

STRENGTH/POWER TRAINING FOR A WORLD CLASS 800M RUNNER

The following paper has been prepared by Ian Harries following a 15-day visit to England from 7-23 November 2002. The trip was funded by Athletics South Africa (Airticket and British Rail Pass) and the Vaal Triangle Technikon (Daily Subsistence Allowance)

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Motivation

The request to undertake this study was motivated by the fact that most material on strength/power training tends to be directed at sprinters, jumpers and throwers. Despite extensive reading most information pertaining to this particular event, the 800m, appears disjointed. It fails to explain the relationship between strength endurance (circuit/stage training and hill running) vs maximum strength (ie squats as a % of bodyweight) vs elastic strength or plyometrics (hopping and bounding) vs running drills (high knees and kick up's) vs pure speed (20-60 sprints) over and throughout a 12-month periodised year of training

British Coaches Consulted

- Dr Norman Poole, Chairman of the British Milers Club and previously the British National Event Coach for 800/1500m. He has had considerable success with athletes in these two events
- George Gandy, Director of Athletics at Loughborough University and who holds a PhD in Biomechanics. An extremely successful Middle and Long Distance Coach probably best known for the preparation and implementation of the strength/power programme of Sebastian Coe
- Carl Johnson, previously a BAF National Coach. Regarded, by some, as an authority on strength training and up to the time of the 1995 IAAF World Championships guided the training of Jonathan Edwards. It was at these Championships that Edwards recorded his world record of 18.29m in the Triple Jump

Categories of Strength

Strength appears to come in a number of categories. They are

Absolute Strength

Maximum Strength

Relative Strength (strength to bodyweight ratio)

General Strength

Strength Endurance; and

Elastic Strength or Plyometrics

The Purpose of Strength

For an 800m runner Strength Endurance and Elastic Strength appear to be the most popular and widely used forms of training. However Maximum Strength is probably the least understood and the most important when applied to the prime movers ie the legs

These 3 types of strength seek to develop the following muscle groups the order of which I will explain later

- The Stabilizers in respect of the upper limbs ie the arms and shoulders, and to a lesser extent the head (the camera), to help counter the movements of the prime movers and to assist in posture
- The second group of Stabilizers in respect of Core Strength related to the stomach and back which play a major role in posture particularly when the runner is under pressure and moreso when fatigue has set in at the end of a race
- The Prime Movers in respect of the legs (the main propellants) or the lower limbs and their relationship to the hips

Popular Forms of Training

The following, in a general sense, are the ways in which the different types of strength are carried out

- **Circuit and/or Stage Training**, with elements of **Weight Training** included, placing different emphasis on the stabilizers and prime movers in respect of sets/reps/weight
- **Hill Training** with the emphasis on (a) running over undulating terrain, to (b) the utilisation of a hilly circuit, to (c) hill repetitions over varying distances ie 100-200m
- **Running Drills** which can be used either to correct (a) technique or (b) as a speed drill or (c) as a speed/strength endurance drills the more practical of which appear to be (a) high knees, (b) kick-up's or butt-kicks and (c) high knee jumps. The best would appear to be the high knee's when extended from a speed drill ie 30m and then extended to 100m as a speed endurance drill
- **Plyometrics** with the most important exercise being (a) hopping over 25-30m with both the right and the left legs, and to a lesser degree (b) bounding and (c) hurdle jumps. The first two drills will be done with run-out's at the end ie a further 20m

Strength Gains as a Benefit to Endurance Running

The equation $\text{Speed} = \text{Stride Rate (Cadence)} \times \text{Stride Length}$ prevails. If the strength levels of the prime movers are improved then it would stand to reason that strength would play some role in the improvement of stride rate ie a strong muscle will contract faster than a weaker one. Leg strength is directly related to the ability to run fast. There are no weak sprinters. Similarly strength plays an important role in stride length along with mobility or flexibility. The hip flexors raise the knee, and continue to do so throughout the race, thereby contributing to stride length

Strength will also, because of the above, play a major role in the prevention of injury. The importance of core strength cannot be overlooked

Therefore strength will contribute to the following

- An increased stride length
- Create an effective overall movement structure
- Create an optimal combination between stride rate/frequency and stride length
- Help maintain the required running speed for a particular distance
- Help prevent injury
- Improve the strength mechanism of the central nervous system

Function of the Muscle Fibres

Muscle fibres have two properties and they are (a) their contractile capacity and (b) increasing their oxidative capacity. This results from training that increases (a) the mitochondria mass, (b) capillarization and (c) enzyme activity. This results in the more effective use of oxygen and the resynthesis of ATP. These are vital ingredients for 800m success

On the other hand excessive strength training may induce (a) myofibril hypertrophy and (b) lower the oxidative capacity of the muscle fibres

Major Questions Pertaining to the Project

The Author believes that the following questions are pertinent

- Is there a role for maximum strength in 800m
- If there is why use maximum strength other than for developing the legs ie the prime movers
- Is there a 'saturation' point or 'ceiling' whereby any further gains in leg strength cannot be expressed in 800m running

The British Coaches visited were quick to point out that the ex world record holder for the 1500m, Steve Cram, never did any exercises at all. His training was running alone included in which would have been hill running. Coe, on the other hand, was the opposite

A consensus appears to prevail which suggests that it is essential to pay particular attention to the development of the prime movers ie the legs by loading them above competition demands in training. The trend has been to reduce the vast variety of strength development exercises and using only speed strength exercises

In effect most of the coaches agree there is a role for maximum strength, that it be limited to the legs and that they suspect there is a ceiling to effective leg strength but they cannot explain it in physiological terms. It comes back to the issue of coaching according to your 'gut' feeling and what appears to work

It can safely be said that 800m runners need the type of strength that induces only mild hypertrophy and avoids any negative influence on the oxidative abilities of the muscle fibres

British Coaches Interviewed

In conversing with the following three Coaches the object was not to glean detailed day to day programming but to get (a) their reaction to strength training, (b) the principles of how they apply it and (c) how they melded each aspect of strength, in relation to each other, into a 12 month periodised year

> Norman Poole (on 15 November)

The discussion which ensued agreed that running formed the most important part of the training programme when viewed holistically. Given Norman's success with female middle distance runners he stressed the need for strength moreso with them than with male middle distance runners. Women lose their strength levels faster than men

Given that a periodised year is from October to September (adjusted from the South African season to coincide with the Northern Hemisphere season and major World Championships) and that all major international competitions are between May and the end of August the following types of strength training were offered thus

Circuit/Stage Training commences at the beginning of November and stops in the middle of April

Hill Training starts in the middle of December with hills reps of 60secs until the middle of February and then immediately followed by hills reps of 30secs until the end of March

The **Running Drills** are started immediately at the beginning of October and done twice per week until the end of February. Thereafter they are built up until they are done in various forms, between the beginning of May to the end of September, 6-7 times per week

However there were some interesting peculiarities

All the **plyometric** work is included into the **Circuit/Stage Training** sessions as was the more traditional weight training work. When asked about the question of squatting the answer was ½ squats @ 2-3 sets x 10 x 30kgs

The **Hill sessions** were interesting in that Norman allowed a 6-week base of mileage to develop before introducing the following sessions

10 x 60secs (jog back recovery) for 2 months leading into

3 x 10 x 30secs (jog back recovery between the runs and 5-7mins between the sets)

leading into

3 x 5 x 30secs on the same principle

but more interestingly into what he called 'Split Hills' as follows

5 x (30secs Hills + 15secs flat jogging recovery + 30secs Hills)

Done once a week to every 10 days

The **Drill sessions** are always done after the main session and are done over 20-30m (2-3 times per week). They mainly include 'High Knee's' (done fast with less emphasis on the knee lift) and 'Kick-up's' all of which include sprinting out of the drill afterwards for a further 20-30m. 'Speed Changes' are, at appropriate times, included as part of the overall session

A detailed analysis of Norman's **Circuit Training** is attached

George Gandy (on 18 November)

There are many similarities between the training methods of Norman Poole and George Gandy. The main difference is in emphasis. Both use their circuit and stage training as an all embracing entity into which they incorporate their circuits together with plyometrics and, in some instances, with the more traditional type of weight training exercises

Using the periodised year above ie October to September the following was offered

Circuit/Stage Training commences immediately in October and finishes at the end of May

More traditional **Weight Training** exercises and in particular the **Squat** are also started in October and are taken right through to the end of August

Hill Running also commences immediately in October and are done as follows

Long continuous hills, as part of an overall road run, are started in October and last for 3 months until the end of December

Loughborough has its own particular set of hills that they work on. From the beginning of January, for another 3 months, until the end of March 900m hill repetitions are done 4-6 times with a jog back recovery interspersed with 180m hill repetitions done 10-20 times again with a jog back recovery. There were a number of variations on this theme

For the next 2-2 ½ months hill repetitions of an undulating nature are done on grass ie 6 x 2mins @ 3-5km pace

Drills are started at the beginning of October with strides. After 1 month, at the beginning of November, and lasting for 2 months until the end of December 2-3 drills are included but form part of the overall Circuit/Stage Training sessions

From the beginning of January until the end of May the Drills are expanded and will include starts

The Drills will include such exercises as High Knees, Claw Down's (for the Gluteals), Bum Kick's, Fast Feet and Double Tap's

Preparatory competitions will be planned to include the last week of May (I stand corrected in my interpretation here) and continue until the completion of the first two weeks of July

The major competitions will be in July and August

George Gandy was particularly interesting. I say this with respect to my other two colleagues. He sits in probably the most successful Tertiary Institution in the United Kingdom with regard to the promotion of Athletics and in particular the Middle and Long Distance Events. Given our successes at the Vaal Triangle Technikon I felt that we mirrored that success here in South Africa in a much smaller and modest way, given our own unique set of circumstances

Given George's interest in Mbulaeni, about which I was forthcoming, I then proceeded to glean the following

George discussed his theory on his influence on Sebastian Coe and his squatting exploits. The Quadriceps (of which there are four in the main muscle group) and the Gluteal Maximus are the most important of the propulsive muscles in the upper legs. It is the question of knee lift, foot contact and leg extension. To a slightly lesser extent the abdominals play an important role

Full Frontal Squats (which isolate the Quads) provide a full range of movement. The exercise has to be started, obviously, with lighter weights. The movement has to be controlled ie no bounce at the bottom at the movement yet with no pause, the feet shoulder width apart, have to point slightly outwards with the knees pointing in the same direction. The Quads initiate the movement and at a certain point the Gluteals complete the movement into the upright position

When working with Coe the Squats were built up to 3 x 6 @ 1½ times Bodyweight. George said that he felt that a 'ceiling' had been reached at this point for Coe. Coe repeatedly stressed that the

confidence he gleaned from these sessions contributed greatly to his racing and record breaking successes

George said that in respect of his women athletes he aimed for 1¼ times Bodyweight

Cleans were also part of the programme but only if the athletes were technically good enough to perform the movement

With these particular exercises there was always the chance of 'bulk' being added. However this was minimised by keeping the sets and reps low ie 3 x 6-8 reps

Included in this section of the Project the following papers are attached

- Aspects of Indoor Conditioning – The Loughborough Circuit
- Stage Circuit – Format 1 (October to January)
- Stage Circuit – Format II (January to April)
- Weight Training – Who Benefits?
- George Gandy/LSAC Weights Programme (Winter 2000-2001)
- Are Top Runners Built on Hills?

Carl Johnson (on 20 November 2002)

From the outset it should be explained that Carl Johnson is a high level track and field coach in the traditional sense especially in the area of throwers and jumpers. He commands enormous respect for his knowledge on strength training. He has had very little experience in the area of middle and long distance running

He did not wish to comment on the area of Hill Training as he said that he had little experience in this regard

In our discussions he was quick to point out that Zatsiorsky's view that to gain strength a session of that nature had to be done every 3 days and to maintain one's strength levels a session had to be done every 4th day

In his view suitable lifts for 800m runners were ½ squats and/or full squats

Other suitable lifts, if the runners was technically competent, would be the Snatch, Clean and Clean and Jerk. He stressed that these were all round exercises that required all the muscles of the body playing a role

However it was important to stress that there should be no weight gain. The gains should be neural as well as muscular and this could be achieved by performing the exercises with low sets (3-4 sets but preferably 3) and low reps (less than 10 with a weight between 60-100% of bodyweight). This involved the ATP-PC system and the recruitment of FT2b fibres. Of course these effects can be achieved either through reps to fatigue or through heavy loading (ie heavy loading/low reps or through the pyramid system ie 6-4-2-1-1 reps)

A cycle of 'work' ie 1 month or a mesocycle consists of 4 weeks made up of 3 weeks work and 1 week of active recovery. This 4th week is an opportunity to perform the various physical 'tests' on the athlete

The suggestion was made that the 800m should attempt 2 heavy sessions ie the prime movers and olympic lifts and 1 session of circuit training in rotation

In terms of periodisation the season runs from October through to the end of December and including ½ of January (Preparation 1)

This is followed by ½ of January, February through to June (Preparation 2). In the early season competitions are used as indicators for adjustments in training for Competition 1, then reverting the Preparation 3, eventually climaxing with Competition 2 which results in a peak at the World Champions/Olympics etc

In terms of maximum strength (prime movers et al) this system is used through from October until June (9 months) using 3 sessions per week at 60-60-65-70-75-80-85-90-100%

July to September (3 months) at 100-100-100% of maximum lifts but only at 1 session per week

Carl is a wonderful teacher of Athletics suggests that with African athletes (who sometimes lack a background of Physical Education) circuit training and certain exercises therein could be a prelude to advancing them towards the more complicated Snatch, Clean and Clean and Jerk movements

Carl concurred with my own thoughts regarding Drills and Plyometrics which I will not elaborate on here

The following paper is included

- Jump Exercises in Sprint Training (Verchoshansky)

I also secured, but have not included in this document the following

- Lifting advisory notes for swimmers
- Power Jump Data with the suggestion that we search out a 50m 'mat' (the electronic type that Lucio de Tizio introduced into South Africa) to accurately measure the hopping data of athletes in terms of their contact, flight and power times

- 2 'floppies' showing (a) the recording of a strength and conditioning data; and (b) a series of Swiss Ball and other exercises and (c) descriptions of the manner in which Cleans, Jerk and Snatches should be executed

Conclusions

The 'art' of coaching for me is in (a) being totally familiar with the science of the sport (b) knowing how to apply that science in a practical manner and (c) understanding your athlete

Being able to look at an athlete run and then immediately identify his or her strengths and weaknesses. It is to then apply certain sessions that will, hopefully, 'plug' those gap

From the outset, and having read extensively, I have to say that I have certain reservations concerning pilates, swiss ball and thermaband methods when seeking strength gains. My impression is that, given the athletes I am coaching, these methods are best used (a) when a particular weakness is identified and requires specialised attention and (b) for remedial or rehabilitation purposes

I am very much a running, hills, circuit, weights, drills and plyometrics coach. Having said that it has been rare when I have been able to apply all these method to one athletes

To use Mulaudzi as an example he is very much a running, some hills, circuit, some weights and no plyometrics athlete. To apply all these methods is to tempt fate. Again the art of coaching prevails and the coach has to know which method will give his athlete the greatest return

What have I learnt from my trip

From the outset anything said here must not be construed as criticism of my coaching colleagues. I felt that Messrs Poole and Gandy pay far too much attention to, what appears to be, enormous amounts of circuit training. In this regard I will retain my methods of applying circuits ie 7 exercises per session and another set of 7 exercises (some the same) in the second session (on a different day)

What fascinated me was the full frontal squat. For now I will stay at a ½ squat for fear of injury problems particular with the knees. From Carl Johnson came the reinforcement of this exercise being done by Messrs Poole and Gandy but with the suggestion of regular 'pyramid sessions' and testing for new 100% values. Mbulaeni is already up to, and slightly in excess of, squatting his bodyweight in sets of 4 x 8 reps. This is something we have approached with more conviction since my return from England

All agree that we should work traditional strength endurance methods to achieve upper body strength (core and stabilizers) and look towards maximum strength for the prime movers (the legs or propellants). Low sets, low reps and heavy weights will alleviate any hypertrophy of the quadriceps

The hill sessions of Norman Poole were good and are to be recommended. We all think the same here more or less

Similarly we all concur with the drills and plyometrics

Interestingly the two running coaches incorporate their plyometrics into their circuits hence doing away with the need for a totally separate session. Another possibility

Given the time that each coach could afford me this was an extremely useful trip. Athletics South Africa should publish what it deems fit from this report. There are still unanswered questions but essentially the guts of the theory is there. It is a matter of interpretation and application. Interested coaches should be encouraged to engage me in conversation over the contents of this report about which I will be more than forthcoming

I wish to extend my deep felt appreciation to both Athletics South and the Vaal Triangle Technikon for providing the finances for this project. It was both stimulating and rewarding in every sense of the word

Thank you

Ian Harries.

ENDURAMAX RUNNING CONSULTANCY.