

Peaking for the Major Competition

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The objective of any training program is to peak and attain the highest performance at the major competition(s) of the year. The achievement of peak performance is the direct outcome of an athlete's adaptation to various types of training. In order to increase an athlete's chances of success, the coach plans various activities which cumulatively will produce the proper result at the proper time.

Peaking is not a psychological mystique, but rather a very complex training state which is attained in a sequential manner. As illustrated in figure 1, at first the athlete reaches the state of degree of training, followed by athletic shape. Peaking is initiated from here.

Figure 1: An illustration of the accumulation and elevation of training states (hypothetical).

Degree of training is the foundation of training states. It is reflected by above-average performance, a high level of athlete efficiency with a high rate of recovery, a good level of skill proficiency, and psychological readiness. An athlete who reaches a high degree of training has a very high level of physical preparation and has perfected all the biomotor abilities required for his/her sport. The higher the degree of training, the higher the organism's effectiveness. When the degree of training is poor, other training states cannot be reached. This lowers the magnitude of athletic shape and, as a result, peaking. Athletic shape is an extension of the degree of training and is characterised by performances close to the athlete's maximum, sport-specific fitness, technical, tactical efficiency and a psychological base from which peaking can be initiated.

Peaking is the highlight of athletic shape. It is the scheduling of activities prior to major competition(s). Its goal is to ensure optimum performance. Peaking is also a temporary state of training produced when physical and psychological elements are maximised and when the levels of technical and tactical preparation are optimal. During this state of training, the organism's adaptation capacities are maximal as well, and the neuro-muscular co-ordination is near perfect.

Peaking is a superior, biological state characterised by perfect health, a quick adaptability to training stimuli and a very good rate of recovery. The organism has a high state of synergism - the joint action of several agents which together increase each other's effectiveness.

The biological characteristics of peaking vary according to the type of sport (Table 1).

Table 1: The characteristics of peaking for various groups of sports.

Group of Sports	Characteristics
1. Dominant Anaerobic	A high capacity to mobilise an organism's functions and an extremely rapid rate of recovery.
2. Dominant Aerobic	High working capacity based on very high efficiency.
3. Combined Aerobic and Anaerobic	Capacity to handle many moments of maximum stimulation.

From a psychological point of view, peaking is a state of readiness for action. The athlete's nervous system adapts quickly and efficiently to the stress of competition.

Athletes who reach this training state are also highly motivated and can tolerate various degrees of frustration which occur before, during and after competition. To produce this level of tolerance, a coach can create many training sessions so the psychological stresses specific to the main competition are created.

1. Factors Which Affect Peaking:

Peaking is an intricate task. No one thing can lead to its accomplishment. There are, instead, several factors which have to be considered. It is important to point out that one factor cannot be substituted for, or compensated by, another. All factors are essential.

A. High working potential and quick rate of recovery are two essential attributes of any athlete who reaches a high training status. An inability to cope with a high volume of work means that high performance expectations are likely unattainable. Similarly, the organism must be able to recover quickly following training and competition.

B. Near perfect neuro-muscular co-ordination refers to an athlete's capacity to perform skills and tactical manoeuvres almost flawlessly in the performance of a routine or skill. Technical imperfection in the performance of a skill usually reduces overall performance.

C. Unloading is a process of progressively decreasing the impact of the stressors (physical, technical, tactical and socio-psychological) an athlete is exposed to in training. This can facilitate a functional and psychological arousal for a competition.

A correct unloading phase prior to the main competition is one of the most important factors in peaking. This phase, which usually follows a long period of hard training and many competitions, aims to regenerate all of the organism's systems, especially the central nervous system (CNS) and the athlete's psyche.

Unloading is usually attained through a reduction in the volume and intensity of training so the athlete may rest and replenish his/her energy reserves. The volume of training is a quantitative component which incorporates time, distance, number of repetitions, etc. The intensity of training is a qualitative component, i.e., velocity, complexity of skills, performed in a given unit of time.

The concept of unloading should be regarded as the enhancement of the finest physical and especially psychological readiness of athletes. For well-trained athletes, the duration of the unloading phase should not exceed two weeks.

The approach used during the two weeks of the unloading phase varies from sport to sport. Figure 2 illustrates a situation in which endurance is the dominant characteristic (i.e., cross country skiing, 800m and 1500m running, swimming, etc.).

Figure 2: The dynamics of volume and intensity during the unloading phase for sports where endurance is the dominant characteristic.

In the first week of unloading, the coach reduces the intensity of training. The number of training sessions is also reduced to a maximum of two per day. The number of intensive sessions may not exceed two per micro-cycle (a weekly training plan) and their duration should be reduced to a minimum. Other activities outside of the sport-specific skills, i.e., weight training, should be eliminated so that time can be used for recovery techniques.

The volume of training may be the same as in previous micro-cycles, or slightly less. Training should include mostly medium and low-intensity methods where the aerobic component is dominant. Such a program is least stressful, but satisfactory in maintaining the level of physical preparation.

In the second week, or the micro-cycle of the main competition, the intensity of training is drastically reduced so stressful activities are eliminated. This allows the athlete to completely regenerate prior to competition.

A different approach is suggested for sports where speed, power, or co-ordination are the dominant characteristics, i.e., sprinting, gymnastics, etc.

As illustrated by figure 3, in the first micro-cycle, the volume of training should be reduced to about 50 percent of the previous cycle's level. A micro-cycle with two

peaks may be used but the intensive training sessions should have long recovery intervals between peaks.

Figure 3: The dynamics of volume and intensity of the unloading phase for sports where speed and/or power are dominant characteristics.

Most exercises done during intensive training should be dynamic, but of short duration and not heavily loaded. Outside of the two intensive sessions, the workouts should be submaximal and alternated with moderate or low-intensity sessions. Weight training should be excluded.

During the main competition's micro-cycle, the volume of training continues to fall while the intensity, which is also progressively reduced, may have one peak in the first part of the cycle, but not of a high intensity.

Figure 4 suggests the approach which may be considered for sports in which both the volume and intensity of training have relatively equal importance (i.e., team sports).

Figure 4: The dynamics of volume and intensity for the unloading phase for team sports where both the anaerobic and aerobic energy systems have an almost equal contribution.

In the first week, unloading is produced by reducing the volume of work. Only one peak may be necessary during the week. Intensity is progressively reduced, but the

coach can still have two intensive training sessions of 60 and 50 per cent of maximum.

In the second week, both curves of intensity and volume taper down. Volume falls to a lower point than intensity. However, even during this week, a micro-cycle with two peaks may be planned. The first peak should be 30 to 40 per cent of maximum and the second 25 to 30 per cent.

Two days before the main competition, training is still scheduled, but it must be short and of low intensity (see Figure 4). During these sessions, enjoyment, confidence building, optimism and team spirit should be striven for.

D. Overcompensation (Figure 5) is the foundation of an athlete's adaptation to the training stimulus. When an individual is training, he/she is exposed to stimuli which disturb the normal biological state by burning supplementary foodstuffs. The outcome is fatigue and this temporarily reduces the athlete's ability to do work. (Phase I)

Figure 5: The overcompensation cycle.

Following training, there is a phase of recovery during which the biomechanical sources of energy are not only replaced (compensation or phase II), but may surpass initial levels by acquiring reserves. This enables the athlete to rebound (overcompensation or phase III).

If the resting phase, the time between two training sessions, is excessive, overcompensation will fade away, leading to a process of involution or a phase IV of little or no improvement in performance.

Overcompensation is the effect of work and regeneration in the athlete. Correct unloading is needed to achieve overcompensation prior to the main competition.

Figure 6 illustrates the last five micro-cycles before the main competition. While during the first three cycles the load in training is still progressively increased, during the last two, the coach unloads the program to facilitate overcompensation.

Figure 6: Correct unloading prior to the main competition helps to produce overcompensation.

E. Recovery and adequate regeneration following training and competitions are important factors in peaking. If recovery techniques are not consistently utilised, the athletes become fatigued. This fatigue may evolve into physical and neuro-psychological exhaustion. Obviously, under such circumstances, performance expectations should be drastically altered.

F. Motivation, arousal and psychological relaxation are instrumental for peaking too, since during training and competitions the athlete is exposed to various physiological and psychological stresses such as fears, threats and national pressure. Therefore, relaxation techniques, massage, and biofeedback are instrumental.

Athlete motivation can be elevated for the competition if high, but realistic goals are set. A high level of athletic aspiration, performance improvements, prestige, recognition, social status, etc. represent important motivators.

Crucial to the athlete's psychological well being prior to competition is the coach's ability to ensure a relaxed environment.

G. Nerve cell working capacity. An athlete whose training is properly developed for competition cannot maximise his/her abilities unless the CNS is in an excellent state and thus has a high working capacity.

Under optimal conditions, the nerve cell's high working capacity cannot be maintained for long. It may be considerably increased only during the last 7-10 days prior to the main competition and may, in fact, be the normal outcome of recovery, relaxation, and overcompensation.

Athletes' activities - the performance of skills - are the outcome of muscular activities caused by nerve impulses. Thus, the force, speed, and maximum number of contractions depend on the nerve cell's working capacity. Such capacity depends not only on the athlete's training state, but also on the cell's level of excitability.

A nerve cell's high working capacity cannot be maintained for a prolonged period of time without the cell becoming strained, or fatigued. When training demands reach the nerve cell's limits, or when the athlete drives himself/herself over such

limits, the cell reacts to training or competition stimuli impairingly. Under such circumstances, the athlete's working capacity decreases abruptly.

In order to protect itself from further stimuli, the nerve cell assumes a state of inhibition, restraining its processes. Certainly, the athlete, calling on his/her will power, may continue to train, but progressively he/she may be driven to complete exhaustion.

Under such circumstances the athlete's performance is far below normal levels. This is why regeneration micro-cycles and training sessions are so important.

The dynamics of nerve cell excitability vary according to the proximity of the date of competition. The excitability increases progressively during the days prior to the competition, reaches its maximum peak during the day(s) of the contest and decreases following competition (Figure 7).

Figure 7: The dynamics of CNS excitability level before, during and after competition (modified from Ozolin, 1971).

Although in most cases excitability levels decrease to normal after competition, they may fall below normal. This signifies a high level of exhaustion. Under such circumstances the training program should be light. This should enhance a full regeneration prior to commencing a normal load.

Athlete peaking and excitability may be affected by the dynamics of training work loading and overcompensation.

Figure 8 (a) illustrates a situation in which an athlete peaked too early because of: 1.) exaggerated intensive training, and 2.) a heavy competition schedule during the pre-competitive or competitive phase.

Under such circumstances the main competition of the year fell in the phase of post-start decrease. Figure 8 (b) shows a case in which the best performance was achieved on a later date than the main competition.

As is often the case following an important competition, there are several days of relaxation and light training, which likely enhanced overcompensation in this case. Or, peaking wasn't achieved by the date of the main competition perhaps because the coach did not unload properly and overcompensation did not occur.

Figure 8: Early peaking (a) and late peaking (b).

A. A **calendar of competitions** is important in periodisation and may enhance or adversely affect peaking for the major contest(s).

Some coaches believe an athlete has to participate with maximum effort in every competition. Obviously, in such a case, the athlete is constantly exposed to stressful activities, which might not lead to an optimal season culmination.

Similarly, a heavy competitive schedule requires many regeneration dates which disturb normal training. Also of concern is the intense psychological stress level an athlete must reach to attain an adequate state of arousal for each competition.

In planning and selecting competitions, except for those set by national and international sport governing bodies, the coach may employ the grouping or cyclic approach.

1. The *grouping* approach involves allocating two to three weeks in a row during which the athletes take part in competitions where they participate in several events per weekend. Figure 9 illustrates such a phase. It is usually followed by a macro-cycle of training only. This allows the athletes to train for another two-to-three-week block of competitions. (A macro-cycle is two to six weeks of micro-cycles.)

Figure 9: A hypothetical example of a grouping approach for a team sport

Training Phase	Competitive Phase														
Dates	May					June									
		1	8	15	22	29	5	12	19	26					
Macro-cycle	6					7					8				
Calendar of Competition				X	X										

Competitive Phase												
July					August				September			
3	10	17	24	31	7	14	21	28	4	11	18	25
9					10				11			
X	X	X										

The hypothetical example illustrated by Figure 9 suggests that at the end of May the athlete/team takes part in a group of competitions spread over two weeks. In each case, competitions are organised over two to three days each weekend.

The first micro-cycle following the first set of competitions is a lower intensity cycle, with one peak at the end. The first part of the cycle (two to three days) is

dedicated to regeneration and low intensity and calm training sessions are organised.

Next, two and a half micro-cycles are planned for hard training, followed by a short unloading phase (two to three days) and again three weeks of competitions.

August 21 is hypothesised to be the qualifying competition for the main championships of the year on the weekend of September 25. For training, the macro-cycles preceding the qualifying and final championships follow the same pattern as the previous ones.

The grouping approach is most suited to individual sports, where the only two competitions are planned in a manner similar to the above. For team sports, such an approach may be utilised only for international competitions, where the grouping concept is a typical model for training for an international tournament.

2. The *cyclic approach* may be used in individual and team sports. Competitions are planned in a repetitive, cyclic manner (figure 10).

Figure 10: A hypothetical example of a cyclic approach for a team sport.

Training Phase					Competitive Phase									
Dates					May					June				
					1	8	15	22	29	5	12	19	26	
Macro-cycle					7					8				
Calendar of Competition						X		X		X	X	X	X	

Competitive Phase												
July					August				September			
3	10	17	24	31	7	14	21	28	4	11	18	25
9					10				11			
X	X	X	X	X	X	X						

The competitions during macro-cycles eight and nine are league games, planned for each weekend. Then, at the end of macro-cycles 10 and 11, the regional and final championships are planned. Since each micro-cycle ends with a game, each may be structured with one peak only, which usually should be on Tuesday or Wednesday.

One or two days prior to the game, there is a progressive unloading phase to enhance overcompensation for the day of the game.

For individual sports where there are no league competitions but only qualifying and final competitions (main competition of the year), the cyclic approach may be considered as in Figure 11. In such a case, the coach decides to take part in other competitions organised by various clubs.

Assuming there are several competitions to choose from, the coach plans to take part only in those which enable a cyclic approach. Consequently, athletes will compete every second weekend, with the time between competitions devoted to training.

Figure 11: A hypothetical example of a cyclic approach for a cross-country skier.

Training Phase	Competitive Phase								
	November				December				
Dates	1	8	15	22	29	5	12	19	26
Macro-cycle	7				8				
Calendar of Competition				X		X		X	

Competitive Phase											
January				February				March			
3	10	17	24	31	7	14	21	28	4	11	18
8 (continued)				9				10			
X		X									

Such an approach is advantageous because the coach can modify training programs according to the feedback received during the competitions. Naturally, this will enhance an ideal preparation for the main competition.

B. The number of peaks per competitive phase is also important in peaking. The hills and valleys of the athletic shape curve depend separately on each peaking factor. When the coach integrates all these factors properly, peaking should take place.

Throughout the competitive phase there may be two to four very important competitions, which are not spread out evenly, or in order of importance. Therefore, the curve of peaking (Figure 12) should be altered according to such a schedule.

Figure 12: A hypothetical calendar of competitions and the curves of athletic shape and peaking.

An attempt to peak for all competitions would be impossible because of the limits of the nerve cell's working capacity and excitability. Such an approach could lead to exhaustion. More likely, the cell will protect itself by refusing to react to external, or competition, stimuli.

Studies of techniques used for long-term planning reveal some precise peaking data. It has been found that seven to 10 competitions are enough to reach a high state of readiness for major competitions. Also, in an annual training plan, most elite class athletes require 32-36 micro-cycles to reach peak performance of the year. Assuming an athlete is involved in daily training sessions, it has been found that peaking may be reached after only 65-80 per cent of the total days of training.

One may conclude that peaking cannot be reached quickly, but rather after a hard and prolonged effort. In general, it may take 200 days of training before an adequate physical and psychological capacity for peaking is reached.

The greater the number of important competitions or peaks per year, the less the number of training days required. If two to four peaks per year are planned properly, this should not represent an impediment since peaking may be achieved, and accumulated, sequentially.

To accomplish higher performances every year, the degree of training has to be increased as well. This could be done by raising the physical level of training from year to year. On such a solid foundation, a higher plateau of athletic shape may be realised from which higher peak performances will be attained. Ignoring such an approach leads to a plateauing-off of an athlete's performances, rather than a continuous improvement.

2. Methods of Identifying Peaking

The identification of peaking is both difficult and controversial. One of the best methods seems to be the dynamics of the athlete's performances.

Track and field athletes were used in a peaking study. Considering the previous year's personal best performance as a reference point (or 100 percent), the first zone, or the zone of high results, was considered to be performances less than 2.0 percent below the reference. Medium results were those within 2.0-3.5 percent below the best performance and low performances 3.5-5.0 percent below. Finally, the fourth zone was reserved for performances over 5 percent lower (poor performance).

It is suggested that when an athlete can achieve performances within the first zone, he/she is in high athletic shape and likely close to a peak performance. Once this point is reached, peaking can often easily be obtained.

When athletes achieve performances classified in the first zone, the organism's adaptation to training is complete. The reaction to training stimuli is consistent, and as a result, the heart rate taken early in the morning reaches consistently low levels.

In addition to this, other data may be considered. These include a urine biochemical test, hand grip test, electrocardiography in resting conditions and aerobic or anaerobic power tests.

Obviously, such tests have to be performed by qualified personnel. Data from various phases of training, especially during the competitive phase, are collected and compared. When all scores are superior, the coach knows his/her athlete is in a very good state of training.

3. Coach/Athlete Relationship in Peaking

Of great importance is that the coach must be in good shape as well. The coach's behaviour, optimism, confidence, enthusiasm, encouragement, and cheerfulness

also represent an important prerequisite for an athlete's peaking, especially when the relationship between coach and athlete is very close.

The coach is not only responsible for training, but for peaking the athlete psychologically too.

A coach has to be psychologically well balanced and calm, or at least appear well balanced and calm, prior to a competition.

A well-controlled behaviour has a tremendous impact on the athlete. A coach must strive to neutralise as many of the stressors as possible (peers, job, etc.) that might affect an athlete's performance.

4. Duration of Peaking

Little precise research data exist regarding this crucial training question. Among coaches and athletes there exists, as well, a wide range of opinions.

The myth that an athlete can peak only once a year for a day still exists.

It is reasonably safe to say the duration of peaking is very individualised. The training program followed by each athlete has a substantial influence on the duration of peaking.

The longer and more solid the preparatory phase, the higher the probability of prolonging the athletic shape and consequently the peaking.

It is rather difficult to separate peaking from athletic shape. As already explained, athletic shape is a very high plateau during which the athlete has a very high working and psychological capacity. The highlight of this plateau is zone one, when an athlete's performances are within 2 per cent of the previous year's peak performance. Assuming the coach organises an adequate training program, the duration of zone one may be 1.0-2.5 months. The duration of peaking may be 7-10 days since the nerve cell's optimal working capacity may be maintained that long. Obviously, following each peaking for a top competition, a short phase of regeneration is strongly desired, followed by training.

The duration of peaking, as well as zone one, may be affected by the number of competitions. The longer the phase of weekly competitions, the lower the probability of duplicating high results. A high number of competitions does not necessarily lead to good and progressively higher performances. Often there is an opposite effect - results decline towards the end of a competitive phase, when championship competitions are usually planned.

After the end of the eighth micro-cycle of competition, there often begins a critical phase. Performance need not necessarily suffer, however. A coach should be more aware of the need to alternate between stressful and regenerative activities. An important method of ensuring adequate peaking is to prolong zone one and consequently the ability to peak. A competitive macro-cycle should usually end with a very important competition. This ensures a progression in the competitions.

The grouping approach to planning competitions allows not only the alternation of phases of training with periods of competitions, but also a lengthening of the period of athletic shape.

Also important is the time required to reach zone one. Although this might differ with each athlete, the average time needed to move an athlete from a pre-competitive level to zone one is about four to six micro-cycles.

During the first three to four cycles, dramatic increases may not be seen, since intensive work results in a high level of fatigue. But after the last one to two cycles, when the athlete has adapted to the training load and when a slight decrease in the stress of training allows overcompensation, higher performance is possible.

As a general guideline, gymnastics and water polo might take six micro-cycles, athletics, rowing, swimming and wrestling approximately four.

5. Factors Which Might Adversely Affect Peaking

Peaking is the natural outcome of several months of hard work and a properly planned training program. Several factors may adversely affect peaking, and it is the coach's responsibility to control them.

A. Factors Related to Competitions

Before taking part in a competition, both the athlete and coach expect normal, standard conditions. In fact, an athlete may expect perfect circumstances. As a result, every unforeseen change may affect the athlete's peaking and performance.

Strong wind or heavy rain may disturb athletes who are not familiar with them. Waves produced by wind can substantially affect performances in canoeing and rowing, especially when the athletes use improper technique. A wet or muddy field dramatically reduces ball control in sports like football and soccer.

In cross-country skiing, a peak performance is directly dependent on the quality of the snow and the ability to wax promptly. Similarly, all athletes are affected by extreme temperatures and altitude.

The answer to all the above problems is model training - the training of athletes under all conditions.

Of no less impact on athletes are changes in the draw, biased officiating and an adverse audience. Exposing athletes to competitions which duplicate the characteristics of the main competition is a necessary prerequisite to peak performance.

B. Factors Related to an Athlete's State

The coach can observe and, therefore, have direct control over the athlete only during training hours. However, what the athlete does between training sessions must also be known by the coach since inadequate sleep, use of alcohol, smoking, poor diet, etc. can reduce an athlete's rate of recovery and adversely affect training.

Similarly, dissatisfaction with family, coach, peers, school/work, etc., reflects negatively on an athlete's attitude during training and competitions.

Therefore, the coach should observe the athlete, collect information from persons close to him/her and make all possible attempts to correct negative attitudes and behaviour.

C. Training and the Coach

Training programs planned improperly, with overly high intensity, quick increases of intensity, or too many scheduled competitions are not only very stressful and taxing, but also impair adequate peaking.

The effect of such mistakes is even more obvious when the competitive phase is very long. Under such circumstances the maintenance of zone one, and a correct peaking for the main competition, (usually at the end of the phase), is almost impossible.

Overlooking the need to alternate work with regeneration may not only reduce an athlete's ability to peak but may even lead to injuries.

A coach's knowledge, attitude, behaviour and inability to disguise personal emotions and frustrations can also affect an athlete's performance. A lack of confidence in the coach's abilities and knowledge, especially if present prior to the main competition, will obviously affect an athlete's performance and, therefore, peaking for that contest. The solution is relatively simple. A coach may require more training knowledge or improved self-control. If a coach cannot deliver these assets, he or she should be honest and advise the athlete to look for another coach.

6. Summary and Conclusions

The entire training process, its planning and structure, is geared towards reaching the peak performance for the main competition(s) of the year. This is the supreme scope of training and, as a result, everything else revolves about it.

Hard work is an important but not singular training attribute. If one expects peak performance to be adequately achieved at the time of the main competition(s), then hard work has to be judiciously complemented by a well-periodised and planned training.

To reach peak performance for a given competition is a very complex task. However, such a task can be simplified if the coach properly comprehends and manipulates all the factors affecting peaking. Only such a refined and comprehensive knowledge will transform peaking from a myth to a well-controlled, training reality.

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