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# The Investigation of the Relationship between Children's 50m Freestyle Swimming Performances and Motor Performances

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## Abstract

The aim of the study is to examine the relationship between children's 50 m freestyle swimming performances and motor performances. There were 32 swimmers (male = 21, female = 11), who had been swimming for at least one and a half year, participated in the study. The motor performances of the participating swimmers were determined through the Dordel Koch Test (DKT) and 50 m swimming performances via the stopwatch. The Spearman Correlation Analysis was used to determine the relationship between children's motor performances and the swimming performances of 50 m. As a result of the statistical analysis, it was determined that the performance categories of DKT sub-dimensions were $DKT_{shuttle}$, $DKT_{push\text{-}up}$ and $DKT_{balance}$ performances of the categories in which both girls and boys were the best. It was determined that male swimmers would perform $DKT_{6min\ running}$ and female swimmers would have a positive effect on the 50 m freestyle swimming performance of $DKT_{sideward\ jump}$ performances ($p < 0.01$, $p < 0.05$). In addition, it was determined that all the swimmers had a positive effect on the 50 m freestyle swimming performances of the $DKT_{sideward\ jump}$, $DKT_{6min\ running}$ and $DKT_{flexibilty}$ performance ($p < 0.01$, $p < 0.05$). As a result, it can be stated that $DKT_{6min\ running}$, which is the demonstration of aerobic performance, increased $DKT_{flexibility}$ and $DKT_{sideward}$ jump performance will contribute to 50m swimming performance.. Moreover, it can be suggested that the performance development of the upper extremity ($DKT_{shuttle}$ and $DKT_{push\text{-}up}$), which is required for the branch in the performance, is categorized as performance.

**Keywords:** Children, Swimming, Motor performance.

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## Contents

## 1. Introduction

Motor skill is specified as the movement or voluntary movement task of one or more body parts towards the learned goal (Gallahue and Ozmun, 2006; Lopes *et al*., 2013). Motor performance is defined as the motor performance required to perform the motor task (Mosston and Ashworth, 1986) or an act of performing a mobility skill (Gallahue *et al*., 2012). Motor skills and motor performance are strong indicators of children's health state and achievement in sports (Vandorpe *et al*., 2012; Callewaert *et al*., 2015; Pion *et al*., 2015).

Motor skills and motor performance are closely related to intelligence, age, general motivation concern, fatigue, environmental factors as well as physical activity or level of participation in sports (level of fitness, training status) (Timmons *et al*., 2007; Sayın, 2011). In a study examining the effect of sports participation on motor skills, Iri and Aktuğ (2017) determined the motor skills of children who did not play sports through the Körperkoordinationstest Für Kinder Test. Iri and Aktuğ (2017) stated that the motor skills of children performing sports were significantly higher than those of non-athletic children. Likewise, Fransen *et al*. (2012) reported that children with high motor skills were more successful in physical fitness tests and they participated in sports more frequently. All physical activity and sports have positive effects on motor skills and motor performance and swimming is amongst these sports.

Swimming is a sport branch that combines a number of factors such as high-level muscular strength, technical skill, coordination, rhythm, speed, explosive strength and correct technique (Garrido *et al*., 2010; Morouço *et al*., 2012; Yapıcı *et al*., 2016). The fact that swimming is of great benefit to children in terms of heart, lung capacity, endurance, flexibility, balance, physical appearance, muscle strength and weight control (Malina and Bouchard, 1991; Çelebi, 2008) has been regarded as both as a sport and a recreational activity in recent years.

The purpose of this study is to examine the relationship between motor performance and 50m free style performance. In addition, when the literature related to motor and performance in Turkey was examined, the studies mostly used the KTK test, TGMD2 test, Eurofit tests and Bruininks-Oseretsky test, whereas in the current study, Dordel Koch test was used to determine motor performance, which indicates the originality of the current study.

## 2. Material and Method

A total of 32 (male = 21, female = 11) swimmers between the ages of 10 and 13 were included in the study. Swimming athletes engaged in swimming were included with the experience of at least one and a half years (average of female swimmers = 1.77 ± 0.47 years, average of male swimmers = 2.07 ± 0.68 years). The selected subjects swim for 4 days a week so that each training will take about 90 minutes on average. The height of the swimmers participating in the study was measured by means of tape measure and their body weights were measured through an electronic scale. Children's BMIs are calculated by formula [body weight (kg) / height ($m^2$)]. Children's shuttle, push-up, balance, long jump, flexibility, sideward jump and 6min running motor performances were measured via the Dordel Koch test, free-standing swimming performances were determined with a stopwatch.

### 2.1. Dordel Koch Test

Dordel and Koch (2004) is a test designed to determine the motor performance and basic functions of children and young people aged 6-16 years. The Dordel-Koch Test consists of 7 different tests. 6 of which are grouped in the established stations (jumping, balancing, stopping, long jump, shuttle, push-up, flexibility), 6 min running was conducted as a final test. The best results were included in the study Dordel and Koch (2004).

$DKT_{sideward\ jump}$ test; the child was folded four times in 15 seconds and applied at the highest speed on the fixed rope in the form of left and right jumping without touching the two feet and the ipe. The test was applied twice to the total score recorded. $DKT_{flexibility}$ test; is a test that measures the flexibility of the waist and especially the hamstring muscles. Children's feet are based on the base of the flexibility board, measured in a straight line extending to the last point where they can reach with their fingers. The point on which the foot base stands is determined as zero (0), the side on which the feet extend is positive (+) and the side with the calf is negative (-). The test was conducted twice and the best value was recorded in cm.

$DKT_{standing\text{-}long\ jump}$ test; the child was measured in the form of a double leg jumble to the farthest point where the legs can reach next, taking the force from the arms behind the determined zero. The last point of the child's heel was recorded in cm. 2 trials were implemented and the best result was included in the study.

$DKT_{shuttle}$ test; the child's head is measured in the back of the head, with the jaws open sideways, and the body bent away from the knees and approaching the knees. Each full motion performed within 40 seconds was accepted as 1 and recorded as units.

$DKT_{balance}$ test; children were measured as single legs for 60 seconds on a fixed rope in double layer. The number of contacts of the legs which was not on the rope was recorded as number.

$DKT_{push\text{-}up}$ test; the children started the the push-up test while lying flat on, and the hands were on their hips. At the beginning of the allocated time, the hands were pressed under the shoulders and the body was lifted and the movement was completed by returning the starting position after touching one hand to another in the same position. The number of push-ups the child could make within 40 seconds was recorded as number.

$DKT_{6min\text{-}running}$ test; this test was conducted when the children ran around the area of a volleyball field (54m) for 6 minutes as fast as possible. The children completed this length within 6 minutes either by running or walking when they felt tired. The total distance was recorded in metre.

Each of the subscales of DKT are scored and evaluated separately, and a general score and evaluation are not conducted in DKT. DKT sub-dimension performances are indicated by scores from 1 to 6. 1 = very good, 2 = good, 3 = moderate, 4 = adequate, 5 = poor, 6 = very poor.

### 2.2. 50 M Freestyle Swimming Performance Measurement

The 50m freestyle swimming performances of the children were measured through a stopwatch (Casio, Japan) measuring at a precision of 0.01 sec. The children were individually tested after 5 minutes of running and flexing

movements on land and after 10 minutes of low and high intensity exercises in water. The 50 m free style swimming test was started with push-out command when they push the pool wall with their feet. When the distance of 50 m was completed, the test was ended. Two measurements were taken from each swimmer and the swimmers were given 30 minutes rest between 2 measurements. The best value was included in the study.

### 2.3. Statistical Analysis

Spearman Correlation Analysis was used to determine the relationship between 50 m free-style swimming performance and DKT sub-dimensions after the data were analyzed through the SPSS 24 software program.

## 3. Findings

**Table-1.** The swimmers' average and standard deviations of demographic variables

| | **Male (21)** | **Female (11)** | **Total (32)** |
|---|---|---|---|
| | Mean±Sd | Mean±Sd | Mean±Sd |
| Age (year) | 12.19 ± 1.72 | 10.91 ± 1.45 | 11.75 ± 1.72 |
| Height (m) | 1.57 ± 0.11 | 1.52 ± 0.11 | 1.55 ± 0.11 |
| Weight (kg) | 49.62 ± 13.58 | 37.63 ± 11.09 | 45.50 ± 13.86 |
| BMI (kg/m²) | 19.73 ± 3.51 | 15.87 ± 2.81 | 18.41 ± 3.73 |
| Sports Age (year) | 2.07 ± 0.68 | 1.77 ± 0.47 | 1.97 ± 0.62 |

**Table-2.** Correlation table between 50m free-style swimming rates and DKT subtests

| | | | **DKT** sideward jump | **DKT** flexibility | **DKT** standing long jump | **DKT** shuttle | **DKT** balance | **DKT** push-up | **DKT** 6 min running |
|---|---|---|---|---|---|---|---|---|---|
| **Male** | 50m Swimming | N | 21 | 21 | 21 | 21 | 21 | 21 | 21 |
| | | p | 0.08 | 0.08 | 0.07 | 0.09 | 0.18 | 0.16 | 0.01 |
| | | R | -0.39 | -0.39 | -0.41 | -0.38 | 0.31 | -0.31 | -0.55** |
| **Female** | 50m Swimming | N | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| | | p | 0.04 | 0.35 | 0.67 | 0.93 | 0.55 | 0.57 | 0.25 |
| | | R | -0.63* | -0.31 | -0.15 | -0.03 | 0.20 | -0.20 | -0.38 |
| **Total** | 50m Swimming | N | 32 | 32 | 32 | 32 | 32 | 32 | 32 |
| | | p | 0.00 | 0.03 | 0.05 | 0.18 | 0.15 | 0.16 | 0.00 |
| | | R | -0.48** | -0.38* | -0.34 | -0.24 | 0.26 | -0.25 | -0.51** |

*p<0.01, *p<0,05

When Table 2 is examined, it is seen that there is a negative correlation between male swimmers' 50 m free style rates and $DKT_{6\ min\ running}$ test ($p < 0.01$). It was determined that there was a negative correlation between the 50m freestyle rates of female swimmers and $DKT_{sideward\ jump}$ test ($p < 0.01$). It was found that there was a negative correlation between total swimmers' 50 m free style rates and $DKT_{sideward\ jump}$ ($p < 0.01$). It was determined that there was a negative correlation between the total swimmers' 50m free style rates and the $DKT_{flexibility}$ test ($p < 0.01$). There was a significant negative correlation between total swimmers' 50m freestyle rates and $DKT_{6\ min\ running}$ test ($p < 0.01$).

**Table-3.** Performance categorization of DKT sub-dimensions

| | **Male (21)** | **Female (11)** | **Total (32)** |
|---|---|---|---|
| **DKT** sideward jump | 6.00 ± 0.00 | 5.91 ± 0.30 | 5.97 ± 0.18 |
| **DKT** flexibility | 3.43 ± 0.98 | 3.55 ± 1.37 | 3.47 ± 1.11 |
| **DKT** standing long jump | 3.33 ± 1.28 | 3.73 ± 0.79 | 3.47 ± 1.13 |
| **DKT** shutle | 1.95 ± 1.20 | 1.45 ± 0.98 | 1.78 ± 1.13 |
| **DKT** balance | 2.24 ± 1.81 | 2.73 ± 2.00 | 2.41 ± 1.86 |
| **DKT** push-up | 2.33 ± 1.24 | 1.91 ± 1.58 | 2.19 ± 1.35 |
| **DKT** 6 min running | 3.33 ± 1.20 | 2.64 ± 1.12 | 3.09 ± 1.20 |

When Table 3 is examined, it is seen that for both male and female swimmers; $DKT_{sideward\ jump}$ performance were is in the poor category, of $DKT_{flexibility}$, $DKT_{standing\ long\ jump}$ and $DKT_{6\ min\ running}$ performances were in the middle category. In addition, it was determined that both female and male swimmers' best categories were $DKT_{shuttle}$, $DKT_{push\text{-}up}$ and $DKT_{balance}$ performances.

## 4. Discussion

As a result of the study, it can be determined that according to the performance categorization of DKT sub-dimensions, $DKT_{push\text{-}up}$ indicating the strength of arm and chest muscles, $DKT_{shutle}$ indicating the strength of body muscles, $DKT_{balance}$ indicating the coordination sensitivity, are all at a good level.

Senol and Gulmez (2017) used a group of 13-year-old swimmers, they were categorized into 3 groups; those performing exercise band (TRX) activities in addition to swimming training, those performing exercises with body weight in addition to swimming training and those performing only swimming exercises. As a result of the study, it can be stated that the strength values of the children who performed extra exercises band increased; moreover, the swimming exercise alone did not lead a change in the children's strength parameters. Değirmenci and Karacan (2017) stated that swimmers aged 11-13 years significantly increased their free-standing grades of 25 m, 50 m, 100 m, 150 m and 200 m in the last test, which applied the theraband stregth exercises for the upper and lower extremities for 12 weeks. In a similar study, the relationship between muscle strength and performance at 50 m and 400 m was determined and found to be positively correlated with free style swimming performance of the upper and lower limb strengths (Hawley *et al.*, 1992).

The results of the study showed that lower extremity muscle strenghts ($DKT_{sideward\ jump}$ and $DKT_{standing\ long\ jump}$) were lower than the desired level, although upper extremity muscle strengths ($DKT_{shutle}$ and $DKT_{push\text{-}up}$) were at the desired level according to performance categorization of DKT subdimensions. Since the 50 m free style is evaluated as short distance and speed swimming performance, the speed characteristic of this distance swimmers is very important. It is hardly possible to reach the maximum speed with lower muscle strength. For this reason, swimmers need to develop all body strengths. The fact that children participating in the current study do not have $DKT_{sideward\ jump}$ and $DKT_{standing\ long\ jump}$ performances with DKT, indicating lower extremity muscle strength, may be due to the fact that swimmer children generally do not utilize jump and leap movements to perform exercises in water.

In the current study, there is a negative relationship between swimmers' $DKT_{flexibility}$ and $DKT_{6\ min\ running}$ values and 50m free-style swimming speeds. In other words, as the flexibility and aerobic endurance of swimmers increase, swimming speeds improves. The flexibility and mobility of the joints and muscles as well as the strength of the muscles are very important for simmers (MEGEP (Milli Eğitim ve Öğretim Sisteminin Güçlendirilmesi Projesi), 2008). Sevim (2002) stated that the flexibility of the children between the ages of 10-13 is good and participating in sports will increase flexibility. Also, Sevim (2002) stated that flexibility at the desired levels will improve the performance of the motoric properties.

As a result, it can be stated that $DKT_{6\text{-}min\ running}$, $DKT_{sideward\ jump}$ and $DKT_{flexibility}$ performances, which are indicators of aerobic performance, positively affected 50m freestyle swimming performances of swimmers. In addition, it can be said that the performance improvement of lower extremity ($DKT_{standing\ long\ jump}$ and $DKT_{sideward\ jump}$) is low, although the performance development of the upper extremity ($DKT_{shutle}$ and $DKT_{push\text{-}up}$) is determined to be high in the categorized performances.

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