

# Analyzing the effect of 8-week swimming training applied to secondary school students on motor skills and 50-meter swimming ratings

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Accepted 16 August, 2023

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## ABSTRACT

This study aimed to analyze the effect of the 8-week swimming training applied to secondary school students on their motor skills and 50-meter freestyle swimming ratings. 24 students having swimming license in the age range of 11 to 14 participated in the study voluntarily. Munich fitness test (MFT) protocol was used to determine the motor skill levels of the athletes, and 50-meter freestyle swimming ratings were used to determine the swimming performances. According to the test of normality results, it was determined that the data collected had a normal distribution. Paired samples t-test was used to determine the difference between the MFT pre-test and post-test. According to the statistical analysis results, a significant difference in favor of the post-test was determined in Goal Throwing, Flexibility, Flexed Arm Hanging, Step Test, MFT total score and 50-meter swimming ratings of the participants. It is believed that the swimming training applied to the students improved their swimming performances and motor skill levels. It may be recommended that swimming exercises, as well as other factors, should be used in the cases where it is desired to improve children's motor skills.

**Keywords:** Swimming, motor skills, Munich fitness test.

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## INTRODUCTION

In recent years, the interest in swimming has been increasing due to the opening of many branch-specific facilities in Turkey, making swimming a part of education by opening swimming pools by private schools, and the fact that swimming is included in the curriculum of the Faculties of Sports Sciences (Bozdoğan, 2006). Swimming is characterized by repeating a series of movements performed by the coordinated activities of the body and legs (Mooney et al., 2016). Swimming is a branch of sports including many factors such as balance, coordination, flexibility, strength, rhythm and correct technique (Ölmez et al., 2017). Although many variables in this branch of sports affect performance, the improvement of main motor features may be determinant in terms of performance efficiency (Kılınç et al., 2018; Kistak et al., 2019). Developing these skills, especially from early ages may be vital in performance improvement.

Motor features developed also affect the improvement of the motor skills of athletes positively. A motor skill is defined as the voluntary movement of one or more body parts toward a specified target (Gallahue et al., 2014).

The term motor skill has identified with the skillful execution of a task, the quality of movement that constitutes the basis of the performance and coordination (Robinson et al., 2015). Motor development includes functions such as motion skills, object control skills and balance. Motor skills represent the level of the quality of movement, coordination, and control as well as the various motor tasks of individuals (Robinson et al., 2015).

It is stated that the best time to teach and improve basic motor skills is the preschool period (Payne and Isaacs, 2016). It is stated that if there is a delay in this critical period, basic motor skills may be at a lower level than they should be and this will cause a limitation in the level of physical activity in the future (Stodden et al., 2008). The fact that it is known that the motor skill levels of children have an important contribution to the prediction of later sportive success accurately (Vandorpe et al., 2012) necessitates determining motor skills and motor performance in both children and the young (Livonen et al., 2016). Therefore, it is tried to determine motor skill levels and the factors affecting motor skills,

develop programs to increase motor skills and reveal the relation and interactions of motor skills with other fields (Kerkez, 2006). Indeed, it is stated that the developmental areas of children should be balanced and a developmental area should not fall behind another development area (Kiliç et al., 2017).

In recent years, it has been observed that there has been an increase in the number of studies on children's motor skills in the literature (Pişkin et al., 2022). However, the limitation in the number of studies on the effect of swimming exercises on the motor skill development of children attracts attention. The fact that the focal point of these studies includes swimmers in different age groups (Kuruoğlu, 2016; Yiğit, 2011) and there are a few studies analyzing the effect of the results on swimming ratings has created a gap in the literature (Yapıcı et al., 2012; Kistak et al., 2019; Şen, 2000). For this reason, this study aims to analyze the effect of 8-week swimming training applied to secondary school students on their motor skills and 50 m freestyle swimming ratings.

## METHODOLOGY

### Research design

A total of 24 secondary school students in the age range of 11 to 14 studying at Niğde ODTU College and who underwent health examinations participated in the study voluntarily. The participants were given swimming training 4 days a week, 90 min each, for 8 weeks. The heights of the participants were measured with a fixed tape measure and their body weights were measured with a precision electronic scale. Munich Fitness Test was used to determine the motor skill levels of the participants. Their 50-meter swimming rates were taken to determine their swimming performances. Informed consent forms were approved by the participants, and this study was conducted in accordance with Helsinki Declaration. For the study, ethics committee approval was obtained from the Niğde Ömer Halisdemir University Ethics Committee to conduct the study (Ethics Commission number: E-95860085-050.02.02-383990, 2023/38).

### Data collection tool

#### Anthropometric measurements

The ages of the participants were determined based on the birth dates on their birth certificates. Height was measured with a Holtaine (England) brand stadiometer by keeping them standing upright with bare feet. Body weight was measured with the Jawon Segmental Body

Composition Anilator (Made in Korea) with bare feet and sports clothing.

#### Munich fitness test

Munich fitness test (MFT) measures both conditional and coordinative skills and includes 6 individual tasks such as ball bouncing, goal throwing, flexibility, standing vertical jumping, flexed arm hanging and step test. This test, which was developed by Rusch and Irrgang (1994), is evaluated according to the T-value in the norm data table determined in accordance with the age and gender of the children and the young at the age range of 6 to 18. Average test values are obtained by dividing the total T-values of the raw data of the 6 tests by 6. The average total value that participants achieve is determined by evaluating Table 1 (Rusch and Irrgang, 1994).

**Ball bouncing (30 s):** A ball is bounced with both hands on a turned-down gymnastic beam at an upright position while the legs are open at shoulder width. If the ball is missed, a new one is given and the missed ball is not counted.

**Goal throwing (500 g):** A 500 g sandbag (20cm x15cm) is thrown to target fields on the floor from a 3 m distance. The targets have points of 1, 2 and 3. A total of 5 attempts are performed and a total score is recorded.

**Flexibility:** A tape measure is set on a gymnastic beam, the center is "0", and it should be -15 upward and +15 downward.

**Standing vertical jumping:** In the beginning, the point that the participant reaches on the board set on the wall with both hands and as hands and shoulders being at the same level while standing is marked. Then, the subject turns aside, moves 20 to 30 cm away from the wall and tries to reach the top point with one hand. The difference between the two measurements is recorded.

**Flexed arm hanging:** The participant hangs on a Swedish ladder as the top step is at the level of his/her nose and the feet are released. The time is stopped when the nose lines up with the lower step and the time the participant stand is recorded.

**Step test (60 s):** The pulse (10sn x 6) of the participant is taken before the test. Then the participant should step up and down on the gymnastic beam 40 times for 1 min. 2 min after the test the pulse in one minute is taken again and the difference between the two pulses is recorded.

#### Assessment of the test

The assessment of the test is shown in Tables 1 and 2.

**Table 1.** Fitness assessment using the MFT scale.

Assessment scale	Insufficient	Sufficient	Satisfactory	Good	Excellent
	5	4	3	2	1
T value scale in points	35 and below	36–45	46–55	56–65	66 and above

**Table 2.** Swimming exercise program.

	<b>Tuesday</b>	<b>Thursday</b>	<b>Saturday</b>	<b>Sunday</b>
1 <sup>st</sup> Week	400 m. warm up 4 x 100m foot 8 x 50m arm 200 m finswimming 100 m soft Sprint- return	400 m warm up 8 x 50 m drill 2 x 200 m finswimming 100 m soft Sprint- return	400 m warm up 2 x 400 m foot 2 x 50 m arm 8 x 50 m technical exercise 100 m soft Sprint- return	600 m warm up 2 x 200 m foot 8 x 50 m arm 200 m finswimming 100 m soft Sprint- return
2 <sup>nd</sup> Week	400 m. warm up 4 x 100m foot 8 x 50m arm 200 m finswimming 100 m soft Sprint- return	400 m warm up 8 x 50 m drill 2 x 200 m finswimming 100 m soft Sprint- return	400 m warm up 2 x 400 m foot 2 x 50 m arm 8 x 50 m technical exercise 100 m soft Sprint- return	600 m warm up 2 x 200 m foot 8 x 50 m arm 200 m finswimming 100 m soft Sprint- return
3 <sup>rd</sup> Week	400 m. warm up 4 x 100m foot 8 x 50m arm 200 m finswimming 100 m soft Sprint- return	400 m warm up 8 x 50 m drill 2 x 200 m finswimming 100 m soft Sprint- return	400 m warm up 2 x 400 m foot 2 x 50 m arm 8 x 50 m technical exercise 100 m soft Sprint- return	600 m warm up 2 x 200 m foot 8 x 50 m arm 200 m finswimming 100 m soft Sprint- return
4 <sup>th</sup> Week	400 m. warm up 4 x 100m foot 8 x 50m arm 200 m finswimming 100 m soft Sprint- return	400 m warm up 8 x 50 m drill 2 x 200 m finswimming 100 m soft Sprint- return	400 m warm up 2 x 400 m foot 2 x 50 m arm 8 x 50 m technical exercise 100 m soft Sprint- return	600 m warm up 2 x 200 m foot 8 x 50 m arm 200 m finswimming 100 m soft Sprint- return
5 <sup>th</sup> Week	400 m warm up 6 x 50 m freestyle (high elbow) 200 m freestyle (one breath after 3 arms) 6 x 50 m freestyle (25 max .25 slow) 100 m soft	400 m warm up 8 x 50 m backstroke foot 8 x 50 m backstroke drill 2x 100 m backstroke 100 m soft	400 m warm up 8 x 50 m breaststroke foot 8 x 50 m breaststroke arm + back foot 2 x 100 m breaststroke	600 m warm up 2 x 200 m foot 8 x 50 m arm 200 m finswimming 100 m soft Sprint- return
6 <sup>th</sup> Week	400 m warm up 400 m freestyle finswimming 8 x 50 m. (25 foot+ 25 swimming) 100 m freestyle	400 m warm up 8 x 50 m (1 right 1 left butterfly stroke) 6 x 50 m backstroke 100 m soft 200-foot Ball:3700	400 m warm up 2 x 100 m breaststroke foot 4 x 100 m breaststroke arm Foot finswimming dolphin 6 x 50 m breaststroke 100 soft	600 m warm up 2 x 200 m foot 8 x 50 m arm 200 m finswimming 100 m soft Sprint- return
7 <sup>th</sup> Week	400 m warm up 2 x 400 m finswimming freestyle 4 x 100 m (50m foot+50m swimming) 100 m soft Sprint- return	400 m warm up 2 x 200 m dolphin (finswimming) 4x100 m butterfly stroke arm (finswimming) 100 m soft Sprint- return	400 m warm up 2 x 200 m foot breaststroke 4 x 100 m breaststroke arm (foot finswimming dolphin) 2 x 50 breaststroke 100 m soft	600 m warm up 2 x 200 m foot 8 x 50 m arm 200 m finswimming 100 m soft Sprint- return
8 <sup>th</sup> Week	400 m warm up 2 x 100 m freestyle 8 x 50 m freestyle (with rest - fast) 100 m soft Sprint- return	400 m warm up 2 x 200 m backstroke foot 2 x 100 m backstroke drill 6 x 50 m backstroke 100 soft Backstroke start	400 m warm up 4 x 100 m breaststroke foot 6 x 100 m breaststroke arm (foot finswimming) 8 x 50 m breaststroke 100 m soft breaststroke start	600 m warm up 2 x 200 m foot 8 x 50 m arm 200 m finswimming 100 m soft Sprint- return

## Analysis of data

The data obtained from the study were analyzed by SPSS 22.0 package program. According to the normality test results, it was determined that the data obtained from the study had a normal distribution. The difference between the pre-test and post-test values of the MFT subtests of the participants was determined by Paired Samples T-Tests. The significance level was accepted as  $p < 0.05$  in the study.

## RESULTS

In this section, the analysis of the data obtained in this study, which was conducted to examine the effect of swimming training applied to secondary school students on motor skills and 50 m freestyle swimming

performances, is included. (Table 3)

**Table 3.** The demographic characteristics of the participants.

Measurements	N	$\bar{x} \pm Sd$
Age (year)	24	12.32 $\pm$ .99
Height (cm)	24	151.95 $\pm$ 9.98
Body weight (kg)	24	45.04 $\pm$ 12.67

## Demographic analysis

### Analysis of participants' MFT test values

When Table 4 is examined, a significant difference was determined between the pre-tests and post-tests of Goal Throwing, Flexibility, Flexed Arm Hanging and Step Test and MFT total values in favor of the post-test. In addition, these data are also in Table 4.

**Table 4.** MFT subtests of the participants and the pre-test and post-test values of MFT total score averages.

Variables	Tests	N	$\bar{x} \pm Sd$	Assessment	t	p
Ball bouncing	Pre-test	24	31.00 $\pm$ 1.74	Insufficient-5	-1.73	.09
	Post-test	24	31.42 $\pm$ 1.76	Insufficient-5		
Goal throwing	Pre-test	24	47.83 $\pm$ 8.70	Satisfactory-3	-3.24	<b>.00</b>
	Post-test	24	52.25 $\pm$ 7.80	Satisfactory-3		
Flexibility	Pre-test	24	10.38 $\pm$ 10.67	Good-2	-2.18	<b>.04</b>
	Post-test	24	12.46 $\pm$ 11.17	Good-2		
Standing vertical jumping	Pre-test	24	42.88 $\pm$ 10.93	Sufficient-4	.64	.52
	Post-test	24	41.88 $\pm$ 10.88	Sufficient-4		
Flexed arm hanging	Pre-test	24	39.04 $\pm$ 7.15	Sufficient-4	-4.36	<b>.00</b>
	Post-test	24	42.17 $\pm$ 8.53	Sufficient-4		
Step test	Pre-test	24	42.83 $\pm$ 7.82	Sufficient-4	-4.19	<b>.00</b>
	Post-test	24	47.21 $\pm$ 6.04	Satisfactory-3		
MFT total score	Pre-test	24	42.15 $\pm$ 4.46	Sufficient-4	-5.56	<b>.00</b>
	Post-test	24	44.39 $\pm$ 4.33	Sufficient-4		

**Table 5.** The pre-test and post-test values of 50-meter swimming of the participants.

Variable	Tests	N	$\bar{x} \pm Sd$	t	p
50-meter swimming	Pre-test	24	51.29 $\pm$ 5.82	5.95	<b>.00</b>
	Post-test	24	49.25 $\pm$ 5.36		

### Analysis of participants' 50-meter swimming values

When Table 5 is examined, a significant difference was determined between the pre-test and post-test values of the 50-meter swimming of the participants in favor of the post-test. In addition, these data are also in Table 5.

## DISCUSSION

It is stated that early ages are important in teaching and improving motor skills (Payne and Isaacs, 2016), and if there is a delay in this process it may cause a limitation in physical activity level (Stodden et al., 2008). In addition, it is known that the level of children's motor

skills provides important contributions to predicting future sportive success accurately (Vandorpe et al., 2012). Therefore, it may be vital to determine motor skills and motor performance in children and the young (Livonen et al., 2016). In related studies, it is tried to determine the factors affecting motor skill level and motor skill, develop programs for improving motor skills and reveal the relation and interaction of motor skills with other fields (Kerkez, 2006). Thus, this study aims to analyze the effect of the 8-week swimming training applied to secondary school students on their motor skills and 50 m freestyle swimming performances.

In the study, while a significant difference was determined in Goal Throwing, Flexibility, Flexed Arm Hanging and Step Test, which were the MFT subtests of the 8-week swimming training, and total MFT assessment scores in favor of post-test, no significant difference was found in standing vertical jumping and ball bouncing subtests. It was also determined that the 50-meter freestyle swimming ratings of the participants were significant in the post-test. It is believed that the reason for the improvement in the motor skills (Goal Throwing, Flexibility, Flexed Arm Hanging, and Step) and 50-meter swimming skills of the participants was the improvement in the parameters of conformity such as general strength, endurance and coordination as a result of the coordinated motions of both upper and lower extremities. It is stated that since athletes have to defeat the passive resistance that water creates in order to move ahead in the water (Maglischo, 2003), they improve strength, and this strength is used in the water more easily (Kraemer and Fleck, 2005). In a study conducted in this context, Yapıcı et al. (2016) reported that the 6-week ground and endurance training improved the lower extremity isokinetic strength values and swimming performance in athletes aged from 13 to 16.

Aktuğ et al. (2019) stated that ground training, as well as pool exercises for improving swimming performance, affected swimming ratings positively and Theraband strength exercises improved motor performance. In addition, it is stated in the literature that regular physical activities improve motor skill levels depending on the improvement in basic motor features in children (Usluer et al., 2021; Pişkin et al., 2020). The fact that there was no significant difference in the ball bouncing including object control skills and standing vertical jumping subtests is thought to be due to the fact that the swimming training did not include exercises for hand skills and jumping skills. The absence of another study in the literature analyzing the effect of regular swimming exercises applied to children on the motor skill determined by MFT has limited the comparison of our results.

It is seen that there is a limited number of studies analyzing the effect of the swimming exercises applied to children on motor features, motor skills and swimming performance in the literature. Kistak et al. (2019) found a significant relation between the 25-meter swimming performances and motor features of the swimmers aged from 8 to 10 and motor tests. Uçak (2019) determined a significant difference in the performance values of flexibility, vertical jumping and shuttle run included in the

swimming exercises of children aged 8 to 10 consisting of 10-week ground and pool exercises in both time-dependent in-group changes and between-group changes. In a study conducted by Pehlivan and Karadenizli (2019), it was reported that while no significant relation was determined between the motor features of the athletes aged 9 to 13 and freestyle swimming endurance, grip strength and 50-meter swimming performance, there was a significant relation between speed, which is one of the motor features, and 50-meter freestyle swimming ratings. In their study, Kurt et al. (2023) determined that the core exercises performed by the athletes improved their functional motions and 50-meter and 100-meter swimming ratings significantly according to the post-test.

The focal point of the studies mentioned above confirmed our results, that is, swimming exercises improve children's basic motor features, motor skills and swimming ratings. It is thought that motor skills, as well as many factors such as stroke frequency, stroke length, physical fitness, training level, nutrition and motivation, are also important for the performance of athletes. In addition, it is thought that motor control and motor skill level of swimmers can be a factor that increases the perfection of swimming techniques by improving functional movement patterns.

## Conclusion

Consequently, it was determined that swimming training significantly improved children's motor skills determined by MFT (Goal Throwing, Flexibility, Flexed Arm Hanging, Step Test and total assessment scores) and 50-meter swimming performance in the post-test. It may be stated that swimming exercises performed in childhood are important in the improvement of children's motor skills and the motor skills improved will contribute to the improvement of swimming ratings.

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**Citation:** Gözel, Z., and Aka, H. (2023). Analyzing the effect of 8-week swimming training applied to secondary school students on motor skills and 50-meter swimming ratings. *African Educational Research Journal*, 11(3): 371-376.

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