (3)	8 (11.9)	3 (4.5)	0 (0)	3 (4.5)
carrot	18 (24.3)	12 (16.2)	11 (14.9)	7 (9.5)	3 (4.1)	12 (16.2)	6 (8.1)	2 (2.7)	3 (4.1)
tomato	16 (23.5)	9 (13.2)	7 (10.3)	8 (11.8)	2 (2.9)	16 (23.5)	5 (7.4)	1 (1.5)	4 (5.9)
mushroom	41 (62.1)	5 (7.6)	5 (7.6)	0 (0)	2 (3)	7 (10.6)	2 (3)	2 (3)	2 (3)
leek	36 (54.5)	10 (15.2)	3 (4.5)	4 (6.1)	0 (0)	5 (7.6)	4 (6.1)	1 (1.5)	3 (4.5)
cucumber	11 (15.1)	8 (11)	4 (5.5)	15 (20.5)	4 (5.5)	16 (21.9)	8 (11)	2 (2.7)	5 (6.8)
lettuce	10 (14.1)	7 (9.9)	5 (7)	12 (16.9)	4 (5.6)	18 (25.4)	6 (8.5)	6 (8.5)	3 (4.2)
corn	22 (30.6)	8 (11.1)	17 (23.6)	3 (4.2)	5 (6.9)	7 (9.7)	6 (8.3)	1 (1.4)	3 (4.2)
onion	17 (23.9)	7 (9.9)	16 (22.5)	9 (12.7)	0 (0)	10 (14.1)	5 (7)	1 (1.4)	6 (8.5)
legumes	14 (19.2)	12 (16.4)	13 (17.8)	7 (9.6)	4 (5.5)	15 (20.5)	3 (4.1)	0 (0)	5 (6.8)
Sweet beans	40 (58.8)	4 (5.9)	7 (10.3)	4 (5.9)	0 (0)	6 (8.8)	2 (2.9)	0 (0)	5 (7.4)
Boiled potato	15 (20.8)	8 (11.1)	16 (22.2)	9 (12.5)	2 (2.8)	9 (12.5)	6 (8.3)	3 (4.2)	4 (5.6)

Table 2. Continued

					Nuts				
Almond	22 (37.3)	8 (13.6)	7 (11.9)	7 (11.9)	1 (1.7)	4 (6.8)	6 (10.2)	0 (0)	4 (6.8)
Cashew	19 (27.5)	11 (15.9)	7 (10.1)	9 (13)	3 (4.3)	7 (10.1)	7 (10.1)	3 (4.3)	3 (4.3)
Peanuts	19 (26.8)	14 (19.7)	6 (8.5)	9 (12.7)	3 (4.2)	6 (8.5)	10 (14.1)	2 (2.8)	2 (2.8)
Pistachio	15 (22.4)	11 (16.4)	9 (13.4)	9 (13.4)	3 (4.5)	8 (11.9)	8 (11.9)	2 (3)	2 (3)
Nutmeg	27 (42.2)	8 (12.5)	11 (17.2)	3 (4.7)	2 (3.1)	5 (7.8)	5 (7.8)	1 (1.6)	2 (3.1)
Hazelnut	27 (41.5)	12 (18.5)	7 (10.8)	3 (4.6)	8 (12.3)	4 (6.2)	3 (4.6)	0 (0)	1 (1.5)
Walnut	29 (46.8)	13 (21)	5 (8.1)	6 (9.7)	2 (3.2)	2 (3.2)	3 (4.8)	1 (1.6)	1 (1.6)
Chestnut	31 (49.2)	14 (22.2)	6 (9.5)	2 (3.2)	3 (4.8)	2 (3.2)	4 (6.3)	0 (0)	1 (1.6)
Mixed nuts	13 (19.1)	13 (19.1)	10 (14.7)	11 (16.2)	4 (5.9)	8 (11.8)	6 (8.8)	2 (2.9)	1 (1.5)
Pumpkin seeds	24 (35.8)	9 (13.4)	9 (13.4)	11 (16.4)	4 (60	7 (10.4)	2 (3)	0 (0)	1 (1.5)
Sunflower seeds	27 (40.9)	12 (18.2)	10 (15.2)	5 (7.6)	3 (4.5)	6 (9.1)	1 (1.5)	1 (1.5)	1 (1.5)

The results (see Table 2) outline the different types of fruit consumed by the participants. In general, the percentage of fruit consumption was high. Among the 16 different types of fruit choices included in the FFQ, the least consumed fruit was grapefruit (not consumed by 79%; n = 64), then canned fruit (not consumed by 81.5%; n = 66). The most consumed fruit was fruit salad, (97.5%; n = 79), followed by dates (93.8%; n = 76). The total fruit index scores ranged from 8–138 with a mean of 63.80 (SD = 28.54). Given that a higher mean indicates a better food index, using the quartile equation, it was determined that 25% of the sample had high fruit index scores.

The frequencies of consumption of different types of vegetables among the participants are presented in Table 2. In general, the percentage of vegetable consumption was high. From the variety of vegetable options provided, the least-consumed vegetables were salad, mushrooms, and leeks (not consumed by approximately 81.5%). The most consumed vegetable was carrots. In addition, the total vegetable index score ranged from 0–172 with a mean of 60.65 (SD = 32.97). Given that a higher mean indicates a better food index, using the quartile equation, it was determined that 75% of the sample had low vegetable index scores.

Table 2 details the frequencies of consumption of different types of nuts. Among the nine different nut choices, the least consumed was almonds (not consumed by 72.8%; n = 59), followed by walnuts (not consumed by 76.5%; n = 62), and then chestnuts (not consumed by 77.8%; n = 61). The most consumed nuts were peanuts (87.7%; n = 71) and cashew nuts (85.2%; n = 69). Moreover, the total nut index score ranged from 0–91 with a mean score of 31.58 (SD = 18.94). Given that a higher mean indicates a better food index, using the quartile equation, it was revealed that 75% of the sample had low nut index scores.

Figures 1, 2, and 3 clarify the descriptive data of fruit, vegetable, and nut consumption per/day respectively. It is obvious that banana, cabbage and sunflower seeds are the predominant consuming items.

To examine the relationship between the food group indexes and selected demographic variables (years of experience in playing soccer, weight, BMI, and fat percentage), a Pearson r correlation test was conducted with the significant level of Alpha set at < 0.05; this revealed the following relationship between the indexes of fruit, vegetables, and nuts with BMI ($r = -0.037$, $p = 0.742$; $r = 0.143$, $p = 0.203$; $r = 0.080$, $p = 0.477$, respectively). Also, there was no significant relationship between fruit, vegetable, and nut indexes and fat percentage ($r = -0.066$, $p = 0.560$; $r = 0.119$, $p = 0.292$; $r = 0.012$, $p = 0.913$, respectively).

Table 3. Relationship between selected demographic and food group indexes

Variables		Experience	Weight	BMI	FAT
Fruits	r2	-.103	-.001	-.037	-.066
	p	.359	.991	.742	.560
Vegetables	r2	.000	.107	.143	.119
	p	1.000	.341	.203	.292
Nuts	r2	-.100	.085	.080	.012
	p	.374	.450	.477	.913

To determine the best predictors of BMI, a forward stepwise (two-step) linear regression was performed setting the P at < 0.05. Five variables (years of experience in playing soccer, fat percentage, fruit index, vegetable index, and nut index) were used as independent variables to predict BMI among the participants. The results revealed that only fat percentage was statistically significant at the alpha level of < 0.05.

Data analysis (see Table 4) revealed that the final one-factor model (regression equation) was significant: F (1, 79) = (44.946, $p < 0.001$), with an R2 of 0.363. BMI was significantly predicted by fat percentage (beta= 0.602, $p < 0.001$). The overall model fit was R2 = 0.363, which means that this model accounted for 36.3% of the variance among the athletes' BMI. The predicted athletes' BMI was equal to 18.191 + 0.408 (fat percentage) total scores.

To determine the best fat percentage predictors, a forward stepwise (two-step) linear regression was performed setting the significance of the alpha level at < 0.05. Three variables (years of experience in playing soccer, BMI, fruit index, vegetable index, and nut index) were used as fat percentage predictors among athletes. The results revealed that the best prediction model consists of BMI and experience only.

Further data analysis (see Table 5) revealed that the final two-factor model (regression equation) was significant: F (2, 78) = (26.28, p = < 0.001), with an R2 of 0.403. Athletes' fat percentages (beta= 0.564, $p < 0.001$) and years of experience in playing soccer (beta= - 0.204, $p = 0.025$) were significantly predicted by BMI. The overall model fit was R2 = 0.403, which means that this model accounted for 40.3% of the variance in the athletes' fat percentages. The predicted fat percentage was equal to – 7.936 + 0.833 (BMI) + - 0.432 (years of experience in playing soccer) of the total scores.

Table 4. BMI predictors

	Unstandardized Coefficients (B)	Standardized Coefficients (Beta)	t	Sig.	95.0% CI	
					Lower Bound	Upper Bound
Constant	18.191		31.039	<0.001	17.025	19.358
Fat percent	.408	.602	6.704	<0.001	.287	.529

Table 5. Fat percent predictors

	Unstandardized Coefficients (B)	Standardized Coefficients (Beta)	t	Sig.	95.0% CI	
					Lower Bound	Upper Bound
Constant	-7.936		-2.613	.011	-13.984	-1.889
BMI	.833	.564	6.332	<0.001	.571	1.095
Experience	-.216	-.204	-2.286	.025	-.404	-.028

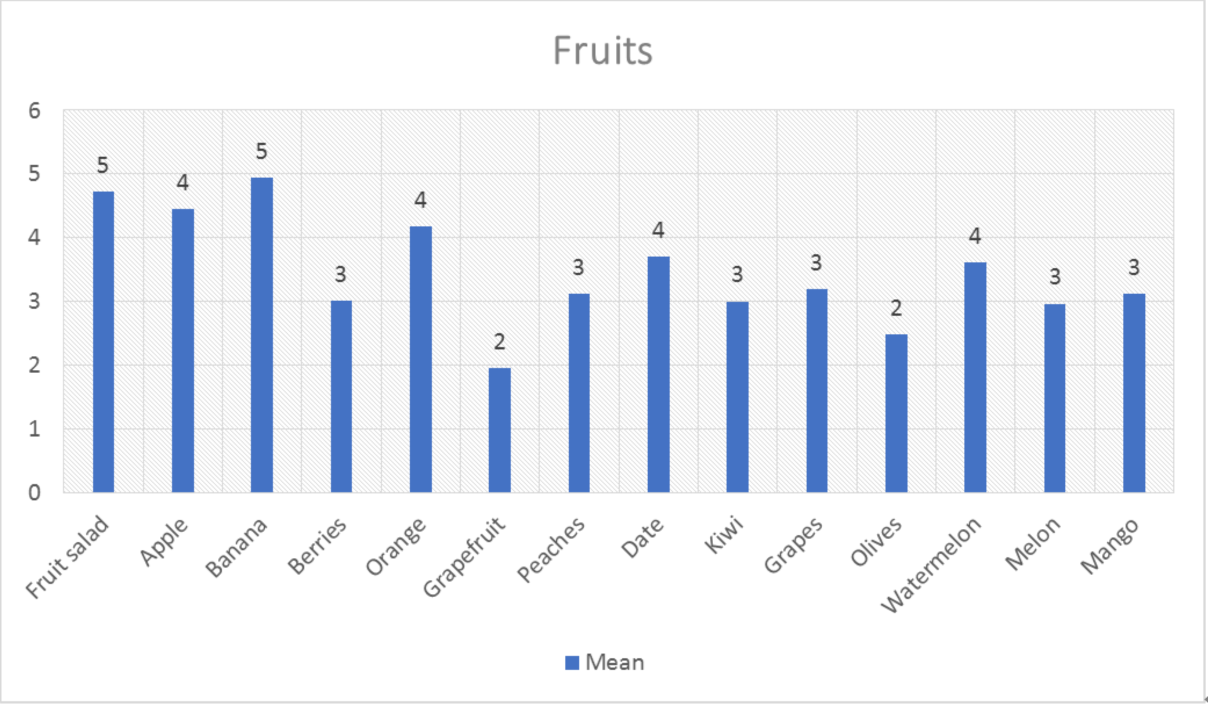

Figure 1. The percentage of fruits consumed in each day.

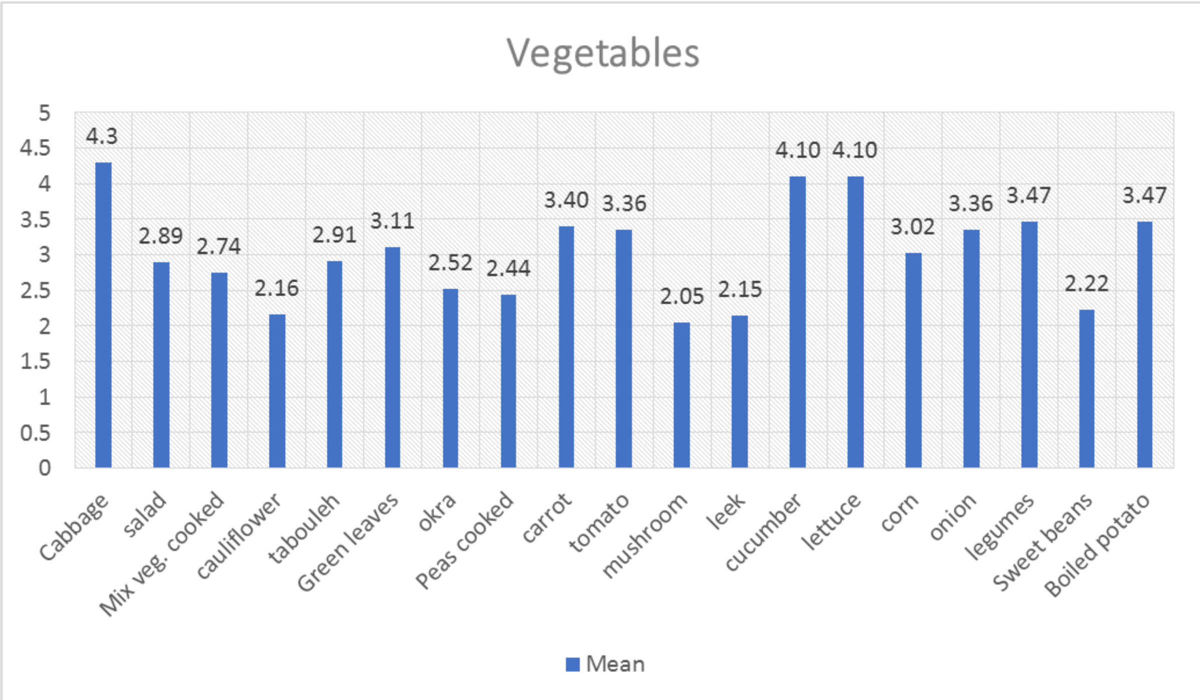

Figure 2. The percentage of vegetables consumed in each day.

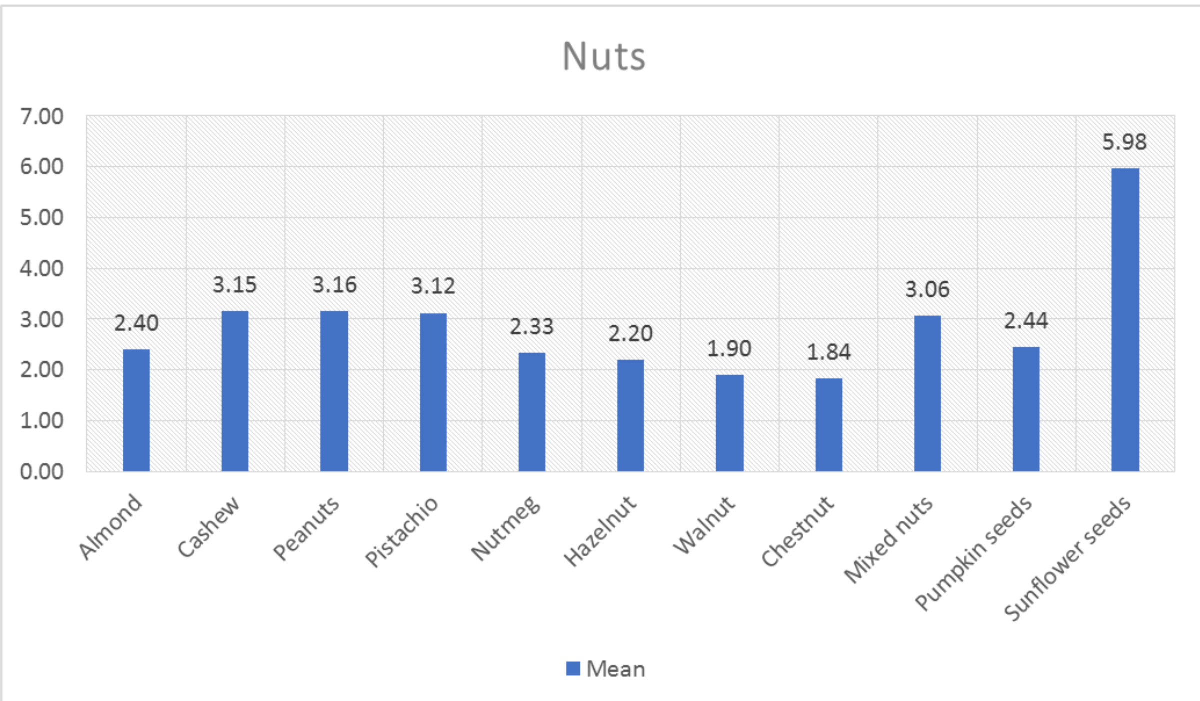

Figure 3. The percentage of nuts consumed in each day.

4. Discussion

This study aimed to evaluate the consumption of fruit, vegetables, and nuts among adult male Saudi soccer players and examine the association between the consumption of these food groups and selected demographic variables (BMI and fat composition). The results highlighted that the average intake of fruit and vegetables was relatively high with total index scores ranging from 8–138 and 0–172, respectively. The consumption of nuts varied with total index scores ranging from 0–91; this indicates that 75% of the sample had a low nut index. However, Abbey et al. [19] reported an increased intake of potassium among football players which indicated a higher intake of fruit and vegetables compared to the participants in the current study. In contrast to the findings of a study conducted by [8], this may be due to the lower intake of fruit and vegetables in that study as fruit and vegetables are known as antioxidants, phytochemicals, and vitamin attributers [20].

In contrast, Folasire et al.'s [21] cross-sectional survey on purposively selected undergraduate athletes (N= 110; females: n = 47; males: n = 63) from the University of Ibadan, Nigeria, found that over 70.0% did not frequently consume fruit, vegetables, and nuts. Moreover, Iglesias-Gutiérrez et al.'s [22] work on male soccer players (N = 33; aged 14–16 years old) from the junior teams of a Spanish First Division Soccer League club found that vegetables, fruit and natural fruit juices, and nuts provided 47% of their fiber intake, but only 11% of their total energy intake; in contrast, nuts accounted for 3% of their total energy intake and 19% of their total fiber intake. Consequently, diets rich in fruit and vegetables are correlated with a lower risk of developing chronic non-communicable diseases such as obesity, diabetes, cardiovascular disease, stroke, hypertension, osteoporosis, and certain cancers, which, in turn, is linked to a decreased risk of mortality [20].

In this study, we found no statistically significant relationship between the consumption indexes of fruit, vegetables, and nuts with BMI and fat percentage. Moreover, through the R square value, there was a low probability that increased consumption of vegetables, fruit, and nuts was related to lower body fat percentage ($r = -0.066$, $p = 0.560$; $r = 0.119$, $p = 0.292$; $r = 0.012$, $p = 0.913$, respectively). Also, through the R square value, there was a moderate probability that increased consumption of vegetables and nuts was related to lower BMI ($r^2 = 0.143$, $p = 0.203$; $r^2 = 0.080$, $p = 0.477$, respectively), however, fruit's correlation to BMI was low ($r^2 = - 0.037$, $p = 0.742$). Similarly, Wall et al. [23] suggested that consuming fruit and vegetables twice or three times per week was negatively associated with high BMI as fruit and vegetables are high in water and dietary fiber content, which may be beneficial in reducing the risk of obesity and increasing satiety. Interestingly, it is important for athletes, and particularly professional ones, to assess their body composition to help optimize performance and monitor successful training.

Our results concur with those of Ludwig [24], who employed a non-randomized, quantitative, pre-post design to investigate the correlations between the consumption of fruit and vegetables with body fat percentage in male and female collegiate athletes (N = 27; aged 18–25), namely, American football players (n = 19), and volleyball players (n = 8). There was a statistically significant correlation between fruit and vegetable intake and body fat percentage in the American football players (r: 0.403 and 0.2298, respectively), indicating a negative relationship between fruit and vegetable intake and body fat percentage. As vegetable and fruit intake increased, body fat percentage decreased. These results underline that the consumption of fruit and vegetables decreases fat mass; here, it is noteworthy that the recommended body fat percentage for male athletes is between 6–13% [24]; athletes are advised to strive for higher muscle mass and lower fat mass [25]. A recent study suggested that irregular food intake and a diet restricted in fruit and vegetables can result in oxidative stress and tissue damage, which results in increased inflammatory processes, decreased immunity, increased susceptibility to injury, and prolonged recovery in athletes [26]. We encourage focusing on specific food items rather than just planning a plain diet.

Nevertheless, lower BMI values are also associated with consuming nuts. This could be possibly explained by the high fiber content of nuts, which causes increased satiety and appetite suppression; nuts are also energy-dense and contain high amounts of non-saturated fat but are low in saturated fat and high in protein. Other explanations for lower BMI values among those who consume nuts include increased satiety, elevated resting metabolic rate, and the fact that the fat contained in nuts is not completely absorbed due to incomplete mastication, thus, a proportion of the available energy from nuts is lost as a result of fecal fat loss [23]. Furthermore, Mellendick et al. [27] found that a diet rich in fruits is associated with lower BMI.

The human body's antioxidant defense system is extremely complex depending on the food intake of minerals and vitamins [28]. Indeed, it's not well known whether naturally the human body's antioxidant defense system is enough to counter act the free radicals induced by training and exercise or further increase in dietary intake is required [29]. Thus, it is generally recommended for athletes to consume diet rich in antioxidants including fruits and vegetables [28,29]. Antioxidants and phenolic compounds contained in fruits and vegetables have been attributed to a positive effect on improving the lipid profile amongst patients with cardiovascular [30,31]. Also, another positive effect of diet rich in fruits and vegetables is lowering cholesterol levels [31]. Hence, to the best of our knowledge, the current study is one of few recent works to evaluate the relationship between specific food item indexes and BMI and fat percentages among elite adult soccer athletes in Saudi Arabia. These results add novel findings that can inform dietary strategies for such athletes to enhance performance and recovery.

5. Conclusions

Nutrition and quality of diet are critical factors that determine the performance of elite soccer athletes and enable them to achieve better competitive results. Proper nutrition is also extremely important to promote normal BMI and fat mass percentages. Our results show that a diet rich in vegetables and nuts was moderately associated with preferable BMI ranges; fat mass percentages were significantly predicted by BMI. Greater consumption of vegetables and nuts was moderately correlated to lower BMI values. Thus, consuming more vegetables and nuts improves BMI. The crucial role of nutritional habits among elite athletes underscores the importance of conducting further research on this area, particularly in Arab countries.

Author Contributions

Conceptualization, HG. GA. And AIA; methodology, GA. AIA. AKB. FNA and KSA; formal analysis, JHS. ATA. JHA and LSN; investigation, HG. FNA. GH and JHA.; curation, AIA. YRG. And AAA; writing—original draft preparation, GH. AAA. YRG. and AKB.; writing—review and editing, YRG. AIA. KSA. AAA. GH. AKB. All authors have read and agreed to the published version of the manuscript.

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Institutional Review Board Statement

This study was approved by the ethical committee at King Saud University (E-21-5659) and conducted as per the guidelines of the Declaration of Helsinki.

Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

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Conflicts of Interest

The authors declare no conflict of interest.

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