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**AUTHOR'S SUMMARY
OF DISSERTATION**

**IMPROVEMENT IN THE TRAINING PROCESS
WITH ELITE BOXERS – JUNIORS AND MEN**

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The dissertation consists of 132 standard typewritten pages. It is illustrated with 8 figures and 19 tables. The bibliography includes 91 literary sources, of which 62 by Bulgarian authors and Russian authors and 29 in Latin. The dissertation was tested, discussed, and directed for official defense at a meeting of the Department of Weightlifting, Boxing, Fencing and Sports for All at NSA “Vasil Levski”.

The public defense of the dissertation will take place on January 26, 2022, from 2.30 pm, in hall A3 of NSA “Vasil Levski”

INTRODUCTION

The issue of the management of the training process of elite boxers is one of the most important in practical terms and one of the most difficult for theoretical proof. Its complexity is determined by the multifactorial nature of the components that determine the management process and the multicomponent dependence of the sports result on it. It is especially difficult to control the state of training in a sport such as boxing, in which the mutual influence of physical, technical, and mental factors is determined by the motor complexity of actions, tactical unpredictability and high emotional stress of fight. The high density in the performance of the motor actions, the extremity of the influences in training and competition situations, set high requirements to the adaptation potential of the boxers. Therefore, the effective management of the training process with boxers requires a comprehensive consideration of the influence of various factors on the adaptation process. The use of objective data for the diagnostics of adaptive reaction of the boxers in the training process will provide an opportunity to objectify the use of training tools and methods to improve the training and competition process. Also, studying the influence of altitude training on the adaptive capabilities of elite athletes is a problem of proven practical and scientific significance. It is no coincidence that athletes from different sports include in their training programs high-altitude mesocycles with different duration and direction. Despite its empirical application by some coaches, the problems of adaptation in altitude conditions in boxing in our country, as well as in foreign scientific literature have not yet found a significant place. The development of scientifically based technology of management of the training

process for highly qualified boxers, based on objective data on the functional mechanisms of adaptation to training loads, will allow a high level of sports and technical results during the main competitions. The research in this dissertation is directed namely in this area.

CHAPTER ONE. STATUS OF LITERARY PROBLEM

Boxing is an acyclic sport. The movements in it are performed with various intensity and are of speed-strength nature. All the actions of the boxer, the use of certain punches or defences, their intensity are determined by the behaviour of the opponent and the situation in the ring. The boxers' fight is a duel of two opponents in the time intervals (rounds) established by the rules or time periods, conditionally chosen by the coach with one-minute breaks between them. The battle in the ring consists of various and sometimes very difficult actions. The boxer, manoeuvres and applies feints, prepares attacks and counterattacks, performs them with lightning speed and then leaves the fight. At the same time, he constantly strives to avoid enemy punches by using various defensive actions.

V.I. Chernev emphasizes that boxing is an acyclic sport with an explosive-dynamic character of the movements performed with various intensity. The physical loads of the boxer are associated with strong emotional arousal and are with maximum and submaximal power (Chernev, V.I., 2007, 2012).

Boxing refers to sports with complex requirements for motor coordination, speed, power, and technical skills, manifested in highly variable forms of action. The composition of the competitive actions in boxing varies dynamically in a wide range and in some of them there is great uncertainty in situations where there is a choice of option. This places particularly high demands on the motor, coordination, and other related abilities of the competitors, including the ability to assess the spatial-temporal con-

ditions and parameters of the paint quickly and accurately, the skilful regulation of the spatial, temporal, and dynamic parameters of the movements, the transformation of one strictly coordinated action into another. At the same time, in many competitive situations there are high requirements for the speed abilities and the specific endurance (in particular, for the coordination and the speed-force relationship) of the boxer. Very high biomechanical loads (shocks) require resistance to body kinematic circuits.

Modern amateur boxing is characterized with an increased density of punches throughout the fight. However, for all the blows inflicted by the boxers, no more than one tenth of them reach their goal.

A systemic boxing training has a positive effect on increasing both aerobic and anaerobic capacity. Thus, the maximum consumption of O₂ and other indicators of aerobic metabolism in boxers are significantly improved by increasing sports skills and increasing experience and specialized training in boxing, which means that such a load, which leads to expanded functionality, associated with the use of oxygen during intense muscle work is extremely important. The conditions of motor activity of boxers also require increased anaerobic capacity.

The analysis of the training and competitive activity of boxers shows that it is characterized with the following main factors: high requirements for sensory-motor and mental qualities of the athlete, which is due to performing actions in risky situations, in conditions of limited time; difficulties in following a strict training regime, especially in the case of the need for artificial weight loss of the boxer and the associated lifestyle; high degree of reliability and high technical level, etc.

V. Bruzas, A. Stasiulis, A. Cepulenas, P. Moskus and others. (2014) note that competitive boxing matches are characterized with dynamic movements, changing situations, a variety of striking defensive actions, as well as great mental stress. During the match, boxers must maintain the intensity of the match, the force of the blow, the speed and accuracy of the movements, even with increasing fatigue. During competition, a boxer's energy depends on aerobic and anaerobic intake and the interaction between them (Bruzas et al., 2014). Aerobic capacity is an important component for the fitness of boxers in all weight categories. Special attention in the training process should be paid to the development of cardiac capacity, both in pure aerobic training and at the level of the anaerobic threshold.

The specifics of training, coaching and participation in boxing competitions require effective planning and management of all training work.

The purpose of the training plan is to enable the coaches to plan for the upcoming trainings and competitions. The most important thing, however, is that the training plan is designed to best organize and manage the boxer's training process and prepare the boxer for the main and / or target competition of the year. When developing a one-year training plan, one of the factors to consider is the time between two competitions.

AIBA (2019) offers the following annual boxing planning scheme:

- 1. Preliminary period with the main purpose** – the physical training of the boxer and he bears the name – general fitness period. During this period, training loads include activities that improve and develop the boxer's cardiovas-

cular system, strength, basic boxing techniques, tactics, and psychological training so that the boxer can focus and concentrate on his training schedule. This period includes from one to three weeks depending on the competition calendar and the level of training of the boxer. The number of training sessions and training hours can be adjusted accordingly by the trainer, but it is not recommended to train more than three hours in one training session and three sessions per day.

2. **Period of general conditioning.** The training goal of the period is to increase and improve the cardiovascular system and the strength of the boxer. In addition, boxing techniques and tactics are being improved. The trainings for psychological development are not interrupted either. The duration of this training period is the same as the pre-training period and is from one to three weeks depending on the competition calendar and the level of training of the boxer. Here, too, the coach is responsible for creating a workout program – intensity, number of hours and training sessions per day.
3. **Specific conditioning period.** During this period the main task is to increase muscle and energy readiness. The long-distance running exercises included in the other two periods are replaced by interval and intermittent training, and strength training includes an individualized weight program, and it is assumed that such individualization will allow to strengthen specific muscle groups. Tactics are more specific and focus on the individuality of endurance, strength, speed, and coordination. The coach must carefully assess the psychological setting of the boxer, observing

his ability to cope and overcome the increased load. High workload values for boxers who overcome difficulties can build confidence and concentration. This period can last from one to three weeks depending on the competition calendar and the level of training of the boxer.

4. **Competition period.** The competition period starts and ends with tournaments according to the competition schedule. During this period, the trainer should program a training plan that includes low-intensity exercises.
5. **Transition period.** After tournaments or competitions, the coach must allow the boxer a break of about a week. This period is designed for relaxation and treatment of injuries received during the competition period. However, there are low-intensity endurance training – exercises such as jogging, long-distance running and jumping (skipping).

Usually, in boxing, a two-cycle periodization is recommended, focused on the important competitions, which includes: 1) a special preparatory stage and 2) a pre-competition stage. The preliminary stage consists of 3, rarely 4 micro cycles. The peculiarities of the construction of micro cycles depend on the tasks to be solved at the stage of preparation for the specific races. The design of micro cycles is based on the logical connection between exercise and rest. The heterochrony of recovery of physiological and mental functions after different loads should also be considered. The main task is to achieve the phase of supercompensation of the leading functions, and the load with different orientation – partial supercompensation does not have a negative impact on the restoration of the main functions. The training process, aimed at the development and improvement of boxers, to build training

and fitness, means optimizing the process of adaptation of boxers to the specific conditions of sports. The influence of training loads should be assessed not only with the parameters of volume and intensity, but also with the psychological complexity that they bring to the athlete. This is especially important in martial arts, such as boxing. According to VN Platonov (1986), the use of the term “adaptation” in research in the field of sports is closely related to the concept of functional reserves: athletes differ from those who do not engage in sports in the ability to mobilize functional their resources. The improvement of the level of training of athletes is reflected in a change in the level of physiological, psychological, and special indicators, but at the same time not the number of changes, but the phenomenon of organic integration associated with new, higher quality, including the intertwining of the various components is the important thing (IP Degtyarev, 1986; FZ Meerson, 1981). Therefore, when diagnosing fitness, a criterion is needed to determine the dynamic characteristics of the organism, based on the principle of “minimization” (AV Rodionov, 1973; VL Marishchuk, 1973). The essence of “minimization” lies in the selective strengthening of the functions, which in this case determine the achievement of a high sports result, high stability in logical unity, with variability and adaptability to changing conditions, especially regarding motor skills (V.S Keller, 1977; Yu.V. Verkhoshanski, 1985, 1988; AV Korobkov, 1971). The high level of training is also characterized with an increased mobility, faster performance of the body and a more perfect ability to switch in the process of motor activity. Practical experience and research have proven the benefits of training at medium altitude. That’s why boxers around the world, preparing for large-scale sports competitions, spend part of their training in high altitude conditions.

Training in altitude conditions significantly increases the functional capabilities of athletes. At a slightly lower temperature of the mountain air, the working capacity is significantly improved, the attention, the accuracy and coordination of the movements, the speed of reaction and the possibility to switch from one type of work to another are increased.

In boxing, altitude training is most often used in the transition period or in the first half of the preparatory period, lasting 20-25 days, and in cases where competitions are planned at 500-1500 m above sea level until the days of the competition. The content of the height mesocycle includes training tools aimed at increasing the specific adaptation capabilities of boxers. The dynamics of adaptive changes in altitude conditions goes through three main stages: acute acclimatization – 4–6 days, during which stage there are primary functional adaptive changes in the body under the influence of altitude-climatic conditions and means of training; second transitional stage to actual adaptation – 5–8 days, with increasing parameters of training effects and third – of actual adaptation – after 15 days of stay in altitude conditions, characterized by high parameters of training effects with both intensity and duration. The emphasis is on specialized exercises. From the second day of their stay in high altitude conditions, boxers begin to walk on uneven terrain, gradually lengthening the routes, choosing increasingly difficult terrain, and increasing the pace of movement. Such walks should be done at least every other day, for 2–3 hours. The load on the body is moderate.

The stay and training of athletes in altitude conditions create favourable conditions for improving performance, lasting a long time when returning to the normal environment in place of the constant training of the boxer.

The high functional requirements for boxers determine the use of altitude training as a key element of the overall training system. Increasing the level of aerobic endurance and speed-strength qualities helps to maintain high performance until the last minutes of the boxing match and until the end of the tournament. This in turn leads to higher efficiency and economy of technical and tactical skills and habits.

The analysis of research shows that further progress in the methodology of training boxers is associated with increasing the role of the principle of individualization. In boxing, the individual style is defined as a complex indicator characterizing the level of general physical, technical-tactical, intellectual, psychological training.

In-depth studies of the training and competitive activities of boxers, with a different style of boxing match, were carried out by VI Filimonov (2003, 2006), P.V. Galochkin (2009), A.V. Gaskov (2004; 2010), A.V. Grigoriev (2002), IS Kolesnik (2005; 2009), OV Menshikov (2007), G.I. Mokeev (2007; 2009).

In this regard, active knowledge of adaptation models is required, as well as the purposeful use of special tools for training and improvement. Obviously, the insufficient development of this problem, as well as the use of altitude training in the annual cycle of elite boxers has long attracted the attention of several authors (Platonov, VN, 1988; Smirnov, YI, 1991).

A fundamentally new methodological approach to the management and planning of the training process for elite boxers is needed, which will allow to reveal and exploit reserves of the physical and mental potential of the athletes.

Working hypothesis: *Achieving a high result in modern boxing is possible only with proper planning and management of training micro and mesocycles within the annual training cycle. This task is feasible through controlling the main factors of the sporting achievement of elite boxers and changes in training effects.*

CHAPTER TWO. PURPOSE, TASKS, METHODOLOGY AND ORGANIZATION OF THE RESEARCH

II.1. Purpose of the study. The purpose of this study is to improve the training process of elite boxers by modelling training micro and meso cycles for maximum development of the functional capacity of the body of athletes.

II.2. Research tasks

1. Establishing the state of the researched problem on scientific literature data and personal coaching practice.
2. Collecting information about the types of micro- and mesocycles and revealing their features in their application with elite boxers.
3. Developing and testing the models of micro and meso cycles with elite Bulgarian boxers.
4. Establishing their effect on the performance of the studied boxers.
5. Establishing the magnitude and quality of changes that occur in altitude conditions on haematological parameters of performance in elite boxers.

The object of the study is the process of building models of training micro and mesocycles in the training of elite boxers.

Subject of the research is the quantitative and qualitative parameters of construction and management of the training process of elite Bulgarian boxers. Twenty elite Bulgarian boxers - men and women, winners of prestigious international and nation-

al awards, including Stoyka Petrova, Daniel Alexandrov, Tervel Pulev – were studied.

This study covers the period from 2012 to December 2021.

II.3. Research approaches and methods

Depending on the purpose and tasks of the research, theoretical and practical approaches and methods of research and analysis of scientific and real facts and data were used.

A. Theoretical approaches for developing the methodological concept and substantiation of the topicality of the researched problem. The following research methods were used for this purpose:

- Review study and theoretical analysis of specialized scientific literature – The study of the literature was aimed at establishing the state of the researched problem and the extent to which its various aspects have been the subject of research by various authors. Ninety-one literature sources in Latin and Cyrillic were studied. A bibliography on the issue was compiled, which allowed to derive the working hypothesis of the research and on this basis the tests and indicators of the research were selected, observing the requirements for reliability, reliability, objectivity, and standardization.
- Documentary analysis of plans, protocols with results from test tests and results from competitions of the national boxing teams of Bulgaria for a period of 15 years.
- Internet analysis of information about the leading trends in the field of sports training management in boxing from sources on the world wide web.

B. Experimental approaches for substantiation of the developed theoretical and methodological concepts and models.

Sports and pedagogical research in the following areas:

1. Characteristics of the training loads:

- Regarding the dose – number of trainings and total training load in hours; boxing work; speed and strength training, speed, energy.
- In terms of functional effect. It is controlled by the indicators of the momentary reactions of the organism. They are determined by the parameters of the load and are characterized by appropriate in size and nature changes in the various functional systems.
- The first criterion is the concentration of La in the blood, which is directly related to the intensity of the load, and accordingly – to the activation of type II fibres, in which mainly lactic acid accumulates. It makes it possible to precisely define the critical limits of the functional impact and to manage the adaptation processes for each specific case.

The second criterion is the pulse rate, which comprehensively represents the energy dynamics of the various functional systems.

3. Anthropometric measurements.

4. Medico-biological tests according to standard methods.

5. Haematological examinations

6. Pedagogical experiment

The physiological mechanism of the body's response to hypoxia is used to increase both aerobic and anaerobic fitness. The results from the research show that training in hypoxia conditions increases the anaerobic strength, which characterizes the ability

to perform short-term loads with maximum intensity. However, some authors suggest that this type of training does not significantly affect the anaerobic capacity or the explosive power of the lower limbs or the maximum running speed.

We accepted the hypothesis that the inclusion of high-altitude training camps in the training of elite boxers will significantly improve the aerobic and anaerobic condition of boxers and will further allow the development of new training methods in this sport using hypoxic training.

The obtained results were subjected to statistical processing.

CHAPTER THREE. RESULTS AND ANALYSIS

III.1. Models of training management in the annual training cycle of elite boxers

The main methodological and managerial problem regarding the construction and management of the training process comes down to finding the appropriate optimum between the sports calendar and the adaptive capabilities of the athlete's body to achieve the objectives, as well as the strategic goals of training. There is a close correlation between these prerequisites, which underlies the construction and implementation of the training process.

The purpose of the boxer's pre-training period is to increase the level of physical condition and move to the next level of development and improvement. It includes loads that improve and develop the cardiovascular system and strength of the boxer, basic techniques, tactics, and psychological training. The duration of this period in the training cycle can be from one to three weeks, depending on the sports calendar and the level of preparation of the boxer. Training up to three hours and three a day is recommended.

In **Table 5** an example training plan for this period is presented.

This period in turn is divided into:

Stage of general fitness, which aims to increase the aerobic capacity and strength of the boxers. In addition, boxing technique and tactics are improved. The duration of this stage is from one to three weeks depending on the competition calendar and the level of preparation of the boxer.

Table 5. Sample training plan (general condition)

Training tools	Duration	Training load	Comment
Dynamic warm up	25 min	Moderate intensity	Designed for warm up flexibility, explosive power, and agility.
<i>Basic part</i>			
Shadow boxing	3min :1min	High intensity	Focus on technique
Sparing	3min:1min	From low to moderate	Simulation of situations
Working with weights	3min:1min	High	Combo succession
Double end bag	3min:1min	High	10 s work/ 10 s rest
Interval work	10 min	High	
<i>Calming</i>			
Stretching	10-15 min	Moderate intensity	Flexibility

The next period is called the specific preparation period. The trainings become more intensive. Interval training and strength training to strengthen specific muscle groups are essential. Boxing technique is more specific and focused on endurance, strength, speed, and coordination. This stage can last from one to three weeks depending on the competition calendar and the level of training of the boxer. (**Table 6**).

The pre-competition period is the period before the race, and it is defined as the most difficult period. All training aids should be

planned with maximum intensity. It mainly works for speed force and speed. In strength training, the boxer uses lighter weights and repetitions are performed at maximum speed.

Table 6. Sample training plan

Training tools	Duration	Training load	Comment
Warm up			
Jumping rope	2 min	Low	Without rest
Jumping rope	2min	Moderate	Without rest
Jumping rope	2 min	Moderate	90 s
Jumping rope	5 min	High	5 min
<i>Basic part</i>			
Sparing – 4x3: 1 min	15 min	High intensity	10-20-30 Return to starting point and repeat
Sprint – pyramid	10-15 min	High intensity	
Stretching	10 min	Moderate	
<i>Calming</i>			
Video	30 min	Low	View a sparring / competition video to allow the boxer to learn through visualization

The approach during this period is individual. Tactical training includes intensive sparring and work with bags and pads. Sparring programs must be performed with a similar intensity to the competition. In practice, this is the period from one week to

three before the start of the race and lasts until the day before the race. As the dates of the competition approach, the emphasis is on competition strategies and tactics, relaxation, and limitation of training with high intensity and volume (**Table 7**).

Table 7. Sample training plan

Training tools	Duration	Training load	Comment
Warm up			
Fight in a shadow	8–10 min	Moderate	Tapering before a competition
Jumping rope	2x4 min	Moderate to high	
Basic part			
Work with glove / pad Heavy bag Work with a workout partner Work with glove / pad	2x3 min	High intensity	1 minute between all rounds. Focus on the strategies set before the start of the training.
Calming			
Stretching and movement	10–15 min	Relaxing	
The coach and the boxer discuss the training	20–30 min		

The competition period begins and ends with the tournament or competition schedule. During this period, the coach can program training sessions by including low-intensity exercises that

will allow the boxer to remain fit for the upcoming fights in the competition schedule.

Transitional period. After tournaments or competitions, the coach must allow the boxer to take an active break for about a week. It should allow boxers to have time to relax and heal injuries. Low-intensity aerobic endurance training, such as jogging, long-distance running and jumping rope, is provided.

Muscle strength is one of the most important factors of specific performance in modern boxing. Muscle strength largely determines the speed of movement, as well as endurance and agility of the boxer. The great variety of movements of the boxer with specific tasks requires quantitative and qualitative assessment of the power component. The typical manifestation of strength in boxing is in the instantaneous (impulse) actions, which are often repeated for a long time. It is basically defined as “explosive” force and endurance. The manifestation of these qualities depends on the activity of the central nervous system, the cross section of muscle fibres, their elasticity and the biochemical processes that take place in the muscles.

In connection with the importance of strength, % active muscle mass, which show our elite boxers is of great interest (**Table 8**).

The values of muscle mass (%) are also influenced by the weight of the athletes and even more so in this case it is a sport with categories and to be able to interpret this indicator correctly it is necessary to calculate the so-called Z-ratings.

The basis of the specific endurance of boxers is good general physical fitness, excellent breathing, the ability to relax muscles between active percussive “explosive” actions and the improvement of techniques, because the more they are automated, the fewer muscle groups participate in the performance of the movement.

The means for developing endurance in boxers are diverse and include exercises that ensure the development of special endurance (alternating running, throwing a solid ball in motion), coordination, speed, accuracy. Exercises on a punching bag also provide the development of special endurance, frequent “explosive” actions when applying a series of blows – these are speed, accuracy, and strength, etc.

Table 8. MM% of elite Bulgarian boxers

№	Boxer	MM%
1.	Tinko Banabakov	48,0
2.	Irene Ismetov	48,6
3.	Peter Belberov	50,49
4.	Nikolai Mutavsky	49,8
5.	Nikolai Koev	57,41
6.	Stefan Ivanov	51,9
7.	Elia Dimitrov	50,2
8.	Zdravko Mikhailov	50,8
9.	Daniel Assenov	46,9
10.	Peter Alexandrov	48,7
11.	Nikolai Assenov	50,4
12.	Emanuil Bogoev	47,7
13.	Tervel Pulev	46,1
14.	Good Naidenov	49,4
15.	Stanimir Petrov	44,5
16.	Stoykova Petrova	43,6
	Average value	49,03

Studies with Bulgarian elite boxers show that VO_2max ranges from 50.49 ml.kg.min to 70.40 ml.kg.min (**Table 9 and Fig. 2**).

Table 9. VO_2max (ml.kg.min) of elite Bulgarian boxers – men and women

№	Boxer	VO_2max ml.kg.min
1.	Tinko Banabakov	63,79
2.	Irene Ismetov	62,69
3.	Peter Belberov	50,49
4.	Nikolai Mutavsky	52,88
5.	Nikolai Koev	57,41
6.	Stefan Ivanov	64,91
7.	Elian Dimitrov	70,40
8.	Zdravko Mikhailov	62,72
9.	Daniel Assenov	67,27
10.	Peter Alexandrov	57,02
11.	Nikolai Assenov	57,77
12.	Emanuil Bogoev	60,77
13.	Tervel Pulev	55,20
14.	Good Naidenov	58,68
15.	Stanimir Petrov	51,57
16.	Stoykova Petrova	58,10
	Average value	59,47

The table shows that the Bulgarian elite boxers are approaching the European elite in terms of their aerobic capacity - the average value is 59.47 ml.kg.min. Daniel Assenov is with the highest values (51 kg.) – European champion at 18, but for men,

Stefan Ivanov (51-54 kg) – Vice-European champion and Tinko Banabakov (48 kg) – medalist from European championship. The values of Stoyka Petrova are impressive (51 kg) – Current Olympic champion and participant in the London 2012 Olympics.

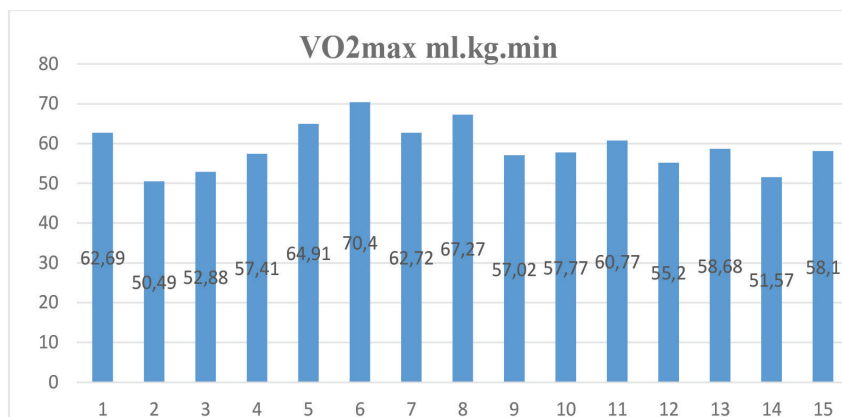


Figure 2. VO₂max (ml.kg.min) of elite Bulgarian boxers – men and women

Heart rate and lactate are other informative indicators for both the level of aerobic capacity and anaerobic. Short rest periods (1 minute) between rounds in amateur boxing emphasize the intensity of the load and identify the critical role of anaerobic glycolysis in maintaining ATP resynthesis during amateur competition.

When the intensity of the activity of the effort increases, the production of lactic acid in the muscles is high, which leads to a high accumulation of lactic acid in the blood. Heart rate is linearly related to oxygen consumption, so heart rate measurements during exercise show aerobic or anaerobic effort, and as the lactate in the blood increases, so does the heart rate. Lactate values measured in elite European boxers are in the range of 13.5 +/- 2 Mmol / l after competition (M.S. Smith, 2006). The average recorded heart rate is 192 beats per minute.

Table 10. HR max (Batt/min) и Lamax (Mmol/l)

№	Competitors	HR max Batt/min	La max Mmol/l
1.	Tinko Banabakov	199	8,8
2.	Irene Ismetov	200	12,6
3.	Peter Belberov	190	9,6
4.	Nikolai Mutavsky	205	12,6
5.	Nikolai Koev	205	10,6
6.	Stefan Ivanov	205	11,2
7.	Elian Dimitrov	201	12,2
8.	Zdravko Mikhailov	209	6,4
9.	Daniel Assenov	193	6,3
10.	Peter Alexandrov	209	7,9
11.	Nikolai Assenov	193	9,7
12.	Emanuil Bogoev	198	7,8
13.	Tervel Pulev	193	9,7
14.	Good Naidenov	183	9,2
15.	Stanimir Petrov	198	8,8
16.	Stoykova Petrova	190	10,0
	Average value	198,18	9,58

The elite Bulgarian boxers studied by us in terms of spiroergometric test inform about the following (**Table 10**):

- Bulgarian elite boxers are approaching the European elite in terms of the response of the cardiovascular system and aerobic capacity.
- They show lower mean lactate values, but in spiroergometric examination.

- The obtained values inform about the level of readiness of the studied athletes.

In the period of the study – after a mesocycle of basic training, some of the athletes react more intensely, which is probably due to the still developing reactions of adaptation after prolonged and intense exercise.

Boxing training loads require tolerance to high lactate levels and heart rate. Therefore, conditioning training is recommended to reproduce these physiological reactions.

Table 11 presents an example program for the preparation of elite boxers at the stage of maximum sports realization.

Table 11. Stage of maximum sports realization

<p>Priorities</p> <p>Optimizing the competitive condition. Specific boxing skills with an individual approach. Achieving competitive sports form.</p>	<p>This is the last stage of many years of training and applies to boxers who have the potential to participate in high-ranking international competitions.</p> <p>Competitors at this level must regularly participate in competitions with strong competition, which increases the requirements for psychological and competitive resilience and endurance.</p> <p>The emphasis in terms of fitness must be entirely on a specific focus.</p>
<p>Condition</p>	<p>Special attention should be paid to:</p> <ol style="list-style-type: none"> 1. the strength of the upper part of the body. 2. aerobic strength and endurance. 3. improvement of weaknesses in the condition, which may have a negative impact on the performance; on performance

	<p>4. fine tuning of all athletic abilities</p> <p>5. dealing with fatigue and overtraining.</p>
<p>Technical and tactical aspects</p> <p>Expanding, if possible, the technical repertoire of the boxer.</p> <p>Stability of performance and sports results in situations of mental stress.</p> <p>Sparring with an emphasis on specific skills.</p>	<p>Optimization and improvement and boxing-specific techniques at this level.</p> <p>Improve competitive strategies against specific opponents and boxing styles.</p> <p>Advanced knowledge of international scoring systems and adequate application of such knowledge in real racing situations.</p> <p>Using video analysis of performance and developing specific racing strategies.</p> <p>Originality and innovation in responding to the actions of the enemy.</p>
Psychological training	<p>Optimizing, improving, and maintaining the following psychological skills:</p> <ul style="list-style-type: none"> • Self-confidence, motivation, and competitiveness. • Independence and autonomy. • Creativity and innovation. • Mental endurance and resilience. • Focus on the „big goal“. • Demonstrate readiness for the unexpected.
Traumatism and prevention	<ul style="list-style-type: none"> • Optimal nutrition and hydration. • Adequate recovery and regeneration. • Minimize the negative effects of long trips on the result. • Appropriate warm-up and soothing practices and procedures. • Use appropriate stretching techniques.

Some recommendations	<p>Weekly participation in 5 or 6 fitness workouts, depending on individual needs.</p> <ul style="list-style-type: none"> • 5–7 boxing-specific sessions, which should last between 60 and 120 minutes. • 8 to 12 matches per year in national and international elite competitions. • If possible, selection of competitions.
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An important condition for the effective management of the training process in the elite amateur boxing is the planning of the training mesocycles.

Table 12 presents an original author’s model of a three-week basic mesocycle held in the town of Asenovgrad – 2014 (second year of the Olympic cycle, before the Games in Rio de Janeiro, 2016). It occupies a central place in the general preparatory stage of the preparatory period. The main purpose of this mesocycle is to increase the level of general physical training with means with special orientation in mixed mode and strength work aimed at the development of muscle groups of the legs, body, and arms. It is composed of three activities a day, except on Sundays. This determines the degree of load as high enough. The training sessions are specific and include boxing exercises combined with fitness training, with a gradual increase in the volume and intensity of the load in the third week. The athletes who participated in this training camp were elite boxers, including Tervel Pulev, Daniel Assenov, Petar Belberov and Tinko Banabakov.

As can be seen, the task of the first week (micro cycle) is the development of general physical qualities with special focus and improvement of technical and tactical skills. The first week is characterized with a stable level of quantitative characteristics of the load: volume – large, intensity – medium, training – complex, us-

ing means for general physical training (sports games, athletics, barbell, solid ball, cross) and for special physical training (conditional fights, improving speed, improving specialized sensations).

Table 12. Basic mesocycle in boxing (original in boxing
(original training model)

First week			
	1-st training	2-d training	3-td training
Monday	Travel to Asenovgrad		Warm-up II 15 min Games – 2x10 min Regular running – 4 km TTP weight b s. 20 min Device 1 / 3x3x1 2 / 3x3x1 Solid ball – 20 min Gymnastic – 15 min
Tuesday	Warm-up – 15 min Cross – 20 min TTP b. dumbbells – 20 min	Warm-up – 15 min Strength complex – 1 Cross – 20 min – 4 km Gymnastic – 15 min	Warm-up – 15 min. TTP b. with dumbbells – 20 min Conditional fight 1 / 3x3x1 2 / 3x3x1 3 / 3x3x1 3 min Nonstop Solid ball – 20 min Gymnastic – 15 min
	Warm-up – 15 min	Warm-up 15 min	Warm-up 15 min

Wednesday	Cross – 20 min TTP b. dumbbells – 20 min	TTP b. Dumbbells – 20 min Conditional fight – 30 min Cross – 20 min Gymnastic – 15 min	TTP b. with dumbbells – 20 min. Conditional fight 1 / 3x3x1 2 / 3x3x1 Solid ball – 20 min. Gymnastic – 15 min
Thursday	Warm-up – 15 min Cross – 20 min TTP b. dumbbells – 20 min	Warm-up – 15 min Strength complex – 1 Cross – 20 min – 4 km Gymnastic – 15 min	Recovery Sauna Massage
Friday	Warm-up – 15 min Cross – 20 min TTP b. dumbbells – 20 min	Warm-up - 15 min TTP b. with dumbbells – 20 min. Conditional fight 1 / 3x3x1 2 / 3x3x1 Solid ball – 20 min. Gymnastic – 15 min	Warm-up – 15 min TTP b. with dumbbells – 20 min. Conditional fight1/ 1/3x3x1 2/3x3x1 3/3x3x1 3 min Nonstop Solid ball – 20 min Gymnastic - 15 min
Saturday	Warm-up – 15 min Cross - 20 min TTP b. dumbbells – 20 min	Warm-up – 15 min Strength complex – 1 Cross – 20 min – 4 km Gymnastic – 15 min	Warm-up – 15 min TTP b. with dumbbells – 20 min Conditional fight 1 / 3x3x1 2 / 3x3x1 Solid ball – 20 min Gymnastic – 15 min

Sunday	Game 2x20 min Strength complex Cross 8 km Solid ball – 20 min. Gymnastic – 15 min		Recovery Sauna Massage
Second week			
	1-st training	2-d training	3-td training
Monday	Warm-up – 15 min Strength complex – 1 Cross – 20 min – 6 km Gymnastic – 15 min	Warm-up – 15 min Strength complex – 1 Cross – 20 min – 6 km Gymnastic – 15 min	Warm-up – 15 min Game – 2x10 min Continuous running – 4 km TTP weight b.s. 20 min Devices 1 / 3x3x1 2 / 3x3x1 3 / 3x3x1 Solid ball - 20 min Gymnastic – 15 min.
Tuesday	Warm-up – 15 min Strength complex – 1 Cross – 20 min – 6 km Gymnastic – 15 min	Warm-up – 15 min Cross – 20 min TTP b. Dumbbells – 20 min Conditional fight – 30 min Cross – 20 min – 4 km Gymnastic – 15 min	Warm-up – 15 min Game – 2x10 min Even running – 4 km TTP weight b. s. 20 min. Devices 1 / 3x3x1 2 / 3x3x1 3 / 3x3x1 3 minutes non-stop Gymnastic – 15 min

Wednesday	<p>Warm-up – 15 min</p> <p>Cross – 20 min</p> <p>TTP b. dumbbells – 20 min</p>	<p>Warm-up – 15 min</p> <p>Strength complex – 2</p> <p>Cross – 20 min – 5 km</p> <p>Gymnastic – 15 min</p>	<p>Warm-up – 15 min</p> <p>Game – 2x10 min</p> <p>Continuous running – 4 km</p> <p>TTP weight b. s. 20 min</p> <p>Tools</p> <p>1 / 3x3x1</p> <p>2 / 3x3x1</p> <p>3 / 3x3x1</p> <p>3 min Nonstop 2x3x1 Impact force (1-2)</p> <p>Gymnastic – 15 min.</p>
Thursday	<p>Warm-up – 15 min</p> <p>Cross – 20 min</p> <p>TTP b. dumbbells – 20 min</p> <p>Gymnastic – 15 min</p>	<p>Warm-up – 15 min</p> <p>Cross – 20 min – 4 km</p> <p>TTP b. Dumbbells – 20 min</p> <p>Conditional fight – 30 min</p>	<p>Recovery</p> <p>Sauna</p> <p>Massage</p>
Friday	<p>Warm-up – 20 min</p> <p>Strength complex – 1</p> <p>Cross – 20 min – 6 km</p> <p>Gymnastic – 15 min</p>	<p>Warm-up – 20 min</p> <p>Strength complex – 1</p> <p>Cross – 20 min – 6 km</p> <p>Gymnastic – 15 min</p>	<p>Warm-up – 15 min</p> <p>Game – 2x10 min</p> <p>Evenly running – 4 km.</p> <p>TTP weight b. s. 20 min.</p> <p>Tools</p> <p>1 / 3x3x1</p> <p>2 / 3x3x1</p> <p>3 / 3x3x1</p> <p>4 / 3x3x1</p> <p>Intervals 6x10</p> <p>2x3x1 Impact force – 1–2</p> <p>3 minutes of movement</p> <p>Gymnastic – 15 min</p>

Saturday	Warm-up – 15 min Strength Cross – 25 min – 5 km Gymnastic – 15 min	Warm-up 15 min Cross – 20 min TTP b. Dumbbells – 20 min	Warm-up – 15 min Game – 2x10 min Continuous running – 4 km. TTP weight b. s. 20 min. Tools 1 / 3x3x1 2 / 3x3x1 3 / 3x3x1 4 / 3x3x1 Solid ball – 20 min Gymnastic – 15 min
Sunday	Warm-up – 15 min Strength complex Cross – 10 min Gymnastic – 15 min	Warm-up – 15 min Strength complex 1 TTP b. s. – 20 min Gymnastic – 15 min	Recovery Sauna Massage
Third week			
	1-st training	2-d training	3-td training
Monday	Warm-up – 15 min Cross – 25 min – 7 km TTP b. dumbbells – 20 min Gymnastic – 15 min	Warm-up – 15 min Cross – 30 min – 7 km TTP Dumbbells – 20 min Gymnastic – 15 min	Warm-up – 15 min Game – 2x10 min Evenly running - 4 km TTP weight b. s. 20 min Tools 1 / 3x3x1 2 / 3x3x1

Monday			3 / 3x3x1 4 / 3x3x1 1x3x1 Impact force — 1-2 Solid ball Gymnastic — 15 min
Tuesday	Warm-up — 15 min Cross — 25 min — 6 km TTP b. dumbbells — 20 min Gymnastic — 15 min	Warm-up — 15 min Cross — 40 min Sprints — 10 Jumps 4x3x1 Gymnastic — 15 min	Warm-up — 15 min Game — 2x10 min Continuous running — 4 km TTP weight b. s. 20 min Devices 1 / 3x3x1 2 / 3x3x1 3 / 3x3x1 4 / 3x3x1 Intervals 6x10 2x3x1 Impact force — 1-2 Solid ball — 20 min Gymnastic — 15 min
Wednesday	Warm-up — 15 min Cross — 20 min TTP b. dumbbells — 20 min Gymnastic — 15 min	Warm-up — 15 min Cross — 30 min — 7 km Strength complex — 1 Gymnastic — 15 min	Recovery Sauna Massage
Thursday	Warm-up — 15 min Cross — 20 min	Warm-up — 15 min Cross — 40 min Sprints — 10	Warm-up — 15 min Game — 2x10 min Continuous running — 4 km

Thursday	TTP b. dumbbells – 20 min Gymnastic – 15 min	Jumps 4x3x1 Gymnastic – 15 min	TTP weight b. s. 20 min Devices 1 / 3x3x1 2 / 3x3x1 3 / 3x3x1
Thursday			4 / 3x3x1 Intervals 6x10 2x3x1 Impact force – 1–2 Solid ball –1x3x1 Gymnastic – 15 min
Friday	Warm-up – 5 min Cross – 20 min TTP b. dumbbells – 20 min Gymnastic – 15 min	Warm-up – 15 min Cross – 40 min TTP b. dumbbells – 20 min Gymnastic – 15 min	Warm-up – 15 min Game – 2x10 min Continuous running – 4 km TTP weight b. s.20 min Tools 1 / 3x3x1 2 / 3x3x1 3 / 3x3x1 4 / 3x3x1 Tools 4 min Nonstop 1x3x1 – Impact force – 1–2 Gymnastic – 15 min
Saturday	Warm-up – 15 min Cross – 20 min TTP b. dumbbells – 20 min. Gymnastic – 15 min	End of the mesocycle	
Sunday			

The task of the second week is to achieve a high level of general physical fitness, to improve the speed-strength relationship and overall endurance. The second week is characterized with wavy dynamics of the load (volume and intensity). The means used are exercises with maximum intensity – running, cross-country, weightlifting, boxing. The task of the third week is to increase the level of both general endurance and the technique and tactics of boxing. The third week is characterized with a relatively stable load in the first half of the week (as the level is high) with a wavy increase in interactivity in the second half to a maximum, with a simultaneous (slight) increase in volume. The means of preparation are sports games, cross country, improvement of individual technique, boxing, exercises on equipment.

Subsequently, the structure of the construction of the special preparatory stage in elite boxing depends on the quantity and quality of work performed during the first stage, namely within the specified mesocycle and the time of the first start and its significance.

In the dissertation work we present other original author's models of mesocycles, used in the training of elite Bulgarian boxers.

II.2. Study of the effect on the adaptation reactions of elite Bulgarian boxers after altitude training

Studying the influence of altitude training on the adaptive capabilities of elite athletes is an issue of proven practical and scientific significance. It is no coincidence that athletes from different sports include high-altitude mesocycles with different duration and direction in their training programs.

Experimental studies were conducted with the national junior and youth boxing team of Bulgaria – a specialized mesocycle – September – October with a duration of 22 days at the mountain base “Belmeken”. The subject of the study was 8 elite boxers.

Table 19 presents the average values and variability of the indicators after the descent from Belmeken. Unfortunately, it was not possible to report hemodynamic values before climbing the mountain, which makes the interpretation of the data conditional, but still points to the marked effect of altitude training on the adaptive reactions of elite boxers.

The results of this study suggest, without being categorically justified, that training in hypoxic (altitude) conditions improves to some extent the aerobic capacity of elite boxers. Our results have practical consequences for the coaches of elite boxers. Despite the lack of a comparative analysis of the changes in haematological parameters, altitude training can lead to an increase in results to maximum effort at sea level and, accordingly, to an improvement in sports results. It is seen that the average value of haemoglobin content is 147.87 ± 2.69 g / l and a low coefficient of variation of 2%. The erythrocyte content (RBC) is 4.95 ± 0.16 T / l and again a low coefficient of variation – 3%. **Fig.6.** illustrates the individual dynamics of these indicators.

The results of this study suggest, without being categorically justified, that training in hypoxic (altitude) conditions improves to some extent the aerobic capacity of elite Bulgarian boxers.

The results obtained may have practical consequences for the coaches of boxers. Despite the lack of a comparative analysis of the changes in the haematological parameters, the altitude training can lead to an increase in the results to maximum efforts at sea level.

Table 19. Descriptive statistic of haematological parameters
(after Belmeken)

Para- meters	R	Min	Max	Mean	S	Skew	Kurt	V %
Hb	8,00	143,00	151,00	147,87	2,69	-,757	-0,179	2
RBC	,44	4,78	5,22	4,95	,16	,965	-0,028	3
WBC	3,90	4,80	8,70	6,58	1,43	,580	-0,804	22
HTC	4,10	41,80	45,90	44,24	1,33	-,817	0,39	3
MCV	8,00	86,00	94,00	89,37	2,92	,603	-1,022	3,2
MCH	3,10	28,20	31,30	29,94	1,14	-,735	-0,686	3,8
MCHC	31,00	321,00	352,00	334,25	9,55	,698	0,738	3
PIT	92,00	165,00	257,00	202,12	33,25	,920	-0,525	16
LYM	23,00	23,70	46,70	32,56	7,81	1,086	0,195	24

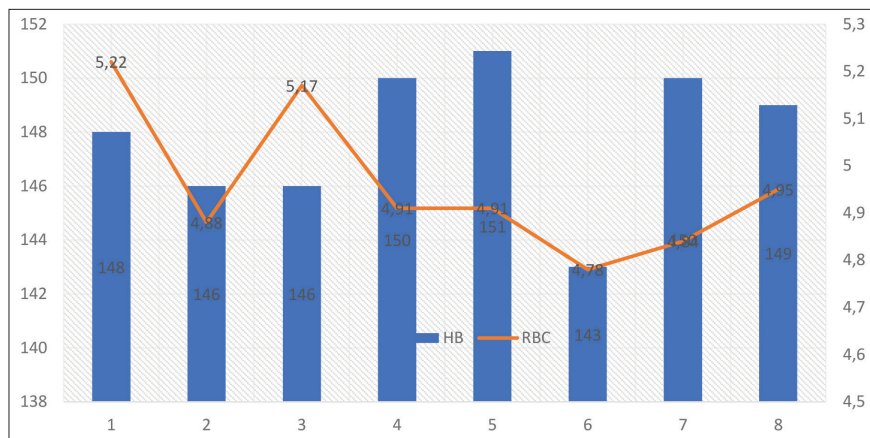


Fig. 6. Individual dynamics of Hb and RBC the boxers studied

IV. CONCLUSIONS AND RECOMMENDATIONS

The analysis of the literature sources, the conducted testing and the interpretation of the obtained results give us grounds to draw the following more important conclusions and recommendations for the sports-pedagogical practice:

1. Derived and logically connected based on theoretical and logical analysis and own research are the main components of sports training in modern BOXING. The problem of rational construction and management of sports training of elite boxers occupies a central place in the theory and methodology of boxing!
2. Conceptual in structure and content models of planning and management of the training process (mesocycles) for elite BOXERS are proposed. They allow, based on the use of the current adaptation potential and the remote training effect, to optimize the general and specific performance of elite boxers.
3. The place has been tested and the importance of altitude training as a powerful factor for causing new adaptation changes in elite boxers has been established.
4. In boxing, altitude training is applied mainly during the preparatory and transitional period with a duration of 3–4 weeks. The altitude training during the preparatory period is aimed at the development of the basic endurance and special strength endurance, the altitude training during the transition period has a restorative and toning orientation and within 2 micro cycles.
5. The individual dynamics of the haematological indicators of elite Bulgarian boxers after altitude camp has been re-

vealed. The results, without being taken for granted, show that training in hypoxic (altitude) conditions improves to some extent the aerobic capacity of elite boxers. Despite the lack of comparative analysis of the changes in haematological parameters, altitude training can lead to an increase in results to maximum effort at sea level.

6. A scientific base has been created to optimize the training of Bulgarian boxers to achieve high sports results in major competitions.

RECOMMENDATIONS

1. We recommend that the Bulgarian boxing Federation apply the developed original mesocycles in the training process in its training of elite athletes – men and young people.
2. We suggest that the inclusion of high-intensity intermittent training be at least three times a week in the pre-competition mesocycle for elite boxers. This will allow the building of tolerance to high values of lactate concentration.
3. The proposed model of altitude training to be introduced as suitable in the training programs of elite Bulgarian boxers. Its content and respective content can be dynamic and flexible and are determined by the focus and the main goals and objectives of the preparation during the respective stages of preparation, observing the logic of the classical periodization structure.

**LIST OF SCIENTIFIC PUBLICATIONS
IN RELATION TO THE TOPIC
OF THE DISSERTATION**

1. **Takov, M.** (2014). Study of influence of specialized altitude mesocycle on adaptation potential with elite boxing athletes. *Proceeding Book of 9th FIEP European Congress + 7th International Scientific Congress "Sport, stress adaptation"*, October, Sofia, 2014, pp. 480-485, Extra issue, 2014, ISSN 2367 – 458X.
2. **Takov, M.** (2021). Models of microcycles in the annual training cycle of elite boxers. 3rd Joint Scientific Conference – Challenges and perspectives for sports science. Problems of modern sport. November 11, 2021. Sofia. (in print).
3. **Dasheva, D., M. Takov** (2021). Study of the effect on the adaptation reactions of elite Bulgarian boxers after altitude training. *3rd Joint Scientific Conference – Challenges and perspectives for sports science. Problems of modern sport.* November 11, 2021. Sofia. (in print).