Adjusting the training of experienced long jumpers

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ABSTRACT

Near the end of an athlete's career, the adaptation capacities of the organism decline. Increasing the training load, or even maintaining the current level, becomes difficult and it is imperative to find new quality solutions. The aim of this study was to identify a training structure that would make it possible for long jumpers to extend their careers. Data characterising the training of elite long jumpers was analysed from two points of view: informative (the type of exercises implemented) and energetic (the type of energy sources). The results show that it is indispensable to maintain a high level of maximum intensity loads and, unexpectedly, contradicts the common belief that the training of experienced athletes should be mainly specialised. It is suggest that experienced long jumpers should make regular use of "oriented" loads, which are structurally and functionally similar to their event but not as close to the performance movement as "special" exercises.

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Introduction

It is obvious that there is a need to systematise an athlete's long-term training in accordance with the logic of the process and conditions dictated by his/her individual development or ontogenesis. Although there are many suggestions on this matter[1, 2], they are based on the same idea – a constant, steady increase in both the specialisation of training activities and the intensity of the training load. But what next? Should athletes continue trying to intensify their training right through the final stage of their career? And should the specialisation of their training activities continue? These questions have not yet been clearly answered.

As far as it is known, training in the Result Stabilisation Phase of an athlete's career (the phase that follows the High Performance Phase) ought to be of an individual character.[3] Often, the decreasing adaptation capabilities of the organism make it impossible for the athlete to increase loads or even maintain them at the level that has been

achieved.[4] It is believed that periodic radical changes in loading or the use of non-standard training methods (e.g. a higher number of jumps using the opposite leg in long jump) can be effective. However, there is no general concept for training in the later stages of an athlete's career.

The aim of this study was to identify a structure of training loads that would make it possible for experienced long jumpers to continue their careers after the High Performance Phase and, on the basis of such a structure, make a number of practical suggestions.

Material

Our study focused on elite long jumpers (n=14) and included data that made it possible to characterise their training. Three annual training cycles were analysed for each of the subjects. The three included the athlete's best cycle from each of the three main career stages, i.e. Basic Specialisation Phase, High Performance Phase and Stabilisation Phase. In all, 42 annual cycles were examined. The particular phases were identified drawing on experts' work with data concerning the performance improvement, age and experience of the subjects. Detailed information is included in Table 1.

Our idea connected with identifying particular aspects of the Stabilisation Phase drawing on the example of the long jump world record holder Mike Powell (USA) as presented in Figure 1.

Methodology

The elaboration of optimal solutions required dealing with a large amount of information describing the individual training process of each of the athletes studied. This involved a classification of training loads[4] taking into account two influence areas, i.e. "informative" (the type of exercises implemented) and "energetic" (estimates of the types of energy sources assessed on the basis of exercise intensity). The registration and analysis of training loads was done with the help of the software programme TREOB4.[5]

The informative area covers the following types of loads:

- General (G) – These activities develop the general movement potential of an athlete. In the case of the long jump they include such training means as squats, squat-style snatches, jerks, shot and medicine ball throws, continuous running, ball games, abdominal and back muscle exercises, flexibility and agility exercises, running used as relaxing exercise after a training session, and exercises forming the part of a general warm-up.
- Oriented (O) – These exercises are structurally and functionally similar to a particular specialisation. For the long jump they include half-squats, step ups, calf

Table 1: Parameters (means ± sd) characterising long jumpers (n = 14) participating in the research in three main phases of their careers.

Parameter	Basic Specialisation	High Performance	Stabilisation
Sport result (cm)	742 ± 27.6	770 ± 31.2	763 ± 22.9
Age (years)	20.40 ± 2.4	24.7 ± 2.3	27.6 ± 2.9
Experience (years)	3.33 ± 0.9	6.6 ± 2.1	8.7 ± 2.2

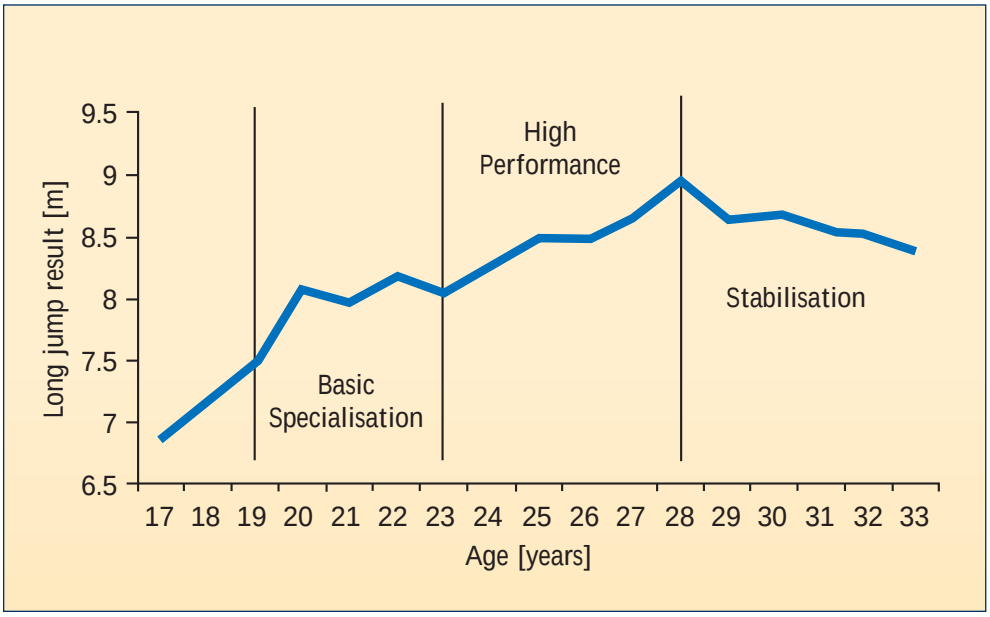

Figure 1: Division of the career of long jump world record holder Mike Powell (USA) into career phases (Results taken from www.maik-richter.de).

raises, standing and running jumps with loads, skipping (A, B, C), short speed endurance training (e.g. interval runs – 4 x 3 x 40m), hurdle exercises, hurdle jumps, multiple jumps and depth jumps.

- Special (S) – These are motor capacity exercises that accurately reflect the internal and external structure of the performance movement (or its elements). For the long jump they include technique exercises involving the whole jump or its phases (e.g. short-approach jumps with running through the pit), exercises imitating a jump technique and runs (up to 120m) performed with maximum and submaximal intensity.

The above-mentioned exercises are performed with different levels of intensity and thus affect different energetic mechanisms. Five ranges of effort intensity (T_1...T_5) were identified. The classification is based on an assumption of the heart rate (HR) before and immediately after a training effort and takes into consideration the duration of the effort at a given intensity. A sixth range (T_6) covering exercises enhancing anabolic processes, i.e. building strength, was also used.

In practice, efforts in particular ranges are defined as follows:

- T_1 – Low intensity aerobic effort, HR after an effort is not higher than 130-140 bpm;
- T_2 – Moderate and high intensity aerobic effort used to form aerobic power and capacity, HR immediately after an effort is 160-180 bpm, the level of lactic acid is 2-4mmol/l, the duration of particular efforts is usually above 300 seconds;
- T_3 – High and submaximal intensity aerobic and anaerobic efforts used to form aerobic power and anaerobic capacity, HR just after the effort is more than 180 bpm, the level of lactic acid is 4-6 mmol/l, the duration of particular efforts is up to 300 seconds;
- T_4 – Submaximal and near maximum intensity anaerobic-lactic acid effort used to develop power and anaerobic capacity, HR immediately after an effort is higher

Table 2: The volume of training loads (means) in a yearly cycle of long jumpers (n = 14) in the main phases of their careers

Training Load	Basic Specialisation	High Performance	Stabilisation	S
TR	142:46:40	147:31:15	147:30:00	2.79
G	132:10:45	136:21:10	135:44:40	2.92
O	08:27:40[f]	08:42:40	9:35:15[c]	6.95**
S	02:08:15	02:27:25[a]	02:10:05[c]	4.89*
T_1	94:00:40	97:20:15	98:34:00	1.22
T_2	29:07:00	29:51:30	28:59:00	0.33
T_3	08:22:20	07:46:05	07:16:35	0.82
T_4	06:51:55	07:16:15	07:32:20	1.76
T_5	04:24:45[e]	05:17:10[b]	05:09:00	7.71**
T_6	04:43:10[e]	05:47:20[a]	05:50:45	4.64*
Average Best Perforamnce (cm)	742[f]	770[b]	763	12.32***

The significance of differences between Basic Specialisation and High Performance – a-p<0.05, b-p<0.01
The significance of differences between High Performance and Stabilisation – c-p<0.05, d-p<0.01
The significance of differences between Stabilisation and Basic Specialisation – e-p<0.05, f-p<0.01
S = standard deviation

than 190 bpm, the level of lactic acid is 6-14 mmol/l, the duration of a particular effort is 20-120 seconds;

- T_5 – Near maximum and maximum intensity anaerobic – non-lactic acid work, HR just after an effort is 150-160 bpm, the duration of particular efforts is not longer than 20 seconds;
- T_6 – Exercises enhancing anabolic processes.

Only one unit, i.e. time, is used in this method. An effective – total – time of application of a particular group of means (without any periods of rest) is the measure of loads. The sum of effort times in the three types of preparation (G + O + S), which is equal to the sum of work done in particular intensity ranges ($T_1 + T_2 + T_3 + T_4 + T_5$), forms the total training load.

We are aware that some matters are simplified by this method however it is pragmatic and rational. The method makes it possible for a coach to quickly analyse loads, make various comparisons and think about connections between different types of loads and performance.

The diversity of training loads between the phases was described with the help of variance analysis (ANOVA). If the result was significant (p<0.05), the differences between the groups were evaluated by means of the Tukey test.

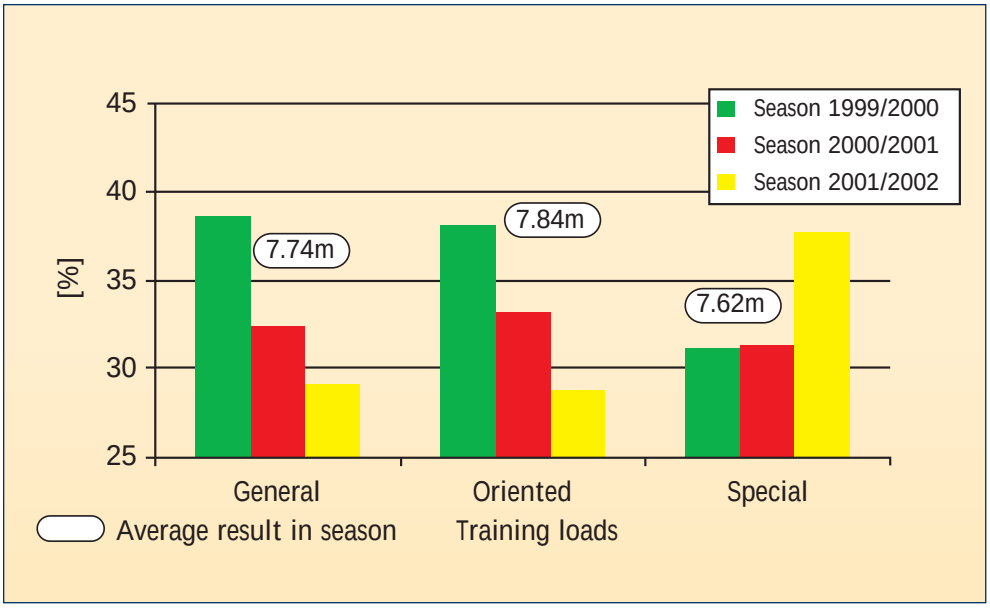

Figure 2: Volume of particular groups of training loads presented in percentages, assuming 100% as the value of the whole three-year training cycle within a given group of loads, for Polish long jump record holder Grzegorz Marciniszyn

Results and discussion

The starting point of our research was to indentify the particular career phases. The dynamics of age, experience and performance parameters (Table 1) confirm that the division we created was right. The high performance level of the subjects in the Stabilisation Phase (the results achieved in this phase did not differ in a statistically significant way from the results obtained in the High Performance Phase) allowed us to acknowledge the identified structure of training loads as a model for the final phase of a long jumper's career (Table 2). However, the way the studied athletes reorganised their training loads in this phase was a bit of a surprise: it turned out that in their best yearly cycle in the Stabilisation Phase the subjects increased the volume of Oriented loads but implemented fewer Special loads in comparison to the best cycle of their High Performance Phase.

Special loads are an extremely effective training stimulus. Because of their structural and functional similarity to the competition movement, they are closely connected with the means of technique perfection. Therefore, they are applied readily, especially in the period of the highest psychophysical capacities. However, increasing special loads in the period of development of maximum capacities eventually leads to diminishing returns and may not bring about anticipated results because an adaptation optimum will be reached. An example of this phenomenon is the Polish long jump record holder Grzegorz Marciniszyn (See Figure 2).

Experienced jumpers are so stable and correct from a technical point of view that they may profit from limiting the volume of Special (technical) loads and instead implement more loads (e.g. Oriented) affecting their motor capacities.

We have to remember that time is ticking away. A progressive decrease in physical function and potential, known as an involutional process, leads to lower and lower adaptation capabilities, which becomes more noticeable

as an athlete ages. For this reason it is necessary to focus more training effort on motor capacities. Oriented loads seem to be an effective tool here. Moreover, the power of the effective influence of Oriented loads may stem from their periodisation, i.e. a small increase in the volume of these loads between the Basic Specialisation Phase and the High Performance Phase. This enables the athlete to create reserves in this area.

We believe that a diametric restructuring of loads may be a non-specific stimulus, which is important in the final phase of an athlete's career. PLATONOW & SOZANSKI[3] maintain that such stimuli form the basis of training in the Stabilisation Phase. Athletes get used to some exercises and the longer these are used, the lower their influence. Therefore, instead of increasing general capacities, these exercises inhibit them. The extent of the effect of this phenomenon is determined mainly by biological laws and by the training methodology used throughout the athlete's career. In order to counteract this, athletes can make use of non-standard training methods and means (e.g. training simulators) or apply microcycles and mesocycles with exceptionally high loads.

As for the second component – intensity – we found the restructuring of the loads between the High Performance Phase and the Stabilisation Phase was not so great. Slight differences in the area of the highest intensity loads (T_5) indicate that it is necessary to maintain a constant level in this range. Decreases in this essential group of loads may lead to a de-adaptation, i.e. negative adjustment changes. Keeping motor abilities such as strength or speed at a high level in the later stages of an athlete's career requires intensive stimuli. Any attempt to return to lower intensity loads will be ineffective because these do not generate maximum muscle shortening, which means they are not powerful enough to improve a given ability.[6]

According to TRZASKOM & TRZASKOM[7], experienced jumpers should base their training on exercises with considerable external resistance, over 70% of a single repetition maximum (RM), and average external resistance, 50-70% of RM, but performed at maximum speed. Both these methods effectively improve strength and power in experienced athletes as they greatly affect the nervous system. According to research results, the development of strength and power as muscle hypertrophy decreases with age depends on the improvement of nervous system adaptation.[8]

Moreover, further intensification of training is not advisable. The lower adaptation abilities of an organism in connection with an exceptionally high level of loading from the previous phase (High Performance) together with increasing intensity may lead to over-training and, as a consequence, to injury. Therefore, in the Stabilisation Phase it is important to carry out an analysis concerning the athlete's individual ability to recover after high intensity training sessions.

The large volume of anabolic loads (T_6) in the final phase may prove the effectiveness of such conduct. With age, the continual loss of speed and jumping ability must be compensated to some extent by the development of other motor abilities. It has been proven in a number of studies that it is possible to achieve this by increasing the amount of strength work.

It is worth referring to the periodisation of supporting and aerobic loads (T_1 and T_2). Statistically insignificant changes concerning these loads in the course of the whole special stage show that big differences in their volume in a long-term training cycle of jumpers are not advisable. On the other hand, the considerable amount of these types of work done in those stages indicates that they play an important role. Not undermining the tendency to a gradual elimination of these exercises, which only use up accumulated energetic substrata and cause tiredness without developing or stabilising special capacities[9], we suggest taking into consideration low intensi-

ty or universal exercises. It is difficult to predict the way eliminating one group of exercises will affect the influencing power of others. We would not recommend giving them up as they form a functional basis of a specific effort adaptation. And although they are not directly connected with a result – as is the case of e.g. aerobic efforts – surely they contribute to a successful development of capacities.

Conclusions

The choice of training loads ought to be made taking into account the athlete's individual psychophysical parameters as well as the level of sports advancement.[10] For experienced long jumpers we suggest that a high level of the highest intensity loads (T_5), i.e. anaerobic – non-lactic acid loads, should be maintained. We recommend not substituting them with lower intensity exercises, as these do not bring about positive adaptation changes.

We maintain that apart from training simulators, which are hard to come by, the stabilisation of results at a high level may be achieved by skilful restructuring of the training loads. Our findings go against the common belief that training of experienced sportsmen has to be highly specialised. In the Stabilisation Phase, athletes are advised to make use of those oriented loads that strongly influence motor capacities. As far as long jumpers are concerned, the exercises include half squats, step ups, calf raises, standing and running jumps with loads, skipping (A, B, C), short speed endurance exercises (e.g. interval runs), hurdle exercises, hurdle jumps, multiple jumps and depth jumps.

Because experienced top-level athletes are normally close to their maximum capacity with regard to the quantity of training, we suggest that further research aimed at improving the quality of training should be carried out.

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Internet resources
www.maik-richter.de from 15.01.2007