Peaking and Tapering

Women's Gymnastics

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Why Now?—Explaining Unexpected Performance Errors

I suspect most coaches have experienced a situation when one or more athletes appear well prepared, have performed successfully in previous competitions, and are motivated. However, when competing in a major championship, the athletes suddenly make unexpected errors resulting in a poor showing. The coach may rub his or her eyes, wondering who these athletes are and what happened to the previous athletes. These phenomena are bewildering, frustrating, and painful for all involved. While athlete performances can vary for many reasons, can we see through the haze of natural human variability to at least enhance the athletes' chances of performing up to their ability in a more sophisticated way? Coaches and athletes can ask "why now" when unexpected performance errors occur, but they will rarely receive a relevant answer.

Hindsight has been compared to a vision report of 20:20, meaning we can create and examine the past with a lofty certainty of cause and effect. However, while at times instructive, such ponderings rarely translate to a better approach for the future. Predictions of the future are wrought with bad guesses and poor outcomes. The modern philosophical sage Yogi Barra noted,

"It's tough to make predictions, especially about the future."

Coaches and athletes are betting their success on the prediction that their training will lead to the rewards they seek. A prediction based on training alone does not lead to a precise estimation of preparedness/performance. Certainly, we do not just guess regarding athletes' future performances. A physician who predicts that medication will have a particular range of effects on a patient knows the range of medication effects is influenced by dosage, timing, gender, and normal human variability, among others. However, the physician and patient proceed by ensuring that the range of effects still cures the patient. Physicians generally know the range of medication effects, the odds of a medication working for a specific malady, and the likelihood of a cure. Both parties will tolerate inaccuracies and welcome a "close enough" approach. Coach and athlete relationships work similarly. Coaches and athletes learn to "play the odds" in predicting whether an athlete will succeed in a particular competition and what success might demand from training. Moreover, the coach and athlete tolerate some inaccuracies if the athlete's preparations produce a "close enough" performance to achieve the competitive goal. Modern gymnastics has become much more competitive shrinking ranking score differences such that a mediocre performance is seldom enough to win and makes prediction of competitive rankings highly uncertain.

What is Peak Performance?

The literature on peak performance seems to involve two concepts 1) what the athlete does and 2) what the athlete experiences. In terms of the athlete's physical performance, a peak performance involves his or her "empirical best." An empirical best is based on or involves a performance verifiable by observation rather than theory or logic. A peak experience is a concept supplied by psychology and

performance physiology and applied to business and sports (68). "A 'state of flow,' often referred to as being 'in the zone,' is characterized by the experience of deep, effortless concentration on the activity one is engaged in" (24, 33). Wells has described peak performance as a "state of superior functioning whose characteristics are clearly focused attention, lack of concern with the outcome, effortless performance, perception of time slowing down, and a feeling of supreme confidence" (68). Wells also describes peak performance as "behaviour which exceeds one's average performance or an episode of superior functioning" (68). The psychological concept of "flow" is also invoked in descriptions and definitions of peak performance. Long and short "flow scales" have been developed and provide a psychometric tool that can indicate the presence and magnitude of a flow state (25).

A "flow state" is both interesting and potentially helpful in establishing whether a performance peaked or was perhaps accidental. However, the danger of definitional entanglement weighs heavily on these concepts. Thus, I would like to concentrate on an empirical or measurable best performance. A "best" performance may indicate an ultimate best (i.e., the best the athlete can do, personal best) or a relative best such as the best performance the athlete can summon under the circumstances. After all, while I can be satisfied that an athlete's peak experience was self-gratifying, I want to know and observe if the peak performance exceeded the athlete's earlier performances and led to competitive success. There are no medals for the athlete's experience, only her measurable performance.

Gymnastics is enigmatic when measuring an empirical best performance. Judges' scores are unlikely to be stable enough to help with an analysis of a gymnast's progress, and gymnasts do not submit their performances to a stopwatch or tape measures like track and field. Moreover, an empirical best performance will be subject to the vagaries of subjective scoring, natural human variability, intrusive external factors such as jet lag and politics, and internal factors such as transient fatigue and mood. In order to measure what can be measured, we must transfer our interest in peak performance to that of peak preparedness. While we cannot reasonably expect to measure and control training and competition <u>performance</u> because of factors we cannot control, we can measure and control <u>preparedness</u> (62). Preparedness is the observable and measurable direct outcome of all facets of training.

How to Achieve a Peak Performance

When planning for future performances the effort becomes probabilistic rather than deterministic. The enormous number and complex range of training and competition variables have to the misuse of many training principles in attempts to gain control of an inherently complicated enterprise (15) No one can predict performance precisely more than a few hours or days in advance (34, 42, 43, 56, 59). However, are there aspects of training preparedness that can be exploited to help increase the <u>odds</u> of performance success? Harre discussed peak performances in the following way:

> "Apart from team games there should be only a few main competitions each year (three to four) which represent important peaks. As a rule, these are championships, qualifying contests leading towards the former, or, particularly important, international competitions which must be made known well in advance. The main competitions should become gradually more difficult. They have to be fixed at such a point in time that they allow systematic preparation for the absolute peak of the year. There should be a long enough pause between main competitions for the athletes to recover

> physically and mentally and to eliminate through training and preparatory competitions, as far as possible, mistakes which have appeared" (14) p 217.

The paragraph above covers several important factors that should be managed carefully to increase the odds of peak performance. First, the paragraph describes sports having a specific competitive period or season. All levels of gymnastics below the national team meet this type of classification. Regrettably, very few current gymnastics coaches and programs limit their important competitions to three or four per year. However, on behalf of your gymnasts I would like to encourage coaches to limit or reduce the number of competitions (18, 51).

> "Another concern relative to athlete selection trials regards the athletes' training schedule. Explicitly, some coaches felt that their athletes were required to 'peak' too many times during the season, and that having to peak at the trials negatively affected their athletes' ability to peak at the Games." (12) p 74.

I was very fortunate to meet Vladimir Issurin (17, 19-23) at a conference. We discussed several issues regarding athlete preparation. He was more than kind in providing me his slides. Two of these slides from his work in Israel are shown as Figures 1 and 2. Note the disparity between the numbers of competitions, training, and training volume. It is my opinion these trends may be responsible for poor performances from some athletes. Sadly however, these trends may be inevitable. Issurin provides a new approach to periodization called "block periodization" that attempts to cope with the problems of many competitions during the year.

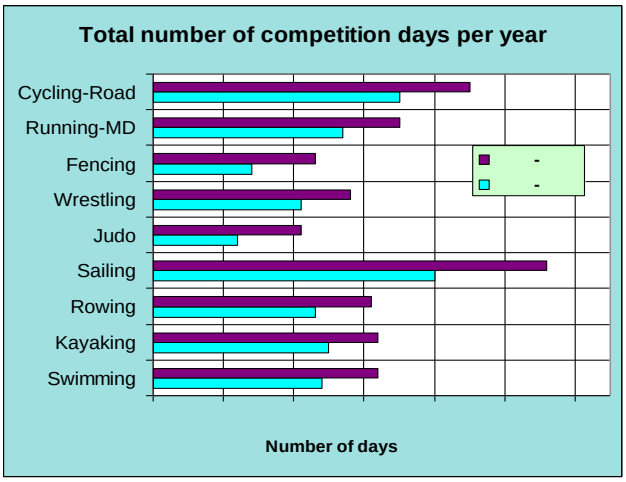

Figure 2. Comparison of the number of days of training and the number of days competing over two decades. Vladimir Issurin, Personal Communication.

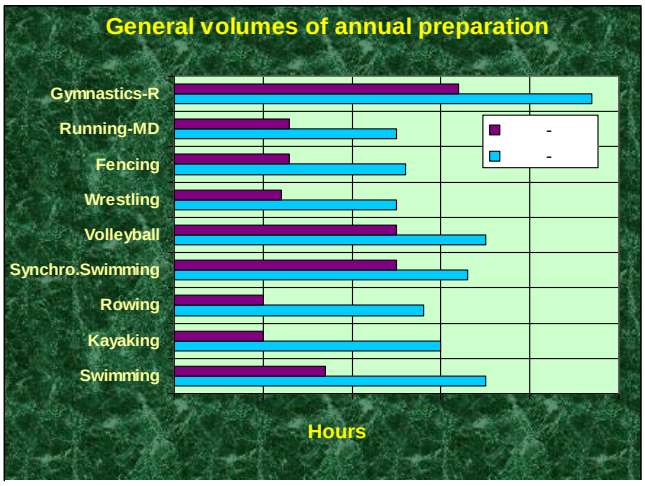

Figure 1. Comparison of volumes of annual preparation (i.e., training) of two decades. Vladimir Issurin, Personal Communication.

Factors that can Increase the Odds of Peaking

Planning and Periodization. First and foremost, training must be planned to ensure an athlete's best performances are more likely. The days of haphazard preparation and "peak by Friday" approaches are no longer viable and probably never were. Planning intelligently involves the use of periodization concepts and principles with several periodization models from which to choose. Verkhoshansky wrote that 22 to 24 weeks of training are necessary to achieve peak preparedness/performance (67). Here, I will describe two of these models, 1) traditional periodization and to a lesser extent 2) block

periodization. Figure 3 shows an example annual plan including both models. Note that traditional periodization is on the top and block periodization is on the bottom. Both models can share some of the facets of the annual plan such as psychology, nutrition, medical control dates, and so forth.

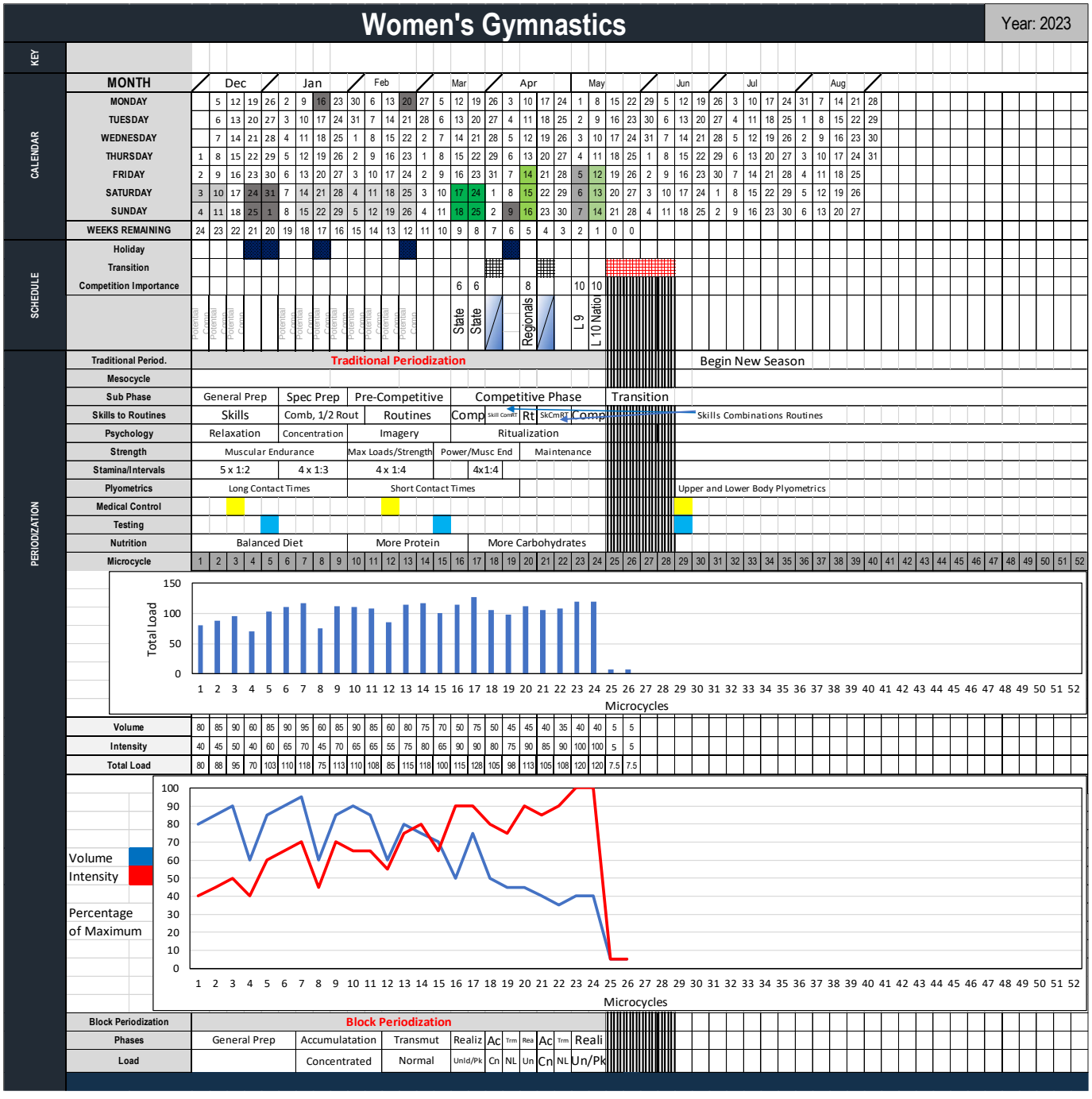

Figure 3. Example annual plan for the USAG Developmental Program athletes. Figure 3 should be self-explanatory; however questions are welcome.

A glossary of the terms used in the annual plan shown in Figure 3 is included below.

Accumulation = Ac – General Preparation emphasizing concentrated loads of high

intensity (17, 18, 21, 23).

Comp = Competition.

Concentrated = Cn – Period of maximum loads (2-5, 7, 9, 11, 52, 53, 57).

General Prep = General Preparation – normal gymnastics training.

Intervals = Systematic approach to short-term endurance/muscular endurance by managing work time and rest time in specific ratios Work(W):Rest(R).

Mesocycle = Intermediate period of the training plan, usually four to six weeks in length.

Microcycle = Smallest period for planning purposes, usually one to two weeks in length.

Musc End = Muscular endurance - anaerobic endurance, short-term stamina.

Normal = NL – Normal training or normal loads, not maximal (2-5, 7, 9, 11, 52, 53, 57).

Intensity = How hard you do it. Essentially the number of repetitions per some time unit, routines per minute, skills per minute, repetitions per some time unit.

Period = Periodization.

Realiz = Realization – Maintenance of fitness and specific preparation for a particular competition (17, 18, 21, 23).

Rt = Routines.

Spec Prep = Specific Preparation – Preparation of competitive skills and fitness.

Transmute = Tran = Transmutation – Specific Preparation for competition involving a shift to normal training (17, 18, 21, 23).

Transition – Describes a period emphasizing rest and recovery-adaptation (2-5, 7, 9, 11, 52, 53, 57).

Unload/Peak = Unld/Pk = Un/Pk – Unloading, taper for a specific competition (2-5, 7, 9, 11, 52, 53, 57). Pk = Peak, peak performance.

Volume – How much you do. Essentially the number of repetitions.

 = Microcycle including first few days of reduced load and final few days of normal load.

Rules of Thumb

Time between important competitions. A problem often arises when two or more competitions are separated in time by only one to four microcycles. This period has been considered a very hazardous time for athletes because of a seductive tendency to continue to train too hard trying to squeak out a few more tenths, a new skill, or a new combination. The athlete is at the height of her fitness, routines are set, she can probably perform skills and combinations with ease, but without careful fatigue management the danger of overtraining is real and often causes poor subsequent performances. The period between important competitions set close together in time requires sthis intervening period proceeds with the normal sequence of training periodization stages (i.e., general preparation, specific preparation, pre-competition, competition, and transition). A brief transition/recovery period should be planned after every competition. Research by Sands, et al. shows the psychological mood state of athletes immediately after a competition is perilously low (49, 54, 58). One should keep in mind the athlete is always better off coming to a competition slightly undertrained than overtrained. During the intervening period between competitions, the athlete should return to a mini general preparation period followed by specific preparation, and then followed by the pre-competitive period – except

pressed for time. Each of these periods may be only a day or two in duration, but by following this approach the athlete benefits from a brief return to skills, followed by combinations, and finally routines. Too often, overzealous coaches will push too hard during these periods and the athlete becomes overly fatigued. Arild Jorgensen (Personal Communication) who is considered nearly a magician in bringing Norwegian skiers to peak preparedness after suffering major failures and fatigue, described one important rule. Immediately prior to a major competition the athlete should reduce training volume in order to manage accumulated fatigue and create an upward acceleration of preparedness leading into the next competition.

Leading up to a competition a training period (described above) is called a "taper" (more later) and is used by nearly every sport on the planet – except gymnastics. A well-executed taper has been shown to result in between two and eight percent improvements in strength and endurance (35, 40, 44, 47, 48, 65). It is no secret the approach used in the States is one of keeping the athletes working incredibly hard through the leadup to a competition.

> "... the final preparation phase in gymnastics features very heavy training loads, implying that a taper as such is not necessarily used to prepare for major competitions; that gymnasts will not normally display in competition performance levels they have not previously displayed in training..." (35), p 152.

Mujika may be correct in that gymnasts do their training the same as they compete. Other sports requiring maximum efforts may benefit more from a taper. Moreover, gymnastics may not require maximum strength like weightlifting and track and field or maximum endurance like distance running. However, evidence of mistakes in fatigue management is the commonplace rise in injuries during this time (6, 8, 10, 13, 27, 64). Kerr and Minden showed there is a significant rise in injuries among female gymnasts during the last two weeks prior to a competition (28-31, 60). Sands and colleagues also showed reduced psychological mood state and increased fatigue in a long-term athlete monitoring program for women's national team athletes in preparation for the 1988 Olympic Trials (49, 50, 54). Caution and vigilance are required during the intervening time between competitions, and risk taking would appear to be counterproductive. One caveat for the training leading up to an important competition is that fatigue management mistakes may not result in failure, but the athletes' performances are likely to be less stable (i.e., more unpredictable). Coaches should explore the idea of tapering to learn and provide information that could benefit gymnasts.

Last Two Microcycles. Personal experience has shown the following loading plan has worked admirably across elite and aspiring elite gymnasts. Note the chart in Figure 4 shows volume not intensity. Intensity during this period will be high throughout. Athletes should be performing full routines with excellent quality. Since the athlete will be expected to perform competition level exercises, she should not be constrained by accumulated fatigue (35, 36). Conditioning during this phase is kept low but with high quality. Mujika and others (35, 36) have shown athletes should not decrease the intensity of training during a taper or the late preparation prior to a competition, or risk dramatic declines in fitness and preparedness. However, one can decrease volume or training frequency during the late period of training prior to competition without a significant decline of the athlete's specific fitness.

Compose Routines with Skills that can be Readily Replaced. Consider reducing the athlete's difficulty expectations by composing routines where the high difficulty skills can be replaced easily. The athlete should often train at her highest difficulty level but compete at a lower level. The routine should be able

to be altered replacing the most difficult skills with easier skills. For example, the athlete should train at 90% to 100% of her skill difficulty, but compete at approximately 70% to 80% of her difficulty. The gymnast should compete with routines that are not considered a safety, social, or confidence threat. She should compete with routines that are well within her ability. From experience, change only one skill at a time in her competitive routines.

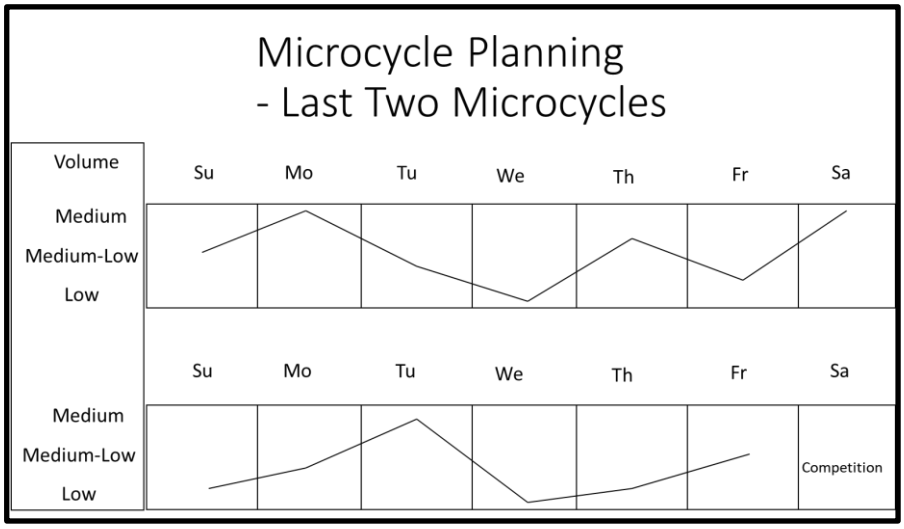

Figure 4. The last two microcycles before an important competition. Note that intensity is not graphed because it is high throughout this phase.

Example of Peaking

A study by Sands (55) monitored university gymnasts for a full academic year. Athletes were tested weekly by an isometric breaking test of knee extension strength. Seven athletes sat on a spotting table and held their right leg at 30 degrees of flexion. A

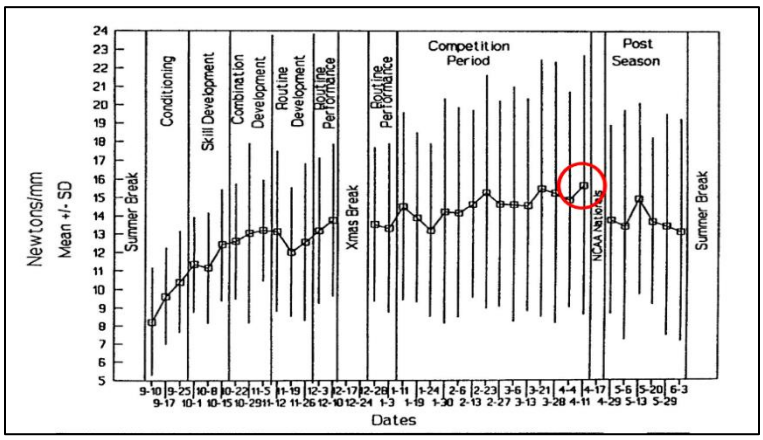

Figure 5. Strength relative to body composition for the entire academic year. The red circle showed when this ratio was highest indicating a peak of strength and leanness. Note that this peak occurred immediately prior to the NCAA Championships. The team placed second at this competition and hit all their routines with high-quality performances. The team that won was frankly a little better.

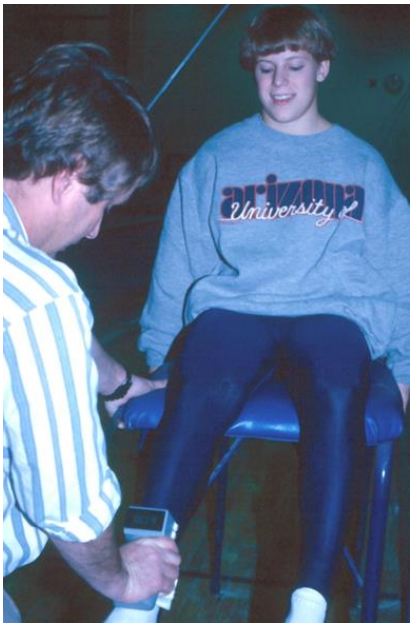

Figure 6. The testing procedure is shown with the author pressing the NMMT on the athlete's shin in 30 degrees of flexion.

Nicholas Manual Muscle Tester (NMMT) was placed on the front of the shin near the ankle bone and held firmly by the author. The athletes were told to maximally resist my downward pressure on the NMMT as I attempted to flex their knee. When I could bend their knee (isometric breaking strength), I read the maximum force off the NMMT display and recorded the data. I also measured four skin folds (chin, tricep, thigh, and mid-calf) (69) and summed the values to represent body composition (41). Gymnasts must be strong, and they must be on the lean side of lean. Figure 6 shows an image of the NMMT test. The results of the experiment are shown in Figure 5.

More About Tapering

Benefits. First, what is a taper? A simple definition is, "a specialized exercise training technique that has been designed to reverse training-induced fatigue without a loss of the training adaptations."(39). A more complex definition is, "A progressive, nonlinear reduction of the training load during a variable amount of time that is intended to reduce the physiological and psychological stress of daily training and optimize sport performance" (37), p 145.

When planning a taper, a duration of one to two weeks is recommended. However, taper durations have varied considerably. Training frequency and volume can be decreased without much influence on the athlete's fitness. However, training intensity (i.e., high quality routines) should be maintained to prevent loss of competitive fitness. The reduction in volume should be substantial, up to approximately 60%. The primary danger when using a taper is detraining (37, 38, 46, 61). The detraining problem demands careful planning of the taper period.

Guidelines for implementing a taper are:

- "Maintain training intensity
- Reduce training volume 60-90%
- Maintain training frequency at >80%
- Individualize taper duration between 4 and 14 days
- Use a progressive nonlinear tapering
- Expect performance improvements of approximately 3%" (35)

The benefits of a taper include, an increase in oxygen uptake (1), increase in anaerobic threshold (70), increase in muscular power (16), increased muscular strength (32), increases in the size, strength, velocity, and power of type IIa muscle fibers (66). Tapering may also result in changes in sleep (63) and mood (45).

Potential Problems. Most coaches do not use a taper and given that they can be successful indicates that a taper may be unnecessary (35). The tapering athlete may face symptoms of withdrawal. "It is as if you had withdrawal symptoms because you can't give your body the activity to which it is accustomed." (26), p 56. Athletes may also suffer from self-inflicted psychological conditions termed "volume guilt," or "intensity guilt." (65). The athlete may be troubled she is not training hard enough and thereby rejects opportunities for rest. Athletes must have confidence in their preparation to allow them to step back from the normal high-volume training and reduce training loads for fatigue management. Anyone can train recklessly and take on excessive loads. Smart athletes and coaches

train with just enough load to succeed. Training is an optimization problem, not a maximization problem. Excessive training load is well known prerequisite for injury.

Conclusion

Of course, peaking and tapering can be intimately related. Peaking is not well understood but lies at the heart of the goals of periodization and long-term training and competition. Tapering has received a great deal of attention in recent years. Most studies of tapering have involved endurance sports and secondarily maximal strength sports. As such, there are many questions that remain when prescribing and using a taper within gymnastics.

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