Physique Characteristics of Ethnic Archers Based on R-cluster Matrix

Yunfeng Wang¹, Yinan Ma¹

¹Sports Institute, Qiongzhou University, Sanya, 572022 ,China

²Yili Normal University, Yining, 835000, China

yunfengwang2011@yeah.net

Keywords: Xibo ethnic archers; Physique characteristics; R cluster matrix analysis

Abstract. Object: the R cluster matrix analysis is used in this research which to explore the correlation of body shape, body composition, physical function and body function of male Xibo ethnic archers in China, and then discuss the differences of physical characteristics among Xibo ethnic archers and other athletes. Method: we used the R cluster matrix analysis and Hierarchical cluster diagram to build the model of physique index of male Xibo ethnic archers. Results: (1) The physique characteristics of Xibo ethnic archers divided into three groups which are LBM/weight, weight and vital capacity, body fat ratio and VO2max; (2) According to T test, some indices such as body fat ratio are similar to the athletes of football and judo, but vital capacity and VO2max are lower than them. Conclusion: the body shape and physical function of Xibo ethnic archers relate to obvious R cluster matrix, and the excellent physique characteristics need the advantage of strength endurance which no less than sports which need body contact, such as football, judo.

Introduction

Since 1973, there are many excellent Xibo ethnic archers who had won the gold metals in many international and national competitions, and the archery school trained 48 national level of athletes, so there are many researches for archers, such as psychological characteristics, body function and training, but there's no research of the R cluster matrix analysis of physique characteristics of male Xibo ethnic archers in China, so this research is to explore the relatives of body shape, body composition, physical and body function of male Xibo ethnic archer in China, and then discuss the differences of physical characteristics among Xibo ethnic archers and other athletes, which may provide the theoretical basis of the selection of Xibo ethnic archers.

Object and Method of Research

Research Object

5 male Xibo ethnic archers who had excellent results in national competitions, and 15-17 years old.

Research Method

Test of physique index

(1) automatic height and weight measurement instrument

measuring range: 0 -999.9s sharpness of separation: 0.1s; accuracy of measurement: 0.1%FS

(2) vital capacity measurement instrument

measuring range: 0 -9999ML sharpness of separation: 1s; accuracy of measurement: 0.5%FS

(3) test of LCSPFT

(4) test of hemoglobin: HiCN

(5) Riva-Rocci sphygmomanometer for the test of blood pressure

(6) test model of step index: platform: 45 cm.

Step index = $\frac{\text{movement time(s)} \times 100}{[2 \times (1 \text{ to } 1.5 \text{ minutes} + 2 \text{ to } 2.5 \text{ minutes} + 3 \text{ to } 3.5 \text{ minutes}) \times \text{heartbeats}]}$

(7) the calculation of VO2max

let the step index (x) into regression equation for conjecture VO₂max (Y)
 $Y(\text{ml/min}) = 13.25X + 1740.86$

Test of BROZEK

(1) testing part: A. skin fold of muscle belly of triceps brachii (mm); B. skin fold under right scapula (mm).

(2) calculate the index of body composition.

① body density (D) = $1.0973 - 0.00146x$, X is skin fold thickness of shoulder blade and arm.

② body fat (F%) = $(4.57 / D - 4.142) \times 100$

③ fat mass = weight (Kg) × F %

④ lean body mass (LBM) = weight (kg) - fat mass (kg)

⑤ LBM / weight × 100

⑥ LBM / height × 100

⑦ fat mass / height × 100

LCSPFT test

(1) 100-meter running (s)

(2) 1500-meter running (s)

(3) standing long jump (cm)

(4) throwing the shot backward (m)

Process of R cluster matrix

Cluster method of Rij correlation coefficient

$R_{ij} = L_{ij} / \sqrt{L_{ii} \times L_{jj}}$ is the formula of R cluster matrix

R_{ij} indicate the correlation coefficient between the two index

i indicates variable quantity if a index; j indicates another variable quantity which relate with i;

L_{ii} indicates squared residuals of i; L_{jj} indicates squared residuals of j

L_{ij} indicates the deviation of product

The correlation coefficient with mathematical derivation

(1) Calculate the two index between 1 and 2, 1 expressed as x(i), 2 expressed as y(j)

(2) Calculate the correlation coefficient (r) of x and y

(3) Calculate $\sum y$, $\sum y^2$.

(4) $L_{xx}(L_{ii}) = \sum (X - \bar{x})^2$ it is the squared residual of x and y

(5) $L_{yy}(L_{jj}) = \sum (Y - \bar{y})^2$ it is the squared residual of y

(6) $L_{xy}(L_{ij}) = \sum (X - \bar{x})(Y - \bar{y})$ it is the squared residual of x and y

$r = L_{xy} / \sqrt{L_{xx}L_{yy}}$, and other correlation coefficients of index are same

1 and 3; 1 and 4; 1 and 5

2 and 3; 2 and 4; 2 and 5: :.....

Finally, draw a hierarchical diagram.

statistics

The statistics of cluster matrix of derived indicators

Software of SPSS16.0 is used to do R cluster matrix analysis and calculate the correlation coefficient matrix of relative index, then describe the male Xibo ethnic archers

The statistics description of physical characteristics

SPSS16.0 is used to do independent samples T test and expressed as

Results

The results of physical characteristics index

table 1 the results of physical characteristics index ($\bar{x} \pm S$)

index	unit	$\bar{x} \pm S$
height	Cm	174.66±9.05
weight	Kg	63.9±5.2
body fat	F%	11.11±0.02
lean body mass	Kg	56.82±6.79
LBM/weight×100	Kg/kg	88.8±5.39
LBM/height×100	Kg/cm	32.59±3.29
Fat mass/height×100	Kg/cm	4.01±0.68
weight/height×1000	Kg/cm	365.66±22.17
vital capacity	ML	4772.00±701.76
vital capacity/weight	ML/kg	74.35±7.68
havard step index	Index	93.8±8.08
VO ₂ max	ML	2983.9±106.9

table2 the results of physical quality($\bar{x} \pm S$)

index	unit	$\bar{x} \pm S$
100 m	s	14.62± 0.63
1500 m	s	327.67±10.38
standing long jump	cm	236.00±14.00
throwing the shot backward	m	9.30± 0.53

Table 1 and table 2 are the physical characteristics and physical quality of male Xibo ethnic archers.

The correlation coefficient matrix of male Xibo ethnic archers

Table 3 relative index matrix of male Xibo ethnic archers

relative index	1	2	3	4	5	6	7
1 LBM/weight	1.000	-.997	-.939	.383	-.051	.558	.090
2 body fat		1.000	.926	-.397	.015	-.507	-.109
3 fat mass/height			1.000	-.050	.103	-.565	.253
4 LBM/height				1.000	.014	.246	.953
5 VO ₂ max					1.000	-.025	.052
6 Vital capacity/weight						1.000	.039
7 weight/height							1.000

fig.1 clustering diagram of relative index matrix of male Xibo ethnic archers

According to table 3, and fig.1, body shape and pyhsical function of Xibo ethnic archers have obvious R cluster matrix and the result of derivative index divided into three groups, they are (1)

LBM/weight, weight/height;(2) LBM/weight, vital capacity/weight;(3) body fat % , fat mass/height, VO₂. So the characteristics of relative index may plays an important role in selection of male Xibo ethnic archers.

Analysis and discussion

Results of body composition among athletes of football players,judokas,and archers

table 4 the result of body composition among football player,judoka,and archer

Item	n	body fat%	lean body mass	LBM/weight	LBM/height	fat mass/height
football	18	12.98±4.70	51.84±4.64	87.00±2.00	29.94±2.14	4.38±0.96
judo	7	10.89±1.12	63.24±7.22	89.00±1.40	36.00±2.20	4.00±0.80
archery	5	11.11±0.02	56.82±6.79	88.80±5.39	32.59±3.29	4.00±0.68

Table 5 T test of body composition

item	value	body fat %	lean body mass	LBM/weight	LBM/height	fat mass/height
Football	difference	- 0.29	4.98	1.80	2.65	-0.38
	t	1.87	2.11	1.72	2.42	1.03
	P	>0.05	<0.05	>0.05	<0.05	> 0.05
Judo	difference	0.22	- 6.42	-0.20	-3.41	0.00
	t	-0.25	1.72	0.34	2.67	0.99
	P	>0.05	>0.05	> 0.05	<0.05	>0.05

According to table 4 and table 5, the lean body mass of archers are hihger than football players, $P < 0.05$, and the index of LBM/weight are also hgiher than football players, but lower than judokas, this shows that the male archers need the training of strength endurance, and the training standard should no less than the sports which need body contact and strength endurance.

Results of derived physiological index among athletes of football players, judukas and archers

Table6 results of derived physiological index among athletes of football players, judokas and archers

item	n	vital capacity/weight	havard step index	VO ₂ max
footba				
ll	18	79.36±6.23	109.82±12.58	3195.99±166.89
judo	7	81.54±7.69	112.05±11.26	3225.55±149.41
archer	5	74.35±7.68	93.80± 8.08	2983.90±106.90

Table 7 T test of derived physiological index

item	value	vital capacity/weight	havard step index	VO ₂ max
football	difference	-5.01	-16.02	-212.00
	t	1.34	3.43	3.42
	P	< 0.05	< 0.01	< 0.01
Judo	difference	-7.19	-18.25	- 241.65
	t	0.99	3.48	3.57
	P	< 0.05	< 0.01	< 0.01

According to table 6and table 7, vital capacity/weight of archers are lower than football players and judokas, $P < 0.05$, havard step index and VO₂max are extremely lower than football players and

judokas, $P < 0.01$, this shows that the request of archerscardiopulmonary function of archers are lower.

Results of physical quality among athletes of football players,judokas and archers

Table 8 results of physical quality among athletes of football players, judokas and archers

item	n	100m	1500m	standing long jump	throwing the shot backward
football	18	13.65±0.71	320.17±16.17	233.00±20.00	8.47±1.15
judo	7	13.53±0.80	306.70±40.24	242.00±27.00	10.98±1.78
archery	5	14.62±0.63	327.67±10.83	236.00±14.00	9.30±0.30

Table9 T test of physical quality

item	value	100m	500m	standing long jump	throwing the shot backward
football	difference	0.97	7.50	3.00	0.83
	t	2.97	1.22	0.38	2.77
	P	< 0.05	>0.05	>0.05	< 0.05
Judo	difference	1.09	20.97	-6.00	-1.68
	t	2.65	1.31	0.50	2.47
	P	< 0.05	>0.05	>0.05	< 0.05

According to table 8 and table 9, the level of 100-meter running of archers is lower than football players and judokas, $P < 0.05$, the speed of 1500-meter running is also lower, but there's no significant difference, the level of standing long jump of archers is higher than football palyers, but lower than judokas, there's also no significant difference. The level of throwing the shot backward of archers is higher than football players, $P < 0.05$, but lower than judokas, this shows that except speed quality, the force and endurance abilities of archers are smiliar to the sports which need body contact and strength endurance, espically the waist muscle strength, the upper and lower body strength are even better than footplayers and judokas.

Conclusion

To sum up, the body shape and pyhsical function of Xibo ethnic archers have obvious R cluster matrix, and the physique characteristics need excellent strength endurance,and the male archers need the training of strength endurance, and the training standard should no less than the sports that need body contact and strength endurance. All those may provide the theoretical basis of the selection of Xibo ethnic archers.

References

- [1] Liu QS. The archery's culture of Xibo ethnic in Xinjiang [J] china science and technology information,2006,5(23):157-158
- [2] He Y,Wang T, Shi Y. Research on Brain Function Feature of Elite Archery Athlete before Major Competition [J]. china sport science and technology and , 2009,45 (1) : 83-93
- [3] Zhou WA,He WG. research on characteristics of brain neurobiology of Elite Archery Athlete in china[J]. Chinese Journal of Sports Medicine,,2007 ,26 (6) :720-722.
- [4] Feng XD,Tian YL, Fu T. A study on stamina training of Chinese high-level archers [J]. Journal of Wuhan Institute of Physical Education,, 2001,35 (3) : 57-60