Chapter-1
Introduction
Badminton is one of the most widely-played sports in the world. The Badminton World Federation (BWF) estimated that about 150 million people play the game worldwide and that more than 2,000 players participate in international competitions. Playing badminton is suitable for all age, it can build a healthier body and stronger character; broaden the social circle, and help to release stress from daily life. Besides, equipments are minimal and the court are flexibility and accessible, which can serve as a sport and entertainment.

Badminton is a non-contact racquet sport requiring jumps, lunges, quick changes in direction and rapid arm movements from a wide variety of postural positions. Badminton has been considered to be a very safe sport. Previous studies, which were mostly done in Europe, demonstrated the risk of injuries in badminton to be 1.6-2.9 injuries per 1,000 hours of play. In India, badminton is one of the most popular sports, apart from cricket. It has been included as one of eight high performance core sports in the country. Despite this, information regarding injuries affecting Indian badminton players is still lacking.

<table>
<thead>
<tr>
<th>Nature of injury</th>
<th>No. (%) of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overuse</td>
<td>169 (36.0)</td>
</tr>
<tr>
<td>Strain</td>
<td>145 (30.9)</td>
</tr>
<tr>
<td>Sprain</td>
<td>122 (26.0)</td>
</tr>
<tr>
<td>Fracture</td>
<td>23 (4.9)</td>
</tr>
<tr>
<td>Others</td>
<td>10 (2.1)</td>
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*Weerapong 2005

As the table indicates 30.9% of patients in Badminton suffer from Strain which are the result of muscular-fiber tears due to overstretching that can be decreased by increasing the flexibility of muscles.
Skeletal muscle strains and tears are a regular occurrence in athletic populations and compose nearly 30% of a typical sports medicine practice. (Garrett, 1996). Consequently, muscle flexibility training has been common in athletic populations in an attempt to reduce the risk of skeletal muscle injury and improve performance.

Hamstring strains are one of the most common, recurrent injuries experienced in the badminton world and often result in significant time out of the sport. Decreased hamstring flexibility is suggested to be one of the predisposing factors for hamstring strains. In addition to that flexibility is used as one of the most important factors in physical fitness in which advancement makes increasing the range of motion in doing sport skills, and muscular relaxation, and avoids muscular injury and tendon. The studies show that the athletes with reduced range of motion are more susceptible to muscle injury than their more flexible counterparts. Besides professional exercises, flexibility plays an important role in general health. For example, stretch exercises are prescribed for pains in the lower part of spinal cord. There are different methods to get suitable flexibility and more motional domain of joints which are Massage and Stretch; however, introducing the best possible method in getting suitable flexibility is the subject of many recent researches.

Massage dates back to early civilization and has a long history of use in sports medicine. Massage has been widely used in the prevention and management of injuries in sport, with recent recognition and acceptance in Olympic sport. Massage accounted for a significant proportion (24–52.2%) of physiotherapists' treatment time at athletics events (Galloway & Watt, 2004).

Stretching is of two types which are (A) static stretch that is performed by placing muscles at their greatest possible length and holding that position for a period of time. In contrast, (B) dynamic stretching involves moving the limb from its neutral position to end range, where the muscles are at their greatest length and then moving the limb back to its original position. This dynamic
action is carried out in a smooth, controlled manner and is repeated for a specified time period. The recent studies are getting more specific such as working on different factors of individual position in stretching, the sort of technical and necessary time for stretching.

**STRETCH**

Muscle extensibility is an important aspect of normal human function. Limited extensibility has been associated with increased risk of injury and reduced levels of function and performance. As a result, stretch exercises are used extensively in clinical rehabilitation and sports medicine in an attempt to improve and maintain muscle extensibility. Stretch issued among a wide spectrum of people, ranging from recreational to competitive athletes, the disabled to the able-bodied children and adolescents to adults. Yet despite the frequent use of stretch, its efficacy in increasing muscle extensibility has been controversial, with discrepancies between anecdotal evidence and good quality randomized controlled trials. Whilst the immediate (positive) effects of stretch have been well documented (Herbert, 2002, Magnusson, 1998, Magnusson et al., 2000, Magnusson et al., 1996), the lasting effects of stretch are less convincing (Benz et al., 1998, Halbertsma et al., 1996, Harvey et al., 2006, Harvey et al., 2002, Harvey et al., 2000, Harvey et al., 2003, Harvey and Harbert, 2002, Lanin et al., 2007, Lanin et al., 2003, Turton and Britton, 2005).

Mounting evidence in recent years has highlighted the disparity between disabled and able-bodied populations on stretch efficacy, leading to further questions of the rationale behind stretch. Furthermore, it has been suggested that improvements in range of motion shown in the able-bodied population following regular stretch are a result of apparent, rather than real, changes in muscle extensibility. That is, regular stretch can alter and increase a person’s tolerance to the uncomfortable stretch sensation and hence result in an apparent improvement in extensibility.
Stiffness is a term frequently used when referring to the passive mechanical properties of a muscle. Stiffness is defined as the rate of change in muscle tension (Newtons) with respect to the change in muscle length (millimeters) (Herbert, 1993). This relationship can be represented by the length-tension curve.

The terms “flexibility” and “extensibility” are often used interchangeably. Many different interpretations of extensibility exist, but within the confines of this thesis, it will be used in reference to the passive mechanical properties of soft tissues spanning joints as reflected by either torque-angle or length-tension curves. Soft tissue extensibility is dependent on the viscoelastic and mechanical properties of muscles, ligaments and other connective tissues. A change in extensibility in response to a stretch intervention must be accompanied by a change in the passive mechanical properties. This can only be verified measures of joint angle taken with a standardized torque. (Hunter, Marshall 2002)

**Types of Stretch**

Numerous stretch techniques have been developed, applied and used by physiotherapists, coaches and trainers. These include isometric, ballistic, dynamic range of motion, proprioceptive neuromuscular facilitation, passive or static stretch (Bandy et al., 1998).

*Isometric Stretch:* Isometric stretch is similar to static stretch, comprising of sustained muscle lengthening with the addition of resistance against an immobile force. The opposing resistance can be provided by either an immobile object or another person. (Hunter et al. 2001)

*Ballistic Stretch:* It aims to provide rapid lengthening of the muscle by using jerky or bouncing movements. (Knudson 2001)
**Introduction**

*The Dynamic Range of Motion Stretch Technique:* The dynamic range of motion stretch technique requires the antagonist muscle to contract, resulting in the joint crossed by the agonist (lengthening muscle) to move through the full range of motion at a slow, controlled speed. All movements are performed slowly and carefully. (Hasselman, et al. 1995)

*Proprioceptive Neuromuscular Facilitation:* Facilitation is a hold-relax performed by another person (such as a therapist) together with the subject. Following a contraction of the antagonistic muscle, the partner performs a passive stretch on the subject. The final two stretch methods are regularly administered and prescribed in both clinical and community settings. (Harrison, et al. 2004)

*Static Stretch Techniques:* Static stretch techniques involve the performance of slow, sustained muscle lengthening. Passive stretches are performed by a person other than the subject, whereas static stretches are self-administered and performed by the subject independently. Depending on the situation and environment, passive stretches may be held for up to 30 to 60 minutes whilst static stretches are usually held for durations lasting between 15 to 60 seconds. (High, et al. 1998)

**Effects of Stretch**

*Short-term effects:* There is convincing evidence to show that stretch produces immediate increases in muscle extensibility due to the viscoelastic nature of soft tissues. However, these short-term effects are transient and quickly dissipate. Upon the application of stretch to soft tissues over a period of seconds or minutes, the tissues undergo progressive deformation as a result of reduced resistance between collagen fibers. These fibers are therefore able to slide past each other more smoothly within the surrounding ground substance (Herbert, 2002). Subsequently, following viscoelastic deformation, soft tissues can be extended further with a constant force (the creep phenomenon) or the
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tissue exert less force when stretched to a constant length (stress relaxation) (Taylor et al., 1990).

Long-term effects: An increase in muscle extensibility is considered long-lasting if the effect remains for at least 24 hours upon removal of the last stretch. This lasting change in extensibility may be due to either changes in the passive mechanical properties of the muscle resulting in increased joint range of motion (indicating real extensibility), or changes in stretch tolerance resulting in improved range of motion without any underlying structural adaptations (indicating apparent extensibility). It is the long-term effects of stretch that are more controversial but arguably of more importance, particularly for patients with functional limitations, disabilities and chronic pain. (Newham et al. 1988)

Despite the popularity and widespread implementation of stretch amongst the general community sporting individuals and patients undergoing physical rehabilitation, considerable uncertainty remains surrounding its lasting effects. The controversy arises from the discrepancies between strong anecdotal and animal evidence supporting the effectiveness of stretch, and high-quality randomized controlled trials.

Both anecdotal and animal evidence strongly support the use of stretch for producing long-lasting changes in muscle extensibility. Positive stretch effects have also been shown in the human able-bodied literature, although most of the studies reviewed were of poor quality leading to inconclusive findings. The strong evidence from the human disabled population, clearly indicating that stretch does not change muscle extensibility, has subsequently led to many questions surrounding this topic. Furthermore, recognizing the distinction between real (structural adaptations) and Apparent (stretch tolerance) changes in muscle extensibility has led to important improvements in methodology when assessing the efficacy of stretch. With increasing evidence in the able-
bodied population suggesting that muscle extensibility changes are due to improvements in an individual’s tolerance to the stretch sensation, it is therefore of interest to further investigate this phenomenon in other population groups where movement tolerance presents as an important issue, such as people with chronic pain. In this study, the researcher will study the effectiveness of static stretch method and massage on the flexibility of hamstring muscles of left leg in male badminton players. The positive result can be recommended to all physical education and sport science as well as rehabilitation centers in which they apply exercise therapy.

**MASSAGE**

Massage has been used for rehabilitation and relaxation for thousands of years around the world. Recent research from the United Kingdom showed that in the past 11 years, massage treatment was administered for approximately 45% of the total time in physiotherapy treatment (Galloway, Watt, & Sharp, 2004).

Massage, is used in general approaches, such as preparation for competition, between competitions, and in assisting recovery from competition, rather than treatment for specific problems. The large proportion of massage application in sports events is due to many coaches and athletes holding the belief, based on observations and experiences, that massage can provide several benefits to the body such as increased blood flow, reduced muscle tension and neurological excitability, and an increased sense of well-being. There is limited scientific evidence, however, to support the use of massage for enhancing performance, enhancing recovery from injury, or for preventing muscular injury. There is a relative lack of good studies or information on massage and its potential to influence muscle recovery, injury prevention and physical performance. Many claims are made about massage, but few have any empirical data to back them up and what little data there is tends to point more to the limitations of massage than to any significant effects. Rather the possible mechanisms and the effects
of massage usually result from authors’ speculations based on general biomechanical, physiological, or psychological knowledge. More scientific data on the benefits of massage is required.

Massage has been defined as "a mechanical manipulation of body tissues with rhythmical pressure and stroking for the purpose of promoting health and well-being (Cafarelli & Flint, 1992). Classic Western massage, or Swedish massage, is the most common form of massage currently used around the world for athletes with purported clinical advantages (see Table 2). There are a number of techniques in existence, and their use depends on the experience of the therapist and the intended clinical advantage desired. The majority of research has used a combination of Western techniques to investigate the effects of massage, with a few studies having used other techniques such as myofascial trigger point massage.

Table-2: Summary of Classic Western Massage Techniques

<table>
<thead>
<tr>
<th>Technique</th>
<th>Definition</th>
<th>Application</th>
<th>Suggested clinical advantage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effleurage</td>
<td>Gliding of sliding movement over the skin with a smooth continuous motion (Tappan &amp; Benjamin, 1998).</td>
<td>• Beginning of a session</td>
<td>• Stimulate the parasympathetic nervous system and evoke the relaxation response.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• During a break after applying a specific technique.</td>
<td>• Enhance venous return.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• End of each session</td>
<td></td>
</tr>
<tr>
<td>Petrissage</td>
<td>Lifting, wringing, or squeezing of soft tissues in a kneading motion, or pressing or rolling of the tissues under or between the hands (Tappan &amp; Benjamin, 1998.)</td>
<td>• Following effleurage.</td>
<td>• Mobilize deep muscle tissue or the skin and subcutaneous tissue.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Increase local circulation.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Assist venous return.</td>
</tr>
</tbody>
</table>
Introduction

Friction
An accurately delivered penetrating pressure applied through the fingertips (Goats, 1994).
- Used for a specific purpose such as to reduce muscle spasm.
- Treat muscle spasm or break up adhesions from old injuries.

Tapotement
Various parts of the hand striking the tissues at a fairly rapid rate (De Domenico & Wood, 1997).
- Finishing a section of the body.
- Before and during a competition.
- Stimulate the tissues either by direct mechanical force or by reflex action.

*Weerapong, 2005

The possible mechanisms of massage: The effects of massage are most likely produced by more than one mechanism. A theoretical model of how biomechanical, physiological, neurological, and psychological mechanisms may be affected by massage is presented in Figure (Table 3). As stated earlier the majority of these mechanisms are speculated by the authors with little empirical data to support the statement. For example, it has been speculated that the possible increase in muscle blood flow, as well as the possible decrease in neuromuscular excitability resulting from mechanical pressure may be factors in any potential effectiveness of massage on muscle compliance. Speculations on the possible mechanisms are needed so further research can be developed to establish the true.

Theoretical model of the expected mechanisms of massage: Biomechanical Mechanisms: Massage involves the application of mechanical pressure on the muscle tissue in order to decrease tissue adhesion. Increased muscle-tendon compliance is believed to be achieved by mobilising and elongating shortened or adhered connective tissue. Improved muscle compliance results in a less stiff muscle-tendon unit (Magnusson, 1998). Biomechanically three main measures are used to assess muscle-tendon unit compliance: dynamic passive stiffness: dynamic active stiffness: and static joint end range of motion (Gleim & McHugh, 1997).
Table 3: Mechanisms and Effects of Massage

<table>
<thead>
<tr>
<th>Biomechanical effects</th>
<th>Physiological effects</th>
<th>Neurological effects</th>
<th>Psychological effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \downarrow ) Tissue pressure on tissues</td>
<td>( \downarrow ) Changes in tissue or organ</td>
<td>( \downarrow ) Reflex stimulation</td>
<td>( \downarrow ) Increased relationship between body and mind</td>
</tr>
<tr>
<td>( \downarrow ) Muscle adhesion</td>
<td>( \uparrow ) Muscle blood flow</td>
<td>( \uparrow ) Muscle tension or spasm</td>
<td>( \uparrow ) Relaxation</td>
</tr>
<tr>
<td>( \uparrow ) Muscle compliance (( \uparrow ) Range of joint motion ( \downarrow ) Active stiffness)</td>
<td>( \uparrow ) Skin blood circulation ( \uparrow ) Parasympathetic activity ( \uparrow ) Relaxation hormones ( \uparrow ) Stress hormones</td>
<td>( \downarrow ) Pain ( \downarrow ) Muscle tension or spasm</td>
<td>( \downarrow ) Anxiety</td>
</tr>
</tbody>
</table>

\( \downarrow \) = decrease; \( \uparrow \) = increase. *Weerapong 2005

**Physiological Mechanisms**

*Increased skin and muscle temperature:* Superficial skin friction increases local heating, and consequently, causes hyperemia within the massaged area. Local heating increases local blood circulation (Black, Vickerson, & McCully, 2003). There is evidence that skin and muscle temperature increased after massage application (effleurage technique).

*Increased blood flow:* One expected benefit of massage with respect to enhancement of athletic performance is the increase in blood circulation. A variety of controlled clinical trials have used venous occlusion...
pethysmography, the Xenon wash out technique, or pulsed Doppler ultrasound velocimetry to examine the effects of massage on blood flow. Although several authors have agreed that massage could increase blood flow (Bell, 1964; Dubrosky, 1982, 1983; Hansen & Kristensen, 1973; Hovind & Nielsen, 1974), study results have been inconclusive largely due to their design limitations. The changes of blood flow could not be expressed quantitatively. Moreover, the venous occlusion pethysmograph technique could not be used to measure blood flow during actual massage.

Hormones: Mechanical pressure of massage might stimulate parasympathetic activity as shown by reducing saliva cortisol levels (an indirect measure of parasympathetic activity). Changes in hormonal levels (serotonin and cortisol) after massage have been reported mostly in specific conditions such as patients with low back pain (Hernandez-Reif, Field, Krasnegor, & Theakston, 2001), HIV positive patients (Ironson et al., 1996), and depressed adolescent mothers (Field, Grizzle, Scafidi, & Schanberg, 1997).

Parasympathetic activity: Massage has shown some evidence of increasing parasympathetic activity by reducing heart rate, reducing blood pressure (Corley, Ferriter, Zeh, & Gifford, 1995; Fraser & Ken, 1993; Groer et al., 1994; Labyak & Metzger, 1997; Longworth, 1982), increasing relaxation substances such as endorphins (Kaada & Torsteinbo, 1989), and increasing heart rate variability (Delaney, Leong, Watkins, & Brodie, 2002). The majority of research in this area has been conducted in nursing using a specific sequence of massage called "back rub", and has been performed in older people (Corley et al., 1995; Eraser & Kerr, 1993; Groer et al., 1994).

Neurological Mechanisms

Neuromuscular Excitability and the Hoffman Reflex: Massage is believed to stimulate sensory receptors and decrease muscle tension by reducing neuromuscular excitability as measured by changes in the Hoffman reflex (H-reflex) amplitude (Morelli, Chapman, & Sullivan, 1999; Morelli, Seaborne, &
Sullivan, 1990, 1991; Sullivan, Williams, Seaborne, & Morelli, 1991). H-reflex is considered to be the electrical analogue of the stretch reflex (Zehr, 2002). The potent inhibitory effects of massage on neuromuscular excitability might be one of the explanations for the reduction of muscle tension or spasm after massage application. However, the reduction of H-reflex after massage (petrissage technique) might not be the reason for reduction of muscle strength (Wiktorsson-Moller et al. 1983).

Pain and Muscle Spasm: Massage has been applied in order to relieve pain. The possible responsible mechanisms are neurological (gate-control theory), physiological (biochemical substances), and mechanical (realignment of muscle fibres). Massage may reduce pain by activating the neural-gating mechanism in the spinal cord. Tactile information from massage might stimulate large fast nerve fibres and then, block the smaller, slower nerve fibres that detect pain. This effect presumably results from local lateral inhibition in the spinal cord (Guyton & Hall, 2000) and explains why touching the painful area is an effective strategy for relieving pain. Massage can increase biochemical substances such as serotonin, which is a neurotransmitter that plays a role in reducing pain.

Physiotherapists usually use massage to break the vicious cycle that causes muscle spasm, and consequently, muscle pain. Muscle spasm causes muscle pain directly by stimulating mechano-sensitive pain receptors or indirectly by compressing the blood vessels resulting in ischemia (Guyton & Hall, 2000). Massage might help to rearrange muscle fibres and increase microcirculation. The realignment of fibers helps to reduce muscle spasm that stimulates pain receptors and helps to reduce the pressure on blood vessels. The increase in blood microcirculation helps to increase nutrition to the damaged area.
Psycho-Physiological Mechanisms

Various mechanisms for the cause of the relaxation response resulting from massage have been proposed. These include an increase of plasma endorphins, decreased arousal level, decreased stress hormone levels or an activation of the parasympathetic response.

Swedish massage has effect on psychology emotional responses such as anxiety, relaxation and recovery from fatigue which are demonstrated in numerous studies.

STATEMENT OF THE PROBLEM

The purpose of the study was to compare the “Effects of Static Stretch and Massage on Hamstring Flexibility of Badminton Players”.

OBJECTIVES OF THE STUDY

The study had the following objectives:

1. To examine the effects of static stretch on hamstring flexibility of male badminton players of male badminton players.
2. To find out the effects of massage on hamstring flexibility of male badminton players of male badminton players.
3. To know the comparative effects between static stretch and massage on hamstring flexibility of male badminton players.
4. To draw out the comparative effects of initial week, sixth week and twelfth week static stretch and massage on hamstring flexibility of male badminton players.

HYPOTHESES OF THE STUDY

On the basis of literature reviewed and scholar’s own understanding of the problem, the following research hypotheses were formulated.

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1. There would be no significant difference in the effects of static stretch on hamstring flexibility of male badminton players.
2. There would be no significant difference in the effects of massage on hamstring flexibility of male badminton players.
3. There would be no significant difference in the effects between static stretch and massage on hamstring flexibility of male badminton players.
4. There would be no significant difference in the effects of initial week, sixth week and twelfth week static stretch and massage on hamstring flexibility of male badminton players.

**DELIMITATIONS OF THE STUDY**

The study was delimited to the following points:

1. The study was delimited to the male badminton players in the age of 13 to 19 years.
2. The study was delimited to 45 subjects (15 subjects in each group).
3. The study was delimited to static stretch and massage (stroking, percussion, effleurage and kneading).
4. The study was restricted to the following variable i.e., hamstring flexibility.
5. The study was further delimited to twelve weeks of experimental period only.

**LIMITATIONS OF THE STUDY**

1. Whole time observation on subjects in order not to do extra exercise and stretching during test period was not possible.
2. Inherited physical differences of individuals could not be controlled.
3. Individual motivations to take part in tests were different.
4. A simultaneous test for all subjects at the same time was not possible.
DEFINITION AND EXPLANATION OF THE TERMS

Stretch

Stretch is the act of applying tension to soft tissues with the aim of increasing muscle extensibility and hence improving joint range of motion. Stretch can be administered via several means depending on the desired duration. Shorter duration stretches can be either self-administered or manually applied by another person such as treating therapist. Longer duration stretches are often administered via specially designed devices such as splints, casts and other equipments. (Harrison, A., & Gaffney, S. 2004)

Static Stretch

This technical includes the inactive Stretching of definite muscle, which is kept in stretching of more than normal situation, in specific period. (Taylor, et al. 1995)

Massage

Massage is the manipulation of superficial and deeper layers of muscle and connective tissue to enhance the function and promote relaxation and well-being. Massage involves acting on and manipulating the body with pressure – structured, unstructured, stationary, or moving – tension, motion, or vibration, done manually or with mechanical aids. Target tissues may include muscles, tendons, ligaments, skin, joints, or other connective tissue, as well as lymphatic vessels, or organs of the gastrointestinal system. Massage can be applied with the hands, fingers, elbows, knees, forearm, and feet. Massage benefits are such as pain relief, reduced trait anxiety and depression, and temporarily reduced blood pressure, heart rate, and state of anxiety. (Braverman, D., and Schulman, R. 1999)
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**Stroking**
Stroking is one of the principal movements of massage and may be performed on any area of the body. It signals the beginning and the end of a massage both preceding and succeeding all other strokes and facilitating the flow from one movement to the next. *(Braverman, D., and Schulman, R. 1999)*

**Percussion**
Percussion movements (tapotement) involve a series of light, brisk, striking actions applied with alternate hands in rapid succession. *(Braverman, D., and Schulman, R. 1999)*

**Effleurage**
Effleurage is a firm rhythmic pressure on the upward stroke yet glide downwards to the starting point. Pressure can be superficial or deep according to the effect required. *(Braverman, D., and Schulman, R. 1999)*

**Kneading**
Kneading is part of the Swedish massage tradition and involves the grasping, lifting and stretching of tissue. It is usually performed with the palms first pressing down on muscle tissue and then lifting it with the fingers in a rhythmic, churning, action. *(Tappan, F, and Benjamin, P. 1998)*

**Hamstring Muscles**
In human anatomy, the hamstring refers to one of the three posterior thigh muscles, or to the tendons that make up the borders of the space behind the knee. In modern anatomical contexts, however, they usually refer to the posterior thigh muscles, or the tendons of the semitendinosus, the semimembranosus and the biceps femoris. *(Magnusson, et al. 1995)*

**Flexibility**
The ability of a joint to move through its full range of motion is defined as flexibility. *(Wilson, et al 1992)*

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**Active Knee Extension Test (AKET)**

AKET is a test to assess the Hamstring muscles flexibility, which is the range of active knee extension in a position of hip flexion at 90 degrees as required in running and kicking.  

**Joint Range of Motion**

Joint range of motion (ROM) is measured by the number of degrees from the starting position of a body segment to its end position at full range of movement. Range of motion refers to the amount of movement attainable across a joint, and is therefore directly (but not solely) influenced by the soft tissues that cross the joint complex. The end position of a joint is often termed the “end of range”, or “end range of motion”. Range of motion is however a poorly defined term, as it depends on what is used to determine end of range. For example, some investigators use electromyographic (EMG) activity while others use patients’ or therapists’ perceptions of “pull”. Other factors are also used to determine end of range; however, all will yield different results unless the torque is standardized.  
*(Godges et. all 1993)*

**SIGNIFICANCE OF THE STUDY**

The present study was conducted to examine the effects of static stretch and massage on the hamstring flexibility of male badminton players and thus improves the standard of sports. The flexibility factor has important role in physical fitness. Flexibility improves by stretch exercises. Different studies have been made about the importance of flexibility as one of the most important factors of physical fitness and as avoidance factor of sport injures.  
Dr Halt, the scholar of stretch scientific method, declares that the current stretching exercises, rarely cope with the need of every sport field. Increasing of range of movement in doing sport skills, increasing rate of oscillation, muscular relaxation, avoidance of sport injuries, pain mitigated all are the
production of suitable flexibility in joint of sportsmen. The result of the study will provide guidelines for physical education professionals, doctors, physiotherapists and coaches for prescribing suitable training /conditioning/ treatments programme to bring out maximum possible improvement in hamstring flexibility. The finding of the study may provide a source of guidance to the coaches to plan the future programme for training with relation to player's present performance. The findings of study will add to the quantum of knowledge in the area of physical education and sports sciences.