

## SUCCESSFULNESS OF GENERAL AND SPECIAL PHYSICAL QUALITIES' DEVELOPMENT ON DIFFERENT STAGE OF STUDENTS-BOXERS' TRAINING

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**Abstract.** *Purpose:* to study indicators of general and special physical condition on different stages of macro-cycle training. *Material:* in testing qualified boxers - 28 sportsmen – participated. Characteristics of general and special fitness were registered. *Results:* it was found that structure of general and special physical qualities can be described by 9 factors, explaining about 80% of total sample variance. It was also determined that factorial structure of general and special physical fitness indicators does not change depending on stages of trainings. At every of the tested stages the marked out factors do not depend on each other. These factors are separate necessary sides of training. It was found that on general preparation stage of training these factors characterize sides of fitness: effectiveness of punches of strong and weak arms; special speed and power endurance; general endurance and strength of muscles (hands' flexors); specific sensor-motor reaction; condition of upper girdle muscles; general speed and power endurance; speed of punch movement. *Conclusions:* when distributing training means and loads it is necessary to uniformly doze correlation of means for all marked out factors. It ensures growth of boxers' spots results.

**Key words:** trainings, students, boxer, physical fitness, special, periods.

### Introduction

Sphere of sports is characterized by exclusively intensive and continuous growth of sports achievements. It is a specific reflection of one of the most substantial and the least studied social phenomena – acceleration of social progress [1].

Increased level of competition's functioning at international sports forums forces coaches and sportsmen to seek more effective means and methods of training. Such approach will permit to solve specific tasks of boxing, directed on training of physical qualities and perfection of sportsmen's technical-tactic skillfulness.

At present development of boxing in the whole world and aggravation of competition gave powerful push to creative search of coaches and boxers. It gave birth to great number of new and original ideas in all links of sports training system. Recent time questions of building of training in boxing have been being paid more and more attention. It is not an occasional phenomenon, because boxers' skillfulness and their sports results to large extent depend on ability to conduct training. Application of elements of constant creative search in training makes it exciting and creative process.

At modern stage development of new methods of training searching of more effective means of workability's rising is the basis of boxers' sportsmanship increase. For example, there are some "reconstructions" in boxer's training: nowadays physical training is often oriented on application of special and general-training means of increased intensity.

The problem of optimal correlation of sportsman's general and special training has been being worked out and discussed for long ago. Recent time it again has attracted increased attention. It is explained by its extraordinary complexity. Sportsman's general and special condition change depending on level of his fitness, individual qualities, specificity of sports specialization, stages of many years' sports perfection process and training periods [5, 6, 15].

Modern theory of sports training does not specify any universal, quantitative standards of correlation of general and special training. The theory gives only principle landmarks. It admits rather wide range of definite correlations' variations, which are formed depending on different circumstances.

Modern level of sports achievements in boxing, intensity of boxers' functioning on ring set increased requirements to their general (GPF) and special (SPF) physical fitness. Rational building of training process in annual cycles on the base of optimal GPF and SPF correlations permits for sportsmen to achieve high results.

Analysis of scientific-methodic literature showed that in perfection of technical-tactic skillfulness in sportsmen's many years' training GPF and SPF level play the main role [2–4, 13, 23].

#### **Purpose, tasks of the work, material and methods**

*The purpose of the work* was to study indicators of GPF and SPF at different stages of qualified boxers' training.

*The tasks of the research:* 1. to detect interconnection of GPF and SPF means in qualified boxers; 2. to determine optimal correlation of GPF and SPF means in qualified boxers at different stages of macro-cycle.

*Material of the research:* qualified boxers (28 sportsmen) participated in testing. Preparatory period of training consisted of three stages: 1<sup>st</sup> stage- involving (18 days); 2<sup>nd</sup>- general-preparatory (20 days); 3<sup>rd</sup> – special-preparatory (21 days); 4<sup>th</sup> – recreational (18 days).

For determination of the most informative GPF and SPF indicators we registered the following characteristics:

**General physical fitness:** 100 m – 100 meters' run; 3000 m – 3000 meters' run; LJ – long jump from the spot; PU – pressing ups in lying positions; CU – chin ups; SP 1– shot put (4 kg with stronger arm); SP2 - shot put (4 kg with weaker arm); HD1 – hand dynamometry of stronger arm; HD2 - hand dynamometry of weaker arm;

**Special physical fitness:**  $V_p$  – mean velocity of punch;  $SMR_1$  – specific sensor-motor reaction in punch of stronger arm;  $SMR_2$  – specific sensor-motor reaction in punch of weaker arm;  $t_1$ – time of achieving of maximal strength by stronger arm;  $t_2$ – time of achieving of maximal strength by weaker arm;  $t_3$ –  $t_1$ – time of achieving of strength by stronger arm;  $t_4$ – time of achieving of strength by weaker arm;  $F_1$ – strength of punch by stronger arm;  $F_2$ – strength of punch by weaker arm;  $S_1$  – strength impulse of punch by stronger arm;  $S_2$ – strength impulse of punch by weaker arm;  $N_5$  – quantity of punches per 4 sec.; +  $F_5$  – total of punches per 5 sec.; +  $S_5$  – total of impulses of punches' strength per 5 sec.;  $F_{x5}$  – average strength of punches per 5 sec.;  $S_{x5}$  – mean impulse of punches per 5 sec.;  $N_{180}$  – quantity of punches per 180 seconds; +  $F_{180}$  – total strength of punches per 180 seconds; +  $S_{180}$  – total of impulses of punches' strength per 180 seconds;  $F_{x180}$  – average strength of punches per 180 seconds;  $S_{x180}$  – mean impulse of punches per 180 seconds; LS – level of sportsmanship.

*The methods of the research:* factorial analysis (principle component method with following rotation of reference axes by Varimax criterion) of the received experimental material was carried out. As a result, factors, determining boxers' GPF and SPF on different macro-cycle training stages were marked out.

On preliminary stage of data processing correlation analysis of indicators (34 GPF and SPF indicators per each boxer) was fulfilled. As a result we found the most informative GPF and SPF indicators for different stages of macro-cycle. We selected 31 the most significant indicators for factorial analysis.

#### **Results of the research**

##### **Involving stage**

Analysis of materials of 1<sup>st</sup> stage of training permitted to determine that structure of boxers' general and special qualities can be described by 9 factors, which explain 84.3% of total sample variance.

In 1<sup>st</sup> factor (36.8% of total sample variance) the most factorial significance belongs to indicators:  $N_{180}$ ;  $F_{180}$ ;  $S_{180}$ ;  $F_{x180}$ ;  $S_{x180}$ ; 3000 m (which characterize special power endurance and general endurance). In 2<sup>nd</sup> factor (9.8% from total sample variance) the most factorial significance belongs to equivalent indicators  $SMR_1$ ,  $SMR_2$  and SP. These indicators reflect specific sensor motor reaction when punching with stronger and weaker arms; condition of arms' muscles. In 3<sup>rd</sup> factor (8.6% of total sample variance) the highest factorial significance belongs to qualitative characteristics of single punches and general condition of muscle groups, participating in punch:  $t_1$ ,  $F_2$ ,  $S_2$ , LJ, SP. These indicators can be considered equivalent. In 4<sup>th</sup> factor (7.1% of total sample variance) high factorial loads were found by the following equivalent indicators:  $F_5$ ,  $S_5$ ,  $F_{x5}$ ,  $S_{x5}$ , PU, CU. They characterize special velocity and general power endurance of muscles (arm's flexors and extensors).

5<sup>th</sup> factor (6% of total sample variance) highly correlates with  $t_2$ ,  $N_5$ . These indicators characterize time parameters of punch by weaker arm and special speed motor skills. 6<sup>th</sup> factor (4.9% of total sample variance) – indicator of 100 meters run. It assesses general speed endurance. 7<sup>th</sup> factor (4.1% of total sample variance) correlates with  $F_1$  and  $S_1$ , which characterize effectiveness of weaker arm's punches. 8<sup>th</sup> factor (3.9 % of total sample variance) correlates with indicator V. It characterizes mean velocity of punch movement. 9<sup>th</sup> factor (3.1% of total sample variance) correlates with equivalent indicators  $t_3$  and  $t_4$ . These indicators characterize time of single punches by stronger and weaker arms and assess effectiveness of these punches.

### **General-preparation stage**

Analysis of 2<sup>nd</sup> stage results showed that structure of general and special physical qualities can be described by 9 factors (explaining 85.1% of total sample variance).

In 1<sup>st</sup> factor (contribution 35.4% in total sample variance) high correlations of equivalent indicators  $F_1, S_1, F_2, S_2, F_5, S_5, F_{X5}, S_{X5}, F_{180}, S_{180}, 3000\text{ m}, HD_1, HD_2$  were found. They characterize effectiveness of single punches by stronger and weaker arms, special speed and power endurance, general endurance and strength of hand's flexors. 2<sup>nd</sup> factor (12% of total sample variance) shows the highest correlation of indicators  $N_5, N_{180}, F_{X180}, S_{X180}$ . They characterize special speed endurance. In 3<sup>rd</sup> factor (9.6% of total sample variance) there is the highest correlation of equivalent characteristics  $t_1, t_3, t_2, t_4$ . They assess quantity of punches by stronger and weaker arms. In 4<sup>th</sup> factor (6.3% of total sample variance) the highest factorial significance belongs to equivalent indicators  $SMR_2$  and  $SMR_3$ . They characterize specific sensor motor reaction when punching by stronger and weaker arms.

5<sup>th</sup> factor (5.6% of total sample variance) shows the highest factorial loads with LJ,  $SP_1$  and  $SP_2$ . They characterize condition of muscular groups of upper girdle. In 6<sup>th</sup> factor (4.8% of total sample variance) the highest correlations were found with indicators of 100 meters' run and PU. They characterize speed and power endurance. In 7<sup>th</sup> factor (4.4% of total sample variance) indicators of arm's flexors' strength and CU were marked out.

8<sup>th</sup> factor (3.8% of total sample variance) shows one indicator - t. It characterizes quality of punch by stronger arm.

9<sup>th</sup> factor (3.2% total sample variance) shows the highest factorial significance of indicator V. It characterizes mean velocity of punch movement.

### **Special-preparation stage**

Analysis of 3<sup>rd</sup> stage results showed that structure of general and special physical qualities can also be described by 9 factors (explaining 84.2% of total sample variance).

1<sup>st</sup> factor, with the highest contribution (35.7%) in total sample variance, correlates with equivalent indicators

$F_1, S_1, F_5, S_5, F_{X5}, S_{X5}, S_{180}, HD_1, HD_2$ . They characterize strength parameters of punch by stronger arm, special-speed and power endurance and general strength of muscles (arm's flexors). 2<sup>nd</sup> factor (10.4% of total sample variance) witnesses about high correlation with equivalent indicators  $SMR_1$  and  $SMR_2$ . They characterize specific sensor motor reaction when punching by weakest and strongest arms. 3<sup>rd</sup> factor (9.5% total sample variance) shows high correlation with equivalent indicators  $t_1, t_3, t_2, t_4$ , which characterize quality of punch by weaker and stronger arms.

6<sup>th</sup> factor (6.5% of total sample variance) shows the highest factorial coefficients with results  $V_p, 100\text{ m}$ . They characterize mean velocity of punch movement and general speed endurance.

5<sup>th</sup> factor (5.9% of total sample variance) highly correlates with indicators  $N_{180}, F_{180}, S_{180}$ . They characterize special power endurance. In 6<sup>th</sup> factor (5.2% of total sample variance)  $N_5$ , and CU have high significance. These indicators characterize speed motor skills and power endurance of arm's flexors. 7<sup>th</sup> factor (4.4% of total sample variance) correlates with LJ,  $SP_2$  and  $SP_1$ . They characterize explosive poser of legs and condition of muscles, participating in punch. 8<sup>th</sup> factor (3.7% of total sample variance) correlates with PU, which characterizes power endurance of arms' flexors. 9<sup>th</sup> factor (2.9% of total sample variance) closely correlates with equivalent indicators  $F_2, S_2, F_{X180}, S_{X180}$ , and 3000 meters' run. They characterize qualitative characteristics of punch by weaker arm, special power and general endurance.

### **Recreational stage**

Analysis of recreational stage results showed that structure of general and special physical qualities can also be described by 9 factors (explaining 86.2% of total sample variance).

1<sup>st</sup> factor (36.8% contribution in total sample variance) has high correlations with indicators  $N_{180}, 100\text{m}, SP_1$  and  $SP_2$ . They characterize quantity of punches per one round, general speed endurance, condition of muscles, participating in punch. In 2<sup>nd</sup> factor (10.9% of total sample variance) we found high correlations with indicators  $SMR_1, SMR_2$ . They characterize specific sensor motor reaction when punching by weaker or stronger arms. In 3<sup>rd</sup> factor (8.9% of total sample variance) high significance was found in indicators  $t_1, t_3, t_2, t_4$ , which characterize quality of punches by stronger and by weaker arms. 4<sup>th</sup> factor (7.2% of total sample variance) correlates with 3000 meters' run indicator, which characterizes general endurance.

In 5<sup>th</sup> factor (6.2% of total sample variance) PU and CU have the highest significance. They characterize power endurance of arms' flexors and extensors. 6<sup>th</sup> factor (contribution in total sample variance 4.7%) shows high correlation with equivalent indicators  $F_2, S_2$ . They characterize quality of punch by weaker arm. 7<sup>th</sup> factor (4.3% of total sample

variance) shows the highest correlation with indicator V, characterizing mean velocity of punch movement. In 8<sup>th</sup> factor (3.9% of total sample variance) equivalent indicators, S<sub>1</sub>, N<sub>5</sub>, F<sub>5</sub>, S<sub>5</sub>, Fx<sub>5</sub>, Sx<sub>5</sub>, F<sub>180</sub>, S<sub>180</sub>, Fx<sub>180</sub>, LJ, HD<sub>1</sub>, HD<sub>2</sub> are marked out. They characterize special speed-power endurance. 9<sup>th</sup> factor (3, 3% of total sample variance) factor of sportsmanship level was marked out.

### Discussion

Indicators of general physical and special fitness of boxers are important elements, by which sportsman's fitness at different stages of macro-cycle is determined. It is witnessed by researches of different authors. For example Nykytenko A.O. et al. found interconnections between indicators of special preparation and general preparation exercises of sportsmen. It permitted to establish statistically confident correlations of: a) indicators of punches power with indicators of single movement; b) indicators of punches' velocity with indicators of distance of 300 grams' balls pushes; c) indicators of motion speed in combat stance with indicators of punches' velocity; d) indicators of punches' frequency with indicators of movements' on feet frequency (maneuvering) [21]. Martsiv V.P. determined correlations between indicators of special preparation and general preparation exercises. It was found that increase of boxers' sportsmanship is manifested in growth of punches' density in fight [19]. Kiprich S.B., Berinchik D.Y. registered absence of confidence distinctions in qualitative characteristics of apidemical shifts in organisms, which growth in process of fulfillment of test task. The authors determined that in different periods (rounds) of duel, in elite boxers there appear different manifestations and combinations of functional fitness's properties [16]. Aksutin V.V., Korobeynikov G.V. registered absolute and relative strength of serial and single punches. Their results witness that attacking style of fight is accompanied by high workability, reduction of fatigue, anxiety and dependence on status of vegetative functions [12]. Martsiv V.P. studied boxers' psycho-physiological state with usage of 9 kinds of anticipation responses at stage of specialized basic training. The author determined regularities of manifestation of every kind of response in given group of sportsmen; envisaged the ways of their application as criteria for assessment of boxers' psych-physiological state [20]. Kipyrych S.V. et al. found that perfection of training process in boxing can be based on assessment of workability indicators and responsive characteristics of cardio-respiratory system of sportsmen [17].

Among many researches we can mark out the works, devoted to psychological training of Olympic teams; to boxing competence and practical experience; to processes of professional boxers' adaptation and other [22, 26–29].

In this aspect our researches supplement and expand information about successfulness of development of sportsmen's general and special physical qualities, which are determined by independent on each other factors. These qualities with high degree of confidence characterize the sides of sportsmen's fitness: strength of punch by stronger arm; special speed and power endurance, strength of hand's flexors; specific sensor motor reaction; time characteristics of punches by stronger and weaker arms. Results of our researches supplement our previous works [14, 18, 24, and 25] about purposefulness of optimization of fitness different sides, oriented on training of sportsmen's power abilities.

We assumed that problems in students' physical education can be corrected by means and methods of boxing. It was found that traditional system of physical education in state higher educational establishments does not realize to full extent the tasks of students' motivation for physical culture practicing. It is connected with absence of scientifically substantiated conception of formation of physical culture education [7–9].

Scientific and methodic worked, fulfilled in this direction, permitted to rather effectively organize learning regime in higher school, to weaken the problem of organism's overload in conditions of educational process; to maintain students' workability in relatively optimal frames in boxing circles [10–11, 18].

### Conclusions

1. Basing on the above delivered we can conclude that in involving stage of training successfulness of development of general and special physical qualities is determined by independent on each other factors. These factors characterize sides of fitness: special and general endurance; total time of motor response and strength of arms' muscles, participating in punch; quality of single punches and general condition of muscular groups, participating in punch; special speed endurance and general power endurance of arms' flexors and extensors; time of punch by weaker arm and quickness of serial punches; general speed endurance; effectiveness of punches by weaker arm; velocity of punch movement; effectiveness of single punches by both arms.
2. From the said above we can conclude that in general-preparation stage successfulness of development of general and special physical qualities is determined by independent on each other factors. These factors characterize the following sides of fitness: effectiveness of single punches by both arms; special speed and power endurance; general

endurance and strength of hand's flexors; specific sensor-motor reaction; condition of upper girdle muscles; general speed and power endurance; velocity of punch movement.

3. Analysis of special-preparation stage results permitted to find that successfulness of development of general and special physical qualities is determined by independent on each other factors. These factors characterize the following sides of fitness: strength of punch by stronger arm; special speed and power endurance and strength of hand's flexors; specific sensor motor reaction; time characteristics of punches by stronger and by weaker arms; general speed endurance; special speed motor abilities; condition of muscles, participating in punch; power endurance of arm's flexors; strength of punch by weaker arm and general endurance.
4. Analysis of recreational stage results permitted to find that successfulness of development of general and special physical qualities is determined by independent on each other factors. These factors characterize the following sides of fitness: condition of muscles, participating in punch; specific sensor motor reaction; time characteristics of single punches by both arms; general endurance; power endurance of arm's flexors and extensors; quality of punch by weaker arm; velocity of punch movement; special speed-power endurance; explosive power of legs and hand's flexors; level of sportsmanship.
5. Results of factorial analysis witness that factorial structure of GPC and SPC of qualified boxers does not change depending on stages of training. It should be noted that on every of the studied stages the marked out factors do not depend on each other and are separate, important sides of GPC and SPC. That is why, when distributing training means and loads it necessary to uniformly distribute and dose correlation of means for all marked out factors, characterizing different sides of fitness. It conditions increase of GPC and SPC level. As a result it ensures growth of sports results of students – qualified boxers.

**Conflict of interests**

The authors declare that there is no conflict of interests.

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