Research on the Influence of Complex Training on the Explosive Force of Adolescent Athletes

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Abstract. Young athletes are the reserved force for the sport development in China, and they are China's long-term future stands in the world,which plays an indispensable role of sports in powerful nations. Among them, the explosive force is used to evaluate and improve the sport level of the athletes as an important indicator. At this particular period of growth and development, they should finish special complexed training according to the physiological characteristics of each stage. Based on the biomechanical model and the factor analysis method, this paper studies the influencing factors that the explosive force involves. Through the correlation analysis on the complex combination of the young athlete's contribution rate, we optimized the training of explosive force in order to study the complex training, which provides scientific theoretical guidance to promote adolescent's explosive force.

Introduction

Adolescent athletes explosive force is an extremely important aspect in the development of sports level, it has realistic significance to the enrichment and development of adolescent athletes' physical training if we can research into the influence and development of daily training to adolescent athletes[1]. It's indicated that early physical training of adolescent athletes, especially the early explosive force training is the adolescent athletes know as soon as possible special technology in a lot of practice in the development of competitive sports, which is the basis of the stable improvement of performance[2]. It has always been questioned although there are many studies have shown that for adolescent athletes explosive force training will get remarkable effect.It's obtained that complex training can greatly improve the adolescent athletes explosive force level combined training optimization in the paper of "Research on teenage sprinters explosive force training method optimization" which writing by Lv Dongjiang[5].

Composition factors of adolescent athletes explosive force

Power is the foundation of all sports, is the foundation of the outstanding athletes[3]. The explosive force is in a very short period of time, the motor unit mobilization of as much as possible work synchronously, so that muscles generate maximum acceleration contraction, overcome the exercise load, performance of maximum instantaneous power, is short span, jumping, throwing and aperiodic sports the most important power quality.The process of explosive force is the basis of cell volume relationship between biological motion unit, motion sequence. Power generating motion unit cell bodies of preferred to raise, when the tension reaches a certain level, large motor unit cell recruitment; explosive force is released, the motor unit cell body small first issued, motor unit cells after the release. To sum up, in order to derive the explosive force time curves[4].

Research mechanism of explosive force factor

a. The method of factor analysis model

Suppose $X=(X_1,X_2,\cdots,X_\rho)'$ is random variables that can be observed, $Y=(Y_1,Y_2,\cdots,Y_\rho)'$ $Y_i=\frac{X_i-\overline{X_i}}{S_i}$ represents the variable X after standard treatment, (i=1,..,p), $\overline{X_i}$, S_i is sample mean and sample standard deviation of variable X_i separately. Suppose $F=(F_1,F_2,\cdots,F_m)'$ （m<p） is random variables that can not be observed, and $E(F)=0$,covariance matrix is $D(F)=I_m$. Suppose there is no correlation between $\varepsilon=(\varepsilon_1,\varepsilon_2,\cdots,\varepsilon_\rho)'$ and F, so

$$E(\varepsilon)=0, D(\varepsilon)=\begin{bmatrix}\sigma_1^{\ 2} & & \\ & \cdots & \\ & & \sigma_p^{\ 2}\end{bmatrix}=diag(\sigma_1^{\ 2},\cdots,\sigma_p^{\ 2}) \quad (1)$$

Assuming the random vector Y can be represented by the following model:

$$\begin{cases} Y_1 = a_{11}F_1 + a_{12}F_2 + \cdots + a_{1m}F_m + \varepsilon_1 \\ Y_2 = a_{21}F_1 + a_{22}F_2 + \cdots + a_{2m}F_m + \varepsilon_2 \\ \cdots \\ Y_\rho = a_{\rho 1}F_1 + a_{\rho 2}F_2 + \cdots + a_{\rho m}F_m + \varepsilon_\rho \end{cases} \quad (2)$$

The model is a factor model, which can be recorded as $Y=AF+\varepsilon$. After the common factor, if the typical variables of the common factor reflect not obvious, need to pass a certain method of each factor rotation, the public factor prominent and has good explanatory ability.

b. Factor Analysis of the influence of explosive force

According to Hill speed equation, we take influence factors of explosive force size as the sample index, respectively is the largest muscle tension F1, contraction time F2, contraction distance F3, contraction speed F4, and then set the indicator variables are: muscle cross-sectional area X1, motor unit type X2, cerebral cortex functional X3, load X4, the movement distance X5 ,technical ability X6.

ection of explosive force factor index

First of all, we can select 6 key indicators factors as analysis of original index explosive force and then number them, from the analysis of Hill speed equation, which is shown in the following Table 1.

Some selected indicators are needed to be dimensionless treatment:

$$d_{ij}=\frac{x_{ij}-x_{j\min}}{x_{j\max}-x_{j\min}}\times 0.6+0.4 \quad (3)$$

2）Factor analysis of investigation of mechanical index is appropriate or not

KMO test and Bartley test of sphericity of index variables, judging from the test of whether the selected indexes can become public factor in factor analysis, as Table 1shown. Then according to the observation and analysis of the statistic Teri test of spherical 3.92E4 as the value of the probability that the corresponding values of P, Sig.=0.000, results show that the obtained results can be selected as the common factor. Finally, through the Kaiser KOM metrics that meaning is clear can reasonably explain the situation can be selected as factor analysis, there is a strong linear relationship between the variables selected.

Table1. KMO test and Bartley test

KMO measure of sampling		0.803
Methods of Bartlett test	Bartlett test of sphericity	3.92E4
	df	77
	sig	0.000

3）Common factor of extraction index

Extracting common factor, to extract factors from X1, it is the eigenvalue greater than 1 public factors named F1, in Table 2, we get 48.423 of its variance contribution rate. Use the same method to separately from the X2, X3 extraction factor F2. extraction factor F3 from X4, X5, extraction of factor F4 from X6.

Table 2. Common factor cumulative contribution rate

Common factor	eigenvalue	Variance contribution rate（%）	Cumulative contribution rate（%）
F1	10.835	47.423	46.438
F2	7.362	29.446	76.884
F3	3.673	15.051	91.935
F4	12.262	56.561	61.878

4）Calculating the comprehensive factor score

This paper can obtain the factor analysis model by all relevant factors to the values, the accumulative contribution rate, and the variance contribution rate calculation, the regression method to estimate the factor score of F, its computational formula is:

$$F = \frac{\lambda_1}{\sum_{i=1}^{m}\lambda_i}F_1 + \frac{\lambda_2}{\sum_{i=1}^{m}\lambda_i}F_2 + \cdots + \frac{\lambda_m}{\sum_{i=1}^{m}\lambda_i}F_m \quad (4)$$

The specific calculation is:F =（47.483*F1+29.446*F2+15.051*F3+56.561*F4）/61.878

And then sorted by score, facilitate the research problem, as the following Table 3 shown.

Table 3. Score and ranking of comprehensive factor

factor	F1	F2	F3	F4	Comprehensive score F
X1	0.1192	0.1319	3.1356	2.342	0.617
X2	0.2957	-0.4641	3.3065	2.876	0.545
X3	0.0267	0.4845	2.7250	1.673	0.613
X4	0.2034	-0.1385	2.5473	1.087	0.477
X5	0.3232	-0.4191	2.6138	1.976	0.460
X6	0.2372	-0.1325	2.3424	1.423	0.388

According to the importance of order: muscle cross-sectional area, motor unit types, the cerebral cortex function, load, operating distance, technology ability. The importance and affected by explosive force size factor, provides the basic condition for the athletes based on its own characteristics to formulate complex training method.

Effects of complex training on explosive force in each stage of youth

The development of adolescent power than the absolute strength development speed, so the adolescent athletes should be put in the first place the explosive force training. Teenagers in human growth and development period, organs, bones, hormone secretion and body motion elements have not yet been fully mature, adolescent athletes explosive force training should be based on the characteristics of the growth stage of the progressive take training mode, in which each individual training program on the basis of the physiological characteristics of an optimal combination of complex training stage.

a. Training method of adolescent explosive force

Adolescent explosive force t for the sport technique learning later. Because of the special nature of youth physical condition, therefore, take the following simple exercises, such as shown in Table 4.

Item	Content	Goal
The lever and the dumbbell exercises	Non standard weights and training	Promote muscle growth
Throwing exercise	Push the ball, discus training	Promote muscle explosive force through joint swing arm rotation
Comprehensive exercise equipment exercises	Integrated apparatus exercises	Comprehensive exercise of muscles
speed training	Sprint, run uphill, traction,	Training of explosive force of lower

	sandy run run	limbs
Plyometric exercises	rope skipping (The height is not more than 50cm)	Improve the ankle joint, knee joint compressive ability
Jumping exercises	Hop, hop with both feet, skip rope, climbing exercises.	Training of explosive force of lower limbs
Static strength exercises of body weight	Sit-ups, push-ups, pull-ups	Promoting systemic muscle growth

b. Correlation analysis of training methods and power factor

We obtain the correlation matrix R by calculating separately the correlation coefficient of dumbbell exercises, throwing exercise, plyometrics etc, seven kinds of explosive force training means and biomechanical strength factors, provides: R={rij}, we can draw each training means for improving the power contribution rate, with the principle of the third part.

$$R_{ij} = \frac{P_{ij}}{n} = \frac{1\times f_1 + 0.75\times f_{0.75} + 0.5\times f_{0.5} + 0.25\times f_{0.25}}{n} \quad (5)$$

Conclusion

The explosive force is the important index of human motion is the most basic quality is the evaluation of the level of the athletes. Adolescent athletes must improve the adaptability and power quality by organ system more complex training to maximize the mobilization of the athlete's body function, so as to achieve the best training effect is expected, .in a specific period of growth and development.

Above all, adolescent athletes in the explosive force training, using the lever body weight exercises, since the static strength, optimized combination of comprehensive strength exercise training can achieve the strongest explosive force. According to the complex training mode optimization combination formed after a period of practice, will have a significant effect on the adolescent athletes' explosive force to improve and enhance the quality of special movement.

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