International Journal of Biology, Pharmacy

and Allied Sciences (IJBPAS)

'A Bridge Between Laboratory and Reader'

www.ijbpas.com

ANTHROPOMETRIC MEASUREMENTS AND DOMINANT ARM RELATIONSHIPS WITH ELITE ASIAN ARCHER'S PERFORMANCE IN 2013 YEAR

ZAHRA SHAMS [1*], HASSAN MATINHOMAIE[2], MAGHSOUD PEERI[3]

1, 2, 3: Department of Exercise Physiology, Faculty of Physical Education and Sports Sciences,

Islamic Azad University, Central Tehran Branch, Tehran, Iran

*Corresponding Author: E Mail: z_archery@yahoo.com; Ph.: +98 2188074905

ABSTRACT

The goal of this study was to investigate relationships of anthropometric measurements considering dominant arm with performance of elite Asian archers.

Twenty Asian elite man and women archers that participated in big prize Asian events Bangkok Thailand with Mean ± SD; age, 25 ± 2.1 years; height, 178 ± 4.6 cm; BMI, 23.7 ± 2.7 kg/m^2) had been examined. One day before starting events after coordinating with coaches needed information was collected using interview and observation and some anthropometric measurements (height, weight, length of 3 fingers, wrist girth and arm length) were measured using correct technique.

After collecting anthropometric data, performance test for 70m distance was done, and all participant scores recorded. Using Pearson correlation test relationship between anthropometrics measures and performance records was measured.

In general results of present study showed that among anthropometric measures of elite men and women archers that participated in Asian games only dimensions of three main fingers for drawing bowstring, dominant hand and eye with 70m records have significant correlations.

Keywords: Anthropometric Measures, Dominant Limb, Archery Performance, Archers, Elite

INTRODUCTION

Individual differences are the main factors that can influences performing of well known skills. Some of these factors like growth are mainly depending on genetics background but some environmental factors like physical activity, nutrition and … can influence them. Any way individual differences in growth, size and body structure can mainly influence performing body skills [1,2].

In past decades importances of sport science have developed in all aspects of sport especially in competitive sports. Anthropometrics measurements are complete reflect of body fitness that have main role in determining performance and success of athletes [3,4].

Identification and discovering sports talents is a main factor in determining success of athletes and their teams. In international high levels events for achieving high levels of performance related skills, survey of anthropometric measurements and body composition are essential [5,6]. Recent information have showed that in most sports there is close and direct relationship between anthropometric and physiological measurements. Whatever this relationship is strong you can guaranties advance of athlete in their professional career using proper

technique and equipment [7], archery is not excluded from this role.

Study of relationship between anthropometric measurement and swimming records showed that some factors like body surface, arm and leg length, body weight, height and age have direct and positive correlation with time of swimming [8]. In archery anthropometric measures like wrist girth, length of three main fingers for drawing bowstring and length of palm are important factors. Because of specific technique in archery, this sport classified as sport that anthropometric and psychological profile had very important role [9]. As well as this in archery upper body limps especially shoulder, elbow, wrist and fingers had major roles that both muscular strength and endurance of them can affects athletes performance and success [9]. According to our knowledge no research in relation to anthropometric characteristics correlation with performance of elite archery athlete's found. Purpose of this study is to investigate the relationship of anthropometric characteristics with performance of the elite archer's in 2013 is Asian games. The most important aspect of this research was participation of elite athletes and recording their performance in real terms of an official

competition. That these factors provide the opportunity for research in real terms, and can also provide an important case reports.

SUBJECTS AND METHODS

Subjects

Twenty elite men and women archers (table 1) with professional physical activity participated voluntary in this study. Participants were free of drug and medication and had no history of injury or disease before and during this study. The Islamic Azad University, Tehran Branch, Ethics Committee initially approved the experimental procedures and study protocols, which were fully explained to all subjects, coaches and a written consent form was signed after having read and understood the details of the study.

Data collection method

After coordination with the President of the Federation of Thailand made and satisfy the relevant coaches with personal informed written consent, archers on the day before the match, in the morning and in the afternoon some of their features and anthropometric parameters were measured and Information the results were recorded in special forms.

Anthropometric indices measuring methods

Height measurements: height was measured to the nearest 0.5 cm without shoes using a calibrated scale. Vertical height from the lowest point of the body to the top of the head included.

Weight, BMI and Fat mass: Body mass and total body fatness was measured using the Tanita Segmental Body Composition Analyzer (Tanita Corporation, Tokyo, Japan) with correction for light indoor clothing. Body mass index (BMI) was calculated as body weight in kilograms divided by height in meters squared (BMI=weight $_{(kg)}$/height^2 $_{(m)}$).

Measuring three fingers in a stretch Bowstring (index finger, middle finger, and ring finger): fingers length was measured with measuring tape and just the fingertips to the end of the third phalange.

Wrist girth Measurement: This wrist girth measurement on the right arm, at a point just distal (away from the body) to the styloid processes was done. This is usually the minimum circumference in this region, the tape moved around to make sure the minimum girth was recorded.

Arm length Measurement: all subject stands with the arms hanging loosely by the side of the body, fingers outstretched. A measurement is made from the acromiale (lateral edge of the acromion process, e.g. bony tip of shoulder) to the tip of the little finger. Measurement is made on the right side, following the anthropometric standard,

though a measurement of either side would be assumed to be the same in most cases.

Performance Measurement: like the ranking round, archers shoot 72 arrows at a target 70 meters (229 feet, 8 inches) away in 12 ends of six arrows each. A perfect score is 720.

Statistical methods

Kolmogorov-Smirnov test was used to evaluate the data distribution normality. Data analysis using descriptive statistics mean standard deviation and draw diagrams and tables. Inferential statistics Pearson correlation test to determine the relationship between anthropometric variables with the 70 meters round records was performed. Data are presented as mean (±SE) unless otherwise stated. Statistical significance was set at $P<0.05$.

RESULTS

Data (mean ± standard deviation) for anthropometric features, height, weight, fat subjects is presented in Table 1. Also among the 20 participants, 19 of them were right hand.

Descriptive data of wrist girth, three fingers length, palm length, arm length, shoulder width, forearm length, average length of three fingers and 70m records are shown in Table 2.

Table 3 shows, Pearson correlation test show high correlation between each finger length separately and average of them with the performance of the archers in 70m records ($P<0.05$). As well as this the size of the palm length with the wrist girth, arm's length with the wrist girth, average of the three fingers with wrist girth, and the palm length with forearm's length of archers showed significant correlations. This indicates the significant and positive correlations. Pearson correlation test showed no significant correlation between wrist girth, arm length, shoulder width and forearm length with 70m performance ($P>0.05$), also shoulder width and forearm length showed no correlation with wrist girth, it represents is a significant lack of correlation ($P<0.05$).

Table 1: Mean (±standard deviation) General characteristics, professional experience and Total Awards of subjects

Variables	Mean	Standard deviation	Minimum	Maximum
Age (years)	25.11	6.30	19	40
Weight (kg)	68.87	13.58	50	105
Height (m)	1.71	0.09	1.53	1.92
BMI (kg/m^2)	23.24	2.7	18.37	28.48
Professional Experience (year)	9.81	4.38	3	20
Total Awards (number of medals)	6.21	6.4	0	20

Table 2: Mean (±standard deviation) wrist girth, three fingers length, palm length, arm length, shoulder width, forearm length, average length of three fingers and 70m records of subjects

Variables	Mean	Standard deviation	Minimum	Maximum
Wrist girth (cm)	16.71	1.33	14.2	19
Index Finger (cm)	23.71	0.39	6.5	8.2
Middle Finger (cm)	8.12	0.36	7.5	9
Ring Finger (cm)	7.46	0.46	7	8.5
Average of Three Finger (cm)	7.60	0.35	7	8.23
Palm Length (cm)	10.78	0.65	10	12
Arm Length (cm)	69.66	3.77	62.5	77.5
Shoulder Wide (cm)	46.56	7.76	37	74.5
Forearm Length (cm)	25.41	2.14	21	29
70m Record (score)	623.40	22.79	566	661

Table 3: correlation matrix between wrist girth, three fingers length, palm length, arm length, shoulder width, forearm length, average length of three fingers and 70m records of all subjects

Correlation Matrix

		70m record	Wrist girth	index finger	middle finger	ring finger	Average fingers	Palm	Arm	Shoulder	forearm
70m record	Pearson Correlation	1	0.246	0.490*	0.561*	0.482*	0.585**	0.330	0.377	0.221	0.203
	Sig. (2-tailed)		0.296	0.028	0.10	0.032	0.007	0.155	0.101	0.349	0.390
Wrist girth	Pearson Correlation		1	0.487*	0.672**	0.475*	0.619**	0.738**	0.646**	0.336	0.440
	Sig. (2-tailed)			0.029	0.001	0.034	0.004	0.000	0.002	0.148	0.052
index finger	Pearson Correlation			1	0.624**	0.516*	0.812**	0.513*	0.567**	0.425	0.380
	Sig. (2-tailed)				0.003	0.020	0.000	0.021	0.009	0.062	0.098
Middle finger	Pearson Correlation				1	0.761**	0.906**	0.678**	0.673**	0.157	0.538*
	Sig. (2-tailed)					0.000	0.000	0.001	0.001	0.509	0.014
Ring finger	Pearson Correlation					1	0.888**	0.744**	0.661**	0.228	0.508*
	Sig. (2-tailed)						0.000	0.000	0.002	0.333	0.022
Average fingers	Pearson Correlation						1	0.747**	0.729**	0.312	0.547*
	Sig. (2-tailed)							0.000	0.000	0.181	0.013
Palm	Pearson Correlation							1	0.789**	0.231	0.742**
	Sig. (2-tailed)								0.000	0.327	0.000
Arm	Pearson Correlation								1	0.189	0.713**
	Sig. (2-tailed)									0.424	0.000
Shoulder	Pearson Correlation									1	0.031
	Sig. (2-tailed)										0.895
forearm	Pearson Correlation										1
	Sig. (2-tailed)										0.000

*** .Correlation is significant at the 0.01 level (2-tailed).*
*.Correlation is significant at the 0.05 level (2-tailed).

DISCUSSION

Today, competition and struggle between nations to win medals in major international competitions such as the Olympic Games and the world cups has been increased [10]. Most countries are trying structurally developing methods to identify incredibly talented athletes at an early age; they are particularly focused on functionality and ability of special persons to raise their progress in certain sports [11].

Wrist girth, arm length, length of three fingers for draw bowstring and size of palm are integral part of archery that considered as the anthropometric characteristics [12]. In this study, the relationship between anthropometric characteristics of the twenty elite male and female Asian archers that participated in Asia Grand Prix in Bangkok Thailand 2013 was studied.

Since the performance of athletes affected by their anatomical and physiological Features, so understanding of the physical and anthropometric characteristics can affect the performance of athletes [4]. This study showed that among all measurements only significant relationship between the size of the finger on bowstring and subjects 70m performance record was significant and other variables such as the palm, arm, forearm and wrist showed no significant relationship with 70m performance record. Sex differences in the proportion of second finger to fourth finger begins in the embryonic period and researchers states that it's depend on the levels of fetal testosterone and estrogen. Sex steroids have significant effects on fetal organs, so the second to fourth finger ratio can be a predictor of performance in sport [13]. Longman et al (2005) found that elite female athletes, with significantly lesser second to fourth finger ratio than a control group of women who did not participate in any physical activity [14].

Anthropometric measure is a simple, practical and inexpensive method to evaluate the size, shape, proportion, composition and maturity to understand the human body that help in understanding of health, growth, level of training, nutritional status and sports performance [4]. The ability to acquire and use accurate information about the body and physiological properties of athletes in sport is a major topic. Anthropometric and physiological characteristics of the athletes may offer an important prerequisite for successful participation in each sport [15]. The findings of this study showed that the average age of Iranian male and female archer athletes in the Asian Games 2013, which is 25 years lower than the value of the American elite archers (28/6 years). The size

and dimensions of the wrist girth, palm and arm length seems to be less important and most important in this case is related to how take a bow and have enough strength for taking a bowstring and shooting, and having higher dimension or size of hand or wrist it not mean that you have higher strength or performance, even this problem is solved with using It is problem with a standard wrist strap that today most archery are also used, can be compensated **[16].** It seems that size and dimensions of the wrist, though not insignificant, but little to do with the results of the functional test is 70 meters. However, if the test is longer and is associated with fatigue, could be more important to show the strength and size of the wrist. The likely in longer functional tests with high fatigue, athletes with stronger and bigger wrist may have better results, indeed more research is needed in this area. Paul et al (2006) showed that professional athletes have a significant negative association with finger ratio of the second and fourth digits and a strong correlation has been found in the analysis of the ability to run. The second to fourth finger ratio is associated with strength **[14].**

Peeters et al in a study in 2011 on the second finger to the fourth ratio and the sumo wrestlers levels concluded that Sumo wrestlers that the relatively have low second

to fourth finger ratio have higher position **[17].**

In all subjects of present study 19 patients with right-handed and only one of whom was left-handed. This indicated the important of been right-hand for be successful in archery. It's obvious that right-hand people are more than left-hand people, but left handed people have more ability in simultaneous use of both hemispheres of the brain, this ability in left handed people make them more successful in maneuver that needed both hemispheres, but archery is seem needed one hemispheres **[18].**

Johann et al (2006) in the study of young men and women came to the conclusion that there is negative correlation between the degree of physical activity and the second to fourth finger ratio of the right hand.

The only factor measured in this study that have quite significant correlation with the performance of athletes was three fingers length that have major role in down arrow, including the average size of three fingers and the size of each of them. All these three factors related to 70 meters records quite significantly, athletes had higher fingers has also have a better record. The reason for such communication can be related to archery biomechanical characteristics. Because at the last minute drop shots from the bow to steer

the beam to the target have longer fingers may enhance the accuracy and strength of targeting. This can be an important factor that can be used in the selection of talent and athletes interested in reaches higher levels. However, the ratio between the fingers 4 and 2 also plays a role in determining athletic talent, little research in this regard is done, and more expanded athletic population is needed.

CONCLUSION

In general results of this study showed that the anthropometric characteristics of the top male and female athletes participating in the Asian Games in 2013 only the size of three fingers in pulling Bowstring has a significant relationship with the 70 meters records and other aspects of the measurement, such as the wrist, hand, arm length, shoulder width and arm's length did not show significant correlation with the 70 meters records. The size and dimensions of the wrist, though not any less important, but little to do with performance test results. If the test is longer in fashion that is accompanied by fatigue, importance of strength and muscular endurance that related to size and dimensions of wrist and arm are more important. Although it should be noted that over 90% of the elite archers were right-handed, it's

possible that the success of right-handed people in the archery is not accidental.

REFERENCES

[1]Peters RH. 1986. The ecological implications of body size: Cambridge University Press.

[2]Okely AD, Booth ML, Chey T. 2004. Relationships between body composition and fundamental movement skills among children and adolescents. Research Quarterly for Exercise & Sport, 75(3): 238-247.

[3]Ugarkovic D, Matavulj D, Kukolj M, Jaric S. 2002. Standard anthropometric, body composition, and strength variables as predictors of jumping performance in elite junior athletes. The Journal of Strength & Conditioning Research, 16(2): 227-230.

[4]Mermier CM, Janot JM, Parker DL, Swan JG. 2000. Physiological and anthropometric determinants of sport climbing performance. British Journal of Sports Medicine, 34(5): 359-365.

[5]Mohamed H, Vaeyens R, Matthys S, Multael M, Lefevre J, Lenoir M, et al. 2009. Anthropometric and performance measures for the development of a talent detection and identification

model in youth handball. Journal of Sports Sciences, 27(3): 257-266.

[6] Vaeyens R, Lenoir M, Williams AM, Philippaerts RM. 2008. Talent identification and development programmes in sport. Sports Medicine, 38(9): 703-714.

[7] Jin HM, Shen XZ. 2004. Characteristics and assessment of IQ, nerve types and response time of shooting and Aarchery talents. Sports Science Research, 25: 65-68.

[8] Knechtle B, Baumann B, Knechtle P, Rosemann T. 2010. Speed during training and anthropometric measures in relation to race performance by male and female open-water ultra-endurance swimmers 1, 2. Perceptual & Motor Skills, 111(2): 463-474.

[9] Eckert H, Wendt D. 1966. Various measures related to draw in archery. Research Quarterly American Association for Health, Physical Education & Recreation, 37(1): 145-147.

[10] McCann S. 2008. At the Olympics, everything is a performance issue. International Journal of Sport & Exercise Psychology, 6(3): 267-276.

[11] Pankhurst A, Collins D. 2013. Talent identification and development: The need for coherence between research, system, and process. Quest, 65(1): 83-97.

[12] Kian A, Ghomshe FT, Norang Z. 2013. Comparing the ability of controlling the bow hand during aiming phase between two elite and beginner female compound archers: A case study. European Journal of Experimental Biology, 3(4): 103-111.

[13] Kilduff LP, Cook CJ, Manning JT. 2011. Digit ratio (2D: 4D) and performance in male surfers. The Journal of Strength & Conditioning Research, 25(11): 3175-3180.

[14] Longman D, Stock J, Wells J. 2011. Digit ratio (2D: 4D) and rowing ergometer performance in males and females. American Journal of Physical Anthropology, 144(3): 337-341.

[15] Santos DA, Silva AM, Matias CN, Fields DA, Heymsfield SB, Sardinha LB. 2010. Accuracy of DXA in estimating body composition changes in elite athletes using a four compartment model as the reference method. Nutrition & Metabolism, 7(22): 7075-7077.

[16] Tentler LA, Kutz BL. 2000. Wrap around bow string release strap. Google Patents.

[17] Peeters MW, Claessens AL. 2012. The left hand second to fourth digit ratio (2D: 4D) does not discriminate world-class female gymnasts from age matched sedentary girls. PloS one, 7(6): e40270.

[18] Annett M. 1985. Left, right, hand and brain: The right shift theory: Psychology Press.