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An investigation of the effect of nutrition on performance and recovery in 9-14 years old male student swimmers

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Abstract

The importance of nutrition is known in swimming as in other sports branches. Knowing the right strategies for nutrition will enable swimmers to improve their recovery time as well as increase their performance. This study aims to investigate the effects of with and without diet training programs on the performance and recovery times of male swimmers aged 9-14. 24 performance swimmers in the 9-14 age group participated in the study. 50m-400m freestyle swimming performances and recovery times of the participants were tested in 2 different conditions (with and without diet). While performing without diet, the participants continued their normal eating habits. Before taking dietary performance, each participant was given a suitable diet program (60% carbohydrate, 15% protein, 25% fat) depending on the individual differences of the participants. After the diet program was applied for 2 days, the dietary performances of the participants were taken. According to the findings we obtained from this study on 24 performance swimmers between the ages of 9-14, it was observed that the nutrition program applied improved the 50m and 400m swimming performance and recovery time of the athletes. Considering the effects of nutrition on performance and recovery time, special diet programs should be prepared for each athlete to increase their performance of the athletes. Considering the individual differences of the athletes, with the help of an expert, the preparation of the diet program according to the needs of the athletes is necessary for optimal performance.

Keywords: Nutrition; swimming; performance; recovery

1. Introduction

Genetics, sports age, and training are very effective in the success of the athletes, but in cases where these factors affecting the success of the athletes are equal, one of the determining factors of performance is nutrition (Akkaya et al., 2019). Nutrition reflects the extent to which an individual's physiological nutritional needs are met at a particular

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life stage. Foods that will support the body's daily needs and metabolic demands should be consumed in a balanced way without being insufficient or excessive. Adequate and balanced nutrition provides an optimal nutritional state that supports growth, development, appropriate cell/tissue cycles, and global health (Picó et al., 2019). For this reason, individuals who exercise both as performance athletes and as leisure time activities should pay attention to their daily food intake (Üstün et al., 2020). As the physical activity levels of individuals increase, their daily calorie consumption also increases, and accordingly, the daily amount of energy they need to take increases (Kayhan & Ünveren, 2017).

Different nutritional strategies (carbohydrate, protein, and fat weighted) produce different results in terms of people's health and physical performance. Carbohydrate consumption is very important in terms of replenishing muscle glycogen stores. Athletes, especially during the intense training period, should take high levels of carbohydrates to fill their muscle glycogen stores (Karabudak & Önür, 2006). Performance in interval sports depends on a combination of aerobic and anaerobic energy systems, both of which rely on carbohydrates as an important fuel source (Baker, et al., 2015). In a study by Baker et al. (2015) on basketball players, carbohydrate intake and intermittent high-intensity exercise capacity were tested. In this study, it was reported that carbohydrate intake (6% solution before and every 15 minutes and 18% solution in the first half; total ~80 g carbohydrate/hour) resulted in a 37% longer shuttle run at the end of the exercise. A carbohydrate-heavy diet is very important for endurance performance. Carbohydrate consumption is also important in elevation training. Adequate carbohydrate intake alleviates immune system problems that occur during altitude exercise (Başoğolu et al., 2005). A ketogenic (low-carbohydrate, high-fat) diet adversely affects the performance of endurance athletes compared to a carbohydrate-heavy diet (Burke et al., 2017). Caffeinated and carbohydrate mouthwashes improve short-term sprint performance (Beaven et al., 2013).

Most scientific research investigating the effects of protein intake on exercise performance has focused on supplemental protein intake. These studies can be divided into two areas, endurance, and resistance performance (increase in maximum strength) (Ormsbee et al., 2022). Few studies have investigated the effects of long-term dietary protein manipulation on endurance performance. Effect of a high protein/moderate carbohydrate diet (3.3 and 5.9 g protein and carbohydrates/kg body weight per day, respectively) versus a diet more typical for an endurance athlete (1.3 and 7.9 g daily protein and carbohydrates/kg body weight in endurance-trained cyclists, respectively) were compared. At the end of the 7-day training period, cyclists on the high-protein diet took significantly (20%) more time to complete the self-accelerating time trial than those on the low-protein/high-carb diet (Jäger et al., 2017). The amount and timing of protein intake are one of the main factors regulating protein synthesis. It has been observed that 20 g of whey protein taken every 3 hours during the 12-hour recovery period after a

single resistance exercise is the most appropriate dietary pattern to promote high protein synthesis rates (Areta et al., 2013).

As in all other sports, nutrition is very important for swimmers. For swimmers to be healthy and increase their physical performance, they need a regular and balanced diet. Malnutrition negatively affects the performance of swimmers. It will be very beneficial for swimmers to apply for a suitable nutrition program with the help of an expert for their health and physical performance (Karabudak & Önür, 2006). Swimmers should consume a carbohydrate-rich meal that is easy to digest 1-3 hours before warming up on the day of the competition. During training, they should consume foods such as fruit, cereal bars, and sports drinks to meet the body's carbohydrate needs and maintain fluid balance. After training, they should consume foods rich in carbohydrates and protein for repair and recovery (Shaw et al., 2014).

Recovery is the state of the organism returning to normal with the replenishment of energy stores after exercise or competition. For a good recovery, Methods such as water therapy, low-intensity aerobic running, stretching, psychological relaxation therapy, nutrition, fluid intake, and the use of ergogenic aids are effective (Gümüşdağ et al., 2015). Carbohydrate, protein, mineral, and fluid intake is essential in the recovery of athletes because of the discharge of glycogen stores after exercise, tearing of fibers because of muscle damage, and high amount of fluid loss in the body through sweating (Canbolat et al., 2021). Recovery after strenuous exercise involves a series of processes that are affected by the timing and amount of intake of essential nutrients. Protein synthesis is the strongest stimuli in the immediate post-exercise period, and the absence of nutritional support currently reduces the recovery response to exercise. After training, there is no effective recovery until the necessary nutrients (carbohydrate, protein, fluid intake) are provided, and when the speed of the recovery process (for example, glycogen synthesis) is slow and there is a limited time between training sessions, it can cause negative performance results (Burke & Mujika, 2014). This study aims to investigate the effects of with and without diet training programs on the performance and recovery times of male swimmers aged 9-14.

2. Method

2.1. Participants

All implications were done according to the Declaration of Helsinki and before all implementations University Ethics approval All experiments were previously approved by the University Ethics Committee (Process number: 07-19-2022) and informed consent from the parents of the participants was obtained. 24 performance swimmers in the 9-14 age group participated in the study. The average age of the participants was 11.7, their average height was 1.49 (m), their weight was 46.6 (kg) and their sports age was 4.1

years on average. Participants consist of athletes who train for two hours each session, six days a week (Table 1). The individuals participating in the study do not have any health problems and do not use drugs and additional nutrients.

2.2. Procedure

A crossover design was used to compare situations with and without diet. According to the research protocol, 50m-400m freestyle swimming performances and recovery times of the participants were tested in 2 different conditions (with and without diet). The performances of 12 of the participants were measured by following the diet program given to them and by continuing the normal diet for 12 of them. For the effects of the previous application to disappear completely, at the end of the 7-day rest period, the dieted and non-diet groups were replaced, and the same application was repeated.

While performing without diet, the participants continued their normal eating habits. Before taking dietary performance, each participant was given a suitable diet program (60% carbohydrate, 15% protein, 25% fat) depending on the individual differences of the participants. After the diet program was applied for 2 days (Naharudin et al., 2020; Wilburn et al., 2020), the dietary performances of the participants were taken. Before the test, the resting heart rate of the participants was measured, and 50m - 400m freestyle swimming performances and recovery times were calculated.

Arzum Fitsense Type Gbf-830 Model Ar 553 Dc 6V (4.1.5V AAA) machine was used to measure the weight of the athletes. Fisco Unı Matic 2 device was used for height measurement. The Casio chronometer device was used to measure performance and recovery times.

2.3. Statistical analysis

A crossover design was used to compare situations with and without diet. SPSS 26 statistical analysis program was used in the analysis of the data. Paired Samples T-Test was used to test the difference between performance and recovery times with and without diet. Bonferroni correction was used to show a statistical difference. The results were evaluated at $p < .05$ significance level.

3. Results

Findings from the research are presented in tables in this section.

Table 1. Anthropometric and demographic characteristics of the participants

	N	Min.	Max.	Mean	S.D
Age	24	9	14	11,79	1,719
Height(cm)	24	126	185	149,42	14,334
Weight(kg)	24	24,20	77,00	46,6417	14,74891
Training Age	24	2	8	4,12	1,825
Weekly Training Time(hour)	24	12	12	12,00	,000
Frequency of Weekly Training	24	6	6	6,00	,000

Table 2. Results of participants' 50 m performances with and without diet

	Degree	Mean	S.D	95% Confidence Interval of Difference		t	df	Sig. (2-tailed)
				Lower	Upper			
50 m (sec.) with diet	39,86	-,77708	,78576	-1,10888	-,44529	-4,845	23	,000
50 m (sec.) without diet	40,64							

Description: According to Table 2, when the results of the dependent sample analysis were examined to determine the difference between the 50 m freestyle swimming performances with and without diet, a statistically significant difference was found in terms of the 50 m freestyle swimming performances of the participants with and without diet (t= -4,845; p< .05). According to this finding, it is seen that diet shortens 50 m freestyle swimming time.

Table 3. Results of participants' 400 m performances with and without diet

	Degree	Mean	S.D	95% Confidence Interval of Difference		t	df	Sig. (2-tailed)
				Lower	Upper			
400 m(min.) with diet	7,51	-,09792	,12459	-,15052	-,04531	-3,850	23	,001
400 m(min.) without diet	7,60							

Description: According to Table 3, when the test results of the dependent sample analysis were examined to determine the difference between the 400 m freestyle swimming performances with and without diet, a statistically significant difference was found between the 400 m freestyle swimming performances of the participants with and without diet (t= -3,850; p< .05). According to this finding, it is seen that the diet shortens the 400 m freestyle swimming time.

Table 4. Results of recovery time of participants after 50 m swimming with and without diet

	Degree	Mean	S.D	95% Confidence Interval of Difference		t	df	Sig. (2-tailed)
				Lower	Upper			
50 m Recovery (min.) with diet	10,38							
50 m Recovery (min.) without diet	11,33	-,958	1,197	-1,464	-,453	-3,922	23	,001

Description: When the results of the dependent sample analysis performed to determine the difference between the recovery time values after 50 m freestyle swimming with and without diet were examined in (Table 4), a statistically significant difference was found in the recovery values of the participants after 50 m freestyle swimming with and without diet (t). = -3.922; p<.05). Based on this finding, diet appears to shorten recovery time after 50 m freestyle swimming performance.

Table 5. Results of participants' recovery times after 400 m swimming with and without diet

	Degree	Mean	S.D	95% Confidence Interval of Difference		t	df	Sig. (2-tailed)
				Lower	Upper			
400 m Recovery (min.) with diet	10,38							
400 m Recovery (min.) without diet	12,00	-1,625	1,439	-2,233	-1,017	-5,532	23	,000

Description: When the results of the dependent sample analysis were performed to determine the difference between the recovery time values after 400 m freestyle swimming with and without diet were examined (Table 5), a statistically significant difference was found in the recovery values of the participants after 400 m freestyle swimming with and without diet (t). = -5.532; p<.05). According to this finding, it is seen that diet shortens the recovery time after a 400 m freestyle swimming performance.

4. Discussion

Even a very small performance increase in professional athletes can be effective in the success of the athlete. For this reason, nutrition is a very effective factor in the success of the athlete (Arı et al., 2020). Few studies have investigated the effects of nutrition on swimmers' performance and recovery time. According to the findings we obtained from this study, which was conducted on 24 performance swimmers aged 9-14 years, it was observed that nutrition improves athlete performance and recovery time.

The effects of low (LGI) and medium (MGI) glycemic index (GI) diets for three weeks on aerobic capacity and endurance performance were investigated in 21 endurance-trained runners. Results showed that a three-week high-carbohydrate LGI diet resulted in a small but significant improvement in athletic performance in endurance runners

(Durkalec-Michalski et al., 2018). The results of this study, in which the LGI diet improved athlete performance, are similar to the results of our research, in which we mainly applied a low glycemic index diet. It has been reported that a three-day high-carbohydrate diet (70% energy intake) using a diet protocol similar to our study with a high carbohydrate ratio increased cycling performance efficiency compared to consuming 20% or 45% carbohydrates (Bestard et al., 2020). Cipryan et al. (2018) examined the effects of switching from a conventional mixed western-based (HD) diet to a very low-carb high-fat (VLCHF) diet over four weeks on performance and physiological responses during high-intensity interval training (HIIT). Performance and cardiorespiratory responses during a graded exercise test and HIIT were not impaired in the group consuming a VLCHF diet compared to the group consuming mixed western-based diets. These results show that the fat-based diet does not adversely affect the performance of the athlete during HIIT training compared to a carbohydrate-heavy diet that we applied in our study.

Bestard et al. (2020) applied two different diets to eight recreational swimmers for three days in a crossover design. One of the diets contains high carbohydrates (69%) and the other high fat (67%). After three days of dieting, long-distance swimming performances of 50-70% of the Vo2max values of the swimmers were observed. There was no difference in swimming performance between swimmers after the two diets. Baldassarre et al. (2021) investigated the effect of carbohydrate supplementation on the performance of swimmers during 10 km open water swimming, and it was observed that carbohydrate supplementation increased performance in the last part of the race. The effects of a diet containing branched-chain amino acids (BCAA), alanine, and carbohydrates on training performance were investigated in thirty-two healthy young adults (20 males and 12 females) without training. The high-intensity endurance cycling test (HIEC) was applied to observe the effect of diet on the participants. According to the findings of the study, an improvement was observed in the HIEC test exhaustion time of the athletes after the diet and it was determined that the diet increased the endurance performance of the athletes (Gervasi et al., 2020). The results of this study, in which diet increases athlete performance, are similar to our research.

In a study on the effects of beta-alanine supplementation on the swimming performance of highly trained athletes, it was observed that 100m and 200m freestyle swimming performance improved. It has been observed that the combined use of beta-alanine and sodium bicarbonate increases the 200 m and 100 m freestyle swimming performance more than beta-alanine alone (de Salles Painelli et al., 2013). In contrast to this study, beta-alanine supplementation did not benefit 400m freestyle swimming performance in a six-week study of thirteen performance swimmers (Norberto et al., 2020). Ivy et al. (2002) investigated the recovery of muscle glycogen stores according to the diet type of seven training male cyclists. Participants were given three different dietary supplements, CHO-Pro (80g CHO, 28g Pro, 6g fat), LCHO (80g CHO, 6g fat), and

HCHO (108g CHO, 6g fat) immediately after exercise (10 min.) and 2 hours after exercise. Although all three diet types effectively replenish glycogen stores, the CHO-Pro diet has been observed to be more effective in replenishing glycogen stores. This study, which shows the positive effect of nutrition on recovery, is like our research results in which diet shortens the recovery period. Considering the positive effects of nutrition on athlete performance and recovery time, the importance of such studies is understood.

5. Conclusions

With the scientific developments and new training methods in the field of sports in the modern world, the competition among athletes is increasing. For this reason, all factors that affect the success of athletes are becoming increasingly important. Previous study results show the positive effects of nutrition on athlete performance and recovery time. Does pre-workout nutrition benefit athlete performance? Does pre-workout nutrition improve recovery time? Does a carbohydrate-heavy diet affect performance and recovery time? The results of our study answer all these questions.

It has been observed that a carbohydrate-heavy diet (60% carbohydrate, 15% protein, 25% fat) improves 50m freestyle swimming performance, 400m freestyle swimming performance, and recovery time after 50m and 400m freestyle swimming performance swimmers aged 9-14. Considering the effects of nutrition on performance and recovery time, special diet programs should be prepared for each athlete to increase their performance of the athletes. Considering the individual differences of the athletes, with the help of an expert, the preparation of the diet program according to the needs of the athletes is necessary for optimal performance.

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