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# The evolution and development of classic theory and method of athletics training

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## ABSTRACT

Athletics is a sport of highly ornamental and is one of the world's most popular sport with long history. After thousands of years of development, people gradually summed up classic training theories and methods such as Fartlek training, interval training, strength response training and "plate" cycle training model in the long-term track and field training practice. These theories and methods not only help athletes pushing the limits again and again in order to promote athletic development, and for many of them has developed into an important role of general training methods and theories for many sports.

## KEYWORDS

Athletics; Training theory; Training method; Evolution; Development.



## INTRODUCTION

Currently, the historic athletics still plays very important role in sports, Even there is a saying : if you win in athletics you win the world, the level of athletics can measure the level of sports development of country. With the aid of new modern training equipment and the increasing requirements of sports training, theories and methods in the world has gone through rapid evolution and development, and constantly being updated, reform, refinement, more and more scientific and comprehensive. In-depth understanding of the formation and development of Athletic Training classical theory and methods helps construction of training theory of Athletic Training and even other sports, the overall development of sports undertakings plays a facilitating role.

Ancient Greece held the first session of the ancient Olympic Games in 776 BC,and since then, athletics became one of the official event. At this point, track and field training is in pristine condition, the athletes trained themselves by their own understanding towards it, the effect is not obvious. until the early 20th century to the mid-50's, athletics has become popular, people began to study how to train, Sweden's Fartlek training and interval training in Germany[1] marked Athletic Training theory has entered a new stage.

After the 1950s, these two methods became widely used, people accumulated scientific theories about the training load and athletic ability by constant experiments. After repeatedly applied Fartlek training methods, Bowman, the track and field sports coach of University of Oregon, sharply found that the body's recovery is equally important, it is one of the important factors affecting the quality of training. Then he put forward "Bauman training system" which took "big load - light load alternate training method" as the core content, pointing out that resilience is essential to grasp the correspondence between training and recovery. Under the guidance of this theory system, Bowman trained middle-distance team and leaded them broke the national record 22 times and broke the world record 13 times. Currently, there are still a lot of coaches train athletes by this theory.

In the late 20th century, a landmark change occurred to Athletic Training theory. American academics and sports training coach James cornhillman took Bowman training systems theory as basis, not only focused on adaptability and resilience of athletes, but also on long-term arrangements for the training load and short-term competitive state regulation, he made more comprehensive short term training for different athletes by their different physiological property[2]. From which he proposed a "3 + 1" week training load mode. Although the initial theory is aimed at swimming training, but this concept effected significantly to track and field training. Get information about the heart rate,ECG and hemoglobin of athletes regularly by medical and other related equipment to made out responding load training plan. Practice has proved that the training method is practical,scientific and the effect of it is obvious. a large number of athletes worldwide benefit from this world-renowned theory.

At 1964, on the basis of a large number of studies to athletes from former Soviet Union, Matt Janvier proposed cycle training theory to long-term training for athletes[3]. The theory broke the chaos and disorder in athletic training situation, made long-term training become orderly, rational and goal-oriented, showing the athletic ability law of form - Hold - subsided, over-training and no training is neither advisable, to ensure the stability and periodic training of athletes, to made athletes perform best in time and location-fixed games. There are 2 training principles: the ratio of load to strength and the arrangements of body training and special training is different at different training period, which canplay a role as leverage in sports training.

In 1970s, many coaches and academics focused in the priority to the development strength,drive and affect the speed and endurance from it. Former Soviet Union Verchoshanski discovered the physical laws of human muscle: in most sports, it did centrifugal stretching firstly and then did concentric contraction. After Cavagna et al made in-depth training study, they proposed a "stretch - shortening - cycle" reaction force issues, the famous former Soviet sprinter Valery Kuznetsov Bauer obtained 100m and 200m gold medal at the 1972 Munich Olympics by applying this method of training, former Soviet Union Banda Cukor's famous track coach and track coach Bang Pa Romanian applied new forces long-term training to the hammer throw and javelin training exercise from which the famous staging training model came into force.

The development theme of the 20th century led to the advancement of various science and high-technology. Athletic Training theories and methods is also deeply influenced by it. Strong theoretical foundation like Austria Kayseri stress adaptation theory in the 1950s,the former Soviet Yakovlev's excess recovery Doctrine in 1970s and fatigue - adapt hyperbolic model by Bannister Canada in the1980s proven the process of the formation,development and maintenance of athletic ability of athletes. Meanwhile, the rapid development of the sport of biological disciplines also contributed to the development of track and field training, in 1967 the Swiss exercise physiologist conducted studies to measure training load and effects by maximal oxygen uptake of distance runners. The American scholar Wasa Man and German scholar Ma Daer has proposed a new concept of anaerobic threshold as a training indicators, promoting the scientific control of Athletic Training. Later, blood lactate, creatine kinase, such as testosterone and serum biochemical markers have also been introduced in which promote the scientific training and quantitative control of athletics further.

In short, it is very important to current exercise training to scientifically and objectively view at a variety of training theory and methods, particular the classical theory and methods, distinguish advantages and disadvantages of various training theories and methods, explore and seek its new features, specify its trends, adhere to combination of theory and practice, while keep innovative and try to be flexible in the use of modern science and technology and biotechnology,only this way the potential of athletes can be fully brought out.

## ATHLETICS CLASSICAL TRAINING METHODS INTRODUCTION

### Fartlek training method

The first one who applied fartlek training method athletes was a Swedish middle distance runner Gunder· Haig. He was in military service in northern Sweden, due to the limited resident conditions, he conducted training in near trails of hills and forest. Hagrid took full advantage of the hilly terrain, made cross-country running every day over 5000m, firstly the main training is easy and low-intensity running while there are mostly fast sprint at last stage, constituting the core of cross-country running. Later, the Swedish national team coach Hummel review and summarize this theory, named it as fartlek training method. Hager fartlek broke the world record 15 times in various middle and long distance running athletics by fartlek training. Due to the great success of Hagrid, fartlek training rapidly became popular among the worldwide athletes of middle long running. The method has been taken as important means as middle and long distance track and field training programs till today, and also been favored by other sports training ask for greater endurance.

The fartlek training, as the early 20th century's most prominent and innovative track and field training methods, the fartlek training method compared with other training wears is shown as TABLE 1, and has the following characteristics:

(1) Increasing the training load. Average weekly amount of training run Hagrid reached 50km, equivalent to the early 20th century a third of the amount of training. A large number of medium and low intensity-based training to effectively improve the athlete's aerobic capacity.

(2) It is still a small amount of attention to high-intensity training. In fartlek style around the 10km cross-country run, Hager has always insisted on the last load of approximately 800 meters sprint strengthened, so that both athletes improved anaerobic lactate metabolism in vivo, but also helps to develop aerobic and anaerobic the varied pace capacity.

(3) Effectively reduce the risk of injuries. Site training to the effect of training places by. fartlek choose foothills conduct training, athletes are generally on the soft grass training athletes fall, when grass and land can cushion the impact force during a fall, reducing the chance of injury.

**TABLE 1 : Fartlek training method compared with other training wears**

| | before the experiment | | | after the experiment | | |
|---|---|---|---|---|---|---|
| | **A group** | **B group** | **C group** | **A group** | **B group** | **C group** |
| 50m （s） | 7.23 ± 0.21 | 7.21 ± 0.18 | 7.25± 0.19 | 7.03 ± 0.25* | 6.97 ± 0.19* | 6.82 ± 0.15** |
| 15000m （s） | 357 ± 3.5 | 252 ± 4.5 | 351 ± 5.1 | 339± 5.2* | 333± 4.8* | 326± 6.3* |
| 5000m （s） | 1056 ± 15 | 1062± 19 | 1053 ± 23 | 1021± 21* | 1003± 24* | 968± 31* |
| Standing leap （cm） | 237± 3.2 | 235± 2.7 | 237 ± 2.4 | 240± 4.6* | 243± 3.5* | 247± 5.3* |
| | **before the experiment** | | | **after the experiment** | | |
| | **A group** | **B group** | **C group** | **A group** | **B group** | **C group** |
| Height(cm) | 169.08± 3.23 | 168.65± 2.28 | 169.27± 3.02 | 170.11± 4.26 | 169.97± 3.86 | 170.33± 3.47 |
| weight(cm) | 67.83± 7.25 | 67.44± 6.76 | 67.94± 7.22 | 65.22± 4.42 | 65.13± 3.78 | 65.35± 4.35* |
| BMI | 24.33± 0.46 | 24.14± 0.39 | 24.52± 0.33 | 23.21± 0.24 | 23.18± 0.27 | 23.16± 0.24* |
| resting heart rate | 75.6± 2.02 | 75.4± 2.13 | 75.5± 2.15 | 71.23± 2.14* | 72.33± 2.07* | 69.47± 2.66* |
| Vital capacity(ml) | 4213± 224 | 4219± 207 | 4237± 264 | 43138± 341 | 4428± 332 | 4475± 357* |

**Note:##: P<0.01; Note:## :P<0.05,** before and after the experiment P<0.01**

TABLE 1 compares fartlek training method with other training methods, A group stands for mean speed continuous training method, group B stands for variable speed continuous training method, group C stands for fartlek training method. Nowadays, with the deeper understanding for the biological basis of endurance training, it is recognized that sustained low-intensity running can improve aerobic capacity, while the hilly terrain and varied play a unique effect, which trained athletes joints, ligaments and small muscle function. TABLE 1 Experimental data demonstrate that the effect of exercise training method fartlek in three kinds of endurance training method is best. So, fartlek not always play as an important role in the middle and long distance track and field training, but also has been further strengthened and developed, and become one of the important means to improve the athletes endurance in many projects particularly in ball games.

### Interval training

Interval training came from Germany professor of sports Wilder Maharaji. Giesler from the University of Freiburg,. He trained his members Rudolf Habige by his own control interval training method, created a world record of 46s at 400m and 1min46.6s at 800m within a year. Initially Professor Giesler adopted Paphos · Numi's training methods from Finnish and fartlek training from Hagrid, but due to his strength at study, he realized there are some shortcomings and deficiencies, if the load and strength training is much smaller than the body tolerance limits, the full potential of athletes can not be brought out, and due to the training ground is natural environment, the amount of exercise can not be accurately calculated. So he learned

the essence of Finns Numi training and fartlek variable motion and other aspects of training, and design standards for the training ground track and field, on the one hand to further improve the training intensity, on the other hand to precisely control the amount of running and intermittent times. To stimulus cardiovascular system of athletes trough training and thus improve the athletes' physical fitness and improve the quality of training.

In the 1935-1940 years, distinguished professor of cardiovascular Giesler join German expert Hal Bot · Laiendaier to study interval training, so it is called a Laiyindeer Giesler law. They set 5 basic factors of running distance, intermittent recovery, repeated running times, running time and status during recovery[4]. Shown in Figure 1, for interval training and continued running heart rate graphs, three groups were respectively 40min continued running, interval running 15/15 training group and 15s quick run +15s relaxation run jog, repeated 71.6 cycles; intermittent 30/15 training group ran a fast run for 30s +15s relaxation run, repeated 51 cycles. Training conducted every 2 days, during the rest,subjects took no special middle-distance-related exercises[5]. Control standards of this method is to run after a set interval heart rate of 170-180 beats / minute, 90 seconds after the interval to the heart rate of 100-125 beats / min and then proceed to the next set of training, this will help strengthen the heart pump function. Heart rate within the set time of 90 seconds of recovery can accurately reflect whether the training load and strength are appropriate.

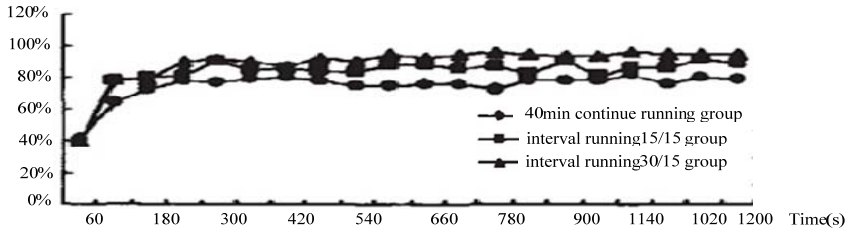


**Figure 1 : Graph of heart rate of continued running and interval training**

The core of interval training is exerting repeated stimulus to athletes in the state is recovery, the purpose is to effectively enhance heart function, improve cardiovascular system and exercise endurance athletes. Currently, interval training methods includes short distance (time) high-intensity interval training, middle distance(time) high-intensity interval training and long distance (time)middle or low-intensity interval training, etc.

Advantages like mechanism clear and quick effect makes interval training very popular in endurance training by a lot of coaches, but there are some problems. Firstly, many coaches step easily into errors of taking intermittent training as equivalent to high-intensity training, excessive increase in load might cause injury to athletes, is not conducive to the healthy development of the athletes. Secondly, when apply the training methods, didn't adhere to scientific guidance, especially not treat differently towards individual differences and special needs, resulting in unreasonable volume and intensity of training, training and intermittent time. In fact, the intensity intermittent training is not static, scientific and feasible adjustments should be made in accordance with the actual situation of the athletes themselves, from weak to strong, to ensure that the strength is within the athlete's tolerance range. Only the correct use of intermittent training method can achieve the purpose of enhancing the professional competence of athletes.

**Plate cycle training mode**

Plate cycle training originated in the 1980s. Verchoshanski, who coaches in jumping events of track and field in former Soviet Union for many years, found a long-term training delayed effect phenomenon in a study of changes in the long-term strength training athletes experiment that athletes train and then resume after interruptions gained power level significantly higher than athletes with no interruption of training. Thereafter coaches led by Verchoshanski started the research training mode which after that been called plate training mode, and he wrote a paper put forward plate training cycle theory in 1988[6]. Developed so far, plate cycle training model is not only been used to train track and field events, but also become a classical theory with universal guiding significance been favored by other speed - power projects. The traditional training cycle mode compares the plate training mode is shown as TABLE 2.

**TABLE 2 : The traditional training cycle mode compares the plate training mode**

| Training preparation Features | Traditional cycle mode | Plate training mode |
|---|---|---|
| The main features of the training load | The comprehensive utilization of different training effects | Focus 1-2 quality development |
| The guiding ideology of the training phase | The ability of parallel development | Stage key development |
| Training program organization | Preparation - the game over | A variety of composite plate |
| Match | To participate in the competition period | Participate in each plate after training |

"Plate" cycle training theory is an innovation of periodic training theory, at the premise of maintaining or even reducing overall training load, taking the mechanisms of different capacity is not compatible into account, the use of stimulus - fatigue - to adapt capability development mechanism, targeted highly focused training an ability. As shown in TABLE 2, compared with the "plate" training mode for traditional training cycle mode. Compared to traditional training cycle management, which has the following characteristics:

(1) proposed the principle of "highly concentrated training load", ie, to select only 1-2 focus on the quality of the training sector, without increasing or reducing the amount of training load situation, to further stimulate the athletes body, improve the effectiveness of the training.

(2) the ability to put forward a different training principles "followed by a sequence of development" that combines biological theory and knowledge, the ability to take full account of conflict and conflict between the phenomenon to develop training programs, followed by the development of various capabilities to enable training to maximize efficiency.

(3) the introduction of a "long-term training delayed effect" of the new concept, and analyzes the causes of the duration of the training and the delayed effects of the delayed effects of different abilities.

TABLE 3 shows examples of different compatible quality and ability exercises in training unit. "Plate" cycle training is a new theory, under widespread concerns by coaches and athletes, someone agreed, someone deny and also some feel unconcern about it, there are different views and opinions towards it, so "plate" cycle training mode still requires further study demonstration. Not to mention it is universal, it can only be applied to high level athletes and projects with high requirements for speed, strength and endurance, not to all athletes and all projects.

**TABLE 3 : Examples of different compatible quality and ability exercises in training unit**

| Special quality with priority to development | Other compatible quality training |
|---|---|
| Aerobic endurance | No lactic acid ability (such as Sprint)<br>After the strength endurance – aerobic<br>The maximum strength (development of muscle cross-sectional area) |
| Anaerobic endurance (glycolysis) | Strength endurance anaerobic<br>Aerobic recovery exercise<br>Aerobic, anaerobic endurance<br>Aerobic endurance |
| No lactic acid ability (such as Sprint) | The explosive force<br>After the maximum strength (development of muscle cross-sectional area)<br>Aerobic recovery exercise |
| The maximum strength (development of muscle cross-sectional area) | The maximum strength - (ruling ability of neural improve)<br>Flexibility<br>Aerobic recovery exercise |
| Learning new technology | After learning the new technology, can develop all quality |

**Reaction strength training**

In 1960s, some muscle physiologist began to notice in the key aspects of stomping off when running and taking off during jumping, the muscle starts with Centrifugal spin and then concentric contraction with a huge burst of energy, known as reactive power. This concept is brought by the former Soviet Union Hoven Hill Chomsky in 1972 in his own invention "impact" on the basis of strength training and summarize the results of the proposed series of studies, and made clear that muscle contraction is a reaction with isometric contraction, centrifugal contraction and the contraction of the heart at the same level and is relatively independent of contraction mode. Komi Finland, Germany Meister et al, strength training for athletes response follow-up study, found that the reaction force is mainly to raise capacity by improving the nerve and muscle to improve coordination between the different obtained. The "jump deep" training which has been used till today is actually a "shock force" training, it affects positively to the performance of athletes[3],thanks to it, the former Soviet Union Bauer Zoff got 100m and 200m gold medal in the 1972 Munich Olympics different sports level of athletes should be take into consider to reaction force quality training, the following matters should be pay attention to:

(1) Muscle Stretching - Shortening is a coherent process of interlocking, should be the overall training, if separate training, in violation of the physical laws of the formation of the force, effectively improve the athlete's super long power would be impossible. Shown in Figure 2, will cause the alert to the new stimulus response of the body, but the body of the tolerance-stimulated or suitability of a certain duration of time only, therefore, respond to the nature and construction of the load to make timely adjustments during training, followed progressive principles, experience increased - to adapt - and then increase - and then the process of adaptation. While also presenting periodic load measure wave changes, the load and the body to stimulate recovery in the best mix of state[7].

(2) Training rapid reaction force should be finished fluently in one time. For example, "jump deep" exercise, should maintain rapid coherent, but points to pursue "high." Because when you jump too deep will make landing weight increases and Jumping prolonged period of time, can not guarantee smooth process and is easy to get injured.

Although reactive power derived from track and field training, but determines the performance of the pros and cons in many sports projects, so training reaction force is critical. At present, our reaction forces in training the problems worthy of our attention, first, there is no division in the understanding of independence reactive power, the second is the lack of effective training methods and techniques, the three are not treated differently in adult and adolescent athletes reaction force training. These problems not only hinder the development of reactive power but also seriously affect the improvement of special achievements. Therefore, the relevant sports workers should be in-depth analysis of the intrinsic physiological mechanism of the reaction force, seriously developed reactive power training methods and techniques, so only in this way reaction force of our athletes can be promoted quickly.

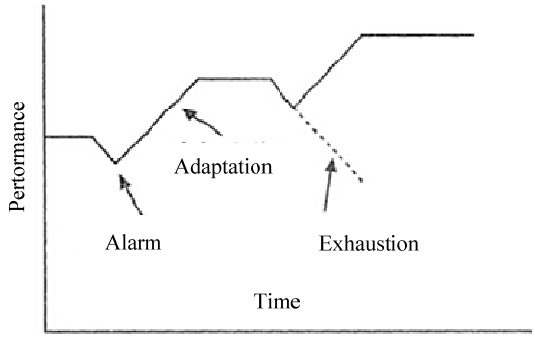


**Figure 2 : Biological basis of phases of strength training theory, Selye universality adapt symptoms schematic**

## CONCLUSION

The development of athletics requires support scientific theories and effective teaching methods. Since the early 1900s, a lot of classical theory results containing many experience and laws of training practice has appeared one by one, played as a significant revolutionary role to track and field training theory, not only exert a strong impetus to the track and field training at that time, and also gave important guiding significance to current sports projects. However, while some classical training theories are influenced by the development of times and being controversial, the theory and method of continuous training requires identify and classification, elimination and remodeling, constantly innovation and improvement therefore to promote the smooth development of athletics training process, which will bring about a new era of technology of our sports development.

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