ASPECTS OF MODERN SPORT PREPARATION RELATED TO TRAINING PLANNING AND PERIODICITY

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The present study is an attempt of pluridisciplinary approach of the difficulties aroused by the achievement of great sport performances. In the last decades the achievement of great sport performances has brought significant material advantages. For these reasons all the people involved in sport activities have looked for concrete means through which to improve the training process. This could be achieved by implementing the results obtained after some researches in different scientific fields. Among these scientific fields that had a real impact not only on the improvement of the training process but also on the value of sport performances we have to mention muscular genetics and neurophysiology of muscular activity.

According to the mentioned above, in the present study we offer a personal approach of the means through which we can use the researches undertaken within these scientific fields in sports training planning.

Introduction. General Aspects

The present study is a multidisciplinary approach to the achievement of high-performance sport topic. In the last decades the attainment of sport high performances has become a source of major material advantages. For this reason all the people involved in the sport activity have looked for specific modalities through which to improve the process of training. This goal could have only been achieved through the implementation of the results of the different researches from different fields of activity. Among the scientific fields with a considerable influence on the development of the training process, but also on the value of the sportive performances, we mention muscle genetics and the neurophysiology of the muscular activity.

There are many factors that have contributed to the progress of the sportive performances, among these we mention:

a. The prestige and the world spread of competitions as: The Olympic Games, World Championships, Grand Prixs, have made that the participation and the achievement of the first positions at these competitions, bring significant material advantages to both the competitors and to the organizers.

b. The high-performance sportive activity has become "an indispensable" preoccupation of the modern society, which led to the development of the sportive phenomenon, in this way setting the basis for the creation and the deepening of a new theoretical discipline, "the science of sport". This new discipline, has founded its theoretical bases through a pluridisciplinary and interdisciplinary approach, which led to the definition of the theoretical-scientific bases of the sportive phenomenon (Bogdan V, 2004, p. 12-13).

The present study brings a new approach regarding the perfectioning of the athletic results, following a different periodicity of the high-performance sportive training, on the basis of the recent researches in muscle genetics, muscle contraction, and the new planning of the training ways in the weekly cycle, emphasizes the following original aspects:

a) The last researches from the human muscle genetics field have advanced a series of hypothesis, which emphasize modifications in the functioning of certain muscle fibers, following certain muscle efforts for the strength development, positioned in a certain succession.
b) The efficient muscle contractions take place only in certain physiological and biochemical conditions. We can't overlook the deep processes of the muscle contraction, as: the sliding filament theory, the theory of the equilibrium and Ca^{2+} ions aport, from the sarcoplasm, which fulfils both the role of a lock (which in the absence of the Ca^{2+} ions impede the muscle contraction) and the key that opens the lock, triggering the muscle contraction. It is not the purpose of the present study to go deep into the neurophysiologic processes and the biochemical mechanisms of the muscle contraction.
c) The physical efforts performed at maximum parameters of dynamic strength (explosive), essentials for the obtaining of high-performance results in the athletic events, may be achieved only in certain conditions and in certain phases from the annual plan of sportive training.

In conformity with these explanations, the programming and the periodicity of the training must consider these new approaches.

The implementation of these new objectives in the training plan is related to the following aspects:

a) What determines the order in which we approach these training means?
b) Which are the muscular parameters favorable to the intensity type required by the training?
c) How do we accomplish the transfer from the raw training (of accumulation, from the training period) to the finishing activity of the physical parameters (from the competitional period)?

Structural aspects of the muscle fibers

The muscle system represents one of the most adaptative structures that form the human body.

The functioning of the muscle system is due, among other factors, also to the type of muscle fibers that forms it. Presently, there are known more classifications of the types of the muscle fibers.

a) Letzelter S., and Eggers R., (2000), advance the following, more complex classification (five types of muscle fibers), but which basically, comprises the same approaches.

- type I: slow twitch muscle fibers from the predominant oxidative metabolism, with slow contraction, resistant to fatigue
- type II: with glicolytic metabolism
- Type II a, fast twitch muscle fibers, medium sized, relatively resistant to fatigue.
- Type II b, fast twitch muscle fibers, big sized, relatively less resistant to fatigue.

- type II c, type of fibers able to transform themselves, intermediate between type I and type II, fast twitch muscle fibers, both with glicoltytic and also with oxidative capacity.

b) Sztipics L. (2001)[1] advances the following classification:

- type I, or slow twitch muscle fibers
- type II, with its variants II a and II x, also named fast twitch muscle fibers

The contraction speed of the fast twitch muscle fibers can sometimes reach values 10 times higher than the contraction speed of the slow twitch muscle fibers. The contraction speed of the type IIa muscle fibers is placed somewhere between the value of the contraction speed of the type I (slow) muscle fibers and that of the type IIx (fast) muscle fibres, that is why these fibers (II a) are also named *intermediate muscle fibers* (hybrid).

Following some experiments and studies that lasted more decades, the Swedish researchers have advanced a series of hypothesis aimed at reorienting some training concepts. The researches were undertaken in two directions:

- What are the training means and stimuli that cause the muscular hypertrophy?
- How can the functions of some muscle fibers be temporarily modified (after what training means)?

The muscular hypertrophy (the increase in diameter of the muscle fiber) is produced after some complex biochemical reactions, following the mechanic stress the muscles are subject to after they training, being also conditioned by the genetic input of each individual.

After some intensive trainings of **maximum strength** in healthy and active individuals, the number of the fast twitch muscle fibers (II x) increases. A significative number of these muscle fibers (fast twitch fibers) temporarily alter their properties (as long as they are subject to a certain type of effort) transforming themselves into type II a muscle fibers; their speed contraction will place somewhere between the contraction speed of the type II x muscle fibers (fast muscle fibers) and the one of the type I muscle fibers (slow muscle fibers).

If these intensive trainings of maximum strength continue with the same intensity, after approximately one month, the total number of type II x (fast) muscle fibers will alter (will modify their properties) transforming themselves in type II a muscle fibers.

The reduction of the training sessions or the elimination of the maximum strength exercises cause the reduction of the muscular hypertrophy, followed by the return of the type II x (fast) muscle fibers to the initial number, and moreover, its number doubles for the immediate period of approximate two months. This duplication is due to the modifications produced over the hybrid muscle fibers, which for that period act like fast muscle fibers.

These modifications should theoretically be followed by a significant increase of the performances (Sztipics L. 2001, p. 19).

Following some supervised trainings, the modifications emerged between the two types of muscular fibers II x and II a (in which one can temporarily overtake the properties of other

[1] The authos quotes from Jesper L. Andersen – Peter Schjerling - Bengt Saltin: Muscle, genes and athletic performance, Scientific American, 2000, september.

and vice versa) are a natural consequence of the scientific alternation of the trainings periods followed by their correspondent pauses.

Planification, phasing of the sportive training (weekly cycle)

The aspect of planification represents one of the most controversial chapters in the sportive training theory and methodics. (Alexe, 1992, p. 424).

The need of "predictability" of the used means and of "maximization" of its effects becomes essential in the framing of the training program. This need has imperatively required the implementation of the novelty registered in the scientific research activity of the fields mentioned above (genetics and muscular contraction), finding its resonance in the improvement of the sportive performances.

Phasing of the preparation:

The phases of the annual sportive training are the following:

Egger J.P..(2003), has advanced a suggestive denomination of the same phasing of the annual sportive training, based on the intensity of the effort, appropriate to each phase:

1. The **extensive** training phase
2. The **intensive** training phase
3. The **explosive** training phase

Objectives and contents of the training phases

1. **The extensive training phase**

General objective of this phase: improvement of the biophysical capacity.

Duration: 10-12 weeks

Specific objectives of this phase:

- Development of the maximal strength
- Development of the general resistance
- Increase of the effort capacity

Content:

- Ample strength exercises, with a large number of repetitions
- Repeated runnings in increased volume
- Pretecnical exercises realized with variable intensities, with great amplitude, in difficult conditions.

Observations:

In this phase one should neither execute explosive dynamic exercises, nor maximum intensity exercises.

Due to the fact that it represents the constitution phase of the basics of the complex physical training, in which we can encounter many physical means, the parameter of effort usually aimed at being the volume, with moderate intensity, weights are being used, starting with

the medium ones until the maximum ones. This phase has very well been named “the extensive phase".

Making the connection with the aspects of the muscle genetics presented above, we highlight the fact that in this phase the physical factor prevails and not the technical one. The means used in this phase are the following:

- Physical exercises with the purpose of muscle hypertrophy; trainings for the development of strength with weights, with an increasing number of repetitions, with medium, large and extra large loads.
- Repeated runnings, predominate aerobic and mixt efforts, repeated runnings on 100-500 meter distances, performed in 50-70% tempo of the maximum capacity, 20-40 minutes runnings with a 5-6 minutes / 1000m tempo
- Special exercises (from the running school) on variable distance; among these exercises we mention the following: high knee running, butt kicks running, performed with or without weights (sand bags, weight belts)
- Special exercises (from the jumping school) performed on variable distances. for exemple: successive jumpings performed on one leg or the other, with sand bags or weights.
- Pretechnical exercises related to the event; for exemple the analytical execution of a sequence of the technical event.

In this phase there is a quantitative accumulation on an amplitude and endurance basis. The training means are performed at big amplitude, with strength, in a large number of repetitions with the purpose of improving both the general endurance and the event specific endurance.
Because of the implementation, in the annual training program of the athletes from my personal training group, of the training principles proposed by the Swedish and Danish researchers, we have elaborated the following training program, taking in account the following aspects:

1. There will be many strength exercises performed with heavy weights.
2. We will select those exercises which elicit the most intense muscle contraction, with a direct effect on the muscle hypertrophy (increase of the muscle fiber diameter).
3. We will avoid the dynamic-explosives exercises which employ rapid executions, because the purpose of this training phase is not to increase the muscle mass (in a transversal diameter).
4. Taking in account the conclusions from the above mentioned experiments, it is obvious that the fast twitch muscle fibers (both fast twitch fibers genetically determined and the intermediate ones, which in this case tend to a slow manifestation) decreases in this period.

2. **The intermediate Pre-Competition Phase (intensive)**

General Phase objective: the increasing and improvement of the neuromuscular excitability
Duration: 4-6 weeks
Specific objectives of this phase:

- Passing from maximal strength to explosive strength.
- The improvement of the speed parameters.

- The improvement of the event specific endurance.
- The implementation of the pretechnique and technique exercises performed in similar conditions to the competitional ones.

Content:

- The obtaining of an explosive strength required both for the speed running and jumping, is produced in specific conditions.
- We move from wide strength exercises to the dynamic, explosives one.
- Training sessions with weights, with small weights, performed on the clock.
- We initiate specific training sessions for speed, explosive strength and multi-jumps.
- Drag exercises, ladder step running, acclivous running.
- Coordination exercises with changing rhythm.

Observations:

In the circle of the athletics specialists there is a paradigm: “without the priority development of the maximal strength, there will not appear the premises for the obtainment of the manifestations of explosive strength".

So, thereby, in this phase we will use explosive strength exercises, training sessions for the improvement of speed over the course of 2 to 3 weeks.

Through this approach we follow the implementation of the recommended conclusions of the experiments presented in the above study.

The "intensive" phase represents the most delicate period from the sportive training schedule. This is due to the passing from one type of activity, in which predominated the maximal strength exercises (performed in a high volume and amplitude), the exercises for the development of the general endurance – generally, the entire activity was directed on the exercises performed in strength and endurance – to another type of activity, characterized by the manifestation of the dynamic - explosive strength, performed in speed, at a big intensity, similar to the ones encountered in the competition.

Because the intensive phase has as prioritary objectives the increasing of the neuromuscular excitability and psycho-volitional, to execute the exercises at maximal speed parameters and in a framework as similar to the technique of the event, it represents the key to competition training.

This phase encompases preparatory exercises, pretechnique and technique exercises performed at speed and amplitude parameters as similar as possible to the competition ones.

The training process will be a gradual one, integrating the principal ways of physical training.

This phase is characterized by matching the physical training with the technical training, so that the execution of the technical exercices be as similar to the model requested in the competition.

Both the physical factor as well as the technical factor predominate in the training of an athlete, so, the approach to the training sessions will have the following priorities:

1. The exercises should have the following goals:

    - The syncronised activity of a large number of motor units
    - The improvement of the neuromuscular excitability and coordination
2. These requests may be accomplished through the following means:
    - The technical and the pretechnical exercises should be performed in special conditions in which the increasing of the intensity should be gradual, so that the passing from the reduced intensity training (specific to the extensive phase), to the increased intensity training be as harmonious as possible.
3. **The specific competitional phase (explosive)**

General phase objective: the maximal expression of the biometric and psychological parameters.

Duration: 4-6 weeks

Specific phase objectives:

- The perfecting of the technique act
- The achievement of the maximal speed and explosive strength parameters
- The perfecting of the specific event endurance

Content:

Specific trainings:

- Repeated runnings with the speedy device, with different weights.
- Draging, on the clock, on 30-50 meters distances.
- Speed runnings.
- 30 minutes repetitions with 30 seconds break, 8-10 times, with maximal intensities.
- Plyometric jumps.
- Control trainings in competition similar conditions.

Observations:

Because we wish to be in resonance with the above mentioned study, we consider that the 4-6 weeks training period should have the following characteristics:

- The strength trainings with high and very high weights will be eliminated.
- On a montly basis the equilibrium of the calcium and magnesium will be checked.
- It is the trainer's expertise that differentiates between failure and success.

This phase is characterized by a few essential aspects which should be in the traniner's attention. These aspects concern the specificity of team work, but also the main objective, that is the obtaining of the sportive shape at a preestablished date, before the competition.

The sportive shape is defined as a "high intensity physiological state, obtained following certain programmed trainings, in appropriate environment conditions, in which the parameters of manifestation of the individual capacities, biological, motrical, and psychological, are at a superior level for an undetermined period" (Bogdan, 2005).

Because “the explosive phase”, by it’s structure and content, serves exclusively for the inducement of the sportive shape, the approaches may be variate, but also individualized.

The characteristics of this phase:

- the elasticity accumulation in the tendons by speed and explosive strenght exercises, completed at maximum parameters (pliometry) (Tihany, 2006)
- The manifaestation of speed and explosive strenght to maximum parameters.
- The practice in competition conditions of the previous addins.

Alternating the physical effort and rest has the following purpose:

- The distribution of the effort on multiple training sessions, but ensuring rest periods for the inducement of overcompensation.

- The “*overcompensation”* may be considered as an inductor of the functional increasing of the physical capacity, following the body’s adaptation to the training stimuli (with an ascendant evolution) and ensuring an *optimal time* for the accelerated recovery of the enzymatic and bioenergetic reserves of the neuromuscular system (Bompa, 2002).

Conclusions

1. Researches based on aspects related to: muscle genetics, muscle contractions as well as different approaches of the training planification must be considered. Besides, these approaches are the ones that ensure in one way or another, the progresss in every domain.
2. In the period of intense strenght trainings (the preparation period), the number of fast twich muscle fibres decreases, and consequently it is recommandable avoiding in this period the dynamic exercises as well as the efforts that require such manifestations.
3. After a 4-5 week period, by eliminating the maximum strenght trainings with more large pauses between the efforts, the number of fast twich fibres doubles for an approximative 4-6 week period.
4. A different approach of the training lessons based on speed improvement or on exercises that request the manifestation of the dynamic (explosive) strength is imposed. The approach of these training lessons, following some periods of prolongued rest, or after difficult trainings (in the case of completing two trainings a day), will not give the desided randament, and the possibility of injuries increases..
5. In the periods of extensive training, the use of dynamic, explosive strength exercises proves to be useless. To the same extent, the maximum strength exercises prove their inutility in the competitional phase.
6. It becomes absolutely essential the monthly control of the blood chart in the period preciding the competition and during the competition.
7. In case sprint runners wish to increase the percent of fast twich muscle fibres (of II x type) in their muscle structure, it is recommendable that their trainings follow the above strategy:
   - in the first part they must complete complex physical exercises (maximum strenght) in order to produce the transformation of these II x fast twich muscle fibres type into II a muscle fibres type.

- After reducing the number of the trainings, excluding the strength trainings for the developing the maximum strength, they must wait until these muscle fibres (hypertrophied) return to their initial state, doubling their number.

8. These approaches are variable, depending of each individual, on the undertaken activity, and last but not least, on the ability of the trainer-athlete couple to engage in such an attempt.

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