Chapter 1

Introduction
1.1 **History of Shooting Sports**

Shooting is considered as one of the sports that can be taken up by any individual or participant regardless of age and sex for recreation and professional involvement. The shooting sports include those competitive sports involving tests of proficiency (accuracy and speed) using various types of guns such as firearms and air guns.

In 1896, French nobleman Baron Pierre de Coubertin orchestrated the first modern Olympic Games with nine sports in Athens, Greece. Shooting sports are categorized by the type of firearm or target used. This fact certainly contributed to the inclusion of five shooting events in the 1896 Olympics. Since then, shooting events have been a part of all Olympic Games. The Olympic Games continue to provide shooting sports the greatest public relations opportunity. Because of its long heritage and broad appeal, the shooting sports are enjoyed by a large number of participants around the world. Over the years, the events have been changed a number of times in order to keep up with technology and social standards. Now a days competitions are taking place under four disciplines; rifle, pistol, shotgun and running target. Participation has grown steadily through the years. While only four nations competed in shooting events in 1896, 83 countries met on the firing lines in Barcelona in 1992. In fact, shooting traditionally attracts the third largest number of participating nations of any sport at the Olympic Games.

The origin of shooting in India can be traced back to the medieval period, when Indians used to practice the game in the form of archery. During the 16th century, the firearms were introduced to the game, which was primarily used for hunting. Shooting competitions were held right from the 11th century, although the game was considered royal, confined to the Maharajas of the princely states of India.

In the present day scenario, the shooting sport in India has gained worldwide recognition. Indian shooters have marked their presence and gained success in prestigious international events
including Olympic Games, Commonwealth Games, SAF Games and Asian Games. Veteran shooters including Abhinav Bindra, Major Rajyavardhan Singh Rathore, Anjali Bhagwat, Gagan Narang and other prominent shooters have brought laurels to the country, thus contributing to the upliftment of the game. Some of the outstanding Indian shooters have received the most prestigious awards, including Rajiv Gandhi Khel Ratna Award, Dronacharya Award and Arjuna Award, for excelling in sports. Achievements of these shooters sparked enthusiasm in the Indian sports population to take part in shooting competitions, with the increasing popularity of the shooting sport in India, the budding shooters are putting strenuous efforts to excel in the game and gain recognition both at the national and international levels. In India, shooting is generally regarded as an expensive sport, which only the affluent, powerful and the talented with institutional support can pursue as a serious career. This is the reason why the sport remains the secondary choice of the sports enthusiasts in India. Nonetheless, with the good work of Indian shooters coming into limelight, more and more youngsters are opting for shooting sport as their profession. Today, shooting has proved to be a stiff competitor of games including cricket and badminton, which score more in popularity.

Shooting activities take place in events such as rifle shooting, pistol shooting, dart throwing, archery and clay-pigeon arc shooting. A basic characteristic of all these forms of shooting is that the participant aims an object at a target, be it a dart, bullet, shot or an arrow. In all forms of shooting, the winner is that person who obtains the maximum score, this usually being the average error from a target center (Mononen et al., 2003b).

In shooting the requirement of good physical and psychological condition as well as technical perfection is highly demanded (Antal and Shankar, 1994). Many studies have investigated the physical factors that determine the sway or tremor of the participant and ways in which it may be minimized to improve the accuracy of shooting. The important use of vision for
shooting necessitates relying less on this cue for balance, leading to compensation through subconscious postural mechanisms based on proprioceptive and vestibular information, such as a less elevation of pre-shot heart rate and blood pressure, lower sweating and a more appropriate preparatory brain activity (Tremayne and Barry, 2001).

The shooting game requires great concentration skills, in order to acquire precision while shooting the target. In this work, investigated pistol shooting and the psychophysiological factors affect the accuracy with which a target may be hit. Pistol shooting is a static activity requiring a strict control of body segments and posture to align the rear sight aperture and the foresight through proprioceptive feedback and gaze fixation either on the target directly or between the target and the weapon and, therefore, to increase precision of the shot (Mononen et al., 2007).

Air pistol shooting is an Olympic sport requiring extreme mental concentration and movement precision for success. The shooters in standing position have to aim at a target consisting of concentric rings each one corresponding to a score, starting from 10 for the inner circle and decreasing of a unit for each circle. The outside scoring ring has a diameter of 16.5 cm, while the 10th ring has a diameter of just 1.15 cm. In 10 m air pistol a movement of the gun of only 0.016° is enough to drop the score to a lower one. In this condition it is evident that the small movements of the body and of the arm gun complex always present during the aiming phase can play a great role on the shooting performance (Zatsiorsky and Aktov, 1990).

The effect of experience of the shooter has been extensively studied as well, mainly for rifle shooting, possibly due to its use in the army. As compared to rifle shooting, there is very little literature related to pistol shooting. In this work, we investigated pistol shooting and several of the psychophysiological factors that affect the shooting performance. While a number of studies have examined both psychological and physiological factors related to shooting performance, to our knowledge,
this is the first study to determine the efficacy of Music Therapy (MT) and Meditation (M) on Heart Rate Variability (HRV) and Salivary Cortisol (SC) in professional shooters.

1.2 Pre-Competition Stress in Sports

Stress is most often used to describe an unpleasant emotional state or condition which is characterized by subjective feelings of tension, apprehension, and worry. In sports context it is commonly known as pre-competition stress or anxiety. Each year, millions of people participate in competitive sport activities. For many athletes, these activities can be filled with anxiety or stress manifested in many ways including; fear of failure, fear of societal consequences, and worry about not living up to the expectations; indicated that enjoyment, performance, interactions with teammates, coaches, and officials and disposition to injury are each influenced by different types of stress or anxiety. Further, research indicated that anxiety has a negative effect on these sport outcomes (Terry and Slade, 1995).

Anyone who has been a sport participant or observer has certainly observed certain athletes who tend to "peak" during competition and, at the same time, other athletes who tend to falter or "choke" in the same competitive situations. Research on how athletes cope with sport-related stress has been recognized for both its practical and its theoretical importance because of the debilitating effects that stress may have on athletic performance (Smith et al., 1998). Stress can affect athletes in ways other than their sport performance. Some, drop out of sport because they find athletic competition to be threatening rather than enjoyable (Gould et al., 1987). Sports medicine practitioners and athletic trainers have found that athletes who find competitive situations stressful or anxiety producing appear injury prone and/or seem to take longer to return to activity following injury.
Smith et al. (1998) reported a conceptual model of sport performance anxiety. A significant component in their model is the athlete's cognitive appraisal of demands, resources, consequences, and personal meaning of consequences. A negative appraisal of these variables may lead the athlete to feel unprepared or ill equipped to handle the demands of the situation and fearful of the consequences a negative performance could mean. These feelings lead to an increase in athlete anxiety. For instance, a lack of attention to activities necessary for successful competition, such as forms of mental preparation, may leave the athlete feeling less than completely prepared and thereby increase anxiety.

Athletes who are involved in competitive sport can expect to be placed regularly under intense physical and psychological demands. These demands require athletes to use not only the technical and tactical skills that they have developed but also cognitive and behavioural coping skills, in order to achieve performance success and satisfaction (Crocker et al., 1988).

Stephen et al. (2009), furthermore suggested that, prior to competing, sport performers encounter more stressors pertinent to performance than those emanating from the organization, these observations highlight that all the demands faced by athletes should be considered when preparing and implementing interventions to manage competition stress.

Pre-competition anxiety is a widely prevalent condition that exists among athletes of all levels and within every sport. Its relationship to performance has been studied both in and out of the sport context through test anxiety research (Liebert and Morris, 1967) and also in the recent anxiety researches with athletes (Chamberlain and Hale, 2007; Kais and Raudsepp, 2005; Swain and Jones, 1996). Despite the large body of research on pre-competition anxiety, our understanding of its relationship to performance remains elusive.

Anxiety, frustration, or anger (related or unrelated to athletic participation) experienced prior to practice may lead to thoughts such as, "I'm too stressed to practice," which in turn results
in the decision to skip practice. This would be an example of rule-governed behavior, as the avoidant behavior is directly governed by the cognitive response to the emotion of anxiety (a personal rule established by the individual) and not a choice of action consistent with the valued goal of improving performance, engaging in athletic competition, and enjoying the process of athletic participation.

Sport is an arena of achievement in which ability is publicly tested, scrutinized, and evaluated. Because of the debilitating effects that stress can have on performance, athletes must learn to cope with the demands and pressures of competition if they are to enjoy and succeed in sports. Research has been conducted to discover or identify the sources of stress in various competitive sports, including basketball (Madden et al., 2004), figure skating (Scanlan et al., 1989), college baseball (Anshel and Marisi, 1978), golf (Cohn, 1990), and wrestling (Gould et al., 1988). Athletes have identified several sources of acute stress in team activities; receiving unpleasant input from peers, fans, coaches, experiencing pain or injury, making a physical or mental error, receiving a "bad" call from an official, and receiving negative feedback from the coach.

Modern life is full of hassles, deadlines, frustrations, stress and demands, for many people, are so commonplace that it has become a way of life. Stress isn’t always bad. In small doses, it can help to perform under pressure and motivate to do the best, but when one is constantly running in emergency mode, the mind and body pay the price. If one frequently finds oneself feeling frazzled and overwhelmed, it’s time to take action to bring the nervous system back into balance and can protect by learning how to recognize the signs and symptoms of stress and taking steps to reduce its harmful effects.

Consistency in psychological factors is widely regarded to be important for successful performance in team sports (Ranglin and Morris, 1994). Pre competition and during competition
stress rises in today’s sports world. Anxiety and stress decreases the concentration and performance level of sports persons (Solberg and Bergulund, 1996).

1.3 Basic Stress Physiology

The endocrine organs of immediate concern to stress management are the pituitary, suprarenals, thyroids and thymus. The pituitary is the master gland which controls the others. It is situated under the front part of the brain and is attached to its base by a long stalk. It contains nerve fibres which connect to the hypothalamus which is part of the nervous system; thus it is the focal point where endocrine and nervous system meets.

The suprarenal glands, as their name implies, are situated over the top of each kidney. They are each divided into two sections: The medulla (inner), controlled by the hypothalamus, secretes adrenaline which regulates the heartbeat, respiratory rate and bowel action. The cortex (outer), controlled by the pituitary, secretes corticoids (substances akin to cortisone) which inhibit inflammatory conditions and protect the body against the effects of stress.

The thyroid glands are situated at the base of the throat. They are regulators that control the metabolic rate at which body and mind operate. They secrete an iodine compound called thyroxin which has a profound effect on both temperament and physique. Excess secretion causes a quickening of respiration and heartbeat resulting in people becoming very nervous and emotional. Insufficient secretion results in them becoming very lethargic and easily fatigued.

The thymus gland is in the chest and contains lymphatic tissue. It governs the maturation of the T cell lymphocytes and is thus responsible for regulation of the auto-immune system which is vital in marshalling the body's capacity to ward off disease. It helps the suprarenal in fighting stress.
There are many circumstances that can precipitate a stress situation. The reaction follows a well defined course. The frontal lobe of the brain stimulates the hypothalamus which, in turn, secretes a 'releasing factor' that triggers the suprarenal into producing extra large quantities of adrenaline. This enters the bloodstream and has an immediate effect upon the sympathetic nervous system. Its nerves go to the heart (which responds by quickening the pulse rate), the blood vessels (which cause a rise in blood pressure) and the respiratory system (which responds with faster breathing) and there is a rise in the level of blood sugar. The whole body is mobilised for ‘fight or flight’.

This is the alarm reaction, necessary for emergency, and if it were activated only in passing conditions of comparatively short duration, there would be no cause for concern because the resultant physical activity would eliminate the adrenaline. Unfortunately, however, anger and frustration can cause a continuing secretion of adrenaline into the bloodstream, resulting in a chronic state of high blood pressure and other signs of acute distress. This is destructive to both body and mind.

The pituitary organ receives a feedback signal and secretes adrenocorticotropic hormone (ACTH) into the bloodstream which stimulates the suprarenal cortex to produce corticoids which are then carried to the points of adrenal inflammation. These create a balance of activity, and the stage of resistance to stress by the body is entered. This balanced steady state is known as homeostasis and it represents the process of 'adaptation to stress'. If this can be maintained, all is well, but if the stress is prolonged and the body cannot continue to adapt, the third stage ‘exhaustion’ is entered. In extreme physical illness or emotional and mental collapse results.

1.4 Types of Stress or Anxiety
Spielberger (1966), postulated that anxiety can take two forms: state anxiety or trait anxiety. State anxiety refers to an emotional state consisting of fear or apprehension while trait anxiety refers to a predisposition to perceive situations as potentially threatening and respond with manifestations of state anxiety.

State anxiety is "characterised by subjective, consciously perceived feelings of apprehension and tension, accompanied by or associated with activation or arousal of the autonomic nervous system" while trait anxiety is an "acquired behavioral disposition that predisposes an individual to perceive a wide range of objectively non dangerous circumstances as threatening and to respond to these with state anxiety reactions disproportionate in intensity to the magnitude of the objective danger".

Athletes who are predisposed to higher levels of trait anxiety will perceive sport competition environments as being more threatening than they may actually be and respond with greater state anxiety responses. Trait anxiety in sport can be manifested in many ways. Sarason (1984), indicated the existence of two distinct dimensions of trait anxiety; Cognitive anxiety and Somatic anxiety. Cognitive anxiety is predominantly psychological in nature and is characterised by feelings of worry about outcomes and the use of negative mental imagery. Conversely, somatic anxiety is physiological in nature and includes increases in heart rate and increased perspiration. An excellent review of the relationship among forms of anxiety has been published (Smith et al., 1998).

State anxiety can be defined as an aversive emotional and motivational state as a result of threat, which is "related to the subjective evaluation of a situation, and concerns jeopardy to one's self-esteem during performance or social situations, physical danger, or insecurity and uncertainty" (Schwenkmezger and Steffgen, 1989).
An often heard comment is that it is not possible to train for these pressures as they are too high and too context-specific. However, to our knowledge it has never been properly investigated whether this is indeed the case. Therefore, in the current study a first attempt was made to examine whether relaxation techniques along with routine sports specific training with mild anxiety, a level that can be simulated in practice, may help in preventing choking under higher levels of anxiety.

1.5 Role of Relaxation Therapies

The World Health Organization estimates that between 65 and 80% of the world population, or about 3 billion people, rely on traditional or "alternative" medicine. Alternative healing does not ignore the importance of allopathic knowledge. Allopathic treatment may be superior for the treatment of some conditions. Rather, a major thrust of integrative medicine is that non-invasive and natural treatments be explored as well. A recent survey revealed that relaxation therapies were used in treating eleven of the top fourteen most frequently reported medical conditions including back pain, fatigue, headache and high blood pressure. Relaxation therapies tend to be less invasive, costly, and have fewer side effects compared to current traditional options.

Applied Sport Psychology, in its efforts to enhance the competitive performance of athletes, has traditionally utilized cognitive behavioral methods and techniques with an emphasis on developing self-control of internal states, commonly referred to as psychological skills training (Whelan et al., 1991).

Historically, efforts to enhance athletic performance have been most clearly related to the development of social cognitive theory (Bandura, 1977) and early skills training models of cognitive-behavioral interventions. From this perspective, athletes develop and utilize
psychological skills such as goal setting, imagery/mental rehearsal, arousal control, self-talk, and precompetitive routines as vehicles to aid in the development of self-control of internal processes such as thoughts, emotions, and bodily sensations, in an attempt to create the ideal performance state (Hardy et al., 1996).

There has been tremendous progress in the non-pharmacologic treatment of anxiety disorders (Barrows and Jacobs, 2002). Cognitive-behavioural therapies reflect a recent integration of the cognitive theories and methods invented by Aaron T. Beck and Albert Ellis, and behavioural theory based on the work of B.F. Skinner and Ivan Pavlov. Relaxation therapy is a behavioural approach which emphasises the development of a relaxation response to counteract the stress response of anxiety.

Relaxation techniques have been used in sports primarily to enhance recovery from training and competition, manage anxiety and improve performance (Solberg et al., 2000). It has been suggested to increase concentration, enhance motor skills and improve ability to handle arousal and stress. The aim of relaxation techniques is to remove the negative effects of stress so that athlete can enter and maintain a quality state for performance.

1.6 Music as Therapy

Music is a mystery. According to Darwin, it "must be ranked amongst the most mysterious (abilities) with which (man) is endowed." Music is a human cultural universal that serves no obvious adaptive purpose, making its evolution a puzzle for evolutionary biologists". In 2008, Nature published a series of essays on music. Their authors agreed that music is a cross-cultural universal, still "none... has yet been able to answer the fundamental question: why does music have such power over us?” "We might start by accepting that it is fruitless to try to define 'music'.
Functions and origins of music have challenged philosophical thought for thousands of years. Aristotle listed the power of music among the unsolved problems. During the last two decades, the powers of music that previously seemed mysterious are receiving scientific foundations due to the research of scientists in several fields. Integration of this research in recent years provides evidence for the evolutionary origins and roles of music. This section provides many different views on the role of music in cognition from ancient philosophers to contemporary research.

Music has a universal language. It influences all levels of human existence. It is a medium for communication, which can be both a pleasant and healing experience. Though the therapeutic values of music have been recognized and employed from a very early stage in the history of mankind, music is known to alleviate both acute and chronic ailments because of the efficacy of sound vibrations in affecting the mental and emotional states and in producing multiple physiological changes in the body. But not enough work has been carried out scientifically to evaluate the efficacy of traditional Indian classical music in healing various ailments.

Musical therapy is an ancient but also a new therapy. According to Vedic literature there is a relationship between the melody of the universe and vital rhythm. Coaches and sport psychology consultants can use a segment of practice to teach the athletes ways to reduce anxiety (e.g., music therapy, meditation, deep breathing) and how they can implement these techniques prior to arousal-producing games. Furthermore, coaches should occasionally call for anxiety-producing drills during practice to properly prepare the athletes to deal with these situations in games.
Modern science and medicine are now rediscovering the healing powers of music. Music therapy, the specialized use of music in treating persons with special needs in mental and physical health, rehabilitation and special education is gaining ground.

Music is an age-old part of Ayurveda, the holistic science which promotes a happy and healthy lifestyle. From time immemorial, music has been a part of Indian culture. In the Vedas too, music has an important place. The 'Samveda' is full of music. The doshas like Vata, Pitta and Kapha can be controlled effectively by Music Therapy. Great composers of Indian classical music have attempted music therapy down the years.

Music therapy has a long history dating back to ancient Orphic school in Greece. Pythagorus, Plato and Aristotle, all were aware of the prophylactic and therapeutic powers of music. Even the Old Testament mentions music therapy where King David is said to have cured an illness by playing on the harp. Hippocrates, the father of modern medicine, used music to cure human diseases. In ancient Egypt music was used to lessen the pain of women during childbirth. Ibn Sina, a famous Arabic writer, has written in detail on this subject. In India legend has it that Thyagaraja, the famous musician of South India, brought a dead person back to life by singing the composition Naa Jeevan Dhara in raga Bihari. In 1729 Richard Browne, a physician wrote the famous text Medicina Musica which describes the use of music as medicine. Dr Burnell has mentioned a manuscript named Raga Chikistsa in the collections of Saraswati Mahal Library in Tanjore which deals with the various ragas that can be used for curing various ailments.

Music has a long history of healing physical and mental illness. Music therapy has been considered to have therapeutic and emotional benefits since ancient times. The use of music in rehabilitation has been well recognized and is becoming a common recommendation (Kathi and
Suzanna, 2005). Historically, it has been used to promote relaxation, however only recently its therapeutic use has been examined under controlled environments (Fergustion, 2004). Music is thought to improve performance by dissociating attention from the feeling of pain that is apparent as exercise progress (Atkinson et al., 2004). Music is widely used to enhance well being, reduce stress and distract patients from unpleasant symptoms. Music appears to exert direct physiological effects through the autonomic nervous system (Rakel and Saunder, 2003).

There is an increased no of people, especially athletes who buy and use CDs and MP3 players. Music is ubiquitous in all human culture and is listened by persons of all ages, races and ethnic backgrounds (Kathi and Suzanna, 2005).

It is believed that music stimulates the pituitary gland, whose secretions affect the nervous system and the flow of blood. It is believed that for healing with music, it is necessary to vibrate the cells of the body, for it is through these vibrations that the diseased person's consciousness can be changed effectively to promote health. The right kind of music helps one relaxes and refresh. Even during the course of working, light music improves efficiency. Listening to music helps control negative aspects of our personalities like worry, bias and anger. In addition, it can help cure headache, abdominal pain and tension. Music therapy is one of the most effective ways of controlling emotions, blood pressure and restoring the functioning of the liver. Music is capable of improving happiness, peace, health and concentration. It is however important to know the method and duration for which Music Therapy is to be administered.

Music Therapy is a newly developed branch of Para medicine in which music or sound pulses that generate different kinds of music are being employed in curing ailments like mesothelioma, asthma, depression, and even Asbestos Cancer, peritoneal mesothelioma etc. Music Therapy is used for selected music to obtain the same expected changes and hormonal alterations in the body, played uninterrupted for a while, to obtain the desired positive effect.
Even though the patient participating in the treatment sessions has no knowledge of music, Music Therapy brings positive results. Recent researches have shown that music has a vital influence on the functioning of human brain and this theory can be utilized in curing various diseases like mesothelioma, Asbestos and Cancer. Many clinical symptoms seem to be reduced after successful music therapy. This branch of science is growing fast and many researchers in the field of music as well as medicine are contributing to it. It is also proven that Music Therapy is especially effective in three key medical areas.

1. Pain, anxiety and depression,
2. Mental, emotional and physical handicaps,
3. Neurological disorders and mesothelioma.

It has also been found that listening to various kinds of appropriate music lowers Blood Pressure, stabilizes irregular heart rate, reduces pre-treatment anxiety, relieves depression and related mental ailments, enhances concentration, reduces the need for sedatives and pain drugs (in an event of surgery), reduces vomiting tendency after chemotherapy and also improves stability of those with Parkinson's disease.

Inevitably, then, music has a very powerful therapeutic effect on the human psyche. Recent studies have shown that music and language share some important neurological aspects in their processing, both involving bilateral hemispheric activities. It has always been part of our association with specific emotions, and those emotions themselves have given rise to great music. Till now, no documented study has been conducted in India regarding the use of music in healing, or whether it can be used as therapy. Even though this has been a popular subject in the West.
“Music is a kind of inarticulate, unfathomable speech which leads us to the edge of the infinite and lets us for a moment gaze in that” observed Carlyle. Music is basically a sound or nada generating particular vibrations which moves through the medium either present in the atmosphere and affects the human body. Ancient Indian music has devised a special therapy based on the 72 ragas. It is appropriate to define Raga at this point. Raga is neither melody alone, nor notes; neither scale nor mode. It's an ensemble of all these. According to an ancient Indian text, Swara Shastra, the seventy-two melakarta ragas (parent ragas) control seventy-two important nerves in the body. It is believed that a person who sings/perform a raga bound to the raga specifications (lakshanas) and with purity in pitch (swara shuddi) will have complete control on the corresponding nerve. To quote a few, for those who suffer from hypertension, ragas such as Ahirbhairav and Todi are prescribed. To control anger and to bring down violence within oneself, Karnatic ragas like Punnagavarali, Sahana and so on, come handy. Not only psychological, but the somatic or physiological impact of ragas have come to light in recent research. For instance, stomach-related disorders are said to be cured with some Hindustani ragas such as Deepak (acidity) and Jaunpuri (constipation) and Malkauns or Hindolam (intestinal gas and fever). Simple iterative musical rhythms with low pitched swaras, as in bhajans are capable of relaxation, as observed with the alpha-levels of the brain waves. They may also lead to favourable hormonal changes in the system. So music is a power or universal energy in the form of ragas.

On the therapeutic side, nothing new is to be invented. We just have to know how to knock the hidden goldmine. There is an urgent need for a detailed enquiry based on scientific parameters and the medicinal effects of Music. No doubt, it’s a long journey, but worth to start off. There is a growing awareness that ragas could complement or even be a safe alternative for many medical interventions. For this purpose, it is necessary that exponents in Indian ragas join
experts in medicine to help evolve a scientific system of raga therapy for the various illnesses of modern times. Music is an inexpensive intervention with no known side effects.

Music is different from other arts in that it affects emotions directly (not through concepts-representations). A scientific theory of music perception began its development in the first half of the 19th century by Helmholtz's theory of musical emotions.

### 1.7 Meditation as Therapy

Meditation originated long before the advent of contemporary psychology. It originated in ancient India more than 3000 years ago and has existed in the ritual practice of some major religions. The word ‘meditation’ can be derived from the Latin word ‘meditatio’, which referred to an exercise originally not predefined between intellectual and physical. In both ways it points to the center (lat. ‘medium’ = ‘center’) of either the body or the mind. Today, ‘meditation’ is related to various practices aiming to alter the state of consciousness, hence belonging to a more spiritual context closely associated with the term ‘contemplation’.

The enormous varieties of meditation techniques that have been developed over the centuries in the world's contemplative traditions have presented an ongoing challenge to finding consistent and encompassing taxonomies. Only recently has this challenge emerged into full focus in the field of contemporary meditational research, the current study is an important contribution in this direction.

Meditation is a growing treatment of psychological conditions and has a wide range of applications. A psychologically-oriented definition states that “meditation is a set of attentional practices leading to an altered state or trait of consciousness characterized by expanded awareness, greater presence, and a more integrated sense of self” (Davis and Thaut, 1989). From
this definition, meditation might be used as a tool for attentional training in the pre-competition anxiety population.

1.7.1 Types of Meditation

There are two general types of meditation: mindfulness meditation and concentrative meditation. Mindfulness meditation is best represented in modern medicine which emphasizes upon an open awareness to the emerging contents of the mind. After a period of practice, the patient will develop a sustainable attentive observational capability without reacting to their own thoughts and emotions. Mindful state with equanimity helps to retrain or decondition the previous pattern of reaction which is usually poorly adapted to external reality. It is represented by mindfulness-based stress reduction programs. The techniques of mindfulness meditation which focus on awareness to develop a detached observation of the contents of consciousness may represent a powerful cognitive behavioural coping strategy for transforming the ways in which we respond to life events (Astin, 1997).

Concentrative meditation is another kind of meditation which by two programs (Barrows and Jacobs, 2002), Transcendental Meditation (TM), which was introduced to the West during 1960s and the relaxation response of Herbert Benson (Bensonian meditation) which was, developed subsequently. Concentrative meditation emphasises focusing the attention onto an object and sustaining attention until the mind achieves stillness. Relaxation and clarity of mind are the results of continuous practice.

Meditation therapy, consisting of concentrative meditation, mindfulness meditation or combination of both. For an intervention to be accepted as Meditation Therapy, It must have been described in the trial report as: meditation, concentrative meditation, opening-up meditation, mindfulness meditation, insight meditation, mindfulness-based stress reduction
program, Qiqong therapy, Pranayama (Hindu breathing meditation), Transcendental Meditation, Kundalini Yoga or Anapanasathi (Buddhist breathing meditation), Zen, ChunDoSup-Bup (Korean style meditation).

For over 25 years, mindfulness training has been introduced into clinical and non-clinical settings, without its spiritual context, as an intervention to facilitate adaptive coping with life stressors and enhancing emotional well-being. Meditation practice, including mindfulness, begins with simply observing basic phenomena such as the breath. Though this may seem of little import at first glance, observation of the breath illustrates the elusive nature of attention control and provides a means of practicing directed attention. The assumption in mindfulness is that turning one's attention inward in a focused, deliberate manner requires committed practice. From a hierarchical perspective, practice observing the breath can proceed to directed or mindful observation of other objects of attention, other sensations, including sounds, visual objects, and finally thoughts.

Interest in and application of meditation for therapeutic effects continues to build, with more potential applications emerging rapidly, including studies on temporomandibular disorders, sleep disturbances, breast cancer, prostate cancer, chronic pain, fibromyalgia, depression, personality disorders, eating disorders, and childbirth, for example. It is interesting to note, however, that meditation is beginning to be considered valuable not just for therapeutic applications, but for performance enhancement (Krasner, 2004).

Meditation is the mental activity associated with attaining a deeply restful yet fully alert state (Mason et al., 1997). Meditation is practiced by many to facilitate their health and adaptation to medical illness, as a form of systematic training in a self-regulatory approach to stress reduction and emotion management (Bishop, 2002; Kabat-Zinn et al., 1992).
Studies on the long-term mental benefits of meditation show that meditation reduces stress and increases reported levels of happiness, self-confidence, and general effectiveness.

In recent years, there have been various studies on the behaviors of the mind during meditation using psychophysiological parameters such as EEG and autonomic nervous activity. But very few studies have been done in HRV and Salivary cortisol. Meditation technique has proved to be useful in reducing anxiety levels, improving levels of health, and as part of drug abuse treatment and prevention programs.

The term 'meditation' refers to a broad variety of practices, ranging from techniques designed to promote relaxation to exercises performed with a more far-reaching goal, such as a heightened sense of well-being. It is thus essential to be specific about the type of meditation practice under investigation. Failure to make such distinctions would be akin to the use of the word 'sport' to refer to all sports as if they were essentially the same. For example, the overly generic description of meditation as a mere relaxation technique (Kabat-Zinn et al., 1992).

Meditation is sometimes considered to be a form of relaxation therapy; however meditation not only creates a relaxation response but also produces an altered state of consciousness which facilitates the meta-cognitive mode of thinking which make possible the expectation of cognitive-behavioural benefits.

Meditation is probably the most commonly used relaxation techniques for stress management and personal growth. The effectiveness of different relaxation techniques has not been compared in sports settings (Weignberg and Comar, 1994). Meditation is easily adapted to the general setting by adequately trained practitioners who have first hand experience of this form of therapy.
Researches have been performed on the physiological responses of music and meditation on normal and diseased persons, but little has been done on the response of sports people especially shooters. The present study was undertaken to investigate the effect of music and meditation on stress and performance of shooters.

1.8 Heart Rate Variability as a Variable

One of the most interesting non-invasive diagnostic methods increasingly used in medicine is analysis of heart rate variability (HRV). Detailed and sophisticated analysis of fluctuation in heart rate can be used to indirectly assess autonomic control of the heart. Change in the HRV pattern provides an early and sensitive indicator of compromised health. A high variability in heart rate is a sign of good adaptability, implying a healthy individual with well functioning autonomic control mechanisms. Conversely, lower variability is often an indicator of abnormal and insufficient adaptability of the autonomic nervous system, implying the presence of a physiological malfunction in the individual for which further investigations are required to yield a specific diagnosis, (Bigger et al., 1993).

Analysis of HRV was first used in clinical practice almost 40 years ago. Simple analysis of variation in heart rate has been used in clinical practice since the early 1960s, with reduced foetal HRV indicating that clinically significant hypoxia may be developing. In the late 1970s, a reduction in HRV was first correlated with increased mortality and arrhythmic events in survivors of myocardial infarction. More recently, reduced HRV has emerged as a strong indicator of risk related to adverse events in normal subjects and patients with wide range of diseases, reflecting the vital role, the autonomic nervous system plays in maintaining health. Heart rate variability (HRV), as the conventionally accepted term to describe variations of both instantaneous heart rate and RR intervals, has aroused more and more interest since its recognition (Tapanainen et al., 2002).
In the last two decades, analysis of HRV has been extensively applied to the investigation of normal physiology and has seen increasing exploration of the potential clinical value of HRV analysis. Prior to the HRV era, investigation of autonomic physiology required the use of complex, highly invasive techniques in animal models or imprecise reflex based tests in humans. The use of HRV analysis has provided a simple reproducible method of non-invasive autonomic assessment. This has helped to clarify the role of the autonomic nervous system in regulating the cardiovascular response to changes in posture (parasympathetic dominance when supine, sympathetic dominance when standing), stress (sympathetic dominance). Now that HRV analysis equipment is available in most cardiac departments, the next two decades may see HRV techniques move into routine clinical use, particularly for risk stratification of cardiac and diabetic patients or in the follow-up of patients after therapeutic intervention.

It is widely accepted that autonomic nervous system (ANS), being not "autonomous" at all, represents an interface between the central nervous system (CNS) and the body. Changes in bodily regulation and function following everyday events, such as emotions, physical and mental stress, sleep, anxiety, social interactions, are mediated by activation of ANS. Therefore, the assessment of the state of ANS that has always been considered of utmost importance in the understanding of the physiology of cardiovascular system has constantly represented a challenging task, and different techniques have been utilized over time. Sympathetic activity may also be directly recorded in humans using microneurographic techniques. Measurements of sympathetic nerve activity to skeletal muscle have provided extensive information regarding cardiovascular reflex control in conditions ranging from rest to postural
changes, exercise, and mental stress in populations ranging from healthy controls to patients with hypertension and heart failure. However this approach being minimally invasive is not suitable for large scale clinical studies. Moreover, a limitation pertaining to all the afore mentioned techniques is that they do not provide any information on the parasympathetic branch of the ANS. More than 30 years have elapsed since the pioneering studies by Sayers, 1973 and his associates introduced a computationally efficient analysis of heart rate variability (HRV) to unveil both cardiac sympathetic and parasympathetic modulations. The last two decades have witnessed an intensive research in this field (Pagani et al., 1991) that has become a florid arena for new findings, interpretations and debates. By now, on the basis of the most relevant observations that appear widely accepted, it is possible to delineate a rather effective conceptual framework which strongly supports the possibility of transforming this methodology into a practical and common preclinical and clinical tool for the study of cardiovascular neural regulation.

The past empirical evidence has lent support to the view that psychophysiological recordings may even provide insight into the skill related aspects of a shooter's psychomotor strategies and determinants of successful shooting performance. Another line of investigation in the field psychophysiological research of shooting performance has been the cardio dynamic functions, of which the most extensively studied measure has been the heart rate (HR). The studies on HR have focused on the relationship between motor preparation and the pre-shot HR changes (Konttinen and Lyytinen, 1992).
Rather than sports items expending athletes more physical strength and demanding endurance, shooting event is technique oriented and needs more concentration and psychological stability in athletes. The athletes are strictly demanded to control their heart beats well when a match is going on, since any bigger fluctuations in their heart beats will lead to shaking of the gun, next a bad shot will come up. Whereas heart beats are regulated by the autonomic nervous system, therefore, professional shooting athletes may have been developing a better autonomic cardiac control due to intensive training and games. A higher value of scaling exponent of heartbeat series under exercise corresponds to a stronger modulating capability of autonomic nervous system. Studies examined whether sports capacity or performance of the shooters is related to the alteration in scaling exponents derived from short-term heart rate variability by relaxation trainings. The result further demonstrates that elite athletes have the ability to better control their heart beats positively, which contributes to a desirable score in the game (Jian Jun Zhuanga et al., 2008).

The process of shooting competition is a very special physiologic state for the athletes, which needs them to concentrate on the target for a long period of time, to keep their psychological activities under control, but expends them less physical energy. Therefore, our focus in this study is on shooting performance enhancement by using relaxation trainings by make alteration in scaling behavior of short inter beat interval time series for professional shooting athletes during competition, which reflects the underlying control mechanism of the ANS on the heart beats in such a unique situation.

Parameters derived from HRV have been proved to be useful in prognosis and diagnosis of heart diseases. Finding and analyzing hidden dynamical structures of these signals are of basic and clinical interest, (Aronson et al., 2004). Most recently, the applications of HRV have also
been extended to sports field. HRV analyses for the athletes have been attempted to monitor sports training. Most of such studies are focused on evaluating modifications of cardiovascular system regulated by the ANS resulting from physical exercise, exploring HRV indicators of fatigue induced by overreaching and overtraining for endurance athletes, as well as quantifying alterations of HRV measures related to workloads and training intensity during different exercise periods (Sztajzel et al., 2006).

The process of shooting match is a very special physiologic state for the athletes, which needs them to concentrate on the target for a long period of time, to keep their psychological activities under control, but expends them less physical energy. Therefore, our focus in this study is on the alteration in stress behavior of short inter beat interval time series for professional shooting athletes during relaxation therapies by applying Music and meditation technique, which reflects the underlying control mechanism of the ANS on the heart beats in such a unique situation. Therefore, professional shooting athletes may have been developing a better autonomic cardiac control due to intensive training and games.

To our knowledge, the HRV has been little evaluated in young athletes and, in such conditions of pre-competitive phases. This work was made possible through the use of non-invasive methods of measures of HRV allowing an analysis of the RR variability, widely used to study the regulation of the chronotropic cardiac activity during intervention, or changes induced by training and/or competition.

1.9 Salivary Cortisol as a Variable

Basal and reactivity measures of the stress hormone, cortisol have been used to examine individual differences in clinical and non-clinical socially anxious children, adolescents, and adults. Much of the work in this area has found that high basal and reactive cortisol characterizes
socially anxious people. In recent years, psychological factors such as anxiety have been increasingly linked to hormonal alterations in the body such as cortisol secretion. The psychological status of an individual, per se, is an effective stimulus for the activation of the adrenal system, which can be demonstrated by saliva cortisol measurement (Kirschbaum and Hellhammer, 1989).

Salivary cortisol measures are increasingly being incorporated into large-scale, population-based, or epidemiological research, in which participants are selected to be representative of particular communities or populations of interest, and sample sizes are in the order of hundreds to tens of thousands of participants. These approaches to studying salivary cortisol provide important advantages but pose a set of challenges. The representative nature of sampling, and large sample sizes associated with population-based research offer high generalizability and power, and the ability to examine cortisol functioning in relation to: (a) a wide range of social environments; (b) a diverse array of individuals and groups; and (c) a broad set of pre-disease and disease outcomes. The greater importance of high response rates (to maintain generalizability) and higher costs associated with this type of large-scale research, however, requires special adaptations of existing ambulatory cortisol protocols. These include: using the most efficient sample collection protocol possible that still adequately address the specific cortisol related questions at hand, and ensuring the highest possible response and compliance rates among those individuals invited to participate.

The salivary hormones are widely used in sport studies. Considering the advantages of saliva sampling, i.e., saliva sampling is noninvasive and non stressful and in this case respects intimacy, and saliva is easy to collect, store, and assay, it is also suggested that this technique may be a useful tool in the detection of steroid drug abuse in sports. The measurement of free
cortisol in saliva has been recommended as a noninvasive method of easy access, with the material being collected and stored at home by the patient, and the result obtained shows an accurate correlation with free plasma cortisol.

Psychologically relevant physiological recordings have provided researchers with a useful method for examining those aspects of psychomotor processing that are vital determinants of successful performance, but which may not be easily inferred from the overt performance or verbalized introspection. This psychophysiological methodology has been found to lend itself to sports like precision shooting, archery, and golf (Collins, 1995). In recent years, the main interest in the field of psychophysiological research of shooting has been directed towards electrocortical (EEG) patterns in non-elite, sub-elite, and elite shooters (Hatfield et al., 2004)

1.10 Statement of the Question

Effect of music intervention and meditation on stress is proved independently in different studies. But there is dearth of studies in sports context and, no studies have been investigated regarding combined effect of music and meditation on pre-competition stress in shooters on the basis of psychophysiological aspects.

1.11 Aim and Objective

The objective of the research is to find out an effective protocol, which could be incorporated to pre-competition training that will enhance the attention span and reduces stress during competition and also enhance overall sports performance.

1.12 Purpose of the Study

To investigate the effect of music, meditation and their combined effect on attention span and pre-completion stress in professional shooters.
1.13 **Null Hypothesis**

There shall be no differences in pre-competition stress and performance of groups of professional shooters getting combination therapy and individual therapies.

1.14 **Research Hypothesis**

1. There shall be differences in pre-competition stress and performance of groups of professional shooters getting combination therapy and individual therapies.

2. There shall be differences in pre-competition stress and performance of groups of professional shooters getting music therapy or meditation therapies.

1.15 **Significance of the Study**

Results of the study helps to set a feasible training protocol to be used prior to games that need decreased stress level, increase attention span and ultimately help to enhance the sports performance.

1.16 **Operational Definitions**

1.16.1 **Shooting Sports**

25 meter free air pistol shooting event in an internationally standard shooting range.

1.16.2 **Pre-Competition Stress or Anxiety**

Stress/Anxiety is an automatic, physical or psychological reaction to danger, threat, or demand. It is the tension and anxiety that are experienced when faced with higher expectation, new, unpleasant, or threatening circumstances especially in sports context.

1.16.3 **Individual Therapies**

Music Therapy or Meditation Therapy.
1.16.4 Music Therapy

Listening to self selected pre-recorded Classical music of Darbari raga, Darbari raga based vocalized Hindi songs.

1.16.5 Meditation Therapy

Practicing the Mindfulness meditation (opening-up, insight meditation), involves the continual maintenance of a specific perceptual-cognitive set toward objects as they spontaneously arise in awareness with a nonreactive attitude, consists of 3 parts; Relaxation, Pranayam and mindfulness.

1.16.6 Combination Therapy

Training on combination of Music and Meditation Therapies.

1.16.7 Heart Rate Variability

Short term (5 minutes) Heart Rate Variability (HRV) record by using HR Monitor i.e. Polar RS800CX™ (Polar Electro Oy, Kempele, Finland) with data analyzed by Polar Precision Performance™ Software both time and frequency domains of HRV.

1.16.8 Salivary Cortisol

Cortisol is released by the adrenal gland, it increases during the stress context, and free cortisol in saliva is more reliable and measured by Enzyme Immuno Assay (EIA) by using Salimetrics™ EIA kit (USA).

1.16.9 Sports Performance

Shooting sports context performance score is the maximum score scored by an individual shooter out of 60 shots per event and total points of 600.