THE APPLICATIONS OF FITNESS EQUIPMENT IN SPORTS TRAINING

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In the recent years, the number of participants in road running, marathons, cycling and triathlon has increased. Taking Taiwan for an example, we find that in the past two decades, the running events from once a year to about three hundred running events a year. The number of participating people is close to one and half million people. Besides, more and more females also take part in these sport activities. The people share the same attitude like professional athletes. They want to challenge their own physical endurance and sports performances. Thus, they are active in fitness and sport-training courses. They would also buy the personalized sport equipment for the sport trainings. As a result, the industrial value of fitness-related software and hardware equipment is also going upward.

We also call the sports capability in doing sports as physical fitness. It defines the combined capability of the body which adopts itself to living conditions and dynamic environment such as temperatures, climate changes or illness, etc. Those with better physical fitness have better vitality and adoptability in physical activities or sports. They

do not easily get tired or unable to catch up. Physical fitness is usually divided into two categories: one is healthy related physical fitness; the other, sports related fitness. Healthy related physical fitness refers to the one which the healthy public needs including body composition, muscle strength or muscle endurance, flexibility and cardiovascular endurance. Sports related fitness generally means the ability in sports competitions or sports skill performances. It differs healthy related physical fitness which rather imposes impacts on the public health. Sports related fitness has no substantial relationship with personal health. However, as to the athletes on the sports arena, all kinds of physical fitness have great influence on sports performance containing agility, reaction time, rate of force development, balance, coordination and speed.

Treadmill, bicycle and spin bike are often used as cardiovascular endurance training tools. Normally, the healthy people would take references of the heart rate zone, that is, 65% to 85% of the largest heart rate, so as to increase their cardiovascular functions. However, for those who need to enhance their cardiovascular functions in a short period of time such as the new participants at marathons or triathlons, etc. Therefore, they use these

high-intensity interval training equipment to promptly increase their cardiovascular functions, applying the fast and slow alternative running or stationary bike spinning. The training time ratio could be set 1:2 or 1:3 according to personal physical condition. Additionally, the technological development in wearable devices with GPS functions or with heart rate sensor can trace and record individual sports conditions. However, the program functions of the wearable devices are not yet designed for those with chronical diseases to provide the proper heart rate zone, tracing cardiogram or heart rate variation records. Once these functions can be applied to specific groups like the slight heart-attack patients, the hypertension patients, the patients with diabetes, metabolism syndrome or post-cancer complications, etc. Or there shall be an application of heart rate variation so as to track the autonomic nervous system of the public who can have better understanding of their own pressure or anxiety. Consequently, the applications can be wider to meet more demands of the users. The frequently-used equipment for increasing muscle strength and muscle endurance (weight training) are dumbbell, barbell and mechanical weight training equipment. For the beginners, it is better to use mechanical weight training equipment and for athletes, they often use dumbbell or barbell fitness equipment. Usually there are training coaches to assist users so as to reduce the risk of getting injured. The major training parameters in the weight training include intensity, set, repetition and interval resting duration (Table 1). Based on the purpose of training, the adjustment of parameters is set accordingly. The current trends are core muscle training and self-body weight training. To strengthen the core muscle training can prevent from the happenings of sports injuries. Numerous of fitness equipment are developed into the applications of core muscle training such as kettlebell and medicine ball. Another two equipment used for functional movement trainings are Russia Twist and kettlebell swing but they cannot be too heavy. If they are overweight; then the upper limbs cannot afford to carry out training exercise. So they have to go with other equipment to do exercise. Nevertheless, they still could be alternative equipment for general weight training and training exercise. In addition, the equipment of body weight training like TRX or Redcord can be used with simple

suspension ropes to design different movement to boost muscle strength. Normally, they can be used at home; besides, because they are economical and space-saving, people like them very much. Many reports indicate the muscle resistance training of suspension ropes also evoke more core muscle to give strength and furthermore it also enhance core muscle strength. Among mechanical weight training equipment, there is one kind of hydraulic resistance equipment which is user-friendly and steady strength training. Therefore, it is safer to get away from sports injuries. It can be a proper fitness equipment for the elderly people or the sports-injured people.

Flexibility, muscle strength, cardiovascular endurance are equally important to physical fitness of the healthy people. They mean the largest range of motion given by all limbs or body parts such as bending, stretching, turning around and other motions. For instance, hurdle racing athletes use their lower limbs to cross over hurdles. They require hamstring extension flexibility and the range of motion of the hip. Once they cannot reach enough flexibility, they will kick off the hurdles. Some other sport categories require athletes to have extremely flexibility such as gymnastic or swimming. The elements to affect flexibility contain the range of motion and muscle and tendon extensibility. Having good and proper flexibility decreases the lower back problems and of neck and shoulder pains, muscles strain while doing sports. It also helps maintain good posture. In order to keep appropriate flexibility, we can do stretching exercises. Stretching is generally divided into static stretch, dynamic stretches, ballistic stretch, PNF (proprioceptive neuromuscular facilitation) stretch, or group sports like yoga. All the stretches can improve flexibility. Stretch sport shall be carried out at least two to three times a week. All body parts or limbs shall be extended at least ten to thirty second every time and repeat two to three times. Nowadays there are not many equipment which can improve flexibility. Most of the fitness equipment are auxiliary appliance such yoga brick, stretch band or strap. The larger equipment are stretch station at true stretch clubs, Proflex stretchTM, Precor stretch trainer, Range3D and other self-stretching tools or equipment. Products like Proflex stretchTM, Range3D mainly focus on the lower body parts; there are limited applications to stretch the upper parts and upper limbs of the body. Additionally, from the muscle-relaxing method to increase the flexibility, it is indeed another way to better flexibility like vibration training equipment. Changing the vibration frequency of the vibration machine enable the body muscles to be strained and relaxed at the same time. The vibration machine can perform these two functions to the most extent. Another viper vibrating foam roller is a must equipment for all NBA players. It is a tool to relax and increase muscle flexibility. Its advantages are short, small, easy to carry and a fair price. However, there is a vibrating motor inside the roller so that it makes larger vibrating noise while put it on the floor. That is the unavoidable shortcomings of using these vibrating equipment.

Table 1: Main training parameters in weight training

	Intensity	Set	Repetition	Interval Resting Duration
Muscle Endurance	60% - 75% of 1 RM power	3-5 sets	12 - 20 times	10-30 seconds
Muscle Strength	75% - 85% of 1 RM	3-5 sets	8-12 times	30-90 seconds
Muscle power	85%~100% 85% - 100% of 1 RM	1-3 sets	1-5 times	30-90 seconds

The six elements of sports related fitness are vital to sport performance of professional athletes. Lacking any one of the physical elements would be influential to their sport records. Agility refers to timely and efficient physical power to change body directions and sports speed. Like the forerunners in American football or rugby , they must be agile at any time to dodge the grapples of the opponents. Generally speaking, two decisive elements affect the agility of athletes: one is the the judgement and decision making ability of the athletes; the other, the speed and techniques of changing body directions of the athletes. The judgement and decision-making ability can be strengthened while they carry out small-group rehearsal and apply their strategies. In addition, they also need to train visual perception ability. But there are only a few of equipment for visual perception training. The modern technology like augmented reality could be a tool to train the visual depth of athletes who can just the distance of the object such as the moment that the American football player needs to catch the ball. Another factor is to train the athletes' speed and techniques to change directions. While the body accelerates to move straight forward and suddenly decelerates and change the body direction, we need to give the lower limbs weight training to enhance straight accelerating body speed or tie a small parachute upon the waist or tie the athlete with a pull rope so as to give more resistance and enhance strength. As to the training to change body directions, agility ladder can be used for training the agility of footwork. Besides, the pyramid can be placed in T shape or in star shape or in other sport-related motion directions for the training.

In many sports, balance is also another important element. Gymnastic athletes need steady balance while landing. Also basketball players also require good balance when they jump, fight for the ball and touch the land.

The definition of balance refers to the balancing and controlling ability either in doing sports or in still condition that the body supports itself. It can help and be help with agility to enhance the body control. For example, female gymnastic athlete jumps upon the balance bar. Her balance ability include static and dynamic balance. The balance capability comes from the vestibular system, the proprioception of joints or muscles and visual system. These three systems are indispensable. When athletes get muscle or joints injuries, their proprioception is damaged consequently and further affect their balance. These ability shall be recovered with the help of physioball, foam mat, air disc, or trampoline and so on. We can design a series of course which combine multiple motions. These courses requests 4-12 weekly training so as to strengthen balance. Moreover, there are many high-end balance training equipment cost 20,000-30,000 US dollars or above. Thus, the high prices affect the willingness of the sports training center to purchase these balance training equipment. In the future, these problem shall be solved and more innovative products can be introduced.

The training methods of CrossFit have been widely discussed over these days on the internet. The training content consists of physical fitness (cardiovascular endurance), muscle strength, muscle endurance, muscle power, speed, coordination, flexibility and so on. Due to the mixed multiple training methods, it is also called complex training. The 3 major training elements of CrossFit include constantly varied, functional movement and high intensity. The training combines all kinds of motions in all sports categories such as Marc drill, gymnastic actions, dead lift, back squat and other high-intensity interval sports actions. It is also required to complete training in the limited timing or regulated sets. Such a training method is in need of all sorts of sport equipment. The current bi-functional fitness equipment combines sliding machine and upper-limb training equipment which can certainly meet the demands of CrossFit-training people.

The athletes, after training, usually have muscle soreness or tense muscles. They need massages to relax muscles. Compression recovery boots an hydromassage

bed are designed to help recover the muscles of athletes. The former is to fully cover the lower limbs and to give massages by sectional air inflation. The latter is to use water flows to relax and to stimulate the muscles of athletes. The water flow could be cold or hot so as to achieve ice or heat curing effects. The effects which athletes receive training or treatment shall be evaluated with assessment tools so that we may better understand the efficiency. The common analysis method is static postural assessment or dynamic functional movement screening. Both assessment methods shall be recorded by taking photos or videoing of the smart phone. Then engineers write application programs to connect the bony landmarks to evaluate the bilateral imbalance of body or postures. When the differences between both sides of the body is larger, there is a higher rate to get sport injuries. Accordingly balance training or treatment to correct the difference of the two-side imbalance of athletes. Later on, the postures or body movement can be assessed again to get a picture of the progress which athletes have made.

In the recent years, the technology has made remarkable progress. Smart mobile phones and wearable devices are more widely used. In the future, these modern technologies and products shall be more developed for the multiple trainings of athletes and fitness lovers so that they can enhance their sports performance and physical health.