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KUŞBURNU SUYU TAKVİYESİNİN TAKIM SPORCULARININ FARKLI PERFORMANS PARAMETRELERİNE ETKİSİ

ROSEHIP JUICE SUPPLEMENT AFFECTS DIFFERENT PERFORMANCE PARAMETERS IN TEAM ATHLETES

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Kuşburnu Suyu Takviyesinin Takım Sporcularının Farklı Performans Parametrelerine Etkisi

ÖZ

Çalışmanın amacı, kuşburnu suyu takviyesinin 14-18 yaş aralığındaki takım sporcularının, farklı performans bileşenlerine olan etkilerini incelemektir. Araştırmada 4 haftalık öntest-sontest kontrol gruplu deneysel model kullanılmıştır. Çalışmaya 14-18 yaş aralığında, haftanın 3 günü sportif faaliyetlere katılan sporcular (n=66) katılmıştır. Katılımcılara ön testler olarak; Queen's College Step Test, Running-based Anaerobic Sprint Test, Hexagonal Obstacle Test, 505 Agility Test, Shuttle Run Test ve 35 Metre Speed Test uygulanmıştır. Araştırma grubunun 4 hafta boyunca haftada 5 gün, 250 ml kuşburnu suyu tüketmesi sağlanmıştır. 4 haftalık takviye sonrası aynı testler tüm katılımcılara uygulanmıştır. Elde edilen verilerin değerlendirilmesinde SPSS 25.0 analiz programından yararlanılmıştır. Hexagonal Obstacle Test verilerinin iki grup arasındaki ön test- son test etki büyüklüklerinin farkı %7; 505 Agility Test verilerinin etki büyüklüklerinin farkı ise %22'dir. Queen's College Step Test verilerinden hesaplanan VO_{2max} değeri, hız performansının değerlendirilmesi için uygulanan Shuttle Run Test ve 35 m Hız testinden elde edilen bulgular araştırma grubu lehine değildir. Anaerobik kapasitenin ve yorulma indeksinin değerlendirilebilmesi için Running-based Anaerobic Sprint Test (RAST) uygulanmıştır. Elde edilen verilerle hesaplanan maksimum anaerobik güç %20, minimum anaerobik güç %22 ve ortalama anaerobik güç %31 oranında artmıştır. Araştırma grubunun yorulma indeksi verilerindeki farkı ise %34'tür. Bu çalışmaya göre; kuşburnu suyu takviyesinin çeviklik performansı (%7, %22), maksimum anaerobik güç kapasitesi (%20), minimum anaerobik güç kapasitesi (%22), ortalama anaerobik güç kapasitesi (%31) ve yorulma indeksi (%34) üzerine etkisi olumlu ve geniş ölçüdedir.

Anahtar Kelimeler: Antioksidan, sporcu beslenmesi, sporcu içeçeği

Rosehip Juice Supplement Affects Different Performance Parameters in Team Athletes

ABSTRACT

The aim of this study was to investigate the effects of rosehip juice supplement on different performance components of team athletes (n=66) aged 14-18 years who participated in sports activities 3 days a week. A 4-week pretest-posttest control group experimental model was used and Queen's College Step Test, Running-based Anaerobic Sprint Test, Hexagonal Obstacle Test, 505 Agility Test, Shuttle Run Test and 35 Metre Sprint Test were administered as pre-tests. Research group consumed 250 ml of rosehip juice 5 days a week for 4 weeks. After 4 weeks, the same tests were administered to all participants. SPSS 25.0 analysis program was used to evaluate data. The difference between pre-test and post-test effect sizes between the two groups was 7% for Hexagonal Obstacle Test and 22% for 505 Agility Test. VO_{2max} value calculated from the Queen's College Step Test data, findings of Shuttle Run Test and 35 m Sprint Test administered for speed performance were not in favour of the research group. Running-based Anaerobic Sprint Test (RAST) was administered to evaluate anaerobic capacity and fatigue index. The data obtained showed that maximum anaerobic power increased by 20%, minimum anaerobic power increased by 22% and mean anaerobic power increased by 31%. The difference of the research group in fatigue index data was 34%. As a conclusion, the effects of rosehip juice supplement on agility performance (7%, 22%), maximum anaerobic power capacity (20%), minimum anaerobic power capacity (22%), mean anaerobic power capacity (31%) and fatigue index (34%) were positive and comprehensive.

Keywords: Antioxidant, sports drink, sports nutrition

INTRODUCTION

During exercise, reactive oxygen species are formed due to increased metabolic rate and oxygen use. These species alter the structure and function of cells and contribute to muscle damage and fatigue[1]. If this situation is not balanced, athletes' performance may become jeopardised[2]. Nutrition and exercise complement each other; exercise increases nutritional needs, while individualised nutrition helps to make training more efficient and to ensure optimal performance during competition[3]. Antioxidant supplement in athletes attracts interest due to its role in helping recovery[4]. Antioxidant supplement may be an effective measure against exercise-induced oxidative stress and muscle damage[1]. Increased antioxidant levels can counteract reactive oxygen species, prevent muscle damage, lead to increased endurance performance and delay fatigue[5]. Antioxidant supplement can alter skeletal muscle signalling during and after exercise, leading to changes in glucose metabolism, power production, sodium-potassium pump function, mitochondrial biogenesis markers and insulin sensitivity[6]. Antioxidant supplement can be considered a useful intervention to reduce muscle damage caused by oxidative stress in athletes[7]. Rosehip (*Rosa canina L.*) is an anti-inflammatory food rich in vitamins C, A, B1, B2, E, K and lycopene[8]. It is also an important source of carotenoids, polyphenols, organic acids and tocopherols[9]. Studies have proven that rosehip has high antioxidant content[10].

Different nutritional supplement drinks containing various amounts of carbohydrates, antioxidants and fluids are very important in sports nutrition[11,12,13,14.] It is stated that preferring a carbohydrate-rich drink before and during competition or training can support athletes' glycogen stores, delay fatigue and increase the capacity of various exercise parameters. In addition, hypohydration is associated with increased cardiovascular stress, impaired cognitive function, increased perception of exertion, decreased physical function and decreased technical skills. After competition or training, primary goal is to replenish athletes' carbohydrate stores and reduce fluid and electrolyte deficiency immediately after competition[13].

In this context, national and international literature was analysed. The keywords "kuşburnu" and "kuşburnu suyu" were used for national literature; "rosehip" and "rosehip juice" were used for international literature, and no study on the effects of rosehip juice supplement on the performance of athletes was found. Therefore, it is thought that this study will contribute to the field in terms of national and international literature. The aim of this study was to investigate the effects of rosehip juice supplement on different performance components of 14-18 years old students engaged in team sports.

MATERIAL AND METHODS

Participants

Population consists of high school students between the ages of 14 and 18 who were engaged in team sports and who participated in sports activities 3 days a week. Sample was determined by using simple random sampling method[15], a subtype of Haphazard Sampling model. Sample consisted of voluntary participants (n=66) in Gümüşhane Sports High School. The participants were allocated to research and control groups by using randomised method[16].

Exclusion criteria were having chronic diseases, smoking and alcohol use, regular use of nutritional supplements and absenteeism from school for more than 10 days.

Experimental Design

The study was conducted with a 4-week pretest-posttest control group experimental model[16,17]. All participants were informed about the study. Detailed information form and parental consent form were requested from participants and parents randomly allocated as research and control groups. Queen's College Step Test, Running-based Anaerobic Sprint Test, Hexagonal Obstacle Test, 505 Agility Test, Shuttle Run Test and 35 Metre Sprint Test were administered to all participants as pre-tests. While the participants continued their own training for 4 weeks, research group consumed 250 ml of rosehip juice 5 days a week between 13.00 and 14.00[18-28]. After 4 weeks of 250 ml rosehip juice consumption, the same tests were administered.

Ethical Issues

This study was approved by the 09/33 numbered ethics committee decision of Giresun University Rectorate Social Sciences, Science and Engineering Sciences Research Ethics Committee. Since the athletes were not adults, "Parental Consent Form" and "Informed Consent Form" were obtained from parents and athletes.

Statistical Analysis

SPSS 25.0 package program was used to evaluate the data obtained. Whether the data were normally distributed was determined by Shapiro-Wilk normality test[29] and Skewness and Kurtosis values[30]. Since the sample groups included less than 50 individuals, Shapiro-Wilk test was taken into account in normality tests; significance value of 0.05 was accepted[31]. Skewness and Kurtosis values were between the limits of ±1.5; therefore, the data were suitable for normal distribution[30]. Independent Samples T Test was used for normally distributed data between research and control groups, and Mann Whitney U test was used for non-normally distributed data[16]. In the analysis of pretest-posttest data within a single group, Paired Samples T Test (Dependent Samples T Test) was used if the differences were normally distributed. When the differences were not normally distributed, Wilcoxon Signed Ranks Test was used[32]. The results of the analyses were interpreted with test statistics and p values, and $p \leq 0.05$ was considered significant[31]. Cohen's d value and eta squared value were used to calculate the effect size between analyses[30].

RESULTS

Data were evaluated according to the Shapiro-Wilk normality test. Data of the control group showed normal distribution, while only fatigue index did not show normal distribution in the research group ($p<0.05$).

Table 1. Analysis of Pre-Test - Post-Test (Dependent Sample T Test) Data of Control and Research Groups

Variable	Groups	N	X	sd	t Test		
					t	sd	p
Hexagonal Obstacle Test	Control Group Pre Test	30	14.91	1.68	11.812	29	.000
	Control Group Pre Test	30	11.40	1.34			
	Research Group Pre Test	36	14.83	1.70	16.000	35	.000
	Research Group Post Test	36	10.86	1.03			

VO_{2max}	Control Group Pre Test	30	41.46	10.65	-4.300	29	.000
	Control Group Post Test	30	47.04	10.42			
	Research Group Pre Test	36	44.23	8.44	-4.121	35	.000
	Research Group Post Test	36	48.52	6.70			
505 Agility Test	Control Group Pre Test	30	2.98	.39	2.313	29	.028
	Control Group Post Test	30	2.84	.34			
	Research Group Pre Test	36	2.89	.29	4.603	35	.000
	Research Group Post Test	36	2.69	.22			
Shuttle Run Test	Control Group Pre Test	30	10.73	1.23	4.009	29	.000
	Control Group Post Test	30	10.05	.88			
	Research Group Pre Test	36	10.58	1.17	3.594	35	.001
	Research Group Post Test	36	9.98	.82			
35 m Sprint Test	Control Group Pre Test	30	5.61	.59	7.075	29	.000
	Control Group Post Test	30	5.22	.48			
	Research Group Pre Test	36	5.40	.58	6.279	35	.000
	Research Group Post Test	36	5.03	.49			
Maximum Anaerobic Power	Control Group Pre Test	30	385.90	204.91	-3.021	29	.005
	Control Group Post Test	30	441.40	213.76			
	Research Group Pre Test	36	546.00	174.94	5.197	35	.000
	Research Group Post Test	36	456.94	145.27			
Minimum Anaerobic Power	Control Group Pre Test	30	236.65	124.84	-3.051	29	.005
	Control Group Post Test	30	288.93	133.65			
	Research Group Pre Test	36	271.25	106.04	-5.453	35	.000
	Research Group Post Test	36	335.86	114.15			
Mean Anaerobic Power	Control Group Pre Test	30	304.43	155.17	-2.609	29	.014
	Control Group Post Test	30	346.46	162.24			
	Research Group Pre Test	36	355.11	116.36	-5.919	35	.000
	Research Group Post Test	36	432.83	137.03			
Fatigue Index	Control Group Pre Test	30	4.23	3.30	-1.703	29	.099
	Control Group Post Test	30	4.96	3.29			

Table 1 shows results of Dependent Sample T Test of the pre-test and post-test data of control and research groups. A significant difference was found between pre-test (X=14.91; sd=1.68) and post-test (X=11.40; sd=1.34) Hexagonal Obstacle results of the control group (t=11.812, p<0.05, η^2=0.82). Variability of control group on Hexagonal Obstacle test is explained by 82%. A significant difference was found between pre-test (X=14,83; sd= 1.70) and post-test Hexagonal Obstacle results of research group (t=16.000, p<0.05, η^2=0.89). The variability of research group on Hexagonal Obstacle test is explained by 89% and the variability is large.

Significant difference was found between pre-test (X=41.46; sd= 10.65) and post-test (X=47.04; sd=10.42) VO_{2max} results of the control group (t=-4.300, p<0.05, η^2=0.38). Variability of the control group on VO_{2max} is explained by 38%. Significant difference was found between pre-test (X=44.23; sd=8.44) and post-test (X=48.52; sd=6.70) VO_{2max} results of the research group (t=-4.121, p<0.05, η^2=0.32). Variability of the research group on VO_{2max} is explained by 32% and the variability is large.

Significant difference was found between pre-test (X=2.98; ss= .39) and post-test (X=2.84; sd=.34) 505 Agility results of the control group (t=2.313, p<0.05, η^2=0.15). Variability of the control group on 505 Agility test is explained by 15%. Significant difference was found between pre-test (X=2.89; sd= .29) and post-test (X=2.69; sd=.22) 505 Agility results of the research group (t=4.603, p<0.05, η^2=0.37). Variability of the research group on 505 Agility test is explained by 37% and the variability is large.

Significant difference was found between pre-test (X=10.73; sd=1.23) and post-test (X=10.05; sd=.88) Shuttle Run Test results of the control group (t=4.009, p<0.05, η^2=0.34). Variability of the control group on Shuttle run test is explained by 34%. Significant difference was found between pre-test (X=10.58; sd=1.17) and post-test (X=9.98; sd=.82) shuttle run results of the research group (t=3.594, p<0.05, η^2=0.26). Variability of the research group on Shuttle Run test is explained by 26% and the variability is large.

Significant difference was found between pre-test (X=5.61; sd=.59) and post-test (X=5.22; sd=.48) 35 m sprint test results of the control group (t=7.075, p<0.05, η^2=0.63). Variability of the control group on 35 m sprint test is explained by 63%. Significant difference was found between pre-test (X=5.40; sd=.58) and post-test (X=5.03; sd=.49) 35 m sprint test results of the research group (t=6.279, p<0.05, η^2=0.52). Variability of the research group on 35 m sprint test is explained by 52% and the variability is large.

Significant difference was found between pre-test (X=385.90; sd=204.91) and post-test (X=441.40; sd=213.76) maximum anaerobic power test results of the control group (t=7.075, p<0.05, η^2=0.23). Variability of the control group on maximum anaerobic power is explained by 23%. Significant difference was found between pre-test (X=546.00; sd=174.94) and post-test (X=456.94; sd=145.27) maximum anaerobic power test results of the research group (t=5.197, p<0.05, η^2=0.43). Variability of the research group on maximum anaerobic power is explained by 43% and the variability is large.

Significant difference was found between pre-test (X=236.65; sd=124.84) and post-test (X=288.93; sd=133.65) minimum anaerobic power test results of the control group (t=-3.051, p<0.05, η^2=0.24). Variability of the control group on minimum anaerobic power is explained by 24%. Significant difference was found between pre-test (X=335.86; sd=106.04) and post-test (X=271.25; sd=114.15) minimum anaerobic power test results of the research group (t=-5.453, p<0.05, η^2=0.45). Variability of the research group on minimum anaerobic power is explained by 45% and the variability is large.

Significant difference was found between pre-test (X=304.43; sd=155.17) and post-test (X=346.46; sd=162.24) mean anaerobic power test results of the control group (t=-2.609, p<0.05, η^2=0.19). Variability of the control group on mean anaerobic power is explained by 19%. Significant difference was found between the pre-test (X=355.11; sd=116.36) and post-test (X=432.83; sd=137.03) mean anaerobic power test results of the research group (t=-5.919, p<0.05, η^2=0.50). Variability of the research group on mean anaerobic power is explained by 50% and the variability is large.

No significant difference was found between pre-test (X=4.23; sd=3.30) and post-test (X=4.96; sd=3.29) fatigue index results of the control group (t=-1.703, p>0.05, η^2=0.19).

Table 2. Analysis of Pre-Test - Post-Test Fatigue Index (Wilcoxon Signed Ranks Test) Data of the Research Group

Variable	Post Test-Pre Test	N	Mean ranks	Rank sum	z	p
Fatigue Index	Negative ranks	8[a]	19.06	152.50	-2.836[b]	.005
	Positive ranks	28[b]	18.34	513.50		
	Equal	0[c]				
	Total	36				

Table 2 shows Wilcoxon Signed Rank Test results of the pre-test and post-test fatigue index data of the research group. Significant difference was found between pre-test fatigue index results of the research group (z=2.836, p<0.05, r=0.53). According to the calculated effect size (r) value, the effect of rosehip juice supplement on fatigue index is in favour of the research group and large (r=0.53).

Table 3. Comparison of Effect Sizes of Pre-test - Post-test Data between Control and Research Groups

Variables	Groups	Effect Size
Hexagonal Obstacle Test	Control Group Pre Test	82%
	Control Group Post Test	
	Research Group Pre Test	89%
	Research Group Post Test	
VO_{2max}	Control Group Pre Test	38%
	Control Group Post Test	
	Research Group Pre Test	32%
	Research Group Post Test	
505 Agility Test	Control Group Pre Test	15%
	Control Group Post Test	
	Research Group Pre Test	37%
	Research Group Post Test	
Shuttle Run Test	Control Group Pre Test	34%
	Control Group Post Test	
	Research Group Pre Test	26%
	Research Group Post Test	
35 m Sprint Test	Control Group Pre Test	63%
	Control Group Post Test	
	Research Group Pre Test	52%
	Research Group Post Test	
Maximum Anaerobic Power	Control Group Pre Test	23%
	Control Group Post Test	
	Research Group Pre Test	43%
	Research Group Post Test	
Minimum Anaerobic Power	Control Group Pre Test	24%
	Control Group Post Test	
	Research Group Pre Test	45%
	Research Group Post Test	
Mean Anaerobic Power	Control Group Pre Test	19%
	Control Group Post Test	
	Research Group Pre Test	50%
	Research Group Post Test	
Fatigue Index	Control Group Pre Test	19%
	Control Group Post Test	
	Research Group Pre Test	53%
	Research Group Post Test	

Table 3 shows effect sizes of the differences between pre-test and post-test data of the control and research groups. Cohen's d value and eta square value were used to calculate possible effect size in the analyses.

When the agility parameter was analysed, effect size in Hexagonal Obstacle Test was 82% for control group and 89% for research group. Effect size was 15% for control group and 37% for research group in 505 Agility Test. In this respect, rosehip juice supplement showed a significant effect on agility parameter in favour of the research group.

When VO_{2max} parameter was analysed, effect size of the control group on the related parameter was 38%, while the effect size of research group was 32%. In this respect, rosehip juice supplement did not show an effect on VO_{2max} parameter in favour of the research group.

When speed parameter was analysed, effect size of the control group on Shuttle Run Test was 34%, while effect size of the research group was 26%. Effect size of the control group on 35 m Sprint Test was 63%, while effect size of the research group was 52%. In this respect, rosehip juice supplement did not show an effect on the speed parameter in favour of the research group.

When anaerobic power parameter was analysed, effect size was 23% for the control group and 43% for the research group on maximum anaerobic power. The effect of control group on the minimum anaerobic power was 24% and the effect of research group was 45%. The effect of control group on mean anaerobic power was 19% and the effect of research group on mean anaerobic power was 50%. In this respect, rosehip juice supplement showed a significant effect on anaerobic power parameter in favour of research group.

When fatigue index parameter was examined, effect size of the control group on fatigue index was 19% and effect size of the research group was 53%. In this respect, rosehip juice supplement showed a significant effect on the fatigue index parameter in favour of the research group.

DISCUSSION

Hexagonal Obstacle Test and 505 Agility Test were administered to evaluate agility performance. Post-test data are analysed by comparing them with the pre-tests, and the variable applied between the two tests is expected to show improvement in athlete's agility[33]. As indicated in Table 3, 7% difference in Hexagonal Obstacle Test data and 22% difference in the 505 Agility Test data of research group proves that rosehip juice supplement has a large effect on agility performance for this study. It can be seen that there are studies reporting parallel results with these findings. Falcone et al. (2018)[34] investigated the effects of 900 mg of peppermint extract a day for 90 days on agility performance and reported that this supplement had a largely positive effect on agility. In contrast, in a study investigating the effects of acute consumption of beetroot juice supplement on Agility T-test, Countermovement Jump Test, hand grip strength, 10 m Sprint Test and 20 m Sprint Test, it was reported that this supplement did not show a significant effect on the above mentioned sportive performance

parameters[35]. Similarly, it was found that acute melatonin supplement with antioxidant effect had no significant effect on agility performance[36].

VO_{2max} is the maximum oxygen capacity of human body, defining the maximum amount of energy accessible by aerobic metabolism. It is a standard for measuring cardiorespiratory fitness and reflects the limits of cardiopulmonary system to maximum exercise. The term VO_{2max} refers to the physiological limit of an individual that is achieved and sustained for a given period of time during maximal exertion[37]. In this study, the Queen's College Step Test, which analyses VO_{2max} value for cardiorespiratory endurance, was implemented. Post-tests are analysed by comparing with pre-tests, and the variable applied between the two tests is expected to show improvement in the athlete's cardiorespiratory endurance[33].

As indicated in Table 3, VO_{2max} data for this study were not in favour of the research group. There are studies reporting parallel results. Askari et al. (2012)[38], in their study with quercetin and vitamin C supplements, showed that the effect of antioxidant supplement on endurance performance was not significant. Nevertheless, they reported that the supplements reduced exercise-induced muscle damage in their study. Roelofs et al. (2017)[39] reported that pomegranate extract increased oxygenation by accelerating vascular diameter and blood flow, so this could be a sign of increased exercise performance. Trexler et al. (2014)[40] reported that pomegranate extract may have similar effects. However, in a study on elite cyclists, it was reported that although pomegranate extract supplement increased VO_{2max} values of participants, it did not cause a significant change in their performance (Crum et al., 2017)[41]. Broome et al. (2021) reported in a study on cyclists that a coenzyme Q10-based antioxidant supplement positively affected $VO_{2\ max}$ value.

Shuttle Run Test and 35 m Sprint Test were administered for speed performance. Post-test data are analysed by comparing with pre-tests, and the variable applied between the two tests is expected to show improvement in athlete's speed performance[33]. When the speed variable was examined for this study, it was not in favour of the research group, as indicated in Table 3. When the literature is reviewed, it can be seen that there are studies reporting parallel results with the findings of this study. In a study analysing the effects of 1000 mg vitamin C and 235 mg vitamin E daily for 11 weeks on 20 m Shuttle Run Test (Beep Test) and VO_{2max} values, no significant difference was found between the research and control groups[42]. However, in contrast to the findings of this study, it was reported that a 7-day supplement of 300 mg blackcurrant extract resulted in a 2.4% increase in cycling speed performance[43]. Murphy et al. (2017)[44] conducted a similar study with the same supplement and reached similar findings and proved that this anthocyanin-rich supplement had a positive effect on speed performance of cyclists.

Running-based Anaerobic Sprint Test (RAST) was administered to evaluate anaerobic capacity and fatigue index. Maximum anaerobic power, minimum anaerobic power, mean anaerobic power and fatigue index values can be calculated with the data obtained. Maximum anaerobic power is a measure of the highest anaerobic power output. Minimum anaerobic power is the lowest power output from six 35-metre runs. Mean anaerobic power is an indicator of athlete's ability to maintain anaerobic power over time. Fatigue index shows the rate at which athlete's power declines[33]. As indicated in Table 3, 20% difference in the maximum anaerobic power capacity, 22%

difference in minimum anaerobic power capacity and 31% difference in mean anaerobic power capacity of the research group proves that rosehip juice supplement has a large effect on anaerobic capacity for this research. The 34% difference in fatigue index data of research group proves that rosehip juice supplement has a large effect on fatigue index for this research. It can be seen that there are studies reporting parallel results with our findings. Godwin et al. (2017)[45], in a study examining the effects of anthocyanin-rich blackcurrant extract on anaerobic power capacity and fatigue index, divided 25 football players into research and control groups; research group consumed anthocyanin-rich blackcurrant extract for 7 days and the control group consumed placebo. They reported a 12% improvement in fatigue index. Similarly, it has been proven that ellagitannin obtained from pomegranate extract can help restore strength lost after exercise[46]. Paschalis et al. (2018)[47] applied Wingate Test to participants in a study with 600 mg N-acetylcysteine supplement twice a day for 30 days and reported that this supplement positively affected anaerobic power capacity. Similarly, 6 weeks of 300 mg Ubiquinol supplement was found to result in a significant increase in maximal power output[48]. However, a study investigating the effects of 4-week resveratrol supplement on anaerobic power and VO_{2max} reported no significant effects[28].

In a study in which RAST, Agility-T Test and Counter Movement Jump Tests were administered in a similar method to this study, but in which exercise-induced muscle damage and muscle soreness were measured, it was found that 15-day vitamin C and E supplement reduced lipid peroxidation (oxidative stress) but did not show a significant effect on muscle soreness and sportive performance test[49]. Bell et al. (2016)[18] investigated the effects of 30 ml Montmorency Tart Cherry concentrate consumption twice a day for 8 days on Maximal Voluntary Isometric Contraction, Counter Movement Jump Test, 20 M Sprint Test and 505 Agility Test and muscle damage markers. They showed that this supplement with high antioxidant capacity had a significant effect on performance tests and improved some of the muscle damage markers. Similarly, other studies on Montmorency Tart Cherry Concentrate showed that this supplement improved markers of muscle damage and muscle soreness[50,51,52,53]. McCormick et al. (2016)[54] reported that 7-day Montromency Tart Cherry concentrate had no significant effect on performance and muscle damage markers in In-Water Vertical Jump Test, 10 m Sprint Test, Repeat Sprint Test and Water Polo Intermittent Shuttle Test and muscle damage markers in water polo players. An 8-week study investigating the effects of 1000 mg quercetin supplement per day on VO_{2max} and fatigue did not find a significant difference in VO_{2max} value, but reported that fatigue decreased significantly[55]. Similarly, a study on quercetin reported that this supplement had no significant effect on VO_{2max} value[56].

In a study in which 150 ml of beetroot juice supplement was used twice a day and jump tests, muscle contraction and sprint tests were performed, it was reported that the supplement both relieved muscle soreness and contributed to the maintenance of performance by accelerating the recovery period[21]. In a study investigating the effects of cocoa, a food rich in flavanols, on jump performance and recovery speed, significant increases in jump performance were reported in favour of the research group, but no significant difference was found in recovery speed[26].

In this study, the effects of rosehip juice supplement on some sportive performance parameters (agility, speed, VO_{2max}, anaerobic power capacity and fatigue index) of

14-18 years old students engaged in team sports were investigated. The results are below.

- Hexagonal Obstacle Test and 505 Agility Test were applied for the evaluation of agility performance. According to the findings obtained; the 7% increase in the Hexagonal Obstacle Test and 22% increase in the 505 Agility Test data of the research group proves that rosehip juice supplement has a large effect on agility performance for this research. Accordingly, rosehip juice supplement may be a preferable beverage for sports where agility performance is at the forefront.
- Queen's College Step Test, which analyses VO_{2max} value for cardiorespiratory endurance, was administered. When the VO_{2max} variable was examined for this study, the results were not in favour of the research group.
- Shuttle Run Test and 35 m SprintTest were applied for speed performance. When the speed variable was examined for this study, it was found that the results of the study were not in favour of the research group.
- The Running-based Anaerobic Sprint Test (RAST) was administered to evaluate anaerobic capacity and fatigue index. Maximum anaerobic power, minimum anaerobic power, mean anaerobic power and fatigue index values were calculated. 20% increase in maximum anaerobic power, 22% increase in minimum anaerobic power and 31% increase in mean anaerobic power of research group proves that rosehip juice supplement has a large effect on anaerobic capacity for this research. Rosehip juice supplement may be a preferable drink for sports where anaerobic power capacity is at the forefront.
- The 34% difference in fatigue index data of the research group proves that rosehip juice supplement has a large effect on fatigue index for this study. Rosehip supplement may be a preferable beverage for sports where delaying fatigue is at the forefront.

Practical Recommendations

Recommendations for Athletes, Coaches and Nutritionists

- Due to its antioxidant capacity and carbohydrate content, rosehip juice supplement may be a preferable beverage in sports where agility is at the forefront and anaerobic capacity is important.
- Rosehip juice can be a preferable drink for post-competition recovery and fatigue relief.
- Rosehip juice can be a preferable drink to meet the fluid and carbohydrate needs during the competition.

Recommendations for Researchers and Organisations

- When the related literature was examined, no study investigating the effects of rosehip juice supplement on sportive performance was found. Conducting studies examining this supplement may contribute to the literature.
- The performance parameters analysed in this study were agility, speed, cardiorespiratory endurance, anaerobic power and fatigue. Studies on strength, balance or body composition can be performed.
- Only performance parameters and fatigue index were studied. Studies investigating the effects of the examined variable on muscle damage and oxidative stress markers can be conducted.
- The effect of the relevant variable on body composition was not investigated, it can be examined in future studies.

- This study was conducted only with adolescent team athletes. Rosehip juice supplement can be studied in different age groups and athletes engaged in different sports branches.
- This study investigated the effects of 4 weeks of supplement. The acute effects of supplement or the effects of longer consumption can be studied.
- In this study, the amount of rosehip juice consumed daily was limited to 250 ml, future studies can be conducted with different doses of supplement.
- Further studies are needed for the effects of this supplement on VO_{2max} and speed performance in this age group of team athletes.
- Training and information activities should be focused on with the participation of universities, Ministry of Youth and Sports, Ministry of National Education, Ministry of Agriculture and Forestry, fruit juice companies, non-governmental organisations and other stakeholders.

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