



**Basic  
Principles  
Of Strength  
Training**

**V.1**

# CONTENTS

<b>Introduction</b> .....	<b>3</b>
Aims of This Booklet	
Benefits of Strength Training	
Key Abbreviations	
<b>General to Specific Model</b> .....	<b>4</b>
<b>Needs Analysis</b> .....	<b>5</b>
Levels of a Needs Analysis	
<b>Athlete Screening</b> .....	<b>6</b>
What Is It?	
Example: RTSB	
<b>Dose Response: How Often to Train</b> .....	<b>7</b>
Intensity, Volume and Frequency Recommendations	
<b>RAMP Warm-Up</b> .....	<b>8-9</b>
Benefits	
Raise, Activate, Mobilise and Potentiate	
<b>Periodization</b> .....	<b>10-11</b>
What Is It?	
Temporal Views	
Phase Potentiation	
Linear Periodization	
<b>RPE and RIR Based Training</b> .....	<b>12-13</b>
What Is It?	
Benefits	
How to Use It	
<b>Percentage Based Training</b> .....	<b>14</b>
What Is It?	
How to Use It	
<b>References &amp; Acknowledgments</b> .....	<b>15</b>

# INTRODUCTION

## AIMS OF THIS BOOKLET

The aim of this document is to **introduce avid gym goers or personal trainers to basic strength and conditioning principles**. Nuance should be applied throughout in your interpretation of the information within the booklet to get the best out of it and aid your future development.

## STRENGTH TRAINING BENEFITS:

- IMPROVED PHYSICAL PERFORMANCE
- IMPROVED SELF-ESTEEM
- DECREASE IN VISCERAL FAT
- IMPROVED INSULIN SENSITIVITY
- IMPROVED CARDIOVASCULAR HEALTH
- REDUCED RESTING BLOOD PRESURE
- INCREASE IN BONE DENSITY
- REDUCED LOW BACK PAIN
- and much, much more...

**'EXERCISE IS MEDICINE'**

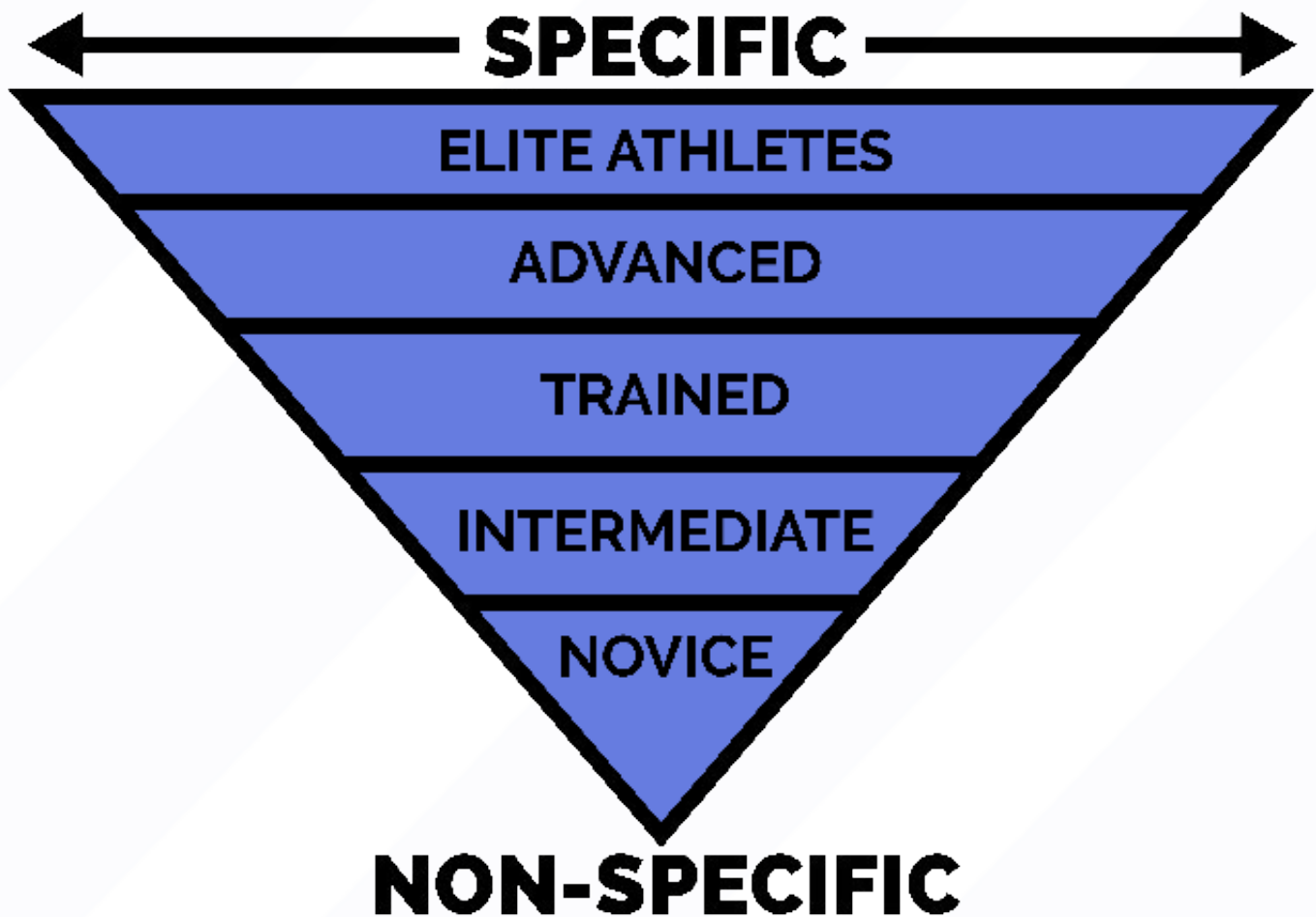


## KEY ABBREVIATIONS:

- **Repetition/rep**= performing a movement or exercise
- **Sets**= a series of repetitions/ reps, often expressed as 'sets x reps' for instance, 5x5, meaning 5 sets of 5 reps
- **1 Repetition maximum**= the absolute most you could lift for a given movement
- **1RM** = 1 Repetition maximum
- **3RM**= 3 Repetition maximum



# GENERAL-SPECIFIC MODEL



The more experienced you become in resistance training, the slower your improvements become, as you get closer to your genetic limit.

Therefore, to continue to make improvements, in any athletic quality, training has to become more specific. For instance, if someone wants to go from using weightlifting (clean and jerk and snatch) as a training tool to actually competing in weightlifting, their training will have to become more specific to weightlifting. This is essentially just applying the principle of **SPECIFICITY (adaptation is specific to the type of training you do)**.

The added time, attention and effort required to continue to make these gains also needs to be taken into consideration, in relation to an athlete's sport or goals...

Is it worth training for two extra hours a week to get a 5kg personal best back squat, for your sport? will it make you better at the sport? will it debilitate other physical qualities required in the sport?

Essentially, **if you want to get really strong, you'll have to prioritise getting really strong**. The more you prioritise it, the stronger you will get, hence the time training certain physical attributes (strength, power, endurance etc.) needs to be calculated based on goals or the athlete's sport.

# NEEDS ANALYSIS

## A NEEDS ANALYSIS CAN BE VIEWED AT DIFFERENT LEVELS:

### SPORT SPECIFIC

- PHYSIOLOGICAL REQUIREMENTS
- COMMON INJURIES
- TIME-MOTION ANALYSIS
- BIOMECHANICAL REQUIREMENTS

e.g. Basketball is heavily reliant on the anaerobic energy systems, with a work:rest ratio of 1:3.6. It also requires high levels of strength, power, agility and acceleration/deceleration. The most common injuries in basketball are ankle ligament sprains (26.2%).

### THE INDIVIDUAL

- PREVIOUS INJURIES
- INDIVIDUAL GOALS
- COMMITMENT TO THE SPORT (FULL-TIME vs PART-TIME)
- LIFESTYLE FACTORS

e.g. if an individual suffers from shin splints then appropriate rehab/prehab for that needs to be added to sessions and as additional work outside of the gym. It's also worth taking into account the individual's goals and commitment to the sport. If they aren't making a living out of the sport, then long term athleticism and health may be the bigger focus.

### NORMATIVE DATA

- COLLECTING NORMATIVE DATA FROM THE SPORT AND COMPARING IT TO THE ATHLETES TESTING RESULT, EXPOSING AREAS OF COMPARATIVE WEAKNESS THAT NEED IMPROVEMENT.

e.g. one study found, in professional rugby league players, a mean 3RM full squat of 157.9 6kg, a mean 3RM power hang clean of 102.2kg and a mean 3RM bench press of 124kg.

Comparisons should then be made against these sorts of values, if you're at, or aiming to be at, a similar competitive level.

A needs analysis isn't just for those competing in a sport. For any individual, it is important to consider their goals, previous injuries and the current fitness levels in relation to where they need/want to get to. If you choose to use normative data, consider using data relative to their playing positions, relative to bodyweight and relative to your competitive level.

**A needs analysis and your screening process work together to shape your programming to your needs! It will write a lot of your programme for you!**

# SCREENING

## WHAT IS IT?

Screening is the process of putting an athlete through a series of tests, prior to a programme, to assess their level and proficiency of movement.

**POSSIBLE BENEFITS** of screening includes **uncovering a lack of mobility**, which may hinder training, **weak unilateral ability** and **imbalances** between limbs.

You can put yourself/your athlete through multiple different screening procedures; you do not have to exclusively use one procedure.

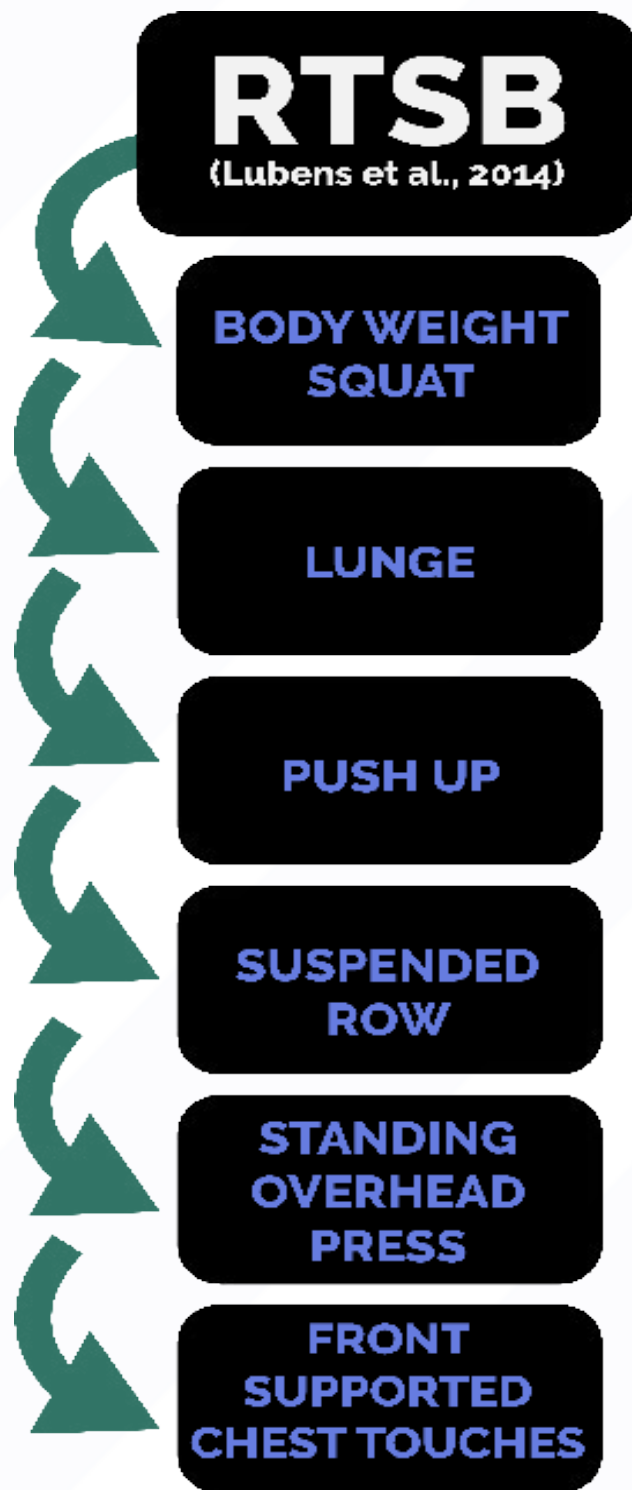
Use the results of your screening to **inform your programming** and to show progress by repeating screening procedures at regular dates, for instance at the end of each month.

## EXAMPLE: RTSB

The RTSB provides an assessment of resistance training skill competency and includes **6 exercises** (i.e., body weight squat, push-up, lunge, suspended row, standing overhead press, and front support with chest touches).

Scoring for each skill is based on the number of performance-based criteria successfully demonstrated. An overall resistance training skill quotient (RTSQ) is created by adding participant's scores for the 6 skills.

It's worth noting that **TECHNIQUE MAY CHANGE WHEN A MOVEMENT IS LOADED**; a bodyweight squat may look better than a barbell squat. Therefore, **attention needs to be maintained** as movements are loaded.



\*EXAMPLE OF A SCREENING PROCEDURE

# DOSE-RESPONSE

## TRAINING RECOMMENDATIONS

Frequency, intensity and volume differ in their dose to response relationship between trained, untrained and elite athletes, in bringing about optimal strength gains. The following guide may help to you loosely understand the changes that may occur with an increased training age.

### UNTRAINED INDIVIDUALS

Per muscle group, untrained individuals should train at an intensity of **60% 1RM**, **3 days per week** and **4 sets per week** for optimal strength gains.



### TRAINED INDIVIDUALS

Per muscle group, trained individuals should train at an intensity of **80% 1RM**, **2 days per week** and **4 sets per week** for optimal strength gains.



### ELITE INDIVIDUALS

Per muscle group, elite individuals should train at an intensity of **85% 1RM**, **2 days per week** and **8 sets per week** for optimal strength gains.



# RAMP WARM-UP

In simple terms, **a warm-up is the process of preparing your body for the exercises to come** and hence is referred to by some as 'movement prep' instead of a warm-up, which could be a better way to perceive it, so as not to diminish its importance and not be seen as a throwaway aspect of training, but instead an essential aspect.

## BENEFITS OF A WARM-UP:

- **Faster contraction and relaxation of agonists (prime movement muscles) and antagonists (muscles that perform the opposite movement to the agonist)**
- **Improved RFD (rate of force development) and reaction time**
- **Improved strength and power**
- **Lowered viscous resistance in the muscles**
- **Improved oxygen delivery, due to the Bohr effect, whereby greater temperature elicits oxygen release from haemoglobin and myoglobin**
- **Increased blood flow to muscles**

## WHAT IS A RAMP WARM-UP?

### RAISE

To **elevate heart rate, blood flow, body temperature, respiratory rate and joint fluid viscosity**, via low-intensity exercises. This is far too often done using the old school jog around a park or jog on a treadmill, which, with the limited time people have in a gym per day, is not the best use of time. This is why more **time-efficient ways to raise one's heart rate should be considered**. For instance, kettlebell swings, with enough intensity to raise heart rate, prior to a deadlift session, combining the 'raise' section of the warm-up with the actual movement prep, making more efficient use of time.







## ACTIVATE AND MOBILISE

To **activate key muscle groups** and **mobilise key joints and ranges of motion**. The activate phase will differ from person to person and often looks to activate certain muscle groups and can be in the form of small prehab circuits, like banded rotator cuff circuits. The mobilisation phase looks more at movements; getting your body use to the ranges of motion needed for the coming session, in a dynamic manner. For example, goblet squats, prior to a front squat session.



## POTENTIATE

This is about improving the effectiveness of subsequent exercises, usually in the form of **gradual increases in intensity, until you're at the intensity required for your session/ exercise**. The potentiate phase can also be used as a time-efficient way to get power work into your training week if you don't have the time for double sessions or power specific session. For example, explosive push press prior to military press.



**TO CONCLUDE...** warm ups have many benefits, for instance, they provide a **coaching opportunity**, an **opportunity to perform rehab and prehab exercises**, an **opportunity to train high-velocity power movements** that you may not otherwise have time for and, most importantly, it **improves performance** of the upcoming session, which is only going to **improve strength gains and accelerate progress**.

**WARM-UPS ARE ABSOLUTELY ESSENTIAL!**

# PERIODIZATION

## WHAT IS PERIODIZATION?

Periodization is a **planned, holistic approach to a training programme**, altering training variables, including frequency, intensity and volume to allow athletes to peak for competition, avoid overtraining, avoid plateaus, increasing strength adaptation.

A periodized programme will include things like, **pre-planned intensity prescription, deload weeks** (for instance, a 3:1 deload ratio) and **intensity and volume tapering** around competition.

## THEY ARE TYPICALLY VIEWED IN DIFFERENT TEMPORAL CYCLES...

**MACROCYCLES** - long length cycle which typically lasts **about a year** (e.g. A football season). For climatic sports this tends to start with higher volume and end with higher intensity.

**MESOCYCLES** - mid length cycle, **usually 2-3 months** and can be either mimic macrocycles in that it's based around volume and intensity alterations, or it can be devoted to a particular phase of training, for example, preparation (GP), transition or competition. Mesos can also be split into sub-categories (often referred to as **BLOCKS**), for instance, general prep and specific prep or max strength and strength.

**MICROCYCLES** - short length cycle, **typically a singular training week**, including details on tapering, training days, rest days etc.

This just means you need to plan a programme at a long-term, mid-term and short-term level...



\*basic example of a periodized programme for a beginner looking to build strength.



## PHASE POTENTIATION

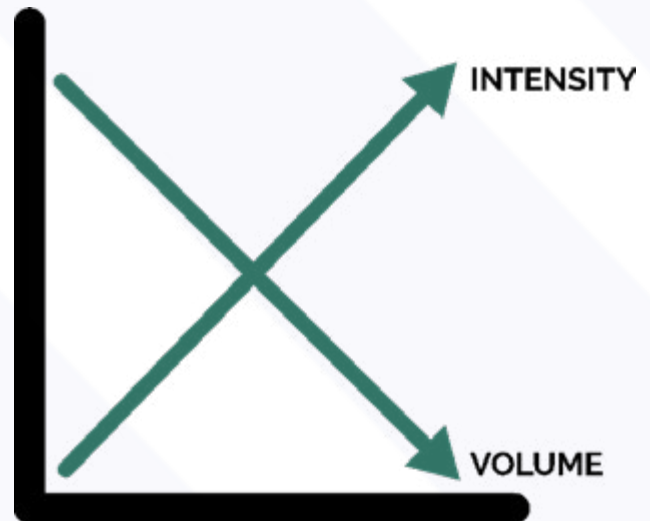
Another important concept in periodization is phase potentiation. This, in simple terms means **arranging your blocks or phases of training into a logical order**, whereby the first block sets you up for the second and the second sets you up for the third, and so on. So, for instance, a strength and hypertrophy phase of training would set you up for power phase, because max strength is a key determinant of power.

## LINEAR PERIODIZATION

Linear periodization is the simplest form of periodization and the easiest to follow (other forms include, non-linear and block periodisation). **It is typically associated with climatic sports**, i.e. ones where the athletes peak for a singular bout of competition, for instance, a sprinter or a powerlifter.

For anyone not actively competing in a sport, this would be the easiest form of periodization to follow.

In a linear programme, **volume starts high and intensity starts low** (in relative terms), and slowly, **volume falls in correspondance with increases in intensity**, in a linear fashion.



## WHAT MIGHT THIS LOOK LIKE IN PRACTISE?

A basic view of a 4-week linear programme, without the addition of any deloading (for viewing simplicity purposes)...

	INTENSITY (%1RM)	SETS x REPS
WEEK 1	73%	3x8
WEEK 2	79%	3x6
WEEK 3	83%	3x4
WEEK 4	87%	3x2

*\*Volume= sets x reps x weight lifted*

*\*%1RM= percentage of your one repetition maximum of a movement*

# RPE & RIR BASED TRAINING

## WHAT IS RPE AND RIR?

Rating of perceived exertion (RPE) measures how hard you are working.

RPE has been modified to better suit resistance training, utilising repetitions in reserve (RIR). This helps determine where on the RPE scale you sit after a set, and thus, whether you're working too hard or not working hard enough; it's a method of quantifying training intensity.

## BENEFITS OF RPE/RIR:

- **Accounts for life factors**, for instance, variation in nutrition, sleep, stress and the day to day fluctuation in strength levels.
- **Accounts for individual levels of progress and recovery**
- **Based on current performance**; %1RM is based on previous performances, which may not represent current performance
- **Accounts for the instability of 1RM in novice lifters**
- **Allows accurate programming of movements that can't be 1RM tested**

## USING RIR/RPE IN PROGRAMMING

Align the RIR/RPE value on TABLE 1 with the RPE value on TABLE 2. Now, where your **assigned RPE and your assigned rep range intersect will be your approximate intensity**, showing how RIR regulates intensity for training programmes and intensity prescriptions.

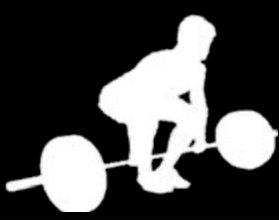
For **OPTIMAL STRENGTH GAINS** it is recommended you work between **7 and 10 on the RPE scale**, which equates to between 3 RIR and 0RIR.

## USING RIR/RPE IN-SESSION

### 1. COMPLETE A SET

**2. ASK YOURSELF 'HOW MANY MORE REPS COULD I HAVE DONE'**- this will determine your RIR value and thus your RPE value; if you could do 2 more reps, that's RIR2, which equals RPE8 (Table 1).

**3. ADJUST LOAD ACCORDINGLY-** if your programme says you should be working at RIR2 and you had 4 reps left over, increase the load accordingly so you're working at RIR2 in the following set.



RPE based on RIR (Repetitions in Reserve)

TABLE 1

10	couldn't do any more reps or load
9.5	couldn't do any more reps but could do slightly more load
9	could do 1 more rep
8.5	could definitely do one more rep, with a chance at 2
8	could do 2 more reps
7.5	could do 2 more reps, with a chance at 3
7	could do 3 more reps
5-6	could do 4 to 6 more reps
1-4	very light to light effort

REPETITIONS PERFORMED

TABLE 2

RPE	1	2	3	4	5	6	7	8
10	100.0%	95.0%	91.0%	87.0%	85.0%	83.0%	81.0%	79.0%
9.5	97.0%	93.0%	89.0%	86.0%	84.0%	82.0%	80.0%	77.5%
9	95.0%	91.0%	87.0%	85.0%	83.0%	81.0%	79.0%	76.0%
8.5	93.0%	89.0%	86.0%	84.0%	82.0%	80.0%	77.5%	74.5%
8	91.0%	87.0%	85.0%	83.0%	81.0%	79.0%	76.0%	73.0%
7.5	89.0%	86.0%	84.0%	82.0%	80.0%	77.5	74.5%	71.5%
7	97.0%	85.0%	83.0%	81.0%	79.0%	76.0%	73.0%	70.0%



**APPLIED-** basic example, keeping RIR constant, for simplicity, to demonstrate how RIR regulates intensity as repetition volume falls, in a linear programme...

TABLE 3

	RIR	REPS	EQUIV %1RM
WEEK 1	2RIR	x8	73%
WEEK 2	2RIR	x6	79%
WEEK 3	2RIR	x4	83%
WEEK 4	2RIR	x2	87%

\*EQUIV %1RM- the equivalent %1RM value based on the reps in reserve at a certain number of repetitions  
 \*RIR= Repetitions in Reserve- kept constant for simplicity in this case

# PERCENTAGE BASED TRAINING

## WHAT IS IT?

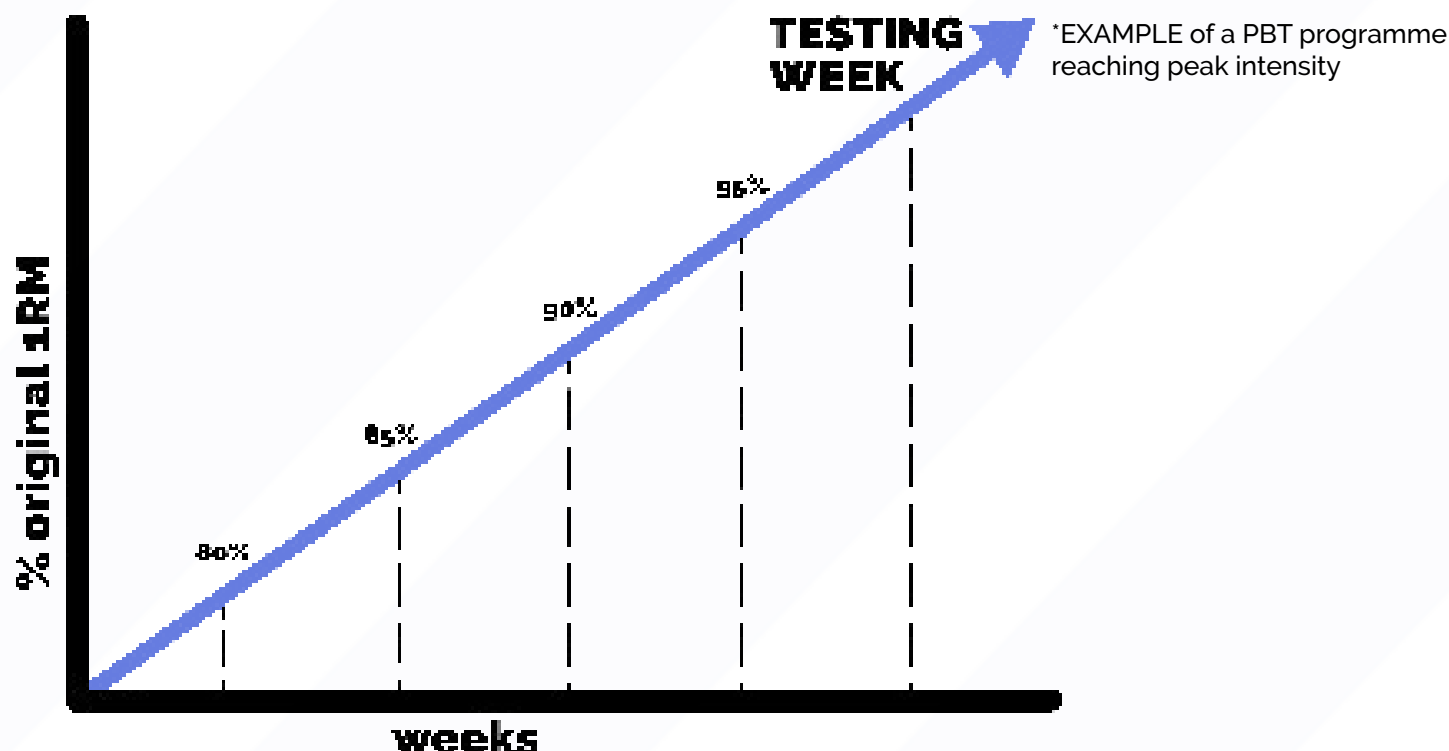
There are many different methods for quantifying intensity within a training programme, the traditional and most common method being 'percentage-based training' (PBT).

This method involves **prescribing sub-maximal loads, relative to a previous one repetition maximum test (1RM)**, as a percentage of the result of said 1RM test.

This method is common in literature and has been shown to be a **valid and reliable** way to programme intensity across a range of populations.

## STEP-BY-STEP GUIDE TO PBT:

- 1. COMPLETE A 1RM TEST-** testing your main lifts, for instance, a back squat or a bench press
- 2. CHOOSE A DESIRED STARTING INTENSITY-** prescribe your intensity to start, based on your goals/goals of your training block (strength, power, hypertrophy etc.)
- 3. PROGRESSIVELY OVERLOAD-** increase your intensity through the programme by slowly increasing the percentage of your 1RM test that you're working at.
- 4. RE-TEST-** once you reach an appropriate intensity, whereby you're ready to re-test your 1RM strength, then taper or deload before doing so.
- 5. START A NEW PROGRAMME-** based on the results of your new 1RM test, create a new programme, aligning with your new goals.



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Tommy Powell:  
Owner of Funktional Gym,  
Photographer for this booklet  
Instagram @**funktional.gym** @**funktional.coaching**

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