EXAMINATION OF ANAEROBIC POWER PERFORMANCES OF ELITE WINTER ATHLETES

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Abstract

The aim of this study is to examine the anaerobic power performance of elite winter athletes. A total of 40 athletes from Alpine skiing (n:10), ski jumping (n:10), snowboarding (n:10) and Short track (N:10) who are active at elite level in different winter sports participated as volunteers. Wingate anaerobic power test (WAnT) was performed using the Monark 894E brand bicycle ergometer to measure anaerobic power parameters of the lower extremities of the research group. The SPSS for Windows 22.0 package program was used to calculate and evaluate the data obtained. The mean and standard deviation of the variables measured are summarized. The normality distribution of the measured parameters was determined by the Shapiro-Wilks test. One-way variance analysis (ANOVA) was used to determine the differences between sports branches because the Normal distribution was shown. The Tukey test from Post-Hoc tests was applied to determine the source of the difference. In this study, significance level was taken as $p<0.05$. When comparing between groups; there was no significant difference between peak power (W), peak power (W/kg) and average power (W) values. The minimum power (W) values were significantly different between ski jumping groups; Alpine skiing, snowboarding and short track groups; and fatigue index (%) values between ski jumping groups; and alpine skiing and short track groups. Consequently, anaerobic performance is important for branches that are completed in a short time or require explosive power. While anaerobic strength, which is an important component of performance, is an important factor for all branches, it is seen that it has much more importance especially in winter sports branches where anaerobic strength is used predominantly. Improving anaerobic capacity positively improves athlete performance. Therefore, regular training of athletes in accordance with the energy system specific to the branch also results in different results on the anaerobic strength of the training differences in winter sports branches.

***Key words**: Winter Sports, Wingate, Anaerobic Performance*

Introduction

Recently, anaerobic performance has been one of the popular physiological concepts for many researchers working in the field of Sports Sciences. The researchers ' notion of anaerobic performance in the limelight is indicative of performance for short-term high-intensity novelization (Bouchard et al., 1991; Arslan, 2015).

Anaerobic performance is a term of great importance for sports branches that are completed in a short time or require explosive force, because the performance of the athlete can be affected by individual and environmental factors and vary. Coaches and sports professionals can determine the strength and capacity of the athlete they employ and prepare a training program accordingly to increase their performance. Regular training results in an increase in anaerobic performance of athletes. In other words, this increase in anaerobic performance is the increase in ATP-PC stores and the efficiency of the lactic acid system. For this reason, the athlete's energy resources and the ability to use these resources are an important element for sporting performance (Özkan et al., 2011).

The prevalence of winter sports is one of the increasing sports activities every day. As winter sports, skiing, snowboarding, ski jumping, short track are seen as the prominent sports. An average of 50-100 million people are involved in winter sports each year. In the 2008-2009 winter season, it was reported that approximately 56 million skiers shifted in France and 30 million skiers in Switzerland, and 55 million in Austria during the 2007-2008 season (Vanat, 2009; Brügger et al., 2010). The increase in the number of ski resorts in our country, the fact that we have hosted international tournaments has led to an increase in the interest in winter sports as well as an extremely rapid increase in the orientation of winter sports.

Anaerobic performance is important for all kinds of sports activities, but the importance of anaerobic performance is increasing in sports branches where it is mainly used. The use of anaerobic power in individual and team sports and the importance of anaerobic power in sports branches is emerging with the number of studies done every day is increasing. Many sports such as winter sports in the formation of branches in sudden and severe anaerobic performance needed for high power more and more to the fore, and the study of literature because of the scarcity of studies that address the forces of anaerobic athletes in the winter to study this importance. The aim of this study is to examine the anaerobic power performance of elite winter athletes.

METHOD

Research Group

A total of 40 athletes from Alpine skiing (n:10), Ski Jumping (n:10), snowboarding (n:10) and Short track (N:10) who are active at elite level in different winter sports participated in the study as volunteers. The data for Age (year), Sport Age (year) and Height (cm) of the research group are indicated in Table 1 below.

Table 1. Defining characteristics of athlete groups

Variable	N	Alpine Skiing	Ski Jumping	Snowboard	Short track
Age (year)	10	21,30±,94	20,90±,99	21,14±,19	20,75±,92
Height (cm)	10	178,20±4,31	173,90±5,83	174,60±5,18	175,80±5,06
Sport Age (year)	10	11,28±1,22	10,87±1,99	9,14±1,19	10,75±1,92

Data Collection

The height of the athletes participating in the tests was measured as ‘cm’ in anatomical posture, bare feet, foot heels United, holding their breath, head frontal plane, head top table Vertex point after being positioned to touch, body weights were measured as ‘kg’ while bare feet and anatomical posture were only in shorts. Anaerobic power parameters were determined by WAnT.

Data Collection Tools

Measurement of Height and Body Composition

The length of the participants was measured in cm with the Charder height measurement device. The body weights of the athletes were measured by the InBody 120 bioimpedance body composition analyzer.

Wingate Anaerobic Power Test (WAnT)

Wingate anaerobic power test (WAnT) was performed using the Monark 894E brand bicycle ergometer to measure anaerobic power parameters of the lower extremities of the research group. For WAnT, a modified bicycle ergometer connected to a computer and powered by compatible software was used. Before the tests, seat and pedal length settings were made for each athlete. In the leg wingate test, the load of 75 gr per kilogram of body weight was automatically calculated on the computer and placed on the bike's plate (Bard et al., 2018).

Before the start of want, the athletes were heated by running for 5-7 min and then pedaled for warming up on the bike for 5 min (70-80 RPM) (RPM: pedal rotation speed of one minute). The last 5 seconds of every 1 minute were loaded with the last speed (between 140-160 RPM). After the warm-up was completed, 2 minutes of stretching was done and the athlete recovered. As soon as the athlete was fully ready, the test was started with the start command and the test was performed for 30 seconds. During the test, the athlete was verbally encouraged. After the Test was finished, the athlete continued to pedal for cooling at low speed for 3 minutes and the test was terminated (Inbar et al., 1996). During the test, measurements were made automatically in six equal time intervals every five seconds and some data about anaerobic performance was obtained as a result of these measurements. During the test, any five-second period, obtained the highest power within “anaerobic power”, formed during the test the average power and anaerobic capacity” during the test, if obtained within the second period caused the lowest of any power five “minimum force” is described as. The results of the Test recorded peak power, peak power (W/kg), average power, minimum power and fatigue index (%).

Analysis Of The Data

The SPSS for Windows 22.0 package program was used to calculate and evaluate the resulting data. The mean and standard deviation of the measured variables are summarized. The normality distribution of the measured parameters was determined by the Shapiro-Wilks test. One-way variance analysis (ANOVA) was used to determine differences between spores, because the normal distribution was shown. Tukey testing was performed from post-Hoc tests to determine the source of the difference. In this study, significance level was taken as $p<0.05$.

Results

Table 2. Body Compositions of Alpine Skiing, Ski Jumping, Snowboarding and Short Track Athletes

	Weight (kg)	BMI (kg/m²)	Fat (%)	Fat Mass (kg)	Free Fat Mass (kg)
Groups	mean±SD	mean±SD	mean±SD	mean±SD	mean±SD
Alpine Skiing	71,88±2,00 **a**	22,29±1,54 **a**	7,45±1,12 **ab**	5,10± ,87 **ab**	66,36±1,10 **a**
Ski Jumping	59,20±4,87 **b**	19,54±1,04 **b**	4,58±1,88 **a**	2,71±1,11 **a**	56,49±4,97 **b**
Snowboard	67,72±1,71 **a**	22,28±1,52 **a**	9,52±3,48 **b**	6,46±2,38 **b**	61,26±2,98 **c**
Short track	65,93±5,90 **c**	21,30±1,33 **a**	8,16±4,18 **b**	5,54±3,23 **b**	60,39±3,78 **db**

a, b, c, d: It is the difference between the means in the same column. ($p<0.05$)

Table 2. when examined, mean and standard deviations of body composition analyses were given. When the comparison is made between groups; values for Alpine body weight of the group; between the groups with short track ski jumping alpine skiing and ski jumping fat percentage body mass index values in between groups in values of the group's ski jumping; ski jumping, snowboarding and short track fat mass between the groups in values of the group; Group values in Alpine and short track, snowboarding and lean body mass between the groups; there were significant differences between ski jumping, snowboarding and short track groups as well as between ski jumping and snowboarding groups. ($p<0.05$)

Table 3. Comparison of Anaerobic Strength of Alpine Skiing, Ski Jumping, Snowboarding and Short Track Athletes

	Peak power (W)	Peak power (W/kg)	Average power (W)	Minimum power (W)	Fatigue index (%)
Groups	mean±SD	mean±SD	mean±SD	mean±SD	mean±SD
Alpine Skiing	803,60±141,35 **a**	12,04± ,74 **a**	588,06±115,80 **a**	357,66±75,47 **a**	55,72±2,70 **a**
Ski Jumping	796,50±171,89 **a**	13,39±2,36 **a**	537,65±64,03 **a**	268,38±61,68 **b**	65,04±10,35 **b**
Snowboard	859,17±111,44 **a**	12,68±1,67 **a**	593,58±46,81 **a**	362,71±36,82 **a**	57,63±1,79 **ab**
Short track	851,42±108,37 **a**	12,99±1,23 **a**	628,88±59,46 **a**	424,18±73,48 **a**	50,69±7,19 **a**

a, b, c: It is the difference between the means in the same column. ($p<0.05$)

When Table 3. is examined, average and standard deviations of anaerobic power values are given. When comparing between groups; No significant difference was found between peak power (W), peak power (W / kg) and Average power (W) values. ($p>0.05$) of the ski jump group of the minimum power (W) values; Alpine Skiing, snowboard and short track groups, fatigue index (%) values of the ski jumping group; There was a significant difference between the alpine skiing and short track groups. ($p<0.05$)

Dıscussıon

The purpose of this study is to examine the anaerobic power performances of elite winter athletes. A total of 40 athletes from Alpine skiing (n:10), ski jumping (n:10), snowboarding (n:10) and Short track (N:10) who are active at elite level in different winter sports participated in the study as volunteers. This study was covered due to limited research on physical and anaerobic performance of athletes engaged in winter sports.

Branch-specific physical fitness and body composition are essential for high performance. For athletes, physical structure or physical characteristics are known to be factors affecting performance (Özkan et al., 2010). Over the years, researchers have conducted extensive research on body composition and measurements, which have an effect on performance in different sports. High body fat percentage in northern skiers is generally known to have performance disruptive effects (Ateş, 2017). Stöggl et al. (2010) anthropometric characteristics of world-class sprint skiers and to determine the ideal body composition for a sprinter in a study to determine the extent of successful national and international skiers skis to the wheels 14 treadmill with double-stick and skate technique implemented to have the maximal speed test. Length as a result of a relationship with no technique to the study, while not weak, body mass ($R = 0.75$, $p < 0.01$), body mass index ($r = 0.66$, $p < 0.01$), total lean mass ($r = 0.69$, $p < 0.01$) and body mass ($R = 0.57$, $p<0.05$) with double-stick have indicated that there is a significant correlation between the maximal positive rate. In the same study, a positive correlation was found between the lean mass values of total lean mass ($r = 0.76$, $p<0.001$), leg ($R = 0.54$, $p<0.05$), arm and torso (both $r = 0.72$, $p<0.01$) and skateboard technique.

Duvillard (1995) reports that anaerobic strength tests, especially the optimal level of body mass, are more associated with ski success than aerobic strength tests. White and Johnson (1993) found that vertical jumping was the best indicator of skier performance, while Haymes and Dickinson (1980) found that vertical jump measurement, a marker of anaerobic strength, was the highest positive correlation with FIS scores. Andersen et al. (1990) found that anaerobic testing had a positive relationship with the highest ski performance. Body composition and anaerobic strength performance make clear their importance for winter sports branches. Physical characteristics or body composition affect the expression of physiological capacity. In the study, although the physical characteristics showed similarities when looking at branch-specific values, significant differences were found between the groups. This difference is thought to be due to branch-specific body composition developments of the physical characteristics of the groups covered.

In their research on sprint skiers competing at international and national levels, Sandbakk and colleagues (2011) stated that although the aerobic capacity values of sprinters and distance runners are close together, their anaerobic capacity is different. The fact that the anaerobic capacity of the sprinters competing in the world class is 8% higher than those competing at the national level proves that anaerobic power is a very effective factor. In their study of Ski Runners, Nillson et al (2004) found that it caused significant increases in anaerobic strength and minimum anaerobic strength values. In their research in Sharp et al (1986), they noted that high intensity sprint workouts have significant effects on anaerobic energy production and power generation. In Vesterinen et al (2009), a study of 16 male ski runners observed a positive relationship between high anaerobic capacity and performance in the first series of sprint competitions.

Ozan et al (2018), in his study of anaerobic power in different branches; the wrestlers ($X_{ort}=21.70\pm2.35$ years, $X_{va}=77.50\pm13.44$ kg), anaerobic power levels of 11.22 W/kg, football players ($X_{ort}=21.80\pm1.75$ years, $X_{va}=70.60\pm6.36$ kg), anaerobic power levels 9.90 W/kg, riders ($X_{ort}=22.70\pm2.54$ year, $X_{va}=72.90\pm4.67$ kg), anaerobic power levels of 10.64 W/kg, the tennis player ($X_{ort}=24.00\pm1.88$ years, $X_{va}=73.80\pm12.64$ kg) 9.81 anaerobic power levels W/kg boxers ($X_{ort}=22.20\pm2.74$ years, $X_{va}=74.20\pm10.56$ kg) anaerobic power levels 9.96 W/kg of taekwondocu ($X_{ort}=22.50\pm3.10$ years, $X_{va}=73.60\pm7.84$ kg if exceeded) 10.51 anaerobic power levels W/kg, it was found that. Compared to the results of the study, anaerobic power performance was low. This low performance is thought to be due to differences between branches. As the peak strength (W/kg) among the groups is evaluated as high performance, ski jumping is 13.39±2.36 w/kg, short track is 12.99±1.23 w/kg, snowboard is 12.68±1.67 w/kg and Alpine skiing is 12.04±, 74 W/kg.

As reported in some research, anaerobic power capacity is known to be demonstrated by the effects and relationship of glycolic and phosphogen energy system (Green et al., 1994, Nebelsick-Gullet et al., 1988, Bulbulian et al., 1996). Demirkan et al., (2012) 11 national wrestlers with an average age of 19.3 years and a body weight average of 82.5 kg reported peak strength levels of 1206 W after the leg wingate anaerobic strength test. In the same study, 37 non-national active wrestlers with an average age of 18.8 years and a body weight average of 76.5 kg reported peak strength levels of 1039 W. Wingate applied 75 g / kg to body kg press as test load. The peak power averages of the wrestler group obtained in the study are 857.94 Watts. There appears to be a similarity of methods and materials between the two studies, but there appears to be a significant difference in peak power levels. This difference may be due to the age difference between the two studies and the performance levels of the subjects. Similarly, Hübner-Wozniak et al., (2004) they reported the peak strength levels of leg wingate of 10 male national wrestlers in the Polish wrestling team with an average age of 22.7 years and a body weight average of 75.5 kg as 859 W and applied the test load as 75 g/kg per body kg. The study found that the anaerobic strength performance of elite winter athletes was higher.

One of the most difficult branches in winter sports, snowboarding, athletes compete individually. It is very important that the athletes competing in this challenging branch have very good physical structure and high level aerobic capacity as well as anaerobic strength in order to be successful. Snowboarding is an activity that requires very high intensity contraction in the leg muscles, especially during turns. Athletes are required to have strong leg muscles during gliding, especially due to changes in knee and elbow flexion (Berg and Eiken, 2000). Landing speed is very important for snowboarding. The athlete's descent rate is linearly proportional to their anaerobic performance (Bompa, 2001). Therefore, the appropriate training programs with the anaerobic capacity of snowboarders with other components should be raised to the top level.

Ustundag et al. (2017) study of short track athletes ' anaerobic strength values; boxing, weightlifting and taekwondo branches have higher values, due to the nature of the branch to maintain the same strength for a long time stressed that. Short track athletes ' age, body weight and height were 17.45±1.76 years, 71.8±6.3 kg and 174.22±5.06 cm anaerobic strength values of 13.95±1.02 W/kg respectively. Zebrowska et al. (2012) age, body weight and height of snowboarding athletes in the study, respectively; They found that 20.0±0.7 years, 67.11±8.44 kg and 179.8±6.3 cm anaerobic power values were 899.0±77.9 w, 13.0±1.0 w/kg. White (1991) found anaerobic power averages of 17.4±0.28 W/kg in his study with Alpine skiing skiers. In the same study, the anaerobic power Average was 16.7±0.52 W/kg in the measurements made with another group. Hogg (2003), in his compilation work on ski jumping and snowboarding, emphasized that elite male and female athletes should have averages of their anaerobic strength of 16.5 (w/kg) and 13.5 (w/kg), respectively. When compared with the research findings, it is seen that the studies have high values.

As a result, anaerobic performance is important for branches that are completed in a short time or require explosive power. Anaerobic strength, which is an important component of performance, is an important factor for all branches, especially in winter sports, where anaerobic strength is mainly used. It is observed that the significant difference between groups is due to the practice and that anaerobic strength values are below international norms. It is thought that the development of anaerobic capacity will improve the performance of the athletes in a positive way, so that the athletes can achieve better success in competitions by performing regular training in accordance with the energy system specific to the branch.

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