THE DYNAMICS OF THE TRAINING LOAD

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The authors present a multi-year study into various training load increases and the corresponding performance improvements. An analysis of the data leads to three major variations of planning training load increases in a four-year Olympic cycle. The article is a translated extract from a study text of the former Leipzig Sports Institute, German Democratic Republic. Re-printed with permission from Modern Athlete and Coach.

There is no doubt that the rate of improvement of performances begins to diminish as the training age of an athlete increases. However, the individual dynamics of the performance development shows distinct variations with noticeable positive and negative deviations from the calculated average values. It is not a rarity to find that the performances of an athlete stabilize, or even drop, after 8 to 10 years of training, in spite of increased loads. This phenomenon is often interpreted as an indication that all possibilities for improvement have been exhausted. A close analysis, on the other hand, indicates that a second wave of improvement is in some cases possible.

DATA ANALYSIS

Our analysis of data showed that the parameter of the load volume of the main training means and the performance changed in the same direction during the initial phases of multi-year training. This made it possible to establish their quantitative relationship for the planning of training.

Table 1 presents generalized data of the main training volumes and the competitive performances of three groups of athletes (n = 40) during their first four to five years of specific training.

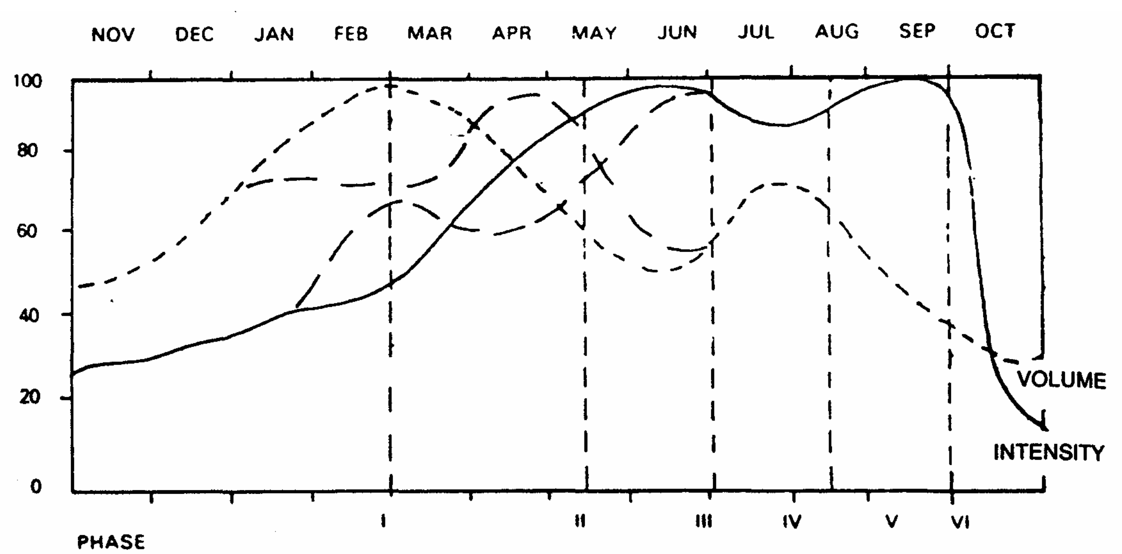
An analysis of the information leads to the conclusion that the improvement of the performance depends in the initial years of training largely on the total training volume. However, it also is obvious that an increase of the total load volume does not always lead to changes in the performance. It appears that the stimulus of the load volume begins to diminish year after year.

There is a tendency that the load volume has to be increased in the single phases of a multi-year training plan in order to secure an improvement of the performance. This forces, not only to employ a larger training volume, but also to a search for a more effective method. An unlimited increase of the training volume is simply not possible.

Training Year	Training Load: Yearly Volume	Training Load: Increaess(%)	Performance Increases (%)	Index Load — Performance Relationship
	Variation a			
2	236			
3	302	28	10	30.2
4	299	-1	9	33.3
	Variation b			
2	130			
3	416	220	9	46.2
4	452	9	8	56.5
2	380			
3	570	50	10	57.0
4	1015	78	8	126.9

TABLE 1: Comparative data on training volumes and the performance of three groups of athletes (swimmers)

The unproportional relationship between the training volume and the performance is further shown in the fact that the largest increases of the volume were in most cases not accompanied by corresponding performance improvements. In the majority of cases the best improvement rates were achieved by "average" increases of the training volume. Some of the differences can be explained by individual characteristics but, as a rule, the most effective results are achieved in the initial years of specialized training with a variation that is in between of the maximal and minimal volume parameters.



THE BASIC MODEL
The recommended basic model of the volume and the intensity of loading in macrocycles

VARIATIONS

The load volume continues to increase after the first phase of specialized training at a reduced rate and not always linearly. There are three variations in our data analysis.

Training Year	Total Volume	Volume of Int.Loads	Performance
2	14	-	1
3	24	17	2
4	15	27	1
5	15	12	1

VARIATION I: Percentage increases of the total volume, volume of more intensive loads and the performance

Variation I is recognizable from a steadily increased total volume with a virtually corresponding dynamics of increased loads and intensities (the volume of more intensive loads).

It has been observed that this variation leads during a four to five year period to relatively stabilized performance improvements, as well as even a performance drop at the end of the period when the maximum has been reached.

The differences in the performance dynamics cannot be explained by age or training age variations, because all subjects in our study were of the same age and virtually of the same training age.

Apparently the main reason for the different influence of this format of increased loading on the performance depends on individual adaptation capacities of the athletes.

Training Year	Total Volume	Volume of Int.Loads	Performance
2	21	9	1
3	15	25	2
4	14	7	-0.5
5	-29	-36	1

VARIATION II: Percentage increases of the total volume, volume of more intensive loads and the performance

Variation II differs from the first variation in the reduction of the year's training volume at the end of the observed period. A drop in the rate of performance improvement can in this variation be seen during the largest increases of the training load.

This applies mainly to younger athletes with a relatively short training age (25 yrs, training age of 6 yrs) and less to 27 to 28 year old athletes with a training age of 8 to 9 years. It indicates that the dynamics of the second variation are better suited to athletes whose organism has adapted itself over many years to large work volumes.

Training Year	Total Volume	Volume of Int.Loads	Performance
2	-15	-	-2
3	4	20	1
4	-17	-11	1
5	31	30	3

VARIATION III: Percentage increases of the total volume, volume of more intensive loads and the performance

Variation III represents a wave-like pattern of the total and the part load volumes with a tendency of a considerable improvement of the performance at the end of the observed period. It can be observed that the performance improvement coincides with the "wave" of an increased training load, while improved performances in the second variation occurred mainly when the training load was reduced.

The above indicates that the last variation provided better conditions for the adaptation to training loads and therefore a more favorable transformation to improved performances.

THE OLYMPIC CYCLE

The world's best athletes, looking for successes in the most important competition, the Olympic Games, are faced with the problem of finding a rationally structured training plan for a four-year cycle. Taking into consideration the above outlined material, we attempt to solve this problem by suggesting the following approach:

- Years 1 and 2: The phase of the fundamental development, concentrating, above all, on the establishment, enlargement and settlement of the prerequisites for the planned Olympic performance.

- Year 3: The phase during which the model of the superstructure and competition system for the following Olympic year is virtually established.

- Year 4: The phase for the realization of the developed capacities for a maximal performance.

It must be understood that this plan can be changed according to the training age and individual capacities of the athlete, as well as taking into consideration the demands of the event involved. In general, the plan is suitable for the younger members of the Olympic squad.

Athletes who have already once performed an Olympic cycle, have to use the first year in the first phase for recovery and restoration.

As already mentioned, there are several variations of increasing the training load in the single years of the total cycle. It is theoretically possible to imagine increases of 0.25 relative units a year (0.25 + 0.25 + 0.25 + 0.25 = 1). On the other hand, practical experience in using the above described variations shows the following possibilities to increase the total load volume in a four-year Olympic cycle:

- Variation I: 0.25 - 0.35 - 0.20 - 0.20

- Variation II: 0.45 - 0.35 - 0.20 - 0

- Variation III: 0 - 0.50 - 0 - 0.50

  (The zero increase rate indicates that the total training volume in this particular year was stabilized or even reduced).

The actual effectiveness of one or another variation depends on the absolute value of the load that is here presented in relative parts of increases. A “unit of increase”, for example, can in a four year cycle mean in one case 1000km, in another less than 500km. The dynamics of the first variation is the safest, provided the load is correctly adjusted to the adaptation capacities of an athlete. The third variation carries the highest risk factor because the planned increases are relatively large.

It must be taken into consideration in the comparison of the third variation with the other two that sudden large increases of the total training load can be responsible for a higher rate of improvement. However, in reality this effect depends largely on the adaptation capacity and the training age of the athlete. As the adaptation capacity diminishes with age, sudden load increases for “older” athletes must be planned with extreme care.

In summary, it can be said that the effectiveness of one or another variation of the distribution of training loads in a four year cycle depends, besides other factors, on the following two main principles:

1. The planned increases of the training loads must correspond to the adaptation capacity of the athlete.

2. A sufficiently reliable system must be available for a continuing complex control of the functional, as well as the developmental state of the athlete.