CHAPTER 1

INTRODUCTION

Chapter I examines the anthropometric and physiological factors that determine success in sport. More specifically it discusses the somatotype ratings, $VO_{2\ max}$ and running economy of triathletes and the individual sporting codes which make up the event namely swimming, cycling and running. The primary aim of the chapter is to establish guidelines for an elite triathlete and assess whether these differ from their single sport counterparts.

The characteristics of physique associated with success in sports and other forms of physical performance have greatly interested scientists for a number of years. The number of studies assessing anthropometry or the morphology of athletes has accelerated rapidly over the last few years. Such studies have focused on descriptions of athletes, comparing athletes between and within sports and the relationships of physique to physiology and sport performance. (Jones, P. R. M. and Norgan, N. G. 1996).

The identification of any attribute that predicts good performance is important. It can be used to design training programmes that aim to modify the phenotype characteristics of the athlete towards the optimum morphology.

It may also be used in programmes to identify talent and to direct young athletes with the desired genotype into the sport of triathlon. (Landers, G. J. et al, 2000). It is therefore, considered valuable to identify any physical characteristics that might be advantageous to triathlon.

The questions asked include:

i) can we predict outstanding athletic ability from body structure?
ii) has a given athlete the physique best suited to his/her sport?
iii) can special training alter the physique or somatotype?
iv) what specific characteristics of physique are important to success in various kinds of physical performance?

Interest in body composition has developed in parallel with the increased application of scientific methods in sport and exercise. The quest for excellence in modern athletics no longer makes allowance for haphazardly constructed training regimes. The scientific approach to training has become an even greater part of the total aspect of sports performance than ever before.

Optimal performance will require certain anthropometric , physiological and psychological attributes. The degree of development of each of these attributes necessary for success in elite competition will vary from sport to sport and even between different events and positions within a sport.

Training for a given event therefore requires a training programme that develops all of the attributes to the levels required for success in that event. Scientific procedures can be used for the identification of those attributes and the level of the attribute required for success. The study of elite athletes therefore should provide information on the attributes required for success in the specific event.

With regard to anthropometric and morphometric attributes, there is substantial evidence that somatotype and success in sport and physical performance are positively related. An aspiring athlete needs to have (or work towards attaining) a somatotype that is characteristic of those who have succeeded in the sport of choice. Athletes in a given sport tend to have, on average, reasonably similar somatotypes and also show a more limited range of variability in somatotype compared to the general population. As the level of competition increases, variation of somatotypes within a sport tends to decrease. Exact anthropometrical studies enable us to deduce ideal values for athletes in different sports (Carter, J. L., Heath, B. H. 1990). This would seem to suggest that success in some sports is related in part to physique. Athletes, particularly at the highest level of play, will tend towards the physique that favours the demands of their sport. (Burke, L 1998).

There must be an optimal value, above which or below which the athlete's performance is negatively affected. Willmore J H (1983) suggests that ideally a range of values should be set for male or female athletes in each sport, recognising both individual variability and methodological error.

For example, not every male distance runner will have his best performance at 6% body fat. Some will be able to achieve slightly lower values and improve performance, and others will find it impossible to get down to values this low and will have to compete at higher subcutaneous fat levels. However, Willmore suggests that in swimming a certain amount of fat is probably an advantage for buoyancy, thus reducing the body's resistance in the water.

Of paramount importance in the profiling of endurance athletes is the determination of the athlete's physical working capacity or aerobic capacity. Coyle et al (1988) as well as others, (Jacobs, I., 1986, La Fontaine, T. P. et al, 1981 and Londeree, B. R., 1986) postulated that athletic performance velocity during endurance exercise is determined by the highest steady rate of oxygen consumption (VO_2) that can be tolerated and the biomechanical economy of movement, defined as the velocity achieved for a given rate of VO_2. In endurance sport such as triathlon, the aerobic capacity of elite athletes, must be high. (O'Toole, M. L. et al, 1987, O'Toole, M. L. et al 1995, Millett, G. P. et al 2004).

Although VO_{2max}. has been shown to be a good predictor of performance, 'running economy' seems to be a more powerful predictor of performance when comparing athletes of similar ability. It is actually easy to observe the difference in the ease of effort when comparing elite swimmers, cyclists, runners, etc, with their less skilled counterparts who seem to expend a considerable amount of 'wasted energy' to perform the same task.

This finding has been most clearly shown by Conley and Krahenbuhl (1980) from a study of twelve runners whose best 10km times were closely bunched between 30:31 and 33:33, concluded that a high $VO_{2max.}$ helped each athlete gain membership to this elite performance group, and running economy and not $VO_{2max.}$ was the factor controlling success within this group. Although oxygen transport and oxygen and fuel utilisation are traditionally the determinants used in describing endurance performance, factors determining muscle contractile function should not be ignored, ie muscle strength and endurance. To gain entrance to the elite group of runners, an athlete needs muscles with superior contractility. These muscles then allow the athlete to achieve a high work rate during the maximum test to exhaustion. (Noakes, T. D. 1986).

The best long distance runners inherit a physique that is slight of build, not only in terms of stature but also in skeletal dimensions. When this physique is blended with a lean body composition, a highly developed aerobic system and the proper psychological attitude for prolonged, intensive training, the proper ingredients certainly exist for a champion. (McArdle, W. D., Katch, F. I., Katch, V. L. 1991).

The aim of this study is to therefore to determine an anthropometrical and physiological profile of an elite male triathlete and to assess whether they differ from their single sport counterparts namely runners, cyclists and swimmers.

The high level competitive triathlete spends considerable time and effort training for each segment of the contest. If form and function are indeed related, the hypothesis of this study is that the ideal triathlete should possess anthropometrical and physiological characteristics that are essentially the average of the elite runner, cyclist and swimmer.

However, if the triathlete had a more extensive training background in one discipline, then his physique may resemble more closely those successful in that sport which may inhibit the ultimate success of the triathlete.