



Introduction



CHAPTER – I

INTRODUCTION

1.1 INTRODUCTION

Human characters are inherited by nature. Since our childhood days we are adapting and changing our characters according to the day- to- day life, social status and the culture. Science has established the fact that all efficient functioning of the body improves when it is used systematically. The well documented physical benefits of exercises and the value of exercises for improving mental health have grown in importance (Hoffman et al., 2008). This means that all the normal organs of our body perform more efficiently and effectively when they are regularly exercised. Human body is built to be active in any activities. The need of physical activity and fitness programme becomes more and more urgent today as a result of increase in use of machines, resulting in a lesser and lesser use of muscular parts of the body. Physical activity is a physiological, psychological as well as a social activity. The main objective of physical activity is to develop physical and mental health. Exercise enhances learning and improves retention, which is accompanied by increased cell proliferation and survival in the hippocampus of rodents (Vanpraag et al., 1999). Participation in regular physical activity promotes normal growth and development, by helping youth build and maintain healthy bones, muscles, joints, (CDC 1997) and has been shown to be important for health and quality of life. Physical activity helps to reduce the risk of developing obesity and also promotes psychological well-being (Audrey F. Manley, M.D., 1996). Further, it has to integrate or to bring about psychological co-ordination, socialization and culture interaction and thus to develop a spirit of tolerance.

Optimal physical fitness and psychological fitness are the basic factors to live a happy, healthy and enjoyable life. Physical exertion is necessary for maintaining a functional mind and physical fitness. Physical activities are as essential as food, rest and sleep for the maintenance of physical and mental health. Physical activity helps a person to look and feel well, carry out his daily duties and responsibilities successfully and still have enough physical reserves to enjoy the other social, civic, cultural and recreational interests. Physical activity is likely to offer greater mental

stimulation than the common alternative of passive television watching can do (Williams PA et al., 1982). Regular training in sports, aquatic and gymnastics is the best way to ensure a long and happy life. Increasing physical activity among the nation's youngsters is important to their wellness and also to the prosperity of the nation. It is every one's responsibility to bring up our children healthy both mentally and physically for taking our nation to the world's super power position. Further more information is needed about aquatic and gymnastics training responses and the underlying mechanisms leading to an improvement in mental and physical performance. Therefore, the present study was undertaken to clarify the comparative effects of aquatic and gymnastics training on selected mental abilities and psychomotor abilities among school boys.

1.2 PHYSICAL ACTIVITY

Physical activity is here defined as all forms of movement associated with an increase of energy expenditure. The definition of physical activity is now accepted as "any bodily movement produced by skeletal muscles that result in a substantial increase of energy expenditure above resting metabolic rate". The metabolic rate is increased by leisure time physical activity, exercise, sport, occupational work and household and other sources. Furthermore, physical activity as a whole has been broken down into the components of spontaneous (i.e., activity associated with daily living), obligatory (i.e., activity we are forced to do to survive), and voluntary (i.e., exercise; Casperson, C.J.1985). In its most general meaning, physical activity is a general state of development of motor skills needed for an enjoyable participation in the promotion of physical fitness, increasing energy expenditure, and promotion of mental ability towards an active lifestyle. In its simplest terms, physical activity is to the human body what fine-tuning is to an engine (Jonathon Hardcastle., 2007). In other words it is the movements associated with all increase of energy expenditure in the water or in the land activities performed individually or in teams and involving some form of competition (FrancoisTrudeau et al., 2009).

Physical perfection has been an integral part in India since our ancient times. Excavations at Harappa and Mohenjo-Daro confirm that during the Indus valley civilization (2500-1550 B.C) the weapons involved in war and hunting exercises included the bow and arrow. These weapons of war, for instance, the javelin (toran)

and the discus (chakra) were also frequently used in the sports arena. Arjuna and Bhima, the two mighty Pandavas, excelled in archery and weightlifting respectively. Chattrapati Shivaji's guru, Ramdas, built several Hanuman temples all over Maharashtra for the promotion of physical culture among the youth. Swimming, sword - fighting, running, wrestling and ball games were immensely popular among the students of Nalanda and Taxila Universities. Unlike the ancient Greeks, ancient Romans valued physical fitness not just for its own merits but because it benefited the government. Physically fit men made better soldiers and workers, who helped protect and expand the empire. People living in ancient Greece recognized the physical fitness as important as knowledge and learning (Active Gay Mormon, 2010). Ancient Greeks strove to be well-rounded individuals and, to them, that meant training the body and the mind. Later, the people gave as much importance to physical activity as to literary education. The principle of “a sound mind in a sound body” was not only accepted but also faithfully practiced. Village schools were usually situated in the temple premises or in the courtyard of mathas, where children played after daytime lessons. Besides this, every village had one or two playgrounds, where sporting events and games were held during the annual fair of the village deity. These involved wrestling, boat rowing, boxing, mallakhambha (pillar acrobatics), the shooting of arrows and demonstrations of strength such as weight lifting.

Growing evidence indicates that children, particularly in the developed world establish an increasingly sedentary lifestyle very early on in life. A decline in physical activity levels is closely linked to the world wide epidemics of obesity, childhood obesity is a growing global concern (WHO), affecting not only developed countries but also some developing countries. Children have become less physically active in recent decades. They expend approximately 600 kcal per day less than their counterparts 50 years ago (Colin Boreham and Chris Riddoch, 2001). The lifestyle of modern people is so different from that of our hunting and gathering ancestors that we can scarcely comprehend it (Blair, 1993). Since the start of the industrial revolution in the 19th century, the need for men and women to be physically active in order to earn a living and manage households has continued to decrease. Farmers no long walk behind plows and driving has replaced walking; many, if not most, of our daily work or household tasks have been mechanized. During the past 30 years, advances in computer and communication technology have continued to reduce daily energy

expenditure during the execution of occupational tasks. Today's young people have many choices for the use of their leisure time that discourage physical activity. Playing video games, watching television and surfing the internet all take children's time away from physical activity (Sallis, et al., 1999). The poor physical fitness levels and rise in obesity have already become a national concern in the United States (USDHHS, 1996).

1.3 IMPORTANCE OF PHYSICAL ACTIVITY

As we enter in to the new century, the importance and value of regular physical activity has been recognized as never before. When children participate at least sixty minutes of physical activity every day multiple mental and health benefits occur. Regular physical activity builds healthy bones and muscles, improves muscular strength and endurance, reduces the risk for developing chronic disease risk factors, improves self-esteem, and reduces stress and anxiety. Frequent and regular physical activity may enhance academic performance, self-concept, mental health and immune system (Stampfer M. J 2000). Obtaining and maintaining physical and mental fitness is a result of physical activity, proper diet, nutrition and physical recovery. The U.S. Surgeon General's report stresses in the strongest terms that regular moderate physical activity can improve mental health, reducing symptoms of depression and anxiety by releasing natural high which improves mood. Physical education programs should be conducted by physical education specialists and more and more physical education programs should be conducted promote lifetime physical activities such as walking, cycling, swimming, gymnastics and that can be conducted throughout an individual's lifetime (Nader et al., 1999).

Physically active people tend to have better mental health (Audrey.F.Manley M.D, 1996). Some of the activity-inducing increase in blood flow is directed to motor areas, but there may also be increased perfusion of other parts of the cortex. In a longer term perspective, regular physical activity may further augment cerebral blood flow by reducing the viscosity of the blood (Ide K et al., 1998). Other types of physical activity and some mental pursuits can increase arousal, but on the other hand, repetitive movements such as walking or moderate jogging have a calming effect. Relaxing forms of physical activity may be helpful in countering the stress of examination and bettering a student's academic grade (Giacobbi PR et al.,

2008). Exercises can regulate neurotransmitter synthesis and stimulate the release of calcium, resulting in dopamine secretion and increased acetylcholine. All these are necessary to maintain nerve functions, foster a positive mood and enhance cognitive function (Cotman and Berchtold, 2002). Physical activity increases the transfer of the serotonin precursor tryptophan across the blood-brain barrier. The resulting increase in cerebral serotonin has an immediate calming effect. It facilitates learning depending on the child's initial level of arousal.

The recent experimental researches on physical activity and cognition have centered on the hippocampus. LTP is an essential process in the consolidation of memory and is characterized by an increase of synaptic efficacy (Cook SF and Bliss T.V., 2006). Physical activity seems to facilitate LTP through several short-term and long term mechanisms: improved synaptic transmission, increased concentrations of neurotrophins, protection against the adverse effects of free radicals, and increased neurogenesis. In rats, improved synaptic transmission after voluntary running has been demonstrated as associated with a faster learning of maze pathways (Anderson BJ et al., 2000). These gains have been associated with increased expression of brain-derived neurotrophic factor (BDNF) (Kempermann G et al., 2000). The hippocampal glutamate receptors of aged rats were unaffected by exercise (Dub M-C et al 1997) suggesting that post receptor mechanisms are responsible for the stronger LTP seen in active animals. However, this remains to be confirmed by the studies of the hippocampus in younger animals.

BDNF not only promotes neural growth but also protects neurons from oxidative damage. Several animal studies have shown increases of BDNF and other growth factors. In young human adults, plasma levels of BDNF have raised with acute bouts of exercise (Gold SM et al., 2003). Physically active exercises for a certain period of time about twenty minutes or longer the body releases endorphins and proteins in the brain that act as the body's natural pain reliever. When endorphins are released, a person may experience a feeling of euphoria. Endorphins act as a natural pain reliever and antidepressant in the body (Thase and Michael, 2007). Endorphins have been regarded for long as responsible for what is known as "runner's high", a euphoric feeling a person receives from intense physical exertion. When a person exercises, both serotonin and endorphins are increased (Byrd and Andrea, 1999).

These levels are known to stay elevated even several days after exercise is discontinued, possibly contributing to improvement in mood, increased self-esteem, and weight management. Exercise alone is a potential prevention method and treatment for mild forms of depression. Research has also shown that when exercise is done in the presence of other people, it can be more effective in reducing stress than simply exercising alone (Plante et al., 1999).

Physical activity also helps people to become more independent and feel better about them. The result is higher levels of self-esteem and self-confidence, which are extremely important to a person's happiness and success. School physical education programs have been potential for the promotion of regular physical activity (Sallis et al., 1999). Yet regular physical education classes do not provide enough aerobic exercise. There is a need to codify the importance of school-based physical activity. Research studies have shown that moderately intense physical activity and especially aerobic exercises like brisk walking, swimming and running lead to improvements in cognitive functions like attention, processing speed, executive function, memory and decision making (Patrick J. et al., 2010).

1.4 TRAINING

The word 'Training' has been a part of human language since ancient times. It denotes the process of preparation for some task. This process invariably extends to a number of days and even months and years. The term 'Training' is widely used in sports. Some experts, especially belonging to sports medicine understand sports training as basically doing physical exercise. Training is not a novelty or a recent discovery (Bompa .T O. and Calcina .O, 1994). It existed in ancient India, Egypt and later in Greece where the people were systematically trained for both military and later for Olympic endeavors. Today, through training, as in ancient times, the individual prepares himself for a definite goal. Training programmes are designed to improve performance by developing the appropriate energy sources, increasing muscular structures, and improving neuro-muscular skill patterns. Training is a systematic activity of long duration, progressively and individually graded, aiming at modeling the human's physiological and psychological functions to meet the demanding tasks.

1.5 AQUATIC TRAINING

Physical activities in water are known as aquatic training. Water offers a unique exercise medium which reduces gravity conditions, decreases the impact forces on joints, while the water itself creates resistance to movement and cushions the body. Aquatic may be an alternative training mode to improve overall fitness especially in persons with low levels of physical and mental fitness (Tapani po Yho Nen et al., 2002). It can be structured or unstructured activities. Doing different types of exercises in the water and swimming with different styles are all known as aquatic training. Several water activities tune the whole body and increase the mental, physical and physiological health.

Written references of human swimming date back to 2000 B.C. While lively drawings from the Stone Age were found in "the cave of swimmers" in the southwestern part of Egypt, near Sura. The first book on swimming was written in 1538 by Nicolas Wynman, a German professor of languages. The sport of competitive swimming began in Europe around 1800, with the breaststroke appearing as the most popular competitive event. According to the Aquatic Exercise Association, "Aquatic fitness is defined as activities performed in the water that promote and enhance physical and mental fitness". Aquatic training is typically performed in a vertical position or in a streamlined position in shallow or deep water. There are numerous applications to appeal to a wide variety of participants. Water buffers the body from gravity and makes a person virtually weightless when they are totally submerged. When a person's head is out of the water, he or she weighs approximately 10 percent of normal body weight. Therefore, exercising in the water offers protective cushioning that land-based exercise cannot. Over the past several years aquatic has become an exercise vehicle of choice.

Swimming is primarily an aerobic exercise, involving long exercise time. Muscles must be constantly supplied with oxygen, with the exception of sprints where the muscles are worked anaerobically. Swimming, particularly in events where the stroke styles are varied between backstroke, front crawl (freestyle) and breast stroke, makes use of all major muscle groups like Abdominals, Biceps, Triceps, Gluteus,

Hamstrings and Quadriceps. A single stroke, for example the butterfly style, requires the co-ordination of various muscles and muscle groups, including latissimus dorsi, posterior deltoids, rhomboid muscles, middle and lower trapezius, external and internal obliques, transverse abdominis, rectus abdominis, longissimus, spinalis, iliocostalis. Hand force applied to the water is actually generated by the rotation of the hips, rather than the muscles of the arm. Torque generated by the larger, stronger hip muscles, allows the swimmer's powerful arm strokes to strike the water with a rapid turn of the hips. For this reason, elite swimmers focusing on increasing the acceleration of their hips are able to double their peak hand force output.

The individual gets many benefits while participating in the aquatic training. Some of them are increases and maintains muscular flexibility, improves mobility and range of motion, increases muscular strength and improves co-ordination, balance postural alignment, high calorie consumption. A massaging effect on the muscles is usually pleasurable and very relaxing. Exercising in the water is a wonderful way to workout. Water is a fascinating medium for strength training, cardiovascular workouts, balance training, sport-specific exercise, and rehabilitative exercise. Water provides resistance in multiple directions. It works muscles on both sides of a joint during the same movement. For example, in the water, a typical bicep curl will make both the biceps and triceps do work. Walking in water is double the workload of walking on land, if the same speed is maintained. According to author Le Anne Case muscular strength is achieved two to four times faster in water than any land based programme. Water provides twelve times the resistance of air. With the lungs submerged in the water, breathing is more difficult and strenuous; as the lungs must be inflated against pressure. They can also perform sport-specific skills, especially balance and agility drills, without the fear of falling. While doing the aquatic training all parts of the body works together. It stimulates different parts of the brain which is responsible for various mental and physical functions.

1.6 GYMNASTICS TRAINING

Gymnastics training is an intense physical activity that strengthens every muscle of the body. It is a combination of several physical movements like walk, run, jump, roll and stretch also improves mental and physical fitness. It is a structured activity. In gymnastics activities the body acts itself as resistance in tone the whole

body system and it inter connect with one another and increase the mental, physical and physiological health. The word "gymnastics" is derived from the Greek word "gymnos" meaning naked. It is believed that some forms of tumbling, jumping and swinging movements were used since early human history. Women were depicted performing acrobatic stunts for nobility. The spread began by 800 B.C. The Greeks, Chinese, Persians, and Indians began using gymnastics in their military preparations. The Romans, during their years of conquest, took in gymnastics and made it their own. They used it to train warriors and as an entertainment. The fall of the Roman Empire almost led to the demise of gymnastics. Gymnastics held on during the middle ages through gypsies and traveling troupes. The circus continued this tradition and carried the tradition forward. Gymnastics were soon found to be beneficial for the body again and began to gain more recognition and acceptance.

Gymnasts have to be strong and agile to perform the moves on the floor or the various apparatus. Although most routines are short in duration, the gymnast must have a good deal of muscular endurance to avoid fatigue and ensure good form. Gymnastics encompasses many different activities and each involves a varying degree of muscle use. A balance between upper and lower body strength is important for the well rounded gymnast. The legs must be strong to jump and flip, and provide a solid base for the beam and other activities. The upper body must be strong enough to support the body during flips and rolls, and lift the body during bars, vaults, and rings activities. Gymnastics have been confirmed to enhance development of bone density and avoid osteoporosis. Gymnastics can also enhance skills essential for many other sports. Most gymnasts excel in different sports such as softball, basketball, football, baseball etc. Moving and lifting their bodies during gymnastics activities helps build upper, lower body strength and flexibility. Children are better capable to learn cognitive skills when they are using both their minds and bodies. The persons who involve in gymnastics activity have higher self-confidence, less abuse of tobacco and alcohol, less levels of depression and anxiety, better hand-eye co-ordination, various communication skills. Gymnastics also boosts children to build and keep their confidence in oneself as well as high levels of self-esteem. Gymnastics creates a greater spatial awareness in its participants. The primary childhood movement education is openly linked to neurological pathways development that helps in

reading readiness. Children who have involved in gymnastics have longer attention spans and build up common problem solving skills more readily.

Gymnastics provides a very comprehensive fitness program that includes strength, flexibility, speed, balance, co-ordination, power and discipline. All of these are critical elements to a fitness program. Gymnastics expose the child to a variety of sensory-motor experiences. According to “Active Living Research,” there is a positive correlation between physical activity and academic achievement. An active lifestyle encourages healthy brain function (Peszek, Luan). Children who have participated in movement education activities have longer attention spans, increased communication skills, general problem solving skills and improved self-esteem. Gymnastics programs provide many social benefits as well. Children learn to work within a team, communicate with their peers, and interact with adults. Gymnastics training teaches kids the value of hard work and dedication. As children have positive experiences in gymnastics, they grow more confident (Rebecca Marson., 2012)

1.7 MENTAL ABILITIES

Mental abilities are the brain-based skills and mental processes that are needed to carry out any task from the simplest to the most complex. Every task can be broken down into the different cognitive skills that are needed to complete that task successfully. If they are not used regularly the mental ability will diminish over time cognitive science is most simply defined as “ the scientific study either of mind or of intelligence”. Mental skills can also be improved at any age with regular practice. The mental abilities like mental speed, attention, learning and memory are the most important skills for the school going children for the better performance in academic and sports.

1.7.1 Mental Speed

Mental speed is a composite measure, which requires rapid processing of information. In any given modality, even at low levels of stimulus complexity, information processing speed requires co-ordination of different areas of the brain. The measures of speed are useful in documenting the efficiency of motor processes and the rate of information processing.

1. 7. 2 Attention

Attention is a mental ability in the cognitive process of selectively concentrating on one aspect of the environment while ignoring other things. In psychology, the act or state of applying the mind to an object of sense or thought. Wilhelm Wundt was perhaps the first psychologist to study attention, distinguishing between broad and restricted fields of awareness. Ivan Pavlov, who noted the role attention, plays in activating conditioned reflexes. Psychologists today consider attention against a background of "orienting reflexes" or "pre attentive processes," whose physical correlates include changes in the voltage potential of the cerebral cortex and in the electrical activity of the skin, increased cerebral blood flow, pupil dilation, and muscular tightening. Attention is an essential element of mental ability. There are three different types of attention. These are focused attention, sustained and divided attention. (Posner, M. I., 1994).

1.7. 3 Sustained Attention

Sustained attention is "the ability to direct and focus mental activity on specific stimuli and it is capacity to attend to a task in hand for a required period of time." In order to complete any mentally planned activity, any sequenced action, or any thought one must use sustained attention. An example is the act of reading a newspaper article; one must be able to focus on the activity of reading long enough to complete the task. Problems occur when a distraction arises. A distraction can interrupt and consequently interfere in sustained attention (DeGangi and Porges 1990). A right frontal parietal network mediates sustained attention (Rueckert & Graffman, 1996). Imaging studies have shown that vigilance tasks that require sustained attention activate a network of structures in the right frontal and parietal cortices (Pardo, Fox & Raichle 1991).

1.7. 4 Divided Attention

Divided attention is the capacity to attend to two or more tasks simultaneously. The concept of divided attention explains dual tasking, wherein two tasks require effort and attention. The multiple resource model of attention formulated by Kinsbourne (1978) conceptualizes attention as a resource that can be divided into three parameters. These parameters are the modality of the stimulus, the nature of processing, and the type of the response. When attention has to be divided, as in dual

tasking, division is easy if the two tasks do not overlap on any of the three parameters. As overlap among the parameters increases, the difficulty of dividing attention also increases. Discrimination of shape, colour and speed of a visual stimulus under conditions of divided attention activated the anterior cingulate and the dorsolateral prefrontal cortex (Corbetta, et al., 1991). Bilateral dorsolateral prefrontal Cortex the central executive, which was tested by the dual task paradigms (D'Esposito, et al., 1995).

1.7.5 Learning and Memory

Learning and Memory are the capacities by which a person is able to gain experience and retain it. Learning is the means of acquisition of new information about the environment and memory is the process of retaining it. Learning and memory are interdependent processes. Memory processes are divided into short-term and long-term memories. Long-term memory is a system of theoretically unlimited capacity enduring over the lifetime of an individual (Baddeley, 1990). One of the important aspects of memory is declarative or explicit memory, i.e. memory that can be brought to conscious awareness. Memory for events, figures, words, scenes and facts are in the domain of explicit memory. Learning and Memory for verbal and visual material are two important domains of explicit memory.

1.7.6 Verbal Learning and Memory

Verbal learning and memory is the capacity to learn and remember verbal material. Lesion studies have shown that acquisition of new information is mediated by a wide network of structures including the anterior temporal cortex, amygdala, hippocampus, entorhinal cortex, prefrontal cortex and retrosplenial cingulate cortex (Habib, et al., 2003). Anterior areas of the temporal cortex are involved in the representation of verbal conceptual knowledge organized categorically (Thompson – Schill, 2003). Lesions in the left temporal lobe disrupt verbal memory and excisions of left hippocampal structures impair verbal memory to a greater extent.

1.7.7 Visual Learning and Memory

Visual Learning and memory is the capacity to learn and remember visual material. This ability is the capacity is to translate a visually perceived form into a three dimensional object or a two dimensional figure. Visuo constructive ability requires attention, visuo spatial perception, visuo motor co-ordination, error

correction abilities and planning. This ability is a composite function which is mediated by bilateral parietal structures, predominantly by the right parietal structure. The prefrontal structures also mediate the planning and error correction required for visuo constructive ability (Lezak, 1995). Lesions of the right temporal lobe disrupt visuo-spatial memory (Smith & Milner, 1981).

1.8 THE ROLL OF PHYSICAL ACTIVITY ON MENTAL ABILITIES

A few studies even suggest that more-active lifestyles may be linked with higher levels of alertness and mental ability, including the ability to learn. Physical fitness is not only good for the body. It also seems to help improve the mental ability. Physically active people tend to have better mental health (Audrey F. Manley, M.D., 1996). Most forms of physical activity lead to a substantial increase of systemic blood pressure, and since there is little vasomotor control of the cerebral circulation, the overall perfusion of the brain typically increases by 14% to 25% during a bout of endurance exercise (Herzholz K., et al., 1987). Increase in aerobic capacity is taught to augment cerebral blood flow, improve the utilization of oxygen and glucose in the brain and accelerate the transport of biochemical waste substances to maintain a stable blood flow, enhance blood antioxidant enzyme activity to clear oxidative free radicals rapidly (Radak.Z, et al., 2001). Brain derived neurotropic factor and insulin-like growth factor stimulates neurogenesis, increase interconnections between synapses and even enhances nerve message processing capacity (Pereira et al., 2007). All these are necessary to maintain nerve functions, foster a positive mood and enhance cognitive function (Cotman and Berchtold, 2002).

The physical activity and exercise produce beneficial effects. They improve self-image, social skills, cognitive functioning, confidence, well-being, sexual satisfaction, anxiety reduction, They have positive effects on depressed mood and intellectual functioning. Physical activity is not only good for our physical health and fitness, but can also help our brain to work better. Physical activity enhances higher brain functions, cognitive abilities in the areas of memory, attention and psychomotor speed, which translates into significant improvements in the higher mental processes of executive functions that involve concentration, planning, organization, strategic thinking, learning, abstract thinking, ability to process and different intellectual tasks in parallel.

In young children, any form of physical activity may be helpful. Thus, one recent experimental study of students in grades two to four found an immediate increase of concentration in response to fifteen minutes of stretching and walking (Caterino MC and Polak E.D., et al., 1999). Being physically active and exercising can help improve learning. This means that a person will be able to be more focused and perform better in class or during other activities. Exercise enhances learning and improves retention, which is accompanied by increased cell proliferation and survival in the hippocampus of rodents effects that are mediated, in part, by increased production and secretion of BDNF and its receptor tyrosine kinase trkB (LiY et al., 2008). Studies of learning and developmental mechanisms have examined the carryover of physical skills and understanding of spatial relationships into academic learning (Sibley BA et al., 2003). The aerobic exercise increase the hippocampal volume associated with increased levels of serum BDNF. It is directly related to improvements in memory performance. (Kirk I. Erickson et al., 2010). In fact being physically active can boost mental processing speed, motor function and even visual and auditory attention. Boosting the heart and lung power with aerobic fitness, it may also end up with a more "fit" mind as a bonus. Improvements in cognition as a result of improvements in cardiovascular fitness are being explained by improvements in cerebral blood flow, leading to increased brain metabolism which, in turn, stimulates the production of neurotransmitters and formation of new synapses. (Angevaren.M, et al., 2010).

1.9 PSYCHOMOTOR ABILITIES

Psychomotor means the process relating to movement or muscular activity associated with mental processes (The American Heritage Dictionary of the English Language, fourth edition, 2000). "Psych" for mind, and "motor" for the motoneuronal system in brain and spinal cord. The mind is that which controls behaviour. Activity that involves both mental and muscular ability such as playing sports and other activities where practice or concentration is involved is known as psychomotor abilities. Psychomotor (mind over muscle) activity is the combination of absorbing and processing external data at high speed through the conscious brain, transferring that data via neural paths to the subconscious level, making decisions into instructions to the muscle structure and executing those instructions through changes in the physical positioning of various body parts. Psychomotor abilities are the relationship

between mental function and physical movement. Psychomotor ability is demonstrated by physical skills such as movement, co-ordination, manipulation, dexterity, grace, strength and speed actions which demonstrate the fine motor skills such as use of precision instruments or tools, or actions which evidence gross motor skills such as the use of the body in dance, musical or athletic performance.

1.9.1 Speed

Speed is the psychomotor ability of a person to execute motor movements with high speed in the shortest period of time. It is equal to the distance covered per unit of time. The element of speed is involved in most of the athletic skills such as in sprint running, some skills of soccer, basketball, swimming, gymnastics etc. In kinematics, the speed of an object is the magnitude of its velocity (the rate of change of its position); it is thus a scalar quantity. The average speed of an object in an interval of time is the distance traveled by the object divided by the duration of the interval; the instantaneous speed is the limit of the average speed as the duration of the time interval approaches zero.

1.9.2 Co-ordination

Co-ordination is a psychomotor ability to repeatedly execute a sequence of movements smoothly and accurately. This may involve the senses, muscular contractions and joint movements. Motor co-ordination is the combination of body movements usually smoothly and efficiently work together. Motor co-ordination involves the integration of processes ranging from how muscles interact with the skeletal system to neural processes controlling them both in the spine and the brain. Motor co-ordination is the ease with which people can stand up, pour water into a glass, walk, and reach for a pen. These are created reliably, proficiently and repeatedly, but these movements rarely are reproduced exactly in their motor details, such as joint angles when pointing or standing up from sitting.

Hand-eye co-ordination is coordinated control of eye movement with hand movement, and the processing of visual input to guide reaching and grasping along with the use of proprioception of the hands to guide the eyes. It is a way of performing everyday tasks and in its absence most people would be unable to carry out even the simplest of actions such as picking up a book from a table or playing a video game. The more dominant behavior in human studies have shown that the eyes

generally direct the movement of the hands to targets. The neural control of hand-eye co-ordination is complex because it involves every part of the central nervous system involved in vision, eye movements, touch, and hand control. This includes the eyes themselves, the cerebral cortex, sub cortical structures (such as the cerebellum, basal ganglia, and brain stem), the spinal cord, and the peripheral nervous system. Some other areas involved in hand-eye co-ordination that has been most studied most intensely are the frontal and parietal cortex areas for the control of eye saccades and hand reach control. Both of these areas are believed to play a key role in hand-eye co-ordination and the planning of movements during tasks. A more specific area, the parieto occipital junction, is believed to be involved in the transformation of peripheral visual input for reaching with the hands, as found via fMRI (Gomi, H. 2008).

1.9.3 Explosive Power

Explosive power is a psychomotor ability of the muscles to release maximum force in the shortest possible period of time. The ability of neuromuscular system to overcome resistance with speed of contraction. Sporting performance at elite levels of competition often depends heavily on the explosive power of the athletes involved. In many individual sports such as track and field events, swimming and gymnastics the ability to use high levels of strength as quickly and as explosively as possible is essential to perform at elite levels. For conceptual purposes, think of a sprinter forcefully driving into the starting blocks, a high-jumper propelling himself off the ground, a football player exploding off the line, or a swimmer diving in to the pool. While each of these movements are markedly different from one another, both in form and speed of movement, they all require explosive power.

1.10 THE ROLL OF PHYSICAL ACTIVITY ON PSYCHOMOTOR ABILITIES

Boys and girls who have better motor abilities are more physically active and less likely to be sedentary than children with poorer co-ordination, research conducted with children between the ages of eight to ten years at the University at Buffalo has shown (Buffalo, N.Y. 2010).The motor proficiency is associated positively with physical activity, and related negatively to the percentage of time in sedentary activity in children. When this association was examined by quartiles of motor abilities,

children in the highest quartile of motor proficiency were the most physically active, compared with children in the lower quartiles (Brian H. Wrotniak, et al., 2006). Regular physical activity builds healthy bones and muscles, improves muscular strength and endurance, reduces the risk for developing chronic disease risk factors, improves self-esteem, and reduces stress and anxiety. Wrotniak noted that "Just by being physically active, a child improves their motor abilities," he said. "I think it is likely that physical activity and movement abilities are interrelated.

1.11 NEED OF THE STUDY

The need of physical activity and fitness programme becomes more and more urgent today as a result of increasing use of machines, resulting in a lesser and lesser use of muscular parts of the body. The association between physical fitness and mental health is as intuitive as "mens sana in corpore sano." Over the time, this Latin phrase has come to mean that only a healthy body can produce or sustain a healthy mind. The main objective of sports is to develop physical and mental health. Further, it has to integrate or to bring about psychological co-ordination, socialization and culture interaction and thus to develop a spirit of tolerance. The philosopher Spinoza once said, "Teach the body to do many things; this will help you perfect the mind and come to the intellectual level of thought" (Learner & Kline, 2006). Throughout history, many philosophers have written about the relationship of physical activity/motor development and learning, along with placing a high level of importance on physical development. Philosophers believed that the soul was developed by the mind, as well as the body (Learner & Kline, 2006).

The need for encouraging daily physical activity for the children is obvious. The children involve in physical activity at least forty five to sixty minutes every day improving their mental and physical health. But society has lost the importance of physical activity and forgotten the crucial role it plays in children's motor development as well as academic achievement. Increasing physical activity among the nation's youngsters is important, to their wellness and to the prosperity of the nation. But children across the country are supporting sedentary lifestyles because of raising academic demands, watching television and playing video games. It is every one's responsibility to bring up our children healthy by mentally and physically for taking our nation to the world's super power position. Aquatic and gymnastics are the

mother of sports and they are the basic level of physical activity for the children. Participation in regular aquatic and gymnastics training promotes physical and mental health. So the researcher motivated to take up the study to find out the comparative effects of aquatic and gymnastics training on mental abilities of mental speed, sustained attention, divided attention, verbal learning, verbal memory, visual learning, visual memory and psychomotor abilities of speed, co-ordination and explosive power among school boys.

1.12 STATEMENT OF THE PROBLEM

The purpose of the study was to find out the comparative effects of aquatic and gymnastics training on selected mental abilities of mental speed, sustained attention time, sustained attention error, divided attention, verbal learning, verbal memory, visual learning, visual memory and psychomotor abilities of speed, co-ordination and explosive power among school boys.

1.13 OBJECTIVES OF THE STUDY

1. To find out whether the aquatic training improves the selected mental abilities of mental speed, sustained attention time, sustained attention error, divided attention, verbal learning, verbal memory, visual learning, visual memory and psychomotor abilities of speed, co-ordination and explosive power among school boys.
2. To find out whether the gymnastics training improves the selected mental abilities of mental speed, sustained attention time, sustained attention error, divided attention, verbal learning, verbal memory, visual learning, visual memory and psychomotor abilities of speed, co-ordination and explosive power among school boys.
3. To compare the aquatic and gymnastics training on the selected mental abilities of mental speed, sustained attention time, sustained attention error, divided attention, verbal learning, verbal memory, visual learning, visual memory and psychomotor abilities of speed, co-ordination and explosive power among school boys.

1.14 HYPOTHESIS

1. It was hypothesized that practice of aquatic training would significantly develop the selected mental abilities of mental speed, sustained attention time, sustained attention error, divided attention, verbal learning, verbal memory, visual learning, visual memory and psychomotor abilities of speed, co-ordination and explosive power among school boys.
2. It was hypothesized that practice of gymnastics training would significantly develop the selected mental abilities of mental speed, sustained attention time, sustained attention error, divided attention, verbal learning, verbal memory, visual learning, visual memory and psychomotor abilities of speed, co-ordination and explosive power among school boys.
3. None of the training methods namely aquatic and gymnastics training would be better than the other in developing the selected mental abilities of mental speed, sustained attention time, sustained attention error, divided attention, verbal learning, verbal memory, visual learning, visual memory and psychomotor abilities of speed, co-ordination and explosive power among school boys.

1.15 SIGNIFICANCE OF THE STUDY

1. This research would help the parents and teachers to choose the most appropriate activities to develop the mental abilities and psychomotor abilities.
2. This research would help the parents and teachers to suggest suitable remedial exercises to develop the mental abilities that are found below the average of the child.
3. This research would create awareness among the parents and teachers about the status of improving their physical health for better mental health.
4. This research would add to quantum of knowledge in the area of physical education and fitness programme.
5. This research would also help the coaches and players to assess their status themselves.

1.16 DELIMITATION

The study was delimited in the following aspects

1. The study was delimited to sixty male school children studying in S.S.V. Hr. Sec. School, Kodumudi ,Erode District, Tamil Nadu, India.
2. The age of the subjects ranged between twelve and sixteen years. All the subjects were healthy and normal.
3. The study was delimited to the selected mental abilities of mental speed, sustained attention time, sustained attention error, divided attention, verbal learning, verbal memory, visual learning, visual memory and psychomotor abilities of speed, co-ordination and explosive power.
4. For collection of data pertaining to criterion variables as for as instruments are concerned it was confined to the instruments that are standardized tests and highly calibrated by reputed firms.
5. Subjects for each group were delimited to twenty participants.

1.17 LIMITATIONS

The following limitations were considered for the study.

1. Regular activities of the subjects were not taken into consideration of the results.
2. Changes in atmospheric pressure, temperature, relative humidity factors during the period of administering the test were not taken into consideration.
3. The influences of their social and economic structure on results if any were not considered as a limiting factor for the present study.
4. No effort was made either to control or assess the quality and quantum of the food ingested the quantum of physical exertion, life style, psychological stresses and other factors that affect metabolic function, as this was recognized as a limitation.

1.18 DEFINITION OF RELATED TERMS

1.18.1 Aquatic

Physical activity or sports in or on the water

1.18.2 Gymnastics

Physical exercise designed to develop and display strength, balance, and agility, especially those performed on or with specialized apparatus. (American Heritage Dictionary: <http://www.answers.com/topic/gymnastics>.)

1.18.3 Mental abilities

Mental abilities are the brain based skills and mental process to learn, retain and execute the knowledge. (wordnetweb.princeton.edu/perl/webwn).

1.18.4 Psychomotor abilities

Psychomotor abilities are the movements of muscular activities associated with mental processes (American Heritage Dictionary of English Edition 2000).

1.18.5 Physical activity

Physical activity is any bodily movement produced by skeletal muscles that result in energy expenditure (Caspersen, C J. et al., 1985).

1.18.6 Mental speed

Mental speed is a composite measure, which requires rapid processing of information. The measures of speed are useful in documenting the efficiency of motor processes and the rate of information processing.

1.18.7 Attention

Attention is a mental process of selectively concentrating on one aspect of the environment while ignoring other things. Attention has also been referred to as the allocation of processing resources.

1.18.8 Sustained attention

Sustained attention is a ability to maintain a consistent behavioral response during continuous and repetitive activity.

1.18.9 Divided attention

Divided attention is the highest level of attention and it refers to the ability to respond simultaneously to multiple tasks or multiple task demands.

1.18.10 Memory

Memory is the ability to store, retain, and subsequently recall information.

1.18.11 Learning and Memory

Learning is the means of acquisition of new information about the environment and memory is the process of retaining it.

1.18.12 Verbal Learning and Memory

Verbal learning and memory is the capacity to learn and remember verbal material.

1.18.13 Visual Learning and Memory

Visual Learning and memory is the capacity to learn and remember visual material.

1.18.14 Speed

Speed is the ability of a person to execute motor movements with high speed in the shortest period of time.

1.18.15 Co-ordination

Co-ordination is the ability to repeatedly execute a sequence of movements smoothly and accurately.

1.18.16 Explosive Power

Explosive power is the ability of muscle to release maximum force in the shortest possible period of time.