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RESEARCH ARTICLE

A PAIRED-MATCH STUDY: EQUINE ATHLETES' NUTRITIONAL HABITS, ANTHROPOMETRIC MEASUREMENTS, AND POSTURES

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ABSTRACT

Background and Purpose: The Mediterranean diet-MeD provides beneficial nutrients that improve athletes' health. Posture is important for the performance of equine athletes-EA. This study aimed to determine adherence to the MeD, anthropometric measurements, and postures of EA.

Methods: There were two study groups, EA(n:121) and non-athletes(n:121). The Mediterranean Diet Quality Index, the Mediterranean Diet Adherence Screener, the Food Frequency Questionnaire, the New York Posture Analyses-NYPA, an electronic scale, and a non-stretch tape were used.

Results: EA's MeD-characterized food consumption (vegetables, fruits, fish) frequencies were more compatible with recommendations($p<0.05$). Whereas body height, body mass index-BMI, and waist circumference were not related to NYPA scores in non-athletes, negative correlations were found in EA($p<0.05$). 62.8% of riders had moderate and high adherence to the MeD, with children performing better than adults(p:0.003). The prevalence of preobesity/obesity was higher among adult riders(p:0.008). Professional adult riders had a lower health risk based on their waist circumferences than amateurs(p:0.036).

Conclusion: Some anthropometric measurements showed a negative association with riders' postures. Although there was no statistical difference between the MeD adaptations and BMI classifications between study groups, the age group influenced these two variables in riders. Equestrian sports subgroups were also found to have an impact on athlete health.

Key-words: Equestrian sports; nutrition; posture; anthropometric measurements

INTRODUCTION

Horses have been a part of human life throughout history. They were one of the most important means of transportation and played an important role in wars and agriculture in the past. And today; their role in human life is more emotional and professional. There is an Olympic sports category called equestrian events. Show jumping is one of the three Olympic equestrian sports (1,2). The popularity of equestrian sports continues to increase. Equestrian sports are one of the rare sports types performed by two different types of living beings. Although the risk of accidents and injuries is potentially higher than in other sports, equestrian sports positively affect human physical and mental health (3). Performance success in equestrian sports depends not only on the performance of horses but also on the rider's anthropometric measurements, muscle strength, nutritional behavior, etc (4,5). The body weight of equine athletes is one of the important anthropometric measurements that can influence performance (6). The Academy of Nutrition and Dietetics, Dietitians of Canada, and the American College of Sports Medicine have published a position paper indicating that healthy eating habits and normal body composition have a very positive impact on athletic performance (7). As a balanced nutritional model, the Mediterranean diet can provide performance-relevant nutrients and dietary components, such as vitamins, minerals, and other antioxidants, for athletes. In addition, the use of the Mediterranean diet has gained worldwide acceptance (8). With this in mind, the present study aimed to investigate Mediterranean diet compliance, dietary habits, anthropometric measurements, and posture in licensed riders of the North Cyprus Equestrian Federation. All results were compared with those of a non-athlete group. This present study is the first to pursue this objective in the northern part of Cyprus and it is also one of the few studies in the literature on this topic.

MATERIALS AND METHODS

Participants

The study was conducted from July to December 2022 in the northern part of Cyprus. In the present study, there were two groups of participants, the equine athletes' group and the non-athletes. The equine athlete group consisted of licensed riders from the North Cyprus Equestrian Federation. The Federation is under the Ministry of National Education, Youth, and Sports of the northern part of Cyprus and there are nine riding clubs under the federation. There was a total of 152 registered (licensed) active riders (6-64 aged), who ride at least once a week, in these nine riding clubs. All riding clubs and riders were licensed in only show jumping. Due to the size of the population, the present study was not conducted with a random sample, but the entire population (N: 152) was invited to participate in the study. Participation in this study was voluntary and all adult participants and parents of child participants signed a consent form. Because some riders (n: 31) did not want to participate, the present study was conducted with 121 adult and child riders. This study was approved and registered by the Scientific Research Ethics Committee of Near East University (Date: 30.06.2022, Decision No: 2022/104-1574).

Procedures

In this paired-match study, all nine riding clubs were visited a few times during this period and nutrition-related data were collected by dietitians, and posture-related data by a physiotherapist. The non-athlete group consisted of people who were not athletes in any type of sport. The non-athletes were selected by the researchers according to the equine athlete group and the 'individual matching/matched pair design' method was used (9). The inclusion criteria for both groups are shown in Figure 1. The data were collected in the face-to-face interviews conducted by researchers. The Mediterranean Diet Quality Index (KIDMED) was used by dietitians for children and the Mediterranean Diet Adherence Screener (MEDAS) for adults to determine dietary adherence across all age groups. Both questionnaires provided the same categories (low-moderate-high adaptation) as a result. The Food Frequency Questionnaire (FFQ) was used to determine all participants' food consumption frequencies. The New York Posture Analysis (NYPA) was used by the physiotherapist researcher to determine the postural status of the participants. Moreover, the dietitian researchers determined the anthropometric measurements of the participants, such as height, body weight, and waist circumference. All of the data collection material is shown as a summary in 1.

Mediterranean Diet Quality Index (KIDMED)

The KIDMED was developed by Serra-Majem et al. in English to assess children's adherence to the Mediterranean diet (10). Kaya and Temiz (2021) validated the questionnaire in Turkish (11). The KIDMED contains 12 questions compatible with the Mediterranean diet, and four incompatible questions for a total of 16 questions. Each positive response to the compatible questions yields +1 point, and adherence to incompatible questions yields -1 point. A score of ≥eight points indicates 'high' compliance with the Mediterranean diet, four-seven 'moderate', and ≤three 'low'(10).

Mediterranean Diet Adherence Screener (MEDAS)

Martínez-González et al. (2012) developed the MEDAS for assessing adherence to the Mediterranean diet in adults. This questionnaire includes 14 questions and each positive response to

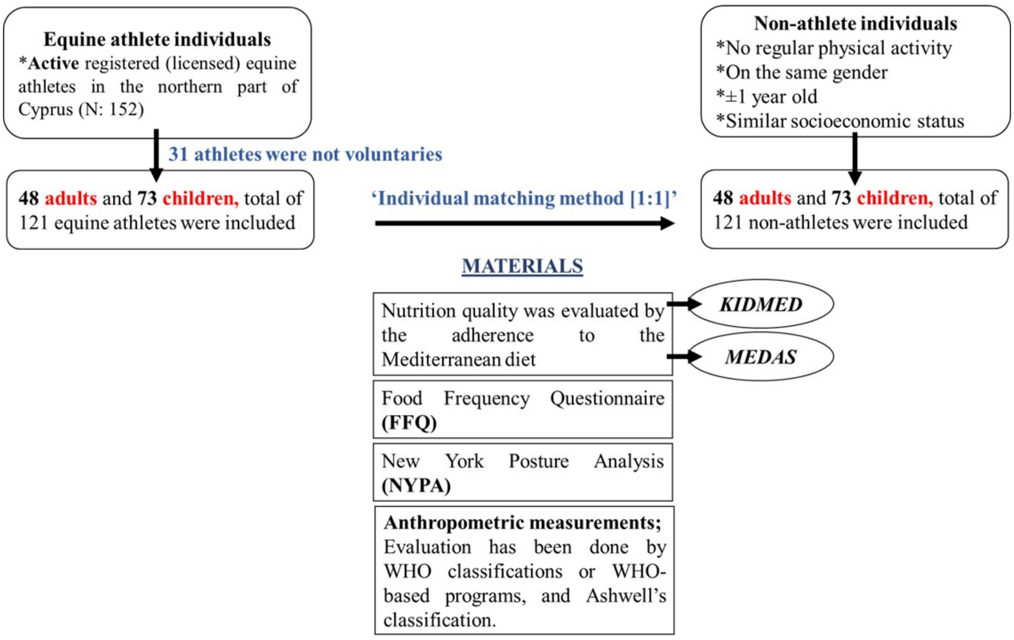

Figure 1. Study design, participant selection, and materials of data collection

all questions yields +1 point. If the participant scores ≥nine points, this indicates 'high', seven-eight 'moderate', and ≤six 'low' adherence to the Mediterranean diet (12). The Turkish validity-reliability study was done by Pehlivanoglu et al (13).

Food Frequency Questionnaire (FFQ)

The Likert-type FFQ was developed by the researchers and there were eight different response options for each food, such as 'every main meal', 'every day, 'one-two times/week', 'three-four times/week', 'five-six times/week', 'twice in a month', 'once in a month', and 'never'. The data from this section were used to assess the dietary habits of the participants according to the principles for optimal nutrition in the Dietary Guidelines for Turkey 2022 (14). According to this guideline, participants' consumption-related responses were categorized as 'recommended frequency' and 'not recommended frequency'.

New York Posture Analyses (NYPA)

The NYPA was published in 1958 and updated in 1992. This questionnaire assesses 13 different parts of the human body to determine the physical condition of various body segments. It is a visual scale and there are three different choices for each body segment, such as 'normal' (five points), 'moderately impaired' (three points), and 'severely impaired' (one point). ≥45 points of the NYPA total score indicate 'very good posture', 40-44 'good', 30-39 'moderate', 20-29 'poor', and ≤19 'very poor' (15,16).

Anthropometric Measurements

All measurements were performed correctly and in accordance with the methods. An electronic scale was used to measure the body weight of the participants (with 0.1 kg sensitivity). Furthermore, height and waist circumference were determined with a non-stretchable tape measure at the Frankfort plane. Body mass index (BMI) was calculated using the [(Body weight) ÷ (Body height)^2] formula. BMI values and waist circumferences of adult participants were evaluated according to the World Health Organization (WHO) classification (14), whereas BMI values of children were evaluated as percentiles using the WHO-Anthro plus package program. In addition, the ratio between waist circumference and height of the children was calculated and the Ashwell classification was used for evaluation. According to this classification, <0.4 signs as 'be careful', 0.4-0.5 'normal', 0.5-0.6 'think of action', and >0.6 'take action' to improve this ratio. As the ratio increases, the risk of childhood obesity increases (17).

Statistical Analysis

Data were analyzed by Statistical Package for the Social Sciences (SPSS) version 24.0. The mean ($\bar{x}$), standard deviation (SD), and minimum and maximum

Table 1. General backgrounds of participants and athletic characteristics of riders

	General Backgrounds of Participants			
	Age (year)			
Study Groups	**Mean±SD (Min-Max)**			
Equine athletes (n: 121)	20.43±11.88 (6.00-64.00)			
Non-athletes (n:121)	20.39±12.04 (7.00-65.00)			
	p_1: 0.664			
	Gender			
	Equine athletes (n: 121)		**Non-athletes (n: 121)**	
	n	**%**	**n**	**%**
Male	47	38.8	47	38.8
Female	74	61.2	74	61.2
Total	121	100.0	121	100.0
	p_2: 1.000			
	Athletic Features of Riders			
	Subcategory of equestrian sport			
	n	**%**		
Show jumping	82	67.8		
Flatwork	30	24.8		
Horseback safari	9	7.4		
Total	121	100.0		
	Aim of the riders			
	n	**%**		
Professional (Competitive) riders	61	50.4		
Non-competitive riders	22	9.1		
Amateurs	38	31.4		
Total	121	100.0		
	Total training day/week Mean±SD (Min-Max)	**Total training duration (mnt)/training Mean±SD (Min-Max)**		
Professional riders (n: 61)	4.09±1.87 (1.00-7.00)	39.18±9.97 (15.00-60.00)		
Non-competitive riders (n: 22)	2.36±1.76 (1.00-7.00)	46.13±12.62 (20.00-60.00)		
Amateurs (n: 38)	2.50±1.65 (1.00-7.00)	38.82±14.65 (15.00-90.00)		
	p_3: <0.001	**p_4: 0.049**		

p_1: Wilcoxon Signed Rank test; p_2: McNemar test; p_3: One-Way ANOVA, Post Hoc test Benferroni-Group comparisons: Competitive-Non-competitive p: <0.001; Competitive-Amateur p: <0.001; p_4: One-Way ANOVA, Post Hoc test LSD-Group comparisons: Non-competitive-Competitive p: 0.022; Non-competitive-Amateur p: 0.026; Bold **p-value** shows statistical significance (p<0.05); SD: Standard deviation

values were used to represent quantitative variables. In addition, the number (n) and percentage (%) were used for categorical variables. For evaluation of normality, the Kolmogorov-Smirnov and Levene's tests were used. Due to the data being collected by individual matching method, study groups were accepted as dependent. So the Wilcoxon Signed Rank test was used to observe the relationship between the two dependent groups (e.g. study groups; equine athletes vs non-athletes) for the quantitative variables. In addition, for independent subgroups (e.g. professional riders vs others in the equine athlete group, adult riders vs children riders, etc.), the Independent Sample t-test was used. For the categorical variables, the McNemar test was used for dependent groups.

On the other hand, the Pearson Chi-square test was used to compare the independent subgroups when the percentage of cells with an expected value lower than five is less than 20% of the total number of cells. Moreover, the One-Way ANOVA test was used to compare quantitative data between three independent subgroups. The LSD and Bonferroni's Post Hoc tests were used to determine which groups were related. In addition, the data were not normally distributed, so the Spearman correlation test was used for the correlations. If the p-value is less than 0.05, this indicates a statistically significant difference.

RESULTS

The general backgrounds of all participants as equine athletes and non-athletes, and the athletic characteristics of the riders are shown in Table 1. Due to the study design, there were no statistical differences between the age and gender of the groups (p>0.05). The majority (67.8%) of equine athletes were licensed show jumpers, half of whom were professional (competitive) athletes (50.4%). When comparing the total training days per week and the duration of training in horse rider subgroups, statistical differences were found (respectively p<0.001; p<0.05). According to the results of the Post Hoc test, the professional riders trained more than others (non-competitive riders and amateurs) in a week, and the non-competitive riders had a longer training duration per ride than other groups (p<0.05). When comparing body weight, BMI, waist circumference, and waist circumference to the body-height ratio (for children only), no statistical differences were found between the study groups. Although the difference was not statistically significant, 58.3% of adults in the non-athlete group had a high or very high health risk based on their waist circumference and this value was higher than adults in the equine athlete group (47.9%) (p>0.05). Furthermore, there was no difference in the Mediterranean diet adjustment status between groups in both adult and child participants. In addition,

Table 2. Anthropometric measurements of the participants and adherence to the Mediterranean diet (n: 242)

	Anthropometric Measurements								
	BMI (kg/m²)			**Body weight (kg)**			**Waist circumference (cm)**		
	Equine athletes	**Non-athletes**		**Equine athletes**	**Non-athletes**		**Equine athletes**	**Non-athletes**	
	Mean±SD (MinMax)		**p1**	**Mean±SD (Min-Max)**		**p1**	**Mean±SD (Min-Max)**		**p1**
Children (n: 73)	20.25±3.75 (13.23-30.81)	20.25±4.47 (12.73-40.06)	0.575	50.40±14.69 (17.50-91.00)	50.58±17.61 (23.20-108.20)	0.531	67.96±11.49 (24.00-95.00)	69.14±12.88 (23.00-110.00)	0.380
Adults (n: 48)	25.08±4.36 (16.72-37.28)	24.98±4.90 (17.57-41.20)	0.272	74.05±14.58 (47.20-109.00)	72.14±16.03 (46.00-132.00)	0.056	83.57±13.55 (61.00-126.00)	87.06±15.94 (57.00-143.00)	0.582
Total (n: 121)	22.17±4.63 (13.23-37.28)	22.13±5.18 (12.73-41.20)	0.747	59.78±18.65 (17.50-109.00)	59.13±19.97 (23.20-132.00)	0.466	74.15±14.49 (24.00-126.00)	76.26±16.62 (23.00-143.00)	0.309

Waist circumference classification of adults (n: 96)					**Waist circumference-body weight ratio classification of children (n: 146)**				
	Equine athletes (n: 48)		**Non-athletes (n: 48)**			**Equine athletes (n: 73)**		**Non-athletes (n: 73)**	
	n	**%**	**n**	**%**		**n**	**%**	**n**	**%**
Low health risk•	25	52.1	20	41.7	Healthy□	52	71.2	53	72.6
High or very high health risk••	23	47.9	28	58.3	Unhealthy□□	21	28.8	20	27.4
Total	48	100.0	48	100.0	Total	73	100.0	73	100.0
p2	0.332					1.000			

	Adherence to the Mediterranean Diet											
	All participants (n: 242)				**Adults (n: 96)**				**Children (n: 146)**			
	Equine athletes (n: 121)		**Non-athletes (n: 121)**		**Equine athletes (n: 48)**		**Non-athletes (n: 48)**		**Equine athlete (n: 73)**		**Non-athletes (n: 73)**	
	n	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Low	45	37.2	51	42.1	27	56.3	25	52.1	18	24.7	26	35.6
Moderate	57	47.1	54	44.6	15	31.3	16	33.3	42	55.5	38	52.1
High	19	15.7	16	13.2	6	12.5	7	14.6	13	17.8	9	12.3
Total	121	100.0	121	100.0	48	100.0	48	100.0	73	100.0	73	100.0
p2	0.298				0.833				0.211			

	Comparison of participants' BMI classifications and MEDAS/KIDMED scores			
	Adults (MEDAS)		**Children (KIDMED)**	
	Equine athletes (n: 48)	**Non-athletes (n: 48)**	**Equine athletes (n: 73)**	**Non-athletes (n: 73)**
	Mean±SD (Min-Max)		**Mean±SD (Min-Max)**	
Healthy BMI value**	6.39±1.85 (3.00-11.00) (n: 28)	6.17±2.21 (2.00-11.00) (n: 28)	5.34±2.69 (0.00-11.00) (n: 47)	4.62±2.78 (0.00-11.00) (n: 48)
Non-healthy BMI values* and ***	6.30±2.49 (1.00-11.00) (n: 20)	6.45±1.73 (2.00-9.00) (n: 20)	5.65±1.99 (2.00-10.00) (n: 26)	5.00±2.38 (0.00-8.00) (n: 25)
p3	0.883	0.650	0.606	0.569

p1: Wilcoxon Signed Rank test; p2 McNemar test; p3: Independent Sample t test; •<80 cm for females; <94cm for males; ••≥80 cm for females; ≥94 cm for males; □: 0.4-0.5 ratio; □□<0.4 or >0.5 ratio; *≤18.4 kg/m² for adults, 3rd-15th percentiles for children; **18.5-24.9 kg/m² for adults, 15th-87th percentiles for children; *** ≥25.0 kg/m² for adults, ≥87th percentile for children; BMI: Body Mass Index; MEDAS; Mediterranean Diet Adherence Screener; KIDMED: Mediterranean Diet Quality Index

no association was found between the BMI classification and mean MEDAS/KIDMED scores. All related results are shown in Table 2.

Table 3 shows the same data from the comparison of rider subgroups. According to these results, there was statistical significance between the BMI classifications of child and adult riders. The prevalence of preobesity and obesity was higher in adults than in children (p: 0.008). Although the results were not statistically significant, the prevalence was lower in the professional riders than in the others (p>0.05). Waist circumferences of adult riders were compared between the professional riders and others. 70.0% of adult professionals had a low health risk as measured by their waist circumference. For the other riders, this value was 39.3% (p: 0.036). In addition, no statistical difference was found between the body-to-height ratio of the child professionals and other riders (p>0.05). When the adaptation status of the Mediterranean diet was compared between children and adult riders, the statistical differences showed that children riders adhered to the Mediterranean diet better than adults (p: 0.003). Furthermore, there was no statistical association between BMI classification and MEDAS/KIDMED scores in equine athletes.

The frequency of consumption of some foods by participants is shown in Table 4. The equine athletes had slightly more compatibility with the recommended consumption frequencies for milk, yogurt, all types of cheeses, processed meat products, chocolate, sugar, and fast foods. Conversely, the consumption frequencies of red meat, poultry, egg, legumes, and carbonated drinks were slightly more compatible with the recommendations in the non-athletes. However, all these differences were not statistically significant (p>0.05). Statistical significance was found for fish, vegetables, and fresh fruit. The frequency of consumption of equine athletes was found to be more consistent with the recommendations (p<0.05).

Table 3. Anthropometric measurements of riders and adherence to the Mediterranean diet (n: 121)

Anthropometric Measurements

Classification of BMI (n: 121)

	Child riders (n: 73)		**Adult riders (n: 48)**	
	n	**%**	**n**	**%**
Thin*	11	15.1	1	2.1
Normal**	48	65.8	28	58.3
Preobese or obese**	14	19.2	19	39.6
Total	73	100.0	48	100.0
	p_1: 0.008			

	Professionals (n: 61)		**Others (n: 60)**	
	n	**%**	**n**	**%**
Thin*	7	11.5	5	8.3
Normal**	43	70.5	33	55.0
Preobese or obese**	11	18.0	22	36.7
Total	61	100.0	60	100.0
	p_1: 0.070			

Waist circumference classification of adult riders (n: 48)

	Professionals (n: 20)		**Others (n: 28)**	
	n	**%**	**n**	**%**
Low health risk•	14	70.0	11	39.3
High or very high health risk••	6	30.0	17	60.7
Total	20	100.0	28	100.0
p_1	**0.036**			

Waist circumference-body weight ratio classification of child riders (n: 73)

	Professionals (n: 41)		**Others (n: 32)**	
	n	**%**	**n**	**%**
Healthy□	29	70.7	23	71.9
Unhealthy□□	12	29.3	9	28.1
Total	41	100.0	32	100.0
p_1	0.915			

Comparison of Mediterranean diet adaptations between child-adult riders (n: 121)

	Child riders (n: 73)		**Adult riders (n: 48)**	
Adaptation status	**n**	**%**	**n**	**%**
Low	19	26.0	27	56.3
Moderate and High	54	74.0	21	43.7
Total	73	100.00	48	100.0
	p_1: 0.003			

Comparison of riders' BMI classifications and MEDAS/KIDMED scores

	Adults (MEDAS)		**Children (KIDMED)**	
	Professionals (n: 20)	**Others (n: 28)**	**Professionals (n: 41)**	**Others (n: 32)**
	Mean±SD (Min-Max)			
Healthy BMI value**	6.26±1.27 (5.00-9.00) (n: 15)	6.53±2.40 (3.00-11.00) (n: 13)	5.88±2.66 (0.00-11.00) (n: 27)	4.60±2.62 (1.00-11.00) (n: 20)
Non-healthy BMI values* and ***	5.60±1.67 (4.00-8.00) (n: 5)	6.53±2.72 (1.00-11.00) (n: 15)	5.50±2.37 (2.00-10.00) (n: 14)	5.83±1.52 (4.00-8.00) (n: 12)
p_2	0.361	0.996	0.649	0.150

p_1: Pearson Chi-square test; p_2: Independent Sample t test; *≤18.4 kg/m² for adults, 3rd-15th percentiles for children; **18.5-24.9 kg/m² for adults, 15th-87th percentiles for children; *** ≥25.0 kg/m² for adults, ≥87th percentile for children; •<80 cm for females; <94cm for males; ••≥80 cm for females; ≥94 cm for males; □: 0.4-0.5 ratio; □□<0.4 or >0.5 ratio; Bold **p-value** shows statistical significance (p<0.05); SD: Standard deviation; BMI: Body Mass Index; MEDAS; Mediterranean Diet Adherence Screener; KIDMED: Mediterranean Diet Quality Index

Almost all participants in both groups had very good postures according to NYPA [Equine athletes (99.2%); Non-athletes (96.7%)]. When comparing the NYPA totals, no statistical significance was found between professional and other riders in both the children and adult groups (p>0.05). On the other hand, there were negative correlations between age, body weight, BMI, waist circumference, and NYPA scores.

The correlations showed that when age, body weight, BMI, and waist circumference increased, the NYPA score of the riders decreased (p<0.05 for all).

Table 4. Food consumption frequencies of the participants. (n: 242)

	Compatible with recommended consumption frequencies				
	Equine athletes (n: 121)		**Non-athletes (n: 121)**		
Food items ▼	**n**	**%**	**n**	**%**	**p**
Milk	50	41.3	38	31.4	0.141
Yogurt	52	43.0	38	31.4	0.103
All types of cheese	62	51.2	56	46.3	0.504
Red meat	45	37.2	55	45.5	0.245
Poultries	36	29.8	38	31.4	0.885
Fish	60	49.6	28	23.1	**<0.001**
Proceed-red meat products	92	76.0	83	68.6	0.262
Egg	65	53.7	75	62.0	0.220
Legumes	92	76.0	99	81.8	0.324
Vegetables	61	50.4	43	35.3	**0.025**
Fresh fruits	62	51.2	45	37.2	**0.040**
Whole grain bread	22	18.2	22	18.2	1.000
Chocolate	61	50.4	58	47.9	0.795
Sugar	78	64.5	74	61.2	0.708
Fast foods	110	90.9	108	89.3	0.832
Carbonated beverages	74	61.2	81	66.9	0.427

p: McNemar test; Bold **p-value** shows statistical significance (p<0.05)

Furthermore, these correlations were found not to be statistically significant for the non-athletes. All results are shown in Table 5.

DISCUSSION

Athletic horses have similar physical characteristics and abilities thus anthropometric measurements of the riders are one of the most important factors that can influence athletic performance and success. However, Diedhiou et al. (2019) reported that there was no relationship between BMI and athletic performance in show jumpers. Furthermore, BMI values were similar in show jumpers and dressage riders (18). In addition to regular physical activity, genetic factors, physiology, and dietary habits can also influence anthropometric measures in humans (19). Although the BMI values for the equine athlete and non-athlete groups were similar, there was a non-significant difference between the BMI classifications of professional riders and other riders in this study. Table 3 shows that the BMI values of professional riders were more consistent with the recommendations of WHO than those of the other riders (p>0.05). On the other hand, when comparing the BMI classifications of the riders with the age groups, statistical significance was found and the BMI values of the child riders were more consistent with the recommendations than adults (p: 0.008).

This could be related to the fact that children adhere better to the Mediterranean diet (Table 3, p: 0.003). In addition to BMI, no statistical differences were found in body weight and waist circumference between the two study groups (Table 2). However, 70% of adult professional riders had a low health risk according to the classification of their waist circumference by WHO. This proportion was almost twice as high as for the other riders (p: 0.036; Table 3). This could be explained by professionals having a higher weekly training frequency than others (p<0.001). The duration and frequency of training are among the effective factors in anthropometric measurements and can therefore potentially affect the health of athletes. In one study, the positive effects of regular and intensive strength training on body weight, BMI, and waist circumference were observed (20).

Nutrition is one of the most important determinants of athletic performance (21). As the healthiest dietary model, the Mediterranean diet is important for reducing the risk of chronic diseases due to its content of nutrients. In addition, the Mediterranean diet can potentially reduce exercise-related inflammation and oxidative stress thereby supporting athletic performance (21,22). Bifilco et al. (2019) have shown that the Mediterranean diet can provide the required nutrient intake and adherence to this nutritional model can reduce the need for supplements (23). Bitler et al. (2018) conducted a study with 526 licensed adult riders and observed normal BMI values, healthy lifestyles, and nutritional behaviors (24). Martínez-Rodríguez et al. (2021) reported that there was a positive association between the Mediterranean diet adaptation of the handball players and their body weight (25).

Table 5. Posture analysis of the riders and the related factors (n: 121)

	All riders (n: 121)		Child riders (n: 73)		Adult riders (n: 48)	
NYPA score	**Professionals (n: 61)**	**Others (n: 60)**	**Professionals (n: 41)**	**Others (n: 32)**	**Professionals (n: 20)**	**Others (n: 28)**
Mean±SD	58.96±4.95	59.11±5.03	60.21±3.76	59.65±4.56	56.40±6.11	58.50±5.54
Min-Max	41.00-65.00	47.00-65.00	51.00-65.00	47.00-65.00	41.00-63.00	47.00-65.00
p_1	0.870		0.565		0.221	

Correlation between age, anthropometric measurements, and NYPA score in riders (n: 121)								
	Age		**Body weight**		**BMI**		**Waist circumference**	
	r	**p_3**	**r**	**p_3**	**r**	**p_3**	**r**	**p_3**
NYPA score	-0.212ǂ	**0.019**	-0.220ǂ	**0.015**	-0.254ǂǂ	**0.005**	-0.228ǂ	**0.012**
Correlation between age, anthropometric measurements, and NYPA score in the non-athletes (n: 121)								
	Age		**Body weight**		**BMI**		**Waist circumference**	
	r	**p_3**	**r**	**p_3**	**r**	**p_3**	**r**	**p_3**
NYPA score	-0.153	0.093	-0.169	0.064	-0.158	0.084	-0.176	0.054

p_1: Independent Sample t-test; p_2: Spearman's correlation test; ǂǂ: Correlation is significant at the 0.01 level; ǂ: Correlation is significant at the 0.05 level; SD: Standard deviation; NYPA: New Yok Posture Analyses; BMI: Body Mass Index; Bold p-value shows statistical significance ($p<0.05$)

However Table 3 shows that the association between Mediterranean diet adaptation and BMI values was not significant in the presented study. Although some studies aimed to evaluate Mediterranean diet adherence in athletes, no data on horse riders were found in the current literature. The study of 2037 cyclists and 2000 triathlon athletes observed that these branched athletes adapted to the Mediterranean diet. It was also found that the mean MEDAS scores of the cyclists were higher than those of the others (26). Mayolas-Pi et al. (2017) conducted a study with three groups: amateur cyclists, indoor cycling instructors, and sedentary adults. The lowest adaptation to the Mediterranean diet was found in sedentary adults. It was also found that the adaptation status of amateur cyclists was better than that of indoor cycling instructors (27). Another study showed that most elite female athletes (58.33%) had poor compliance with the Mediterranean diet (28). On the other hand, Alacid et al. (2014) observed that the adaptation status of female athletes to the Mediterranean diet was more than moderate, and more than half of the female participants had high adherence. Furthermore, similar to our results, no differences were found between the Mediterranean diet adherence and BMI values in this study (29). Although there were no statistically significant results when comparing the two study groups for Mediterranean diet adherence, more than half of the riders had moderate and high adaptation status (62.8%) (Table 2). In addition, child riders were more compliant with the Mediterranean diet than adults. This difference was statistically significant (Table 3). The result may be related to nutritional care needs in childhood. Parents with higher socioeconomic status may have well nutritional knowledge that can influence children's dietary behaviors. Dayi et al. (2021) observed on the island of Cyprus that children's mean KIDMED scores and dietary diversity were related to the mothers' educational level and dietary behavior (30). Consumption of olive oil, vegetables, fruits, nuts, lentils, and whole grains is high; consumption of fish, red wine, and dairy products is moderate, and poultry, red meat, and processed red meat products are rare in the Mediterranean diet (31). When the frequency of food consumption was compared between study groups, it was found that the frequency of fish, vegetable, and fruit consumption was more in line with the recommendations in the equine athlete group ($p<0.05$). Although there was no statistical association between the groups' Mediterranean diet adjustments, higher adherence to some food consumption frequencies was observed for the Mediterranean diet food components in the equine athlete group (Table 2; Table 4).

The postural profile has important implications for general health, well-being, aging, and also athletic performance. Growth and development speed, sedentary lifestyle, etc. are related to postural defects. Physical activity provides muscle strength and physically active people spend less time in a sitting position than sedentary people (32). However, some sports can be crucial for postural development, especially in adolescents (33). Jurjiu and Pantea (2018) conducted a study with male athletes from different sports such as basketball, volleyball, and football. When they assessed the postures of the athletes based on their stance positions, they reported that athletes from each sport had negative postural changes and the type of changes depended on the sport (34). In this study, 99.2% of equine athletes had very good posture according to NYPA assessments. And, almost all participants from the non-athletes group also had good posture. One study underlined that the postures of the riders, especially during training, are very important for the movement of the horse and thus for athletic performance (35). Hobbs et al. (2014) collected posture data using 3-D motion capture technology from 134 adult dressage riders. The result of the study was that competitive dressage riders were at higher risk for developing asymmetry (36). As shown in Table 5, there were no statistically significant differences between the average NYPA scores of professional and other riders, both for riders overall and for children and adult riders. From this, it can be said that the purpose of riding in the present study was not found to be effective on the postures of the athletes. However, negative statistically significant correlations were found between athletes' age, body weight, BMI, waist circumference, and NYPA scores while there were no important correlations for non-athletes in the present study (Table 5). That is when age, body weight, BMI, and waist circumference increase, the NYPA scores of the riders decrease and this shows that postural health deteriorates. One study found similar results in children and observed a negative correlation between age, body weight, BMI scores, and New York Posture Rating Chart scores (37). In addition, some studies in the current literature show that weight gain has a negative impact on posture (38, 39). Although there are not enough studies on the determinants of postural conditions of athletes, a study by Andreeva et al. in many sports such as shooting, boxing, tennis, football, running, etc. (except horse riding) found that age is one of the determinants of posture, and postural stability deteriorates as athletes' age (40).

Strengthens and Limitations

Generally, when the authors compared results with other published similar articles, the method of the presented study (individual matching/matched pair design) strengthens the evidence level of results. In addition, 3-D motion capture technology could be better for determination of participants' postures. Also, participants' detailed body analyses by Body Impedance Analysis (BIA) could be better. The presented study can be a guideline for future studies that will aim to use these materials.

CONCLUSION

The present study aimed to determine the effects of equine sports on athletes' Mediterranean diet compliance, anthropometric measurements, and posture. No statistically significant effect on the Mediterranean diet adaptation status was observed for both equestrian sports and sub-branches. However, the adaptation of children riders was significantly better than that of adults.

On the other hand, although the Mediterranean diet adaptation status was similar for both study groups, the frequency of food intake characterized by the Mediterranean diet in equine athletes was more in line with the principles of optimal nutrition. In addition, the prevalence of preobesity and obesity was lower in child riders than in adult riders. And, when the waist circumferences of adult riders were assessed, the adult competitive riders were found to have a lower health risk than the other adult riders. The lower health risk might be related to competitive riders' higher training frequencies. Some anthropometric measurements were found to be risky for postural health in equine athletes. When their height, BMI, and waist circumference increased their NYPA values decreased, while this situation was not observed in the non-athlete group. Equine athletes' posture has an important role in the performance of both riders and horses. Thus, this situation may affect their athletic performance. In the current literature, there are only a limited number of studies on the general health status of riders, their lifestyle behavior, and also their posture. Therefore, this study is essential and sheds light on the unknown areas of the sports, physiotherapy, and nutritional sciences. However, there is still a need for more studies on this topic with similar objectives to increase the level of evidence of the existing results.

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