

Aerobic And Anaerobic Training : How Marathon Training Can Enhance Freediving Performance

Mohd Azam Abdul Hamid

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Introduction

I have been involved in endurance/distance and multisport for more than 15 years. Among the sports that I do are triathlon (including ironman), open sea swimming, marathon/ultra marathon and adventure racing. I train almost all year round consistently and participated in races.

Three years ago I started to involve in a new sport : freediving. This sport is in a way different from what I am used to do. Not so much physical but more on mental. In less than a year involved in freediving I started to take part in competitions. So far I have participated in seven competitions.

While most of freedivers include yoga or meditation as part of their training, in which benefit them. I am personally not interested in that. Maybe I have no patience for that. My approach towards freedive training is freedive training itself and also physical training (endurance/distance training).

According to American Collage of Sports Medicine (ACSM), there are five basic components of physical fitness⁶ :

- Cardiovascular - Respiratory Endurance
- Muscular Strength
- Muscular Endurance
- Body Composition
- Flexibility

In this presentation I will talk about the Cardiovascular – Respiratory endurance and also my training in endurance sport (running specific) and how could this enhance my performance in freediving.

Warning

Anaerobic training can be stressful to your body and heart. Therefore if you are over 40, a smoker, never exercise for the past two years, or have any pre-existing medical problems or injuries, it is recommended you consult a doctor before engaging in high intensity exercises.

Always warm up and stretch before and after exercise.

Definitions

Aerobic⁶ : Literally means “with oxygen”. This means any oxygen demand by the body during physical exercise will be adequately supplied by the cardiovascular system. The body will not be in oxygen debt situation. Intensity normally between 70 – 80% of maximum heart rate. To find your maximum heart rate simply minus your age from 220 ($220 - \text{your age} = \text{max heart rate}$).

Anaerobic⁶ : Literally means “without oxygen”. This means any oxygen demand by the body during physical exercise will NOT be adequately supplied by the cardiovascular system. The body will be in oxygen debt situation. Intensity normally between 80-90% of maximum heart rate.

VO2 max⁷ : The maximum rate of oxygen uptake that your body can utilise during highly intense exercise periods. Measured in ml/kg/min. Intensity range between 90-100% of maximum heart rate.

Factors determine the limits of apnoeic duration⁸

- Total body gas storage capacity in lungs, blood and tissues.
- Tolerance to asphyxia (The extreme condition caused by lack of oxygen and excess carbon dioxide in blood, produced by interference with respiration).
- Metabolic rate.

Now let's look into marathon training and how it could help in achieving the above conditions which could be beneficial in freediving.

My training

I run four to five times a week, logging around 40-60 km a week depending on my work schedule and training programme. I do interval training twice a week and “long run” once a week. Other days I do easy/recovery run, “semi long run”, or swimming. For the long run I increase my mileage around ten percent every week. I log the most mileage three weeks before a marathon race before I start to taper, which means I start to reduce the training volume but at the same time increasing the intensity. I also do freedive training two to three times a week at the pool (STA,DYN).

For my performance tracking, I use Suunto Ambit watch which has GPS and heart rate monitor function. Data recorded will then transferred to Suunto Moveslink software. With this software I can view my heart rate, respiration rate, VO2 max and many more details to make comparison in my training/racing to see any improvements or otherwise.

Aerobic training and it's benefits

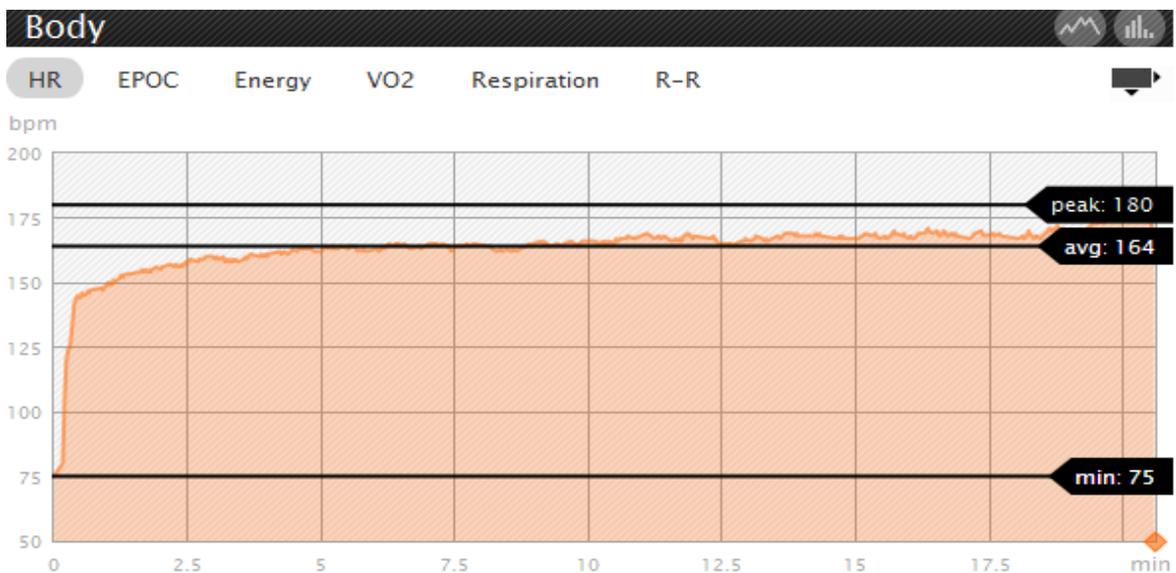


Figure 1 : Sample of aerobic threshold training heart rate

I do aerobic training two to three times a week, with the longest run on weekends. Examples of aerobic training are :

- Easy pace run for 30 minutes to 3 hours (Long Slow Distance – lower intensity).

- 5-10km run at aerobic threshold intensity (higher intensity).

Training at Long Slow Distance (lower pace) is the base of aerobic fitness and it is the fundamental workout in building cardiovascular endurance^{6,7}.

Training in the higher intensity of aerobic level (fig. 1) will increase the aerobic threshold and athlete will remain longer in aerobic zone before lactic acid starts to accumulate^{6,7}. Since freediving is a combination of aerobic and anaerobic exercise, the delay of lactic acid accumulation could improve performance.

Anaerobic training and it's benefits

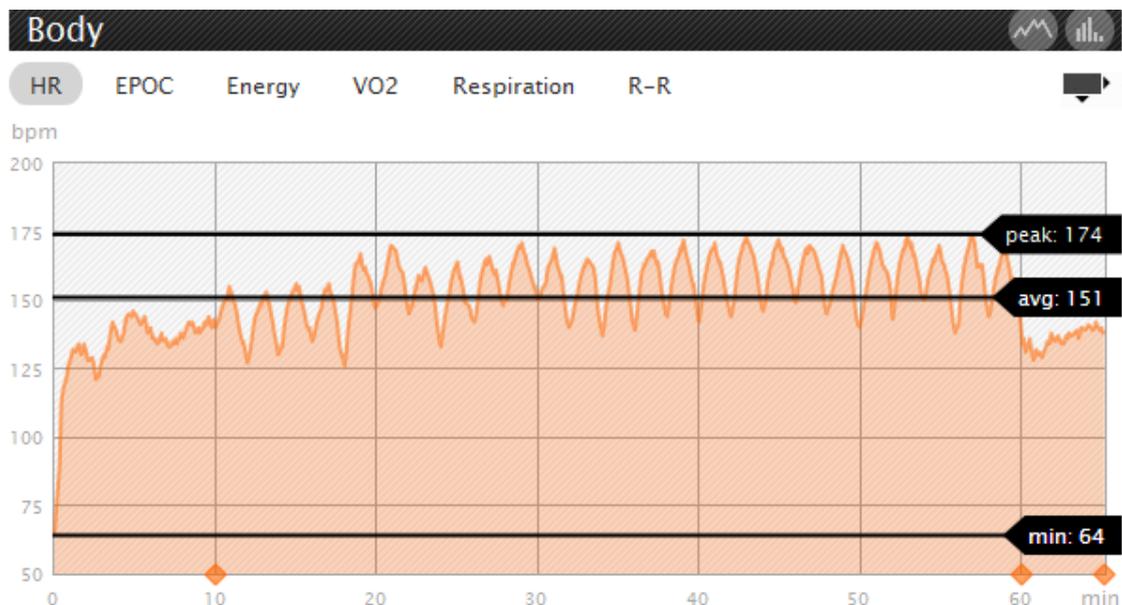


Figure 2 : Sample of interval training heart rate

I normally do interval/anaerobic training twice a week. It consists of alternates of high intensity run and recovery in between. Duration of the hard run range from several seconds to few minutes. Example of interval training are;

- 60 minutes of 1 min hard run/ 1min easy
- 30 x 400m run every 3 minutes

Anaerobic training produces lactic acid which leads to performance deterioration^{6,9}.

Training at this zone allows us to be more tolerant to higher level of lactic acid physically and

mentally^{4,6,9}, similar to CO₂ training tables in freediving. High intensity training also improves VO₂ max^{3,6,7,9}.

Although VO₂ max is important for aerobic endurance sports, during apnea VO₂ min (minimum oxygen uptake) is probably one of the most important features determining performance⁸.

However high VO₂max would result in other physiological adaptations which could be beneficial in other aspects.

Other benefits

1) Reducing risk of decompression sickness^{2,3}

During deep or repetitive dive, Nitrogen will dissolve in tissues. Cardiovascular system will then remove the excess Nitrogen from our tissues as we surface. More blood vessels means more pathways for transporting the excess gas, stronger heart can pump better and the better you lung will make the gas exchange process faster. All these can be gained from exercise³.

Nitrogen also believed to be dissolve more in fatty tissues^{2,3}. Marathon training can make a person leaner and have less body fat percentage. This means less nitrogen will be dissolve in the body thus reducing the risk of decompression sickness. Body composition is one of the five component of physical fitness⁶.

2) Faster recovery⁴

High VO₂ max, stronger heart, efficient lungs and good blood circulation will result in better muscle oxygenation and faster lactic acid and carbon dioxide elimination³. This enable a diver to recover faster after a dive especially when almost at their limit. This will be a good defense against blackout. Freediver will also recover faster in between dives, so training could be maximize. Running also improves sleeping pattern and makes me wake up fresh for training the next day.

3) Maintaining body temperature⁴

A good circulation system will be more efficient in maintaining body temperature, especially good in dealing with heat when wearing wetsuit.

4) Lower resting heart rate^{4,6,7,9}

Aerobically fit person will have lower resting heart rate compared to an average unfit person.

My resting heart rate is 40 beats per minute. At the start of apnea this means my body will significantly consume less oxygen and also produce less carbon dioxide compared to a person with heart rate of 60 beats per minute. Bradycardia during mammalian dive reflex will further reduce my heart rate making it even less oxygen required/carbon dioxide produced. This can result in longer breath hold time.

5) Higher red blood cell count^{1,4,6}

Our body will produce more red blood cell as an adaptation to the demand of more oxygen required during high intensity training^{1,6}. Hemoglobin value is also higher^{4,6}. Studies have found that triathletes have higher hemoglobin mass and increased blood volume compared to moderately trained apnea divers and scuba divers⁸. Higher red blood cells enables the body to enhance blood transportation and blood oxygen saturation. Training at high altitude (around 4000-6000 feet) can produce red blood cell even more^{1,6}. Athletes will also increase VO₂ max, more tolerant to hypoxia and acid lactic in high altitude training. This adaptation will definitely benefit apneist during their breath hold and recovery. High altitude training also described as “natural doping” by some sportsmen¹.

6) Psychological benefits

Running a marathon requires mental toughness and taking part in races can help to develop it. Running races will allow you to experience nervousness, tension, excitement and disappointment. Taking part in races makes an athlete able to tolerate stress better in competitive environment⁶. Studies have shown that resting heart rate of breath hold divers prior and during static apnea are

higher during competition compared to their routine training. Competitive stress is the contributing factor⁵. The effect of higher heart rate could possibly reduce the potential of the diving response to conserve oxygen. Therefore I believe by exposing yourself to this competitive environment as much as possible would make you more tolerant to stress, especially if you are competitive freediver .

Part of mental preparation before a race is visualization. Visualization helps an athlete to be more prepared for the event and the effect can be calming,inspiring, motivating and focusing⁶. Same approach can be used in freediving by mentally visualizing the dive as part of dive preparation.

Long distance running can also be considered as meditation and physical combined. Distance runners and freedivers have similarity when it comes to their relationship to time :

“Time is not a constant thing by any means. When you’re in a good race, everything comes together. Time flies when you’re having fun.”. Olympic Marathoner Lorraine Moller of New Zealand quoted⁷.

Runners will have to train their mind from thinking how far or how long more they have to run. This principle can be applied in freediving as well. Whether during a static apnea or freefall during constant weight freediver will enter this “marathon” phase. Running can develop good mind practice for freediving in where one will not think of time,depth or distance factor during the dive.

Running can also function as stress relief⁶. Running after a stressful day at work normally makes me feel fresh and de-stressed after the run. This could improve relaxation of the mind in freediving as well.

Conclusion

While freediving specific training will improve your apnea performance, aerobic and anaerobic training can further enhance your apnea performance on the physical and psychological aspects. I suggests freedivers to do some sports other than freediving alone. Do sports you enjoy most in order to maintain consistency. Unless you have injuries, running is a good choice. You can do running as cross training, or run during your freedive off season, or simply when you are bored of freediving and want to take a short break from diving. Combining these two types of training with

another approach to training (yoga, meditation etc) could result in optimum apnea performance.

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