IJBPAS, January, 2016, 5(1), Special Issue: 481-492

ISSN: 2277–4998

International Journal of Biology, Pharmacy and Allied Sciences (IJBPAS)

'A Bridge Between Laboratory and Reader'

www.ijbpas.com

TALENT IDENTIFICATION IN ROCK CLIMBING WITH AN EMPHASIS ONBIOMECHANICAL, ANTHROPOMETRIC, PHYSIOLOGICALAND POSTURAL PARAMETERS

SHAHIN SHADMEHRI[1], YAHYA SOKHANGUYI, ZINAT NIKAEEN [3]

[1]Master of Physical Education and Sports Science, Sports Biomechanics

shahinshadmehry@gmail.com

[2]Faculty member well-being and rehabilitation university of Tehran

yahya0102@yahoo.com

[3]Assistant Professor of Islamic university of Tehran

dr.zinatnikaeen@gmai.com

ABSTRACT

One of the basic concepts of sport and physical education is the process of talent identification. Objective definition of talent identification is the identification and selection of people who had a greater ability for a specific sport in comparison with others. Talent identification and nurturing the talents is a fundamental part in more sport programs. The aim of this study was to identify talent in rock climbing with an emphasis on biomechanical, anthropometric, physiological and postural parameters. In this descriptive study, 60climbers were selected, having the ability to climb a rout with a grading difficulty of 5.11 and higher – based on the grading system of Yosemite decimal America- the average age of participants was 28. In this study, 5 biomechanical and physical fitness parameters, 6 balance tests, 33cases of right and left joint angles measurements were evaluated, also 51 cases in the anthropometric section including : stature, body mass, body height, limb girth, body width and fat skin were measured, in physiological section 7 cases and in the postural section 17 body postures were measured. Using correlation, principal components analysis and factor analysis, the advanced, prominent parameters in each section were identified with a significance level of (P≤0 / 01). The results

showed that in the fitness and biomechanical balance the following elements were identified as prominent parameters: sit-up, pull-ups, BESS balance tests, C, D, E, F test sections, Romberg, Sharpened Romberg, stable Angel on the right and left feet with open eyes, unstable angel test on the right foot with closed eyes. But obtained correlations were very low in the joint angles. In the anthropometric part, 21 prominent parameters were identified which had a weighted coefficient higher than 0.7; stature, body mass, acromiale- radiale length, midstylion- dactylion length, foot length, leg height of the internal tibial condyle to internal tibial eminence in ankle, iliospinale- base, trochantrion- base height, trochantrion- sphyrion tibiale length,arm span, arm girth, forearm girth, elbow girth, chest girth, head girth, biacromial breadth, bi-styliod breadth, bi-metacarpale breadth and the percentage of fat. In the physiological part, 5prominentparameters were identified: resting heart rate, chest girth relaxed, in a deep breath, 1 milerun and Sargent jump. But in the postural part, no physical conditions were identified as the prominent parameter.

Keywords: Biomechanical parameters, anthropometric, physiological, postural, rock climbing

INTRODUCTION

Sport, in today's world, where competition is common in the field of science and technology between different countries, is a means of expression and excellence. It is used as a mean to express countries' progress. Addressing the scientific roots of sport is essential. But applying this knowledge, without specifying the requirements, limits the application of this useful knowledge; thus, the responsibility of coaches, other than knowledge of the physical sciences, is to select talented athletes for the desired field. So the main purpose of talent identification, is the identification and selection of athletes who have special talents for sport. Using talent identification and based on actual methods, we can evaluate the potentials of the athletes, plan and boost these potentials (46). Understanding the biomechanical, anthropometric, physiological, physical and postural characteristics of the athletes in a particular sport, is useful for the identification, discovery and supporting of the talents, and this knowledge, is a key in training programs (62). The rapid growth of knowledge and technology, has affected various aspects of life and by making positive changes in the productivity of time, quality and quantity has improved life. The

consequence of this development in the field of sports, has resulted in the different professional fields of sport. Achieving higher levels of performance and achievement records in the past has become an important goal (43). Successful participation in society, indicates an increase in the international economic, political, cultural and scientific participation (46).One of the important international sporting events is the World Championships and the Olympics. The growing concern of sport stakeholders in the world, is to get the gold, silver and bronze medals in the World Championships and Olympic Games. Identifying talents with the aim of avoiding the trial and error processes, includes the fundamental aspects of strategies and policies in championship. The researchers stress that a combination of genetic and environmental factors is effective in the emergence of an elite athlete. But so far, no research is conducted to identify talents in rock climbing with an emphasis on biomechanical, anthropometric, physiological and postural parameters.

RESEARCH METHOD

The research method is descriptive

The population and sample size

The population of the study included 60climberswho had the ability to climb a rout with agradingdifficultyof5.11 and higher – based on the grading system of Yosemite decimal America-.

The samples included men and women climbers who attended the gyms of Tehran, Hamedan, Karaj and Kangavar regularly and did climbing exercises three times a week. They are aged between 24 to32 years.

Characteristics of the subjects in this study are as follows: the average age of28.5± 4.4years, the average body mass of61.7± 9.1kg, average stature of169.2± 9.4cmandfat percentage of 10.4± 4.4.

Statistical method

To describe the data we have used the descriptive statistics including; mean and standard deviation and of inferential statistics including; multiple correlation coefficient of statistical analysis. Multiple correlation coefficient has been conducted separately for each biomechanical factors(balance, speed, agility, flexibility, muscle strength and motor angles), anthropometric factors in 51 cases (size and dimensions of body, physiological factors including aerobic and anaerobic capacity, resting heart rate and blood pressure), and conditioning factors in seventeen cases. After reducing the number of parameters, statistical methods PCA are used for each parameters of the biomechanical, anthropometric, physiological and postural characteristics to

determine the main components of the data. After determining the main components of each parameter, factor analysis method is used to determine the parameters.

FINDINGS

In this section, using inferential statistics, we examined the research objectives. Before using factor analysis-principal component analysis, the multiple correlation for each group of variables was separately conducted and parameters with low correlations were removed and only those were extracted whose correlation coefficients were greater than0.7. As a result, the number of anthropometric parameters reached from 51 to 28, biomechanics parameters reached from 56 to13, and physiological parameters reached from 7 to 5.

Anthropometric characteristics

Using advanced analysis, factor analysis and principal component analysis, 28parameters were extracted from the multiple correlation of the climbers, among which three main components were selected that allocated 86.28 of the whole variance (Table 2).

In the above Table 3, the weighting coefficient of characteristics, represents the multiple correlation of the desired characteristics which were extracted from other characteristics of the climbers, were achieved through the rotation of the matrix correlation of multiple features.

Objective 1: To determine the main anthropometric parameters (body mass, stature, and body width, height of limbs, limb girth and subcutaneous fat) in climbers with an emphasis on talent identification.

Using advanced analysis, factor analysis and principal component analysis, 28 parameters were extracted from the multiple correlation of the climbers, then 21 prominent anthropometric parameters were identified which had a weighted coefficient higher than 0.7; stature, body mass, acromiale- radiale length (arm length), palms, midstylion-dactylion length (hand length), foot length, leg height of the internal tibial condyle to internal tibial eminence in ankle, iliospinale-base height, trochantrion- base height, trochantrion- sphyrion tibiale length, arm span, arm girth, forearm girth, elbow girth, chest girth, head girth, biacromial breadth, bi-styliod breadth, bi-metacarpale breadth and the percentage of fat.

Physiological characteristics

Using advanced analysis, factor analysis and principal component analysis, 5 parameters were extracted from the multiple correlation of the climbers, among which one component allocated 76.95 of the whole variance.

In Table 6, the weighting coefficient of characteristics, represents the multiple correlation of the desired characteristic which was extracted from other characteristics of the climbers was achieved through the rotation of the matrix correlation of multiple features.

Objective 2: To determine the main physiological parameters (aerobic and anaerobic capacity, muscle strength, blood pressure and heart rate), with an emphasis on talent identification.

Using advanced analysis, factor analysis and principal component analysis, 5parameters were extracted from the multiple correlation of the climbers, which had a weighted coefficient higher than 0.7; including resting heart rate, chest girth relaxed, chest girth in deep breath, 1 mile Run and Sargent jump.

Biomechanical characteristics

Using advanced analysis, factor analysis and principal component analysis, 13 parameters were extracted from the multiple correlation of the climbers, among which four main components were selected that allocated 80.82 of the whole variance (Table 8).

Table 1: selected anthropometric characteristics of athletes' multiple correlation

Number	Anthropometric characteristics selected from multiple correlation	Number	Anthropometric characteristics selected from multiple correlation
1	BMI	15	forearm girth
2	Mass(body mass)	16	elbow girth
3	stature	17	wrist girth
4	acromiale- radiale length	18	chest girth
5	acromiale- radiale length	19	waist girth
6	height of palms	20	ankle girth
7	midstylion- dactylion length (hand length)	21	head girth
8	leg height of the internal tibial condyle to internal tibial eminence in ankle	22	Arcgirth of the foot
9	iliospinale- base height	23	biacromial breadth
10	trochantrion- base height	24	foot length
11	trochantrion- sphyrion tibiale length	25	bi-styliod breadth
12	arm span	26	bi-metacarpale breadth
13	arm girth relaxed	27	a-p chest depth(the anterior- posterior depth of the chest at mesosternale level) -1
14	arm girth flexed and tensed	28	body fat percentage

Table 2: Rotation matrix components (with a higher ratio of 5/0)

Variable	Component 1	Component 2	Component 3
BMI			-0.67
Mass(body mass)		0.74	
stature	0.77		
acromiale- radiale length	0.67		
radial- stylion length	0.81		
height of palms	0.89		
midstylion- dactylion length(hand length)	0.89		
leg height of the internal tibial condyle to internal tibial eminence in ankle	0.77		

iliospinale- base height	**0.88**		
trochantrion- base height	**0.89**		
trochantrion- sphyrion tibiale length	**0.92**		
arm span	**0.87**		
arm girth relaxed		**0.84**	
arm girth flexed and tensed		**0.92**	
forearm girth		**0.77**	
elbow girth		**0.71**	
wrist girth	**0.69**		
chest girth		**0.82**	
ankle girth		**0.63**	
head girth		**0.83**	
Arcgirth of the foot	**0.66**		
biacromial breadth		**0.81**	
foot length	**0.82**		
bi-styliod breadth	**0.72**		
bi-metacarpale breadth	**0.71**		
a-p chest depth(the anterior-posterior depth of the chest at mesosternale level)	**0.63**		
body fat percentage			**-0.84**

Table 3: Weighting coefficients of anthropometric parameters obtained from the three components using factor analysis (values higher than7.0)

Variable	Component 1	Component 2	Component 3
Mass(body mass)		**0.74**	
stature	**0.77**		
radial- stylion length	**0.81**		
height of palms	**0.89**		
midstylion- dactylion length(hand length)	**0.89**		
leg height of the internal tibial condyle to internal tibial eminence in ankle	**0.77**		
iliospinale- base height	**0.88**		
trochantrion- base height	**0.89**		
trochantrion- sphyrion tibiale length	**0.92**		
arm span	**0.87**		
arm girth relaxed		**0.84**	
arm girth flexed and tensed		**0.92**	
forearm girth		**0.77**	
elbow girth		**0.71**	
chest girth		**0.82**	
wrist girth		**0.83**	
biacromial breadth		**0.81**	
foot length	**0.82**		
bi-styliod breadth	**0.72**		
bi-metacarpale breadth	**0.71**		
body fat percentage			**-0.84**

Table 4: Physiological characteristics selected from multiple correlation of athletes

Number	Selected Physiological characteristics obtained from multiple correlation
1	**Resting heart rate**
2	**Size chest at rest**
3	**Size chest at deep breath**
4	**1 mile Run**
5	**Sargent Jump**

Table 5: Indicated the main component, physiological parameters with a weighted coefficient of higher than 0.7. This table was used in the next analyses.

Variable	Component 1
Resting heart rate	-0.91
Sizechestatrest	0.89
Sizechest at deep breath	0.90
1 mile Run	-0.76
Sargent Jump	0.89

Table 6: Weighting coefficients of physiological parameters obtained from the three components using factor analysis (values higher than 7.0)

Variable	Component 1
Resting heart rate	-0.91
Sizechestatrest	0.89
Sizechest at deep breath	0.90
1 mile Run	-0.76
Sargent Jump	0.89

Table 7: Selected biomechanical properties of athletes' multiple correlation

Number	Biomechanical Characteristics selected by multiple correlation	Number	Biomechanical Characteristics selected by multiple correlation
1	20-meters Sprint	8	Romberg balance test
2	Sit ups	9	Sharpened Romberg balance test
3	Horizontal bars	10	Stable Angel on the right foot with open eyes
4	Balance test c	11	Stable Angel on the left feet with open eyes
5	Balance test d	12	unstable angel test on the right foot with closed eyes
6	Balance test e	13	unstable angel test on the left foot with closed eyes
7	Balance test f		

Table 8: Indicated the main component, biomechanical parameters with a weighted coefficient of higher than 0.7. This table was used in the next analyses.

Variables	Component 1	Component 2	Component 3	Component 4
20-meters Sprint			0.60	
Sit ups				0.72
Horizontal bars				.920
Balancetest c			.741	
Balance test d			.704	
Balance test e		.888		
Balance test f		.917		
Romberg balance test ,	.727			
Sharpened Romberg balance test	.841			
Stable Angel on the right foot with open eyes	.868			
Stable Angel on the left feet with open eyes	.855		.783	
unstable angel test on the right foot with closed eyes			783	
unstable angel test on the left foot with closed eyes		.575	.640	

Table 9: Weighting coefficients of biological parameters obtained from the four components using factor analysis (values higher than 7.0)

Variables	Component 1	Component 2	Component 3	Component 4
Sit ups				0.72
Horizontal bars				.920
Balance test c			.741	
Balance test d			.704	
Balance test e		.888		
Balance test f		.917		
Romberg balance test ,	.727			
Sharpened Romberg balance test	.841			

Stable Angel on the right foot with open eyes	**.868**			
Stable Angel on the left feet with open eyes	**.855**			
unstable angel test on the right foot with closed eyes			**783**	

In the above Table 9, the weighting coefficient of characteristics, represents the multiple correlation of the desired characteristic which was extracted from other characteristics of the climbers was achieved through the rotation of the matrix correlation of multiple features.

Objective 3: To determine biomechanical parameters (flexibility, endurance, agility, balance, speed) in climbers with an emphasis on talent identification.

Using advanced analysis, factor analysis and principal component analysis, 13 parameters were extracted by the multiple correlation of the climbers, then 11 prominent biomechanical parameters were identified which had a weighted coefficient higher than 0.7; Sit ups, Horizontal bars, Balance test c, Balance test d, Balance test e, Balance test f, Romberg balance test , , Sharpened, Romberg balance test, stable Angel on the right foot with open eyes, stable Angel on the left feet with open eyes, unstable angel test on the right foot with closed eyes.

Postural characteristics

Objective 4: To determine the main postural parameters of climbers with an emphasis on talent identification.

The postural parameters are not based on subjects' genetic and congenital abnormalities but on abnormalities caused by working conditions and etc. Which result in abnormal or normal postural. So this case is not like the biomechanical, anthropometric and physiological parameters and we cannot use factor analysis, to analyze postural factors. However, according to the high percentage of Genu Varum, head tilted forward, and the crooked thumb, it is realized that due to the work and the history of climbing, the subjects' body postures are more abnormal. Some sports, regarding the position of the athlete and the nature of the sport, create special anomalies in the long run. For example, in equestrian, Genu Varum is common based on the sitting position of the rider on the horse, in the climbing, the climbers due to the nature of the climbing, have to keep their bodies in a way that energy consumption is reduced and balance is increased. This fact is possible by horizontal abduction and great opening of feet. The repeating of this position increases the risk of abnormalities over time.

DISCUSSION

The aim of this study was to identify Talent in rock climbing with an emphasis on

biomechanical, anthropometric, physiological and postural parameters.

The first specific objective was to determine the prominent biomechanical parameters in climbing. Based on the findings of the study, it was revealed that there are some prominent biomechanical parameters in. 11 prominent biomechanical parameters were identified Sit ups, Horizontal bars, Balance test c, Balance test d, Balance test e, Balance test f, Romberg balance test, Sharpened, Romberg balance test, stable Angel on the right foot with open eyes, stable Angel on the left feet with open eyes, unstable angel test on the right foot with closed eyes. The results of this study were compatible with achievements of Classenset al. (1990), which were based on efficiency and technical factors of physical fitness in rock climbing. They realized that the parameters of age, stature, body mass, the amount of subcutaneous fat, flexibility, power of legs and etc. are important factors in rock climbing. Paul Tomaszewski(2011) investigated the somatotype features of rock climbers and stated that they have small stature, low mass, low body fat percentage and grip strength relative to their bmi. Cheung(2009) described the anthropometric and physiological characteristics of 11 male elite climbers, he found that climbers who had a normal stature of 179 cm, body mass 58 kg, body fat percentage of 10.96 and great aerobic capacity had a better arm span in comparison to their statures. Peterson et al.(2008) reviewed the physical fitness of 21 male and 9 female rock climbers, they found that cardiorespiratory fitness and horizontal bars in male subjects were stronger than females. Watts et al. (2002) in a study on anthropometric characteristics of young climbers found that the prominent anthropometric features of climbers include small stature, low bmi, low fat content, the higher grabbing ability to the bottom bmi, great arm span and linear body type. The studies' of Queen et al. (2003), and Romelu et al(2001) are also consistent with this research. Mer Mayor et al (2000) investigated the relationships of anthropometric and physiological characteristics of 44 climbers with the ability range of 5.6 a - 5.13 c and motor functions. They found that there isn't a significant relationship between anthropometric characteristics and performances of the climbers. This achievement is not in line with our findings, this incompatibility is resulted from the different levels of climbers. However, the relationships between physiological characteristics and motor function are significant. Grant et al. (2001) in their study compared the anthropometric,

flexibility, endurance and strength features of 10 elite climbers with an average ability of 9.5 with 10 recreational climbers and 10 non-climbers athletes. Their findings suggested that there were no significant difference between elite climbers and the other two groups in sit and reach flexibility test, but in thigh tests, elite climbers were higher than the other two groups. In the fingers and grip strength's test, elite climbers significantly acted better than non-climbers and leisure climbers. But there were no meaningful relationships between the groups in sit and reach flexibility test, which is incompatible with the findings of the present research. The probable reason for the incompatibility is resulted from the differences in the levels of climbers. Fatemeh Akbari (2011), investigated the relationships between some anthropometric and physiological characteristics in the elite and novice climbers. Akbari's results suggested that there were no significant relationships between elite climbers and novice ones in anthropometric characteristics(stature, body mass, arm and leg length, monkey index- the ratio of stature of the subjects to their arm ranges of –and fore arm size and characteristics of body composition such as body fat percentage and bmi). Physiologically, there were no significant relationships between resting blood pressure and resting heart rate in climbers. These achievements were incompatible with the results pf this study and the probable reason lies in the comparison of experienced climbers with no vice ones. But there was a significant difference between resting heart rate and muscle power in no vice climbers and horizontal bars in elite climbers. Also, there was a significant relationship between the level of physical fitness factors such as Harvard step test, maximum oxygen consumption, flexibility, endurance and muscle strength in trained climbers and no vice ones.

In the joint angles parameters of the climbers, it was tried to first find the correlation between angles and climbing parameters and then, using the factor analysis, the angles be extracted, so that in the final step, the joint angles with very high weighting coefficients could be revealed in the correlation as the most prominent parameters selected for the motion range. However, the correlation analysis showed that the obtained correlations were very small and in practice, based on the motion range of parameters, there searchers failed to achieve a prominent parameters in the biomechanical part. There weren't any comprehensive literature in the issue of joint angles and

range of motion. But the researchers could find some studies on the issue and stated the facts above.

In the Anthropometric part, 21 prominent parameters were identified which had a weighted coefficient higher than 7.0; stature, body mass, arm length, palms, mid stylion-dactylion length, foot length, leg height of the internal tibial condyle to internal tibial eminence in ankle,iliospinale- base height, trochantrion- base height, trochantrion-sphyrion tibiale length, arm span, arm girth, forearm girth, elbow girth, chest girth, head girth, bi-acromial breadth, bi-styliod breadth, bi-metacarpale breadth and the percentage of fat. The findings were in line with the achievements of Viviani (1991), Rousseau (1992), Classen et al.(1990), Watts (2002), Chung (2009), Tomaszewski(2011), Pedernso et al. (2008), Quinn (2003), Romelu (2001). However, the results were not compatible with the findings of Mermayr (2000) Fatemeh Akbari et al. (2011), and Grant (2001).

In the physiological section, using advanced analysis, factor analysis and principal component analysis, 5 parameters were extracted as the prominent parameters of climbing, including resting heart rate, chest girth relaxed, chest girth indeep breath, 1 mile Run and Sargent jump. There searches of Classenet al. (1990), Chung(2009), Petterson et al.(2008), Quinn(2003), Romelu et al. (2000) and Fatemeh Akbari(2011) were consistent with the findings of this study. However, one of the results of Fatemeh Akbari was incompatible with the current results. She suggested that there were no significant relationship between blood pressure and heart rates and climbing experiences.

In the postural characteristics, there searcher couldn't find any research on the characteristics of the posture in the body posture of the climbers.

CONCLUSION

Biomechanical, anthropometric and physiological parameters should be considered in rock climbing to identify talents. Also, according to the identified parameters we may suggest that the use of PCA statistical methods and factor analysis are efficient in finding parameters in other fields as well.

REFERENCES

1. Adams, Genom. Instructions for Exercise Physiology. 2013. Translation: Farhad Rahmani-Nia, Hamid Rajabi, Abba ali Gaeini and Husseinmujtahidi. Tehran, Hatmi Publications, Second Edition.

2. Aqaali Nejad, Hamid. Talentin the sport.2000.Paper presented at the First International Congress on Physical Education and Sport Sciences of female students in Tehran.

3. Ebrahim, Khosrow, Hallaji, Mohsen. Sportstalent, 2007, Tehran, Bamdad publication.

4. Akbari, Fatemeh. The Relationship between anthropometric and physiological characteristics with a history of climbing and comparison subjects (climbers) and no vice ones. December2011.Master's thesis, University of martyr Rajai.

5. Aule, R; Loko, J.(1983). Selection of Young athlets. Modern Athlete and Coach, 21 (4): 3 – 6.

6. Bar – Or , O. (1975). Genes and training for athletic performance revisited. Sport. 5(2): 1 – 3.

7. Bloomfield, J. (1995). Talent Identification and Profiling, Sci & Med in Sport, Black Well Science. 206- 220.

8. Bompa, T. O. (1999). Periodization: theory and methodology of training. 5: 344 – 349.