

如何準備長途耐力運動

How to prepare for long distance endurance sports

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近日新聞經常報導，有很多郊遊人士因迷路或中暑而遇到意外。其實除了要注意活動前的預備，訓練良好體能亦是預防意外發生的重要因素。現時正值山野比賽季節前夕，很多人會因為訓練不足而患上不同的傷患，所以今次與大家分享基本體適能的訓練理論。

Hikers have been frequently reported lost or suffering from heat stroke in recent weeks. Apart from good preparation before every hike, good pre-event physical training is also an important factor to avoid accidents. Winter is the start of many mountain competitions when many are injured because of lack of training. So, I would like to share some basic physical training principles with you.

在 很多長途耐力賽的簡介會中，我都會講解有關如何預防傷患及其處理的方法。然而參加者往往只注重裝備的選擇、比賽飲食及伸展運動等，這些固然重要，但我每次都希望強調，想於比賽得到好成績，及減少受傷機會，最重要是付出——付出足夠時間正確地訓練。

雖然不同的耐力運動有不同的體適能特性，但最基本總離不開鍛鍊心肺適能和肌肉適能。心肺耐力依賴良好的心臟供血能力，肺、血和肌肉細胞的攝氧能力等。另外，長時間而低強度的肌肉運動，極依賴良好的局部肌肉耐力及肢體的血液循環。那麼，怎樣訓練才能提升心肺耐力及肌肉的表現呢？

就算是大部分未經訓練的健康成年人，都能依循以下幾項心肺適能和肌肉適能的基本訓練理論：

1. 適應期

一般人對新嘗試的運動都需要多個星期甚至多個月的適應期，才能掌握運動的特性、基本技巧及協調身體，所以在完全適應一項新運動之前，切勿過份勞累或重複某一動作太多，以免埋下勞損性傷患的伏線。

2. 針對性原則

特定的訓練效果取決於特定的運動種類、訓練模式、強度、速度和技巧等。例如：游泳所訓練得來的心肺耐力不大顯現於跑步的表現當中。又或者以高速的短跑訓練得來的肌力不大配合長



一些上落幅度大的長跑比賽(如長城賽跑比賽)，如沒有良好的四頭肌耐力，很容易導致膝關節勞損。For long run competitions that involve great altitude differences (such as The Great Wall Run), strong quadriceps can help to minimize joint wearing.

Every time I give injury precaution and management advice in most of the participants' briefings of endurance events, their query is often only focused on the choice of equipment, nutrition and stretching exercises, etc. Though these preparations are important, I prefer to emphasize more on the importance of sacrifice, the giving up of time to train properly, in order to obtain a better result while minimizing the chance of getting injured.

Though different types of endurance sports require different modes of physical training, the basic is to train the cardiorespiratory and muscle fitness. Cardiorespiratory endurance requires not only good blood pumping ability of the heart but also oxygen carrying ability of the lung, blood and muscle cells. Additionally, high repetition and low intensity muscle works relies very much on good local muscles endurance and blood circulation around them. However, how can we improve our cardiorespiratory endurance and muscle performance?

The following are some basic training principles for cardiorespiratory and muscle fitness, and are suitable for healthy untrained adults:

1. Adjustment period

Most of us need a few weeks or even months to be skillful at the specialties and basic techniques of a new sport, and to coordinate the body. Therefore, before fully adapting to the new sport, avoid being overtired or repetition of the same movements as these will predispose potential overuse injuries to our body.

Tips & Technique

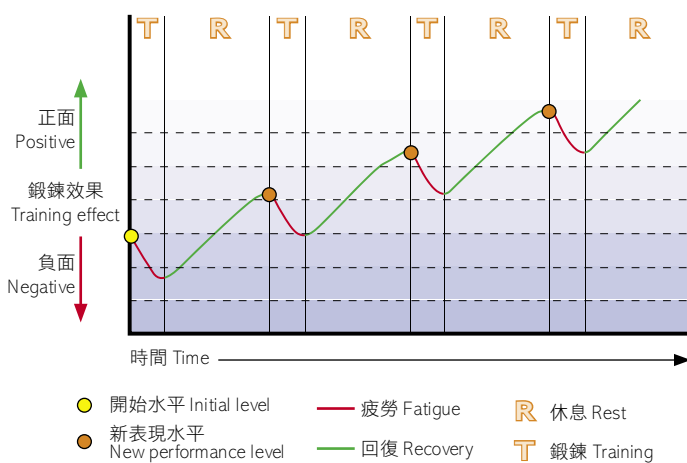
跑需要的肌力。換句話說，要長跑表現好，最重要就是多進行長跑的訓練。不過，現今的研究顯示，沒有足夠的肌力保護關節而長期重複做單一動作，很容易造成勞損，所以我們亦需注重肢體及腰腹肌肉的負重訓練。

3. (漸進) 超負荷原則

每一種運動都要根據它的特性漸進地提升訓練的強度、時間及頻密度，才能保持對身體的刺激，不斷地進步。中國人有一名言：「中庸之道」，這句話用來形容訓練量與身體適應的關係非常貼切。其實每一次有效的訓練，都會對心臟及肌肉細胞造成一些輕微的撕裂或損耗，不過身體會對這些刺激作出反應，把相對的肌肉修復得更強壯，細胞內的物質及周邊的血管亦逐漸地改變成更切合該運動的特性。但一段時間過後，仍沒有新的刺激（訓練頻密度不夠）或刺激的強度不夠或沒有加大（訓練的強度、時間不足），體能表現就不會再有明顯的進步、甚至退步（註圖一）。

相反，若訓練量太大，大得身體接受不來，就會造成急性的受傷或慢性的勞損。我還記得首兩年參加山野間及海上的耐力比賽，完全不注重休息和訓練，將比賽時就臨急抱佛腳，沒比賽時便投閒置散，還對友人笑說因為年青可以應付過來。怎料踏入比賽第三年以後，記錄在書本上的最常見傷患都出現在我雙腿和肩膀上，勞損就是勞損，怎樣物理『自』療、中西醫藥治療也不能完全復原，我唯一的得著可能是更了解如何醫治每一種傷患，以及有何方法在負傷下仍可訓練和比賽。

我的經歷希望可以提醒大家，訓練一定要適時、適量、適當。七十年代以後，很多科學家對長跑運動的訓練量做了很多的研究，我把這些數據歸納於（圖二）。圖中顯示，要好好訓練心肺耐力而不大增加受傷機會，最佳的訓練強度需介乎於個人最大攝氧量的60-80%或最大運動心率的65-85%。而訓練最初期每次運動時間約20-30分鐘，每星期訓練3至4天。在每星期完結時檢討一下，如沒有不尋常的身體不適，就可每星期增加10%的總訓練量（訓練的強度×時間×頻密度）。所以，一個未經訓練的健康成年人，要安全地成功跑畢馬拉松，足足需要半年的時間去累積里數。



▲ 圖 1：正確訓練對身體的刺激
Diagram 1: Stimulations to the body by proper trainings

2. Principle of Specificity

A particular training effect can be only achieved by specific training mode, intensity, speed and techniques. For example, the cardiorespiratory endurance gained by swimming training does not directly beneficial to running performance, and the muscle trained by short sprints will not match the muscle requirement of a long run. In other words, one need to train according to one's targeted sport type. However, current researches showed that continued repetition of the same movement without adequate muscles to protect the joint will easily result in weariness. This is why weight training for our limbs and core (trunk and abdominals) are also important.

3. (Progressive) overloading principle

To maintain the stimulation to the body and continuous progression, one has to increase the training intensity, duration, frequency and modes progressively. The Chinese say 'all things in moderation' which is best to describe the relationship of the training volume (amount of training) and the human body adaptation. An effective training program will cause slight wear and tear of the heart and responsible muscles cells. Our body will thus react to these stimulations and the recovered heart and muscle cells will be much stronger. The materials inside the cell and the surrounding vessels will change slowly and adapt to the sport types. However, if there is no new stimulation (low training frequency) after a certain period of time or no gradual progression of stimulation (lack of progression of training modes, intensity and duration), gained physical performance can not be improved further or even be maintained yet. (Diagram 1)

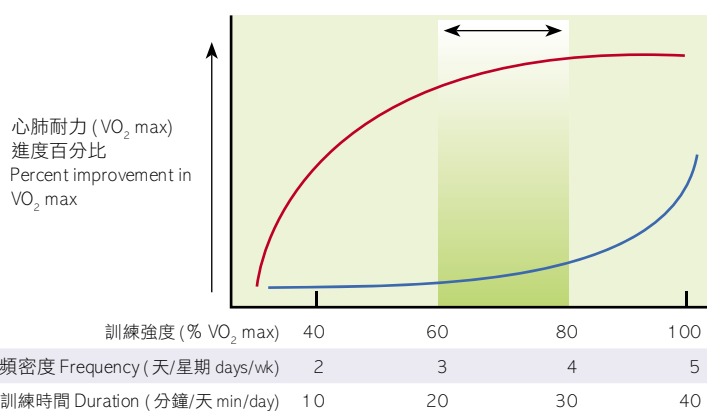
The Chinese say 'all things in moderation' which is best to describe the relationship of the amount of training and the human body adaptation.

On the other hand, if the training is so intense that the body cannot endure it, it will lead to an acute injury or chronic overuse injury. When I first joined mountain and water endurance competitions, I was not aware of the need for adequate rest and training. I trained only when the competition was approaching and believed that I was young enough to overcome anything. After entering the third year of my competition life, all the common injuries that can be found in reference books also appeared on my legs and shoulders. As you know, weariness cannot be fully reversible though I practised physiotherapy, western and traditional Chinese therapy to my body. The only gain for me is more familiar with various treatments for most of the injuries and how to train and compete along with these injuries by sport physiotherapy techniques.

I hope that my experience reminds everyone to train in proper hours, frequency and ways. Scientists have conducted various researches on the training volume of long runs for untrained adults.

另外，如果想在某一特定距離賽（如10公里）縮短自己的個人最佳時間，就要配合其他訓練方法，例如間歇跑、變速跑、慢均速連續跑、越野速度遊戲、轉變呼吸法或跑姿的訓練、不同的負重跑法等等，現不詳述，反而一直被耐力賽運動員忽略的肌肉負重訓練，我一定要重申它的重要性。其實，任何類型的運動都需要配合肌肉負重訓練，才能有效地保護關節、防止肌肉拉傷及令活動動作變得更高效率及流暢。尤其是長跑類型的運動，如果沒有良好的臀大肌、臀中肌、四頭肌、股內側肌、腓腸肌、比目魚肌、脛骨後肌、腓骨長肌等的肌耐力，很容易引致不良跑姿及慢性勞損。還有，鍛練腰、腹、胸、背的肌耐力有助保持在身體疲倦時跑姿也不走樣，大大提升跑步動作的效率及流暢性，減少浪費不必要的能量。

一般肌耐力負重訓練的指引都建議使用最大負荷量之50至70%作為應負重量，做鍛練的動作時要流暢及配合該運動類型的速度，收緊要鍛練的肌肉約3秒，然後放鬆；重複鍛練動作約20次，同一動作做1至3組。最理想同一組肌肉每星期可鍛練2至3天。鍛練形式可由固定的器械訓練做起，兩、三個月後逐漸加入可考驗腰腹穩定性和下肢負重的姿勢去鍛練肌肉，例如正確的箭步蹲負重訓練等。



↔ 最佳訓練強度、頻密度、訓練時間。Optimal training, intensity, frequency & duration.
 — VO₂ max所得。Gain in VO₂ max.
 — 可能出現骨科、心臟併發症等危機。Risk of orthopaedic and cardiac complications.

▲ 圖 2：理想的耐力訓練區域
 Diagram 2: Ideal endurance training zone

4. 調整期

在重要的賽事前有條理地降低訓練強度及時間，再配合適當的比賽飲食，研究顯示，有助提升比賽表現達3%或以上。而背後的最主要原因就是讓久經訓練的身體有足夠時間完全復原以及調整心情和策略去比賽。對於長跑類型的運動來說，一般指引調整期為一星期。

I reanalyzed the data and created Diagram 2. The diagram shows that the optimal training intensity is in between 60-80% of the maximum oxygen consumption or 65-85% of the maximum target heart rate. In adjustment period, one should train for 20-30 minutes every time and 3-4 days a week. These are the optimal training zone of cardiorespiratory endurance that reasonably effective with low injury rate. When a week ends and there is no unusual discomfort, you may increase the overall training volume by 10% per week (Intensity x Duration x Frequency). Therefore, it takes half a year for a healthy untrained adult who want to accumulate enough mileages for a marathon safely.

If you would like to shorten your personal best record in a specific distance competition (let say 10k), then other training methods are needed, such as interval training, vary speed runs, LSD, terrain cross training, applying different breathing method or running posture and different types of weight running. Among various training methods, I would like to emphasis the importance of muscle weight training which is often neglected by endurance athletes. For any sport, you need to train the muscle fitness not only to protect the joint, prevent muscles from getting injured, but also increase the movement economy. Sports that require long runs in particular, need good gluteus maximus, gluteus medius, quadriceps, vastus medialis, gastrocnemius, soleus, tibialis posterior and peroneus longus muscles, etc. If the muscles do not have enough endurance, it will easily lead to improper running posture and chronic overuse injuries. Moreover, good core (trunk and abdominals muscles) stability helps an athlete maintaining proper posture even when tired. It also helps to improve the efficacy and smoothness of the running movement that reduces energy waste.

General guidelines for muscle endurance training suggest that the proper weight should be around 50-70% of the maximum bearable weight. The training should match the speed of the sport; contract and hold corresponding muscle for 3 seconds and then relax. One should repeat 1-3 sets of same movement and around 20 repetitions should be performed for each set. The optimal training frequency for the same muscle groups should be 2-3 times a week. Initially resistance machine training can be used for familiarization of movement. After 2-3 months, you may add some training that challenge the core stabilization and balance in weight bearing position, such as Lunges, Squat, etc.

4. Tapering

According to research, before a major event, systematically reducing the training intensity and volume can help to improve actual performance by at least 3%. The reason behind this is to allow the body to fully recover, and adjust mood and strategy for the competition. Generally tapering for a long run takes one week.

希望讀者能細嚼以上論述的四大基本訓練理論的意義何在。不過提供的數據較偏重適合長跑類型的運動。如果大家想重溫常見的傷患及其處理方法、正確的伸展運動或想多認識如何訂定訓練強度、或其他類型的運動的訓練方法，可參考往期的文章、我在各大型運動比賽或網頁 www.protrek.com.hk 及 www.aasfp.com.hk 所撰寫的文稿。

The above-mentioned training parameters in the four basic training principles mainly focus on endurance running. If you would like to review common injuries and its management methods, or learn more about stretching exercises and how to set the training intensity and volume for other kinds of sport, you may take my previous articles or visit www.protrek.com.hk and www.aasfp.com.hk for reference.