Investigation of the effect of sport climbing training on some physical parameters of athletes

Investigaçào do efeito do treinamento de escalada esportiva em alguns parâmétros físicos dos atletas

Mustafa Bingöl

Abstract
This study was carried out to determine the effect of climbing training on the physical parameters of the athletes. The research group consists of 16 male volunteer athletes actively continuing in the climbing branch. A training program for climbing of 80 minutes a day, four days a week for ten weeks, was applied to the athletes in the research group. The research group consists of 16 male volunteer athletes with an average age of 14.82 who continue actively in the climbing branch. A training program for climbing of 80 minutes a day, four days a week for ten weeks, was applied to the athletes in the research group. Height, body weight, leg strength, hand grip strength, vertical jump, speed, flexibility and agility values of the research group were measured at the beginning and end of the training. SPSS statistical package program was used in the analysis of the data. The significance level was accepted as p>0.05. As a result of the research, it was determined that there was a statistical difference in the physical parameters of climbing players, such as leg strength, hand grip strength, vertical jump, flexibility, agility and ten meters (p<0.05), while there was no statistically significant difference at the twenty-meter value (p). >0.05). As a result, it has been seen that climbing training positively affects the physical parameters of the athletes. In this context, we believe that regular training will improve the performance of the athletes.

Keywords: Training. Physical Parameter. Sports Climbing.

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Resumo
Este estudo foi realizado para determinar o efeito do treinamento de escalada nos parâmetros físicos dos atletas. O grupo de pesquisa consiste em 16 atletas voluntários do sexo masculino que continuam ativamente no ramo de escalada. Um programa de treinamento para escalada de 80 minutos por dia, quatro dias por semana durante dez semanas, foi aplicado aos atletas do grupo de pesquisa. O grupo de pesquisa é composto por 16 atletas voluntários do sexo masculino com uma idade média de 14,82 que continuam ativamente no ramo de escalada. Um programa de treinamento para escalada de 80 minutos por dia, quatro dias por semana durante dez semanas, foi aplicado aos atletas do grupo de pesquisa. Os valores de altura, peso corporal, força nas pernas, força nas mãos, salto vertical, velocidade, flexibilidade e agilidade do grupo de pesquisa foram medidos no início e no final do treinamento. O programa estatístico SPSS package foi utilizado na análise dos dados. O nível de significância foi aceito como p>0,05. Como resultado da pesquisa, determinou-se que havia diferença estatística nos parâmetros físicos dos jogadores escaladores, como força da perna, força da mão, salto vertical, flexibilidade, agilidade e dez metros (p<0,05), enquanto não havia diferença estatisticamente significativa no valor de vinte metros (p>0,05). Como resultado, tem sido visto que o treinamento de escalada afeta positivamente os parâmetros físicos dos atletas. Neste contexto, acreditamos que o treinamento regular melhorará o desempenho dos atletas.


Introduction

It is thought that human beings could climb since their existence. This ability is thought to have emerged to meet needs such as survival, hunting, and climbing trees and is considered an instinct (Şeren, 2018). When we look at the beginning of human life, i.e. infancy, it is seen that human beings have the ability to climb before they start to stand up and take steps, and for this reason, it is accepted as one of the basic forms of movement of human nature (IFSC, 2014). When it comes to mountaineering or climbing, the first thought usually evokes high altitude climbs, long walks for days, challenging obstacles, mountains, or efforts to reach high hills. However, mountaineering, also known as alpinism, is not limited to this, it consists of different disciplines such as independent camping, high-altitude climbing, hiking on ice and snow, rock climbing, and ice climbing (Schöffl et al., 2010).
Climbing, which has increased in popularity in recent years, has not only been limited as a recreational activity but has also become a sport branch. Today, sport climbing is a rapidly developing sports branch that has been included in the official program of the Olympic Games since 2020. Sport climbing, which is done for both sports and recreational purposes, has also become popular as a competitive sports branch. As it has become a competitive branch, it is also seen as a training for climbers to improve their physical capacity and technical skills (Gassner et al., 2022; Sanchez et al., 2019; Bertuzzi, 2017). It has been stated that the main resistance that climbing athletes need to overcome during climbing is their own body weight. In order to overcome body weight resistance, climbing athletes need to actively use their lower and upper extremities. In order for climbing athletes to overcome the resistance created by their own body weight, the maximum force should be proportionally higher between maximum force and body weight (Ozimek et al., 2016). In addition to these, sportive performance levels of the upper and lower extremities such as high-level endurance, flexibility, speed, quickness and balance must also be high in order to achieve successful climbing and a high performance. However, experts and practitioners in climbing sport training have stated that success in climbing depends especially on strength and endurance (España-Romero et al., 2009).

Sport climbing is a sport branch that requires great strength in the fingers and arms to overcome the resistance created by body weight during sport climbing and a great upper extremity strength due to the fact that it requires both intermittent and continuous isometric contractions of the forearm muscles almost continuously (MacDonald, 2018). For these reasons, the forearm muscles and fingers in the upper extremities have the most important role in the vertical climbing of the body during sport climbing, and both the strength and endurance of these muscles are one of the important physical characteristics required for good performance in climbing. However, it is not only the strength and endurance in the lower and upper extremities that affect performance during sport climbing, but also the athlete's body somatotype, height, body fat mass directly affect performance. High body weight, especially fat mass, can increase the resistance against the arm and finger muscles in the upper extremities, causing these muscles to fatigue in a shorter time and cause loss of performance in climbing or termination of climbing (Mermier et al., 2000; Grant et al., 2001).

Based on this information, in this study, we aimed to determine the effect of sport climbing training on athletes' physical parameters. We also aimed to clarify whether sport climbing training has the potential to improve athletes’ performance, providing a series of physical advantages such as increasing upper and lower body strength, improving endurance,
increasing flexibility and improving balance abilities. One of our sub-objectives is that the results of this study will be useful in the process of designing and implementing training programs for athletes. Sport climbing coaches can use the information obtained from this study to understand the specific needs of athletes and improve their performance. In addition, we think that evaluating the physical parameters of athletes with the results we obtained and adapting training programs accordingly may contribute to the development of more effective training strategies in the field of sport climbing.

**Methodology**

2.1 **Research Group**

The research group consisted of 16 male athletes with an average age of 14.82 years who were licensed in the climbing branch and regularly participated in the training.

2.2 **Training Program**

2.2.1 **Body Weight & Height**

A digital scale was used to determine the body weight of the athletes and the determined values were recorded as kg. The height of the athletes was determined with the help of a tape measure fixed on a flat wall surface and the measured values were recorded as cm.

2.2.2 **Back and Leg Strength**

The leg strength of the athletes was determined with a Takkei (Takei-Back&Lift, Japan) back and lift dynamometer. The athletes placed their feet on the dynamometer stand with their knees slightly bent, arms stretched, back straight, and torso slightly forward, grasping the dynamometer bar with the right or left hand, and pulled up the dynamometer bar vertically using their legs to the maximum extent. The measurements were repeated twice and the best result was recorded (Karakulak et al., 2019).
2.2.3 Hand Grip Force

The hand grip strength measurements of the athletes were determined with a Takkei brand hand dynamo meter (Hand Grip) with a sensitivity of 0.100 kg. Hand grip strength measurements were performed with the athletes standing, without bending their arms, and with their hands not touching the body. The measurements were repeated twice for both hands and the best result was recorded as kg (Işın et al., 2018).

2.2.4 Vertical Jump Test

The vertical jump values of the athletes were determined using a Smartspeed brand mat. The athletes were asked to jump upwards when they felt ready by placing their hands on the mat on the ground and putting their hands on their waist. The measurements were repeated twice and the best degree was recorded as cm (Ayan et al., 2019).

2.2.5 Speed Test (10, 20 Meters)

The athletes were given enough time to warm up before the start of the speed tests and the athletes were placed one by one at the starting line of the 10, 20-meter track and after the athletes were given the exit signal, they were asked to cross the finish line at maximal speed by crossing the starting line. The time taken by the athletes from the start line to the finish line was determined with a photocell. The speed measurements of the athletes were repeated twice and the best time was recorded in seconds.

2.2.6 Flexibility Test

The flexibility values of the athletes were determined by sit and reach test. To determine the flexibility values of the athletes; the participants were asked to sit on the floor and place the sole of their bare foot flat on the test table, reach to the last point they can reach with their torso forward and without bending their knees and wait for one or two seconds in this way. Flexibility measurements were repeated twice and the best result was recorded as cm (Baynaz et al., 2017).
2.2.7 Pro-Agility Test

The agility of the athletes was determined by the pro-agility agility test, also known as the 20-yard dash test. The test area is determined by placing funnels 5 yards (4.57 m) to the left and right of the starting line. A photocell gate is placed at the starting line and the agility values of the athletes are determined by repeated passing times. Before the start of the agility test, the athlete takes his/her place at the starting line and the test is started with the start command, first touching the funnel on the right and then the funnel on the left, and the test is terminated by crossing the starting line. The agility test was repeated twice and the best grade was recorded in cm seconds (Erdoğan et al., 2020).

2.3 Data Analysis

The data were analyzed using SPSS statistical package program. Shapiro Wilk-W normality test was used for the normality analysis of the data and after it was determined that the data showed normal distribution, the "Paired Samples t" test was used to compare the pre-post test values of the research group. The significance level was evaluated as p<0.05.

Results

<table>
<thead>
<tr>
<th>Measurements</th>
<th>N</th>
<th>X</th>
<th>ss</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age(years)</td>
<td>16</td>
<td>14,82</td>
<td>0,62</td>
</tr>
<tr>
<td>Length(cm)</td>
<td>16</td>
<td>168,17</td>
<td>5,11</td>
</tr>
<tr>
<td>Body weight (kg)</td>
<td>16</td>
<td>53,23</td>
<td>9,90</td>
</tr>
<tr>
<td>Sport Age (years)</td>
<td>16</td>
<td>5,62</td>
<td>1,00</td>
</tr>
</tbody>
</table>

Table 1: Characteristics of Demographic Status of Sport Climbing Athletes
*p< 0.05
Source: the author

When Table 1 was examined, it was determined that the demographic values of the athletes; age, height, body weight and sports age averages were 14,82±0,62 (years), 168,17±5,11 (cm), 53,23±9,90 (kg), 5,62±1,00 (years) respectively.
Table 2. Pre-Post Test Analyses of Physical Parameters of Sport Climbers

*Significant difference at p<0.05

Source: The author

When Table 2 was evaluated, it was determined that there was a statistically significant difference in leg strength, hand grip strength, vertical jump, flexibility, agility and ten meters values (p<0.05), while there was no statistically significant difference in twenty meters value (p>0.05).

**Discussion**

The popularity of climbing sport has been on a continuous increase from past to present, and with the increase in sport climbing competitions and the increase in the number of athletes turning to this sport, there is a parallel increase in the number of researches on this subject and continues. However, although the physical parameters that are effective on climbing performance have been examined in the studies, the main focus has been on injuries in climbing sports and how to protect against these injuries. Of course, there are studies examining the anthropometric and physiological characteristics of athletes in sport climbing, but these studies are few and insufficient. For this purpose, we evaluated leg strength, right-left hand grip ability, vertical jump, agility, flexibility and 10-20 m sprint parameters to evaluate the effect of climbing training on the performance of climbing athletes between the ages of 14-16. As a result of the analysis of the data we obtained, we determined that climbing
training had positive effects on anthropometric properties such as strength parameters (leg, grip strength, vertical jump), speed, agility and flexibility.

Medernach et al. reported that fingerboard training increased right and left grip strength in rock climbers in order to evaluate the effect of grip strength on climbing performance (Medernach et al., 2015). Wong and Gabriel reported that isokinetic endurance training in sport climbers increased flexion and extension resistance in resisting body weight and showed a positive correlation with climbing performance (Wong and Ng, 2008). Schweizer and Furrer examined the relationship between forearm strength and climbing performance and reported that forearm and grip strength increased climbing performance (Schweizer and Furrer, 2007). Grant et al. examined the anthropometric characteristics of climbing athletes and reported that grip strength and flexibility parameters of climbing athletes were effective in demonstrating a successful climbing performance (Grant et al., 2001). In a different study, Erdoğan determined that the long-term training applied positively affects the physical profiles of the athletes (Erdoğan, 2020). Browning reported that climbing training increased motor control skills, body coordination, strength, balance and social communication skills in individuals with autism (Browning, 2017). Gasner et al. reported that therapeutic climbing training had positive effects on physical, psychological and social parameters. Similarly, in a study conducted on primary school children, it was reported that at the end of a 6-week climbing exercises program, improvements were observed in strength, flexibility, vertical jump, 20m shuttle run, 30m sprint parameters (Şen, 2002). In their study, Vidinovski and Dimitrova reported that physical and technical training for athletes who were new to climbing had a positive effect on motor parameters such as claw strength, grip strength and jumping (Vidinovski & Dimitrova, 2018). Mutlu Bozkurt et al., in their study, found that children who received their basic football training with educational games, They determined that the physical fitness profile affected more positively than the children who did not play with the games. In line with the results we obtained, it shows that sport climbing training can positively affect the physical parameters of athletes and is in line with the studies in the literature. This information can be used to guide sport climbing coaches in understanding the specific needs of athletes and improving their performance. Furthermore, assessing athletes' physical parameters and adapting training programs accordingly may contribute to the development of more effective training strategies in sport climbing. However, the limitations of this study and the small sample size should be considered. Research supported by larger samples and long-term studies is necessary for a more comprehensive understanding of the effects of sport climbing.
Conclusion

In line with the results we obtained, it shows that sport climbing training can positively affect the physical parameters of athletes and is in line with the studies in the literature. This information can be used to guide sport climbing coaches in understanding the specific needs of athletes and improving their performance. Furthermore, assessing athletes' physical parameters and adapting training programs accordingly may contribute to the development of more effective training strategies in sport climbing. However, the limitations of this study and the small sample size should be considered. Research supported by larger samples and long-term studies is necessary for a more comprehensive understanding of the effects of sport climbing.

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