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## Weight Training. The Missing Links

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# Weight Training ...the missing links

## INTRODUCTION:

Often when designing a training program for clients or ourselves, only the bare basics of program design are considered. These being Reps, Sets, Rest, Recovery and occasionally Overload. Even in these circumstances often these parameters are only given modest attention. This session will revise, expand and explore missing / forgotten areas of program design. After all how well would a cake turn out if only baked with a fraction of the ingredients, and those ingredients used only roughly measured?

## REVIEW AND EXPANSION:

- Repetition Range: Neural Drive vs Duration of Stimulus  
Fibre Types and Motor Unit Summation
- Repetition Speed: Force – Velocity Curve  
10 Reps at 2 Secs: 5 Reps at 4 Sec = Training Stimulus?
- Set Range: 1 Set vs Multiple Sets
- Rest: Metabolic Factors  
Neural Factors
- Recovery: Volume  
All the Prime Movers, Fixators and Synergists
- Exercise Selection: All the Prime Movers  
Metabolic Considerations  
Biomechanics of the exercise  
Length – Tension Curve  
Previous and Potential Injuries



## TRAINING LOADING

Training load is commonly determined by volume x intensity (Fleck & Kraemer, 1997; Shield, 1995; Zatsiorsky, 1995; Charniga et al., 1993). These two factors have an inverse relationship. If an athlete is going to perform a high intensity training session, they would not be able to last for a long duration and hence the volume would be short and visa versa. It is through an understanding and careful manipulation of both volume and intensity that effective progression and overload can be applied. Generally volume is the initial training factor and as the athlete moves through their training cycles, volume decreases as intensity increases (Healy, 1998)

### Volume.

Volume relates to the amount of work and as such is usually determined in quantities, be they distances, times, repetitions etc. If the volume of training is going to be high the intensity of the session would have to be moderate to low.

- Overload is provided by increasing the number of sets and reps.
- The load on the bar is increased infrequently and only too a small extent.
- High volume training is often associated with development of hypertrophy in strength / power sports who predominantly train in the lower repetition range.
- It is also used for 'base' or anatomical adaptation development.

### Intensity.

Intensity relates to how close to a maximal effort is performed. It can be determined by proximity to 1RM or as a percentage of ability 9 Repetitions of a 10 RM load would be a 90% intensity.

- During the high intensity phase, the number of sets or duration of training remains mostly constant with the major overload coming from increases in weight or speed.
- High Intensity work is often associated with development of maximal strength and power due to the low repetition and heavy weight training regime which requires high neural drive and summation.

## PERIODISATION

Periodisation involves the long term planning of the training process in order that peak performance be achieved at the most appropriate time. This is accomplished by the dividing of an annual plan into smaller more manageable phases and sub phases. From a resistance point of view, DeVries & Housh (1994,pp.434, 435) define periodisation as the '**systematic changes in resistance, number of sets, and/ or number of repetitions performed during a chronic weight training program.**'

In a non-periodised training program all the physical parameters contributing to sporting performance receive equal attention throughout the year. This is less efficient than sensible periodisation because:

- There is not enough time in a single week to fully attend to all the parameters which influence performance.
- Furthermore, the development of some physiological parameters are interfered with by the concurrent development of others. *Eg. Trying to increase endurance and muscle size at the same time is often less successful than developing size then working on endurance.*
- Some components of performance can not be adequately developed before certain pre requisites are met. *Eg. A bodybuilder is wasting time cutting up to display muscular definition, if he has yet to build up sufficient mass.*

## THE ANNUAL PLAN

The annual plan is the plan used by coaches to plot training schedules, specific times of peak performance and is based around the requirements of a competitive season or specific event / goal. To allow for easier control, monitoring and planning an annual plan is divided into smaller phases. Depending on the references used these phases are also termed periods or training cycles. The three basic phases are : **Preparatory Phase, ( Pre - season), Competitive Phase, ( In- season), and Transition Phase, (Active rest/recovery).**

Two of these phases, the preparatory and the competitive, are again broken down. The Preparatory Phase is sub – divided into General and Specific Preparation Phases. The Competitive Phase is sub – divided into the Pre Competitive and Competition Phases

These phases and sub phases are again broken down into smaller components called cycles. When it comes to the training cycles, there are various classifications used, each with their own different time periods. Bompa's and Nadori's (1985 as cited by Istvan & Hamilton 1995,p.3) adapted model, in conjunction with the above phases and sub phases, consists of macro-cycles, of a two to six week duration (Matveyev's meso-cycle), and microcycles, of one week duration (Aitken,1996; Bompa, 1994, Meir,1994; Woodman & Jarver, 1991).

### Planning to Periodise – Manipulating Time

- *Step 1.* The first and key step is to determine the end point, what the training is aimed to achieve, is it the Olympic games in four years time, national titles in September or simply best possible physical condition for summer.
- *Step 2.* Determine the amount of time to the target date of the goal. If a full training year is available, then obviously 52 weeks of the year are available to work with.
- *Step 3* Determine the duration of the competitive season and plot all competitions. This will allow a determination of what time is available for use.
- *Step 4.* Divide the remaining training time in the phases of development. (See Figure 13 ).
- *Step 5.* Determine the amount of time to be spent on each of the components required by the athlete in each phase. Eg. Speed, endurance, technique, flexibility etc.
- *Step 6.* Determine how much time will be allocated to each component during the individual macro - cycles.
- *Step 7.* Determine how much time will be allocated to each component during the micro - cycles. Also consider the manipulation of volume and intensity for each component during each session

## THE PRINCIPALS OF TRAINING

Although more popular in the coaching industry, the principals of training are infrequently applied to everyday training. These principals do however need to be considered if optimal gains are to be made in ANY realm of fitness.

### **PRINCIPAL OF OVERLOAD**

The principal of overload revolves around the need for the body and its systems to be placed under a stress that it is not accustomed to. This training effect causes an adaptation response from the body (Damm,1997; Powers & Howley,1997; Wilmore & Costill,1988; Sharkey,1986; Calder, nd.).

**Pyke and Woodman (1991,p.115) explain why the term progressive is often associated with the principal of overload. ‘The term progressive is best linked to overload to ensure that the training stimulus is gradually increased’.**

Overload must be high enough to induce fatigue and therefore a training response, it must not however reach the point where adaptations become negative due to excessive fatigue (Pyke & Woodman). As a general guide there should be no more than a 10 % increases in load per week (Powers & Howley 1997,p.397; Pyke & Woodman 1991,p.116). ‘*It is not necessarily true that if some training is good more is better.*’ Pyke and Woodman (1991,p.117). Another problem arises if the training stimulus is inadequate. If the systems of the body are not stimulated sufficiently the training effect will be low and adaptations minimal (Pyke & Woodman,1991).

Common overload methods include: Forced Reps, Negative Reps, Drop Sets, Blitzing, etc.

### **PRINCIPAL OF RECOVERY**

Recovery is often the most neglected principal applied to training programs. With goals and time in mind, overload often builds and builds given the adaptive reserve little time to replenish.

Although the intensity of training is important, another key factor is the type of training performed. For example, exercises that have a higher eccentric component, like negative repetitions, would require more recovery time than say a general repetitions, which in turn requires more recovery than concentric only repetitions.

Besides the components of training loads, volume of muscle trained, synergistic use of muscles and speed of repetitions, there are several other physiological factors that influence the rate of recovery, with age and experience being two of the more prominent (Bompa,1994).

Bompa (1994,p.116) states ‘...it seldom happens that an athlete will fully recover between training lessons, the coach should consider the employment of various methods of recovery.’ Rushall and Pyke (1993,p.66) also agree with this statement and add that ‘Today’s training loads are so demanding that ‘natural’ recovery alone can no longer provide adequate recovery.’

Besides enhancing recovery with active rest (kinotherapy) and sleep (Bompa,1994; Rushall & Pyke,1993), several other methods can be utilised including : Physiotherapeutic means, (Massage, Electrostimulation, Hydro – therapy), Reflexology and Chemotherapy (Vitamins and Ergogenic aids).

It is important to note that recovery is said to be more effective if a variety of techniques are used rather than just a single method alone (Bompa,1994; Rushall & Pyke,1993).

### **PRINCIPAL OF REVERSIBILITY**

The principal of reversibility or disuse follows the common slogan ‘Use it or Lose it.’ As training effect requires an overload of stimulus to adapt and develop the reverse also applies. With insufficient stimulus the body will adapt and return to a capability of the lower workload. If someone who trained regularly ceased training, their body would ‘detrain’ over a period of time and only maintain a level of fitness applicable to their current lower work rate (Wilmore & Costill,1994).

The first thing many people want to know is “How much detraining takes place?”. In regards to resistance training, Wilmore & Costill (1988) have found that reductions in strength are relatively small during the first few months after training ceases and that fortunately, it is easier to regain lost strength, power and muscular endurance than it is to develop it initially.

**‘Recent studies have made it clear that a few days of rest or a reduction in training will not impair, but may even enhance performance... However, at some point a reduction in training or complete inactivity will produce a deterioration in performance.’ (Wilmore & Costill 1988,p.200)**

## PRINCIPAL OF INDIVIDUALITY

As can be expected, all athletes have individual differences, from genetics (like sex and fibre type distribution) to training history and lifestyle. Several factors, recommended by Rushall and Pyke (1993,p.84 - 91), need to be considered.

- Tolerance to training. - Some may enjoy hard session others may not.
- Responsiveness to training. - The ability for their bodies to respond to training. Eg. Fibre types and hypertrophy.
- Recovery from training and competition.
- Training needs. - Knowing strengths and weakness of the athlete.
- Training preferences. - Ensuring they not only train what they enjoy but their weak areas as well.
- Nutritional preferences. - Eg. Vegetarians would prefer iron from non-meat products.

A strong statement by McArdle, Katch & Katch (1996,p.396) summarises the principal of individuality. *'Training benefits are optimised when programs are planned to meet the individual needs and capacities of the participants.'*

## PRINCIPAL OF SPECIFICITY

The principal of specificity revolves around the training effect being specific to the overall objective. The reasoning behind specificity is fairly clear, those requiring beneficial adaptations for their activity need to utilise the systems and muscles of that activity if they desire them to gain a training effect and adapt. Therefore for a client wanting muscle hypertrophy, Strength training would not provide ***optimal*** results.

As McArdle, Katch & Katch (1996,p.394) state *'Specific exercises elicits specific adaptations creating specific training effects.'* At point to remember however is that *'Specificity does not mean that you should avoid training opposite muscle groups or adjacent muscles'* (Sharkey 1990,p.403)

The primary error in the fitness industry when applying this principal is the implementation of specific training to early before a fitness base has been established, for example performing a Dumbbell Bench Press before basic pressing techniques have been learnt. *'If training becomes too specific too quickly, injuries are likely to occur.'* (Damm 1996a,p.12 )

## THE PRINCIPAL OF VARIETY

The importance of variety is not just the - spice - of - life. Variety ensures that the athlete does not 'stagnate' on a set training load (Damm,1996b). We know that the body adapts to a training stimulus, if the same stimulus were to be used without change, after initial adaptation gains would be low and the chances of over use or repetitive strain injury would be increase. Obviously certain elements of specificity are lost when methods of training, other than event specific, are used, however goals can still be catered for. For example: Leg Pressing and Lunging train similar muscles yet a Leg Press is a bilateral, open kinetic chain activity with a low core stability requirement whilst a Lunge is the complete opposite.

Some more basic forms of variety come from a simple change of venue. Utilising different gymnasiums or training at a different time of day are simple means of providing variety.

With this in mind, variations can be given throughout a training year or program. During pre - season training or development training, when the requirement for specificity is low, alternating forms of training can provide variety. During the pre - competitive and competition phase, when specificity is the priority, variety can come from the change in venues, training groups etc.

***General Leg Training:***Squat, Lunge, Leg Press, Sprints, Deadlift.

***Specific Leg Training:***Squat, Front Squat, Jump Squat, Split Squat (At Different Venues and Times)

## CONCLUSION

There are a variety of less popular or more specific principals that can be found in different text including the principals of long - term training (Sharkey 1990,p.404), moderation (Sharkey 1990,p.404), potential (Sharkey 1990,p.405), active participation in training (Bompa 1994,p.29), and multilateral development (Bompa 1994,p.31).

All these principals can be used to improve effectiveness of training and, although some principals counter act each other (eg variety and specificity), they are still be combined to supplement each other and improve responses.

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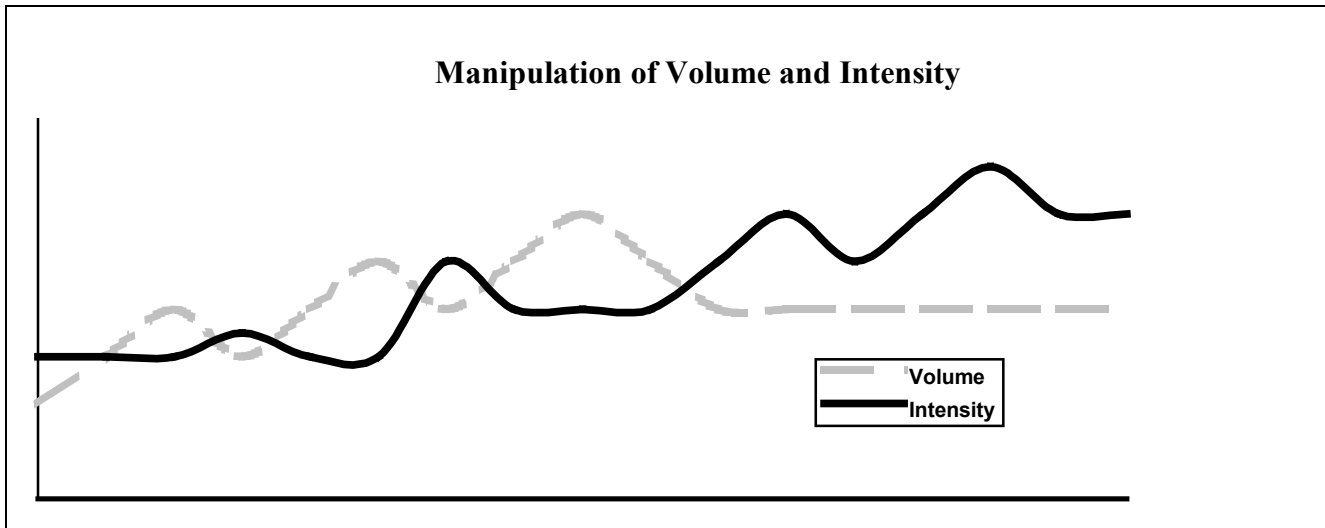


Figure 1. A generic manipulation of volume and intensity.

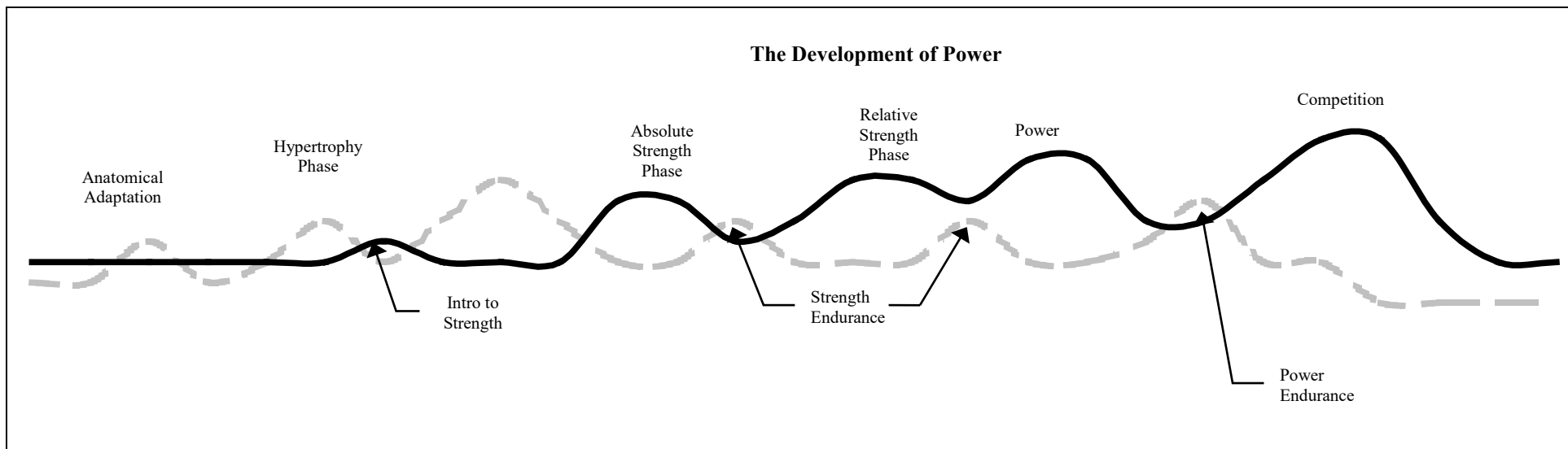


Figure 2. A specific resistance training manipulation of volume and intensity for the development of a power based athlete.