EFFECTS OF UPPER BODY RESISTANCE TRAINING ON MUSCLE ACTIVATION, PSYCHOPHYSIOLOGY AND SHOOTING PERFORMANCE AMONG COMPOUND ARCHERS

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UNIVERSITI PENDIDIKAN SULTAN IDRIS
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ABSTRACT

The aim of this study was to evaluate the effects of upper body resistance training on muscle activation, psychophysiology and shooting performance among compound archers. This study involves a pre and post experimental design with experimental groups and control group. Thirty compound archers (Mean age = 19.0 ± 2.3 years) completed the whole study protocol. All parameters were measured at pre-intervention and post- intervention. Electromyography was used to measure muscle activation. Heart rate monitor was used to measure the physiological variable. The revised Competitive State Anxiety-2 was used to measure competitive state anxiety and shooting performance was assessed through the total scores of double 50 meters round. The results of Mixed factorial analysis of variance revealed a significant interaction between the experimental group and control group ($p < 0.05$) after the intervention for anconeus muscle and self-confidence. The experimental group was found ($p = .02 < .05$) for muscle activation on anconeus muscle compared to control group during shooting. Furthermore, the experimental group was found ($p = .02 < .05$) for self- confidence compared to control group during shooting. After 12 weeks of intervention, the results shown a significant difference between athletes 'characteristics including age ($p = .02 < .05$), weight ($p = .04 < .05$), sports performance ($p = .003 < .05$) and years of experience ($p = .001 < .05$) except for race, height and BMI towards shooting performance. While for the psychophysiological aspects, the results also shown a significant difference on somatic anxiety ($p = .001 < .05$) and self-confidence ($p = .002 < .05$) except for cognitive anxiety toward shooting performance among compound archers. In addition, there are several parameters found to have a positive relationship with shooting performance that need to be considered in helping archers to improve their performances in the future.

KESAN LATIHAN BEBANAN BAHAGIAN ATAS BADAN TERHADAP PENGAKTIFAN OTOT, PSIKOFISIOLOGI DAN PRESTASI MEMANAH DALA KALANGAN PEMANAH KOMPOUND

ABSTRAK

Matlamat kajian ini adalah untuk menilai kesan latihan bebanan bahagian atas badan terhadap pengaktifan otot, psikofisiologi dan prestasi memanah dalam kalangan pemanah kompaun. Kajian ini melibatkan reka bentuk eksperimen pra dan pasca dengan kumpulan eksperimen dan kumpulan kawalan. Tiga puluh pemanah kompaun (Min umur = 19.0 ± 2.3 tahun) menyelesaikan keseluruhan protokol kajian. Semua parameter diukur pada pra-intervensi dan pasca-intervensi. Elektromiografi digunakan untuk mengukur pengaktifan otot. Pemantau kadar jantung digunakan untuk mengukur pembolehubah fisiologi. Kebimbangan Keadaan Kompetitif-2 yang disemak semula telah digunakan untuk mengukur kebimbangan keadaan persaingan dan prestasi memanah telah dinilai melalui jumlah markah pusingan 50-meter berganda. Keputusan analisis faktorial campuran varians menunjukkan interaksi yang signifikan antara kumpulan eksperimen dan kumpulan kawalan ($p < 0.05$) selepas intervensi untuk otot anconeus dan keyakinan diri. Kumpulan eksperimen didapati ($p = .02 < .05$) untuk pengaktifan otot pada otot anconeus berbanding kumpulan kawalan semasa memanah. Tambahan pula, kumpulan eksperimen didapati ($p = .02 < .05$) untuk keyakinan diri berbanding kumpulan kawalan semasa memanah. Selepas 12 minggu intervensi, keputusan menunjukkan perbezaan yang ketara antara ciri-ciri atlet termasuk umur ($p = .02 < .05$), berat ($p = .04 < .05$), prestasi sukan ($p = .003 < .05$) dan tahun pengalaman ($p = .001 < .05$) kecuali untuk bangsa, ketinggian dan BMI. Manakala bagi aspek psikofisiologi, keputusan juga menunjukkan perbezaan yang signifikan terhadap kebimbangan somatik ($p = .001 < .05$) dan keyakinan diri ($p = .002 < .05$) kecuali kebimbangan kognitif terhadap prestasi memanah dalam kalangan pemanah kompaun. Selain itu, terdapat beberapa parameter didapati mempunyai hubungan yang positif dengan prestasi memanah yang perlu diambil kira dalam membantu pemanah meningkatkan prestasi mereka pada masa hadapan.

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LIST OF ABBREVIATIONS

1RM	One-Repetition Maximum
ANOVA	Analysis of Variance
bpm	Beats Per Minute
CFA	Confirmatory Factor Analysis
CSAI-2R	Competitive State Anxiety Inventory-2 Revised
CVR	Content Validation Ratio
EMG	Electromyography
HR	Heart Rate
HRV	Heart Rate Variability
MAT	Multidimensional Anxiety Theory
MVC	Maximum Voluntary Concentration
NRRST	Normal Routine Resistance Training
SPSS	Statistical Package for the Social Science
UPRST	Upper Body Resistance Training
UPSI	Universiti Pendidikan Sultan Idris

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CHAPTER 1

INTRODUCTION

1.1 The Study's Background and Scope

Training is one of the fundamental component of sports performance and encompasses a variety of methods to enhance athlete abilities. These methods can be broadly categorized into four types of training in sports: Technical Training, Strength and Conditioning Training, Tactical Training, and Mental Training. Exercise that uses resistance to develop and grow muscles is referred to as resistance training, strength training, or weight training. Resistance training is a crucial component of any athletic training program, and archery is

no exception (Winters-stone, Donek, Bennett, Maddalozzo, Ryan, Beer, 2014). Resistance training is incredibly important in archery for several reasons.

Shooting arrows at a target with a bow is the sport of archery. The aim is to shoot arrows as accurately as possible, with the center of the target being the highest-scoring area. Archery has been practiced for thousands of years and has been used for hunting and warfare, as well as for sport and recreation. In modern times, archery is practiced in various forms, including Olympic-style target archery, field archery, 3D archery, and traditional archery. Different bows and arrows may be used in each type of archery, and each has a different set of rules and regulations. Archery requires physical skill and mental focus, as well as proper equipment and training. Besides, archery also requires patience, concentration, and high mental endurance. Therefore, an archer must have a basic technique, movement mechanisms, mentality, and good physical condition. Since archery is a quantitative activity and physical condition plays a major part, success can be gauged through practice or competition. (Yachsie, Suharjana, Wijaya, & Nasrulloh (2022).

According to Kolayiş and Ertan, 2016, Archery is characterised as a static activity that demands shoulder girdle endurance and upper body strength. In order to increase accuracy in the static sport of compound archery, archers must organise their shooting stance and reduce their motions when aiming the target. Bow hold, drawing, full draw, aiming, release, and follow-through are the six stages of archery. An archer uses one arm to push the bow towards the target during the drawing and release phases; the shoulder is

in the position of regulating the force from the drawing arm. To draw the bow, the shoulder muscle needs to be strong enough (Kolayiş & Ertan, 2016; Simsek et al., 2018). Strong arm muscles allow the archer to hit targets in their preferred position, which affects their performance (Humaid, 2014). An archer cannot complete a draw during the drawing phase if their arm muscles are weak. Additionally, the archer will not be able to shoot with proper technique. The strength and endurance of both upper extremity muscles, particularly the forearm and shoulder girdle muscles, are crucial for a well-balanced performance of these sequential phases. (Kim, Lee, Hong, Jeon & Jeong, 2018).

Few studies have examined the shoulder girdle muscles (Hennesy and Parker, 1990; Lin et al., 2010), and even fewer have examined the function of the forearm muscles in archery shot (Clarys et al., 1990; Ertan, 2009; Ertan et al., 2003). Without using any kinesiologic techniques, including isokinetic assessments, the majority of these investigations concentrated solely on the electromyographic study of the forearm or shoulder girdle muscles' activation patterns.

Archery is a sport that demands three to four hours of daily exercise five times a week (Keast et al., 1989; Kilinc et al., 2010). Given that archery is a static activity, muscle strength and endurance are two physical attributes that are rarely taken into account but are essential for archery athletes (Simsek et al., 2018). Strength and endurance are physical attributes that significantly promote achievement for archery athletes, particularly in the arm muscles. One of the key components of archery is muscle strength training, which

helps them shoot the appropriate targets and achieve a high score (Sezer, 2017). In shooting sports, the goal of physical training is to prepare the archer to endure the physical and mental demands of competition. An archer in good physical condition is one who can manage their heart rate and strength, which results in a higher shot rate and daily improvements in their success (Sezer, 2017). A somewhat safe and efficient way to boost performance and lower the chance of injury is through resistance training. Additionally, resistance training can be beneficial for archers to improve their strength, stability, and overall performance. While archery is not as physically demanding as some other sports, it does need a certain stage of strength and endurance, particularly on the muscles used for drawing the bow and holding a stable shooting position. When incorporating resistance training into an archery training regimen, it's crucial to focus on exercises that target the specific muscle groups used in archery and promote balance between different muscle groups.

In addition to regular practice, archery demands expertise to improve performance. Nonetheless, training that takes into account muscular fatigue will produce positive results. Previous studies have demonstrated that muscle endurance, which comprises shoulder and arm muscles as well as archery precision, is the primary component of archery (Ashadi, 2018; Asaribab & Siswantoyo, 2015). The ability of an athlete's organs to combat exhaustion during activities or work is referred to as endurance in the sports industry. The capacity to labour for extended periods of time is known as endurance (Obrusnikova et al., 2021). The body's capacity to engage in athletic activities for an extended period of time without experiencing severe weariness is known as endurance (Franssen et al., 2005). The

capacity to continuously generate voluntary force or to sustain voluntary force generation by a particular muscle or muscle group at a submaximal level for extended periods of time is known as muscular endurance (Khalafi et al., 2021). This can be inferred from the views of the experts mentioned above. The ability to move with one's entire body for extended periods of time at a moderate to fast pace without experiencing extreme pain or exhaustion is known as endurance. For this reason, improving archery's power component accuracy was crucial to the sport's stability and ability to release arrows precisely on target. Fatigued muscles are more likely to sustain injuries that will take a long time to completely recover (Mann & Littke 1989). It is necessary to manage muscle fatigue in order to prevent this condition. Archery studies are conducted by a number of researchers (Clarys et al., 1990; Ertan, Kentel, Tumer & Korkusuz, 2003; Guttmann & Mehra, 1973; Hennessy & Parker, 1990; Lin et al., 2010; Mann & Littke, 1989; Martin, Siler, & Hoffman, 1990; Nishizono, Nakagawa, Suda, & Saito, 1984; Palsbo, 2012; Rayan, 1992; Soylu, Ertan, & Korkusuz, 2006). Among the first researchers to examine the main group muscles used in the three stages of archery activity are drawing, holding, and releasing in athletes with disabilities were Guttmann and Mehra (1973).

Martin et al. (1990) assess the flexion and extension muscles both before and after drawing the bow. Ertan et al. (2003) conducted research on muscle contraction and relaxation strategies for a variety of athlete groups, including elite, skill, recreational, and novice. Less research has been done on the activation of the muscles in an archery compound bow. Thus, the goal of this case study is to ascertain the muscular power exerted on archers during the six stages of compound bow archery performance: bow hold,

drawing, full draw, aiming, release, and follow through (Simsek, Cerrah, Ertan, & Soylu, 2018).

Because the sport is so precisely, reducing the number of movements made during the aiming phase makes this closed loop skill more repeatable and consistent (Baker & McLean, 1994; Era, Konttinen, Mehto, Saarela, & Lyytinen, 1996; Mohamed & Azhar, 2012). Other target-based sports, like shooting a pistol or rifle, have numerous examples that show that reducing movements during the aiming phase leads to better results (Aalto, Pyykko, Ilmarinen, Kahkonen, & Starck, 1990; Ball, Best, & Wrigley, 2003a, 2003b; Era et al., 1996; Mason, Cowan, & Gonczol, 1990; Mononen, Konttinen, Viitasalo, & Era, 2006; Pellegrini & Schena, 2005; Zatsiorsky &Aktov, 1990).

Numerous authors agreed that archery is primarily a mentally demanding activity (Kim et al. 2015; Muazu Musa et al. 2019; Verawati & Valianto, 2020; Hashmi et al., 2020), yet there is currently a dearth of solid proof and research findings regarding particular mental training. High-achieving athletes are also acknowledged to possess strong mentalities, abilities, and physiological capacities (Turgut & Yasar, 2020). According to Swann, Keegan, Crust, and Piggott (2016), that is a powerful mindset linked to motivation, game focus, emotional control and self-confidence, and stress and anxiety management. Hardy, Jones, and Gould (2018) assert that in order for athletes to succeed, especially at significant competitions like the Olympic Games, they must be ready and concentrate on their performance during practice and competition. According to Poulus, Coulter, Trotter,

and Polman (2020), mental skills are expected to have a greater impact on competition results than any other single element at the highest levels of competition.

Smith (2003) believes that a player's physiological state will impact and influence their life, technical, tactical, and mental abilities. Factors influencing the technical aspects of movement, tactical and mental approach during competition, player development, training, and physical management include anatomy, body composition, movement measurement and assessment, nutrition, ergogenic aid, fatigue mechanisms, and environmental stress (Brooks, 2000). Building the muscle and cardiorespiratory systems required to enhance archery skills, competitiveness, and scoring is the primary goal of the archery fitness program (Musta, 2004). During aerobic exercise, heart rate rises linearly as workload increases (Franklin, 1998). Some of the notable bradycardia (slower heart rate) seen in highly conditioned endurance athletes, whose heart rates typically range between 40 and 60 beats per minute, can be attributed to aerobic exercise training, which can improve the heart's capacity to pump blood at rest (Noordegraaf et al., 1996).

The majority of the literature concentrates on professional archers in nations like Turkey, Taiwan, South Korea, the United States, and Italy where archery is considered a significant sport (Açıkada et al. 2019; Liao, C. N et al, 2022; Kim & Chang, 2020; Terzioğlu, & Çakir 2020). Archery is a cognitive sport that requires both psychological and physical skills, according to Ruis and Stevenson (2004). Competitive archery requires archers to shoot arrows at the target from a certain distance with accuracy, which requires

concentration because they must discriminate between internal and external stimuli (Haywood & Lewis, 2013). Before and during competition, Italian archers employed autonomic control, imagery, task-focused concentration, and reaction to incorrect techniques, according to Robazza and Bortoli (1998). According to international research, archers' primary concerns during shooting are arousal and anxiety management, and better performance has been linked to appropriate training in these areas. (Sut Txi, Hashim, & Krasilshchikov, 2020; Lu, Li, Wu, Liu, & Wu, 2021; Hung, Tang, and Shiang, 2009).

1.2 Problem Statement

Southeast Asian nation Malaysia actively competes in archery competitions at the Sea Games, Asian Games, World Championships, and even the Olympics. Archery has become one of the favorite sports in the world. Archery in Malaysia has becoming as one of the sports with the potential to produce medals at the Olympics. In archery, there are two types: compound and recurve. However, compound category is not listed in the Olympics Games, but World Archery have been trying to add compound in the upcoming Olympics Games. On the other hand, it is reasonable for compound category to be given an early attention and not only focusing on recurve category only.

In archery, shooting technique is essential to achieving high accuracy scores at the ending of the game. However, shooting technique in recurve archer and compound archer are different. Past studies have shown more on recurve category, and it is still lack of studies on the compound category. According to Kamarudin et al. (2021), the lack of studies on muscle activation during shooting among compound archers limits our understanding of the biomechanics and performance factors involved in this specific type of archery. Therefore, future research should prioritize investigating muscle activation patterns and their impact on compound archery performance. Given the complexity and unique demands of compound archery, it is crucial to explore how different muscle groups are activated during various phases of the shot cycle. Therefore, future research should prioritize investigating muscle activation patterns and their impact on compound archery performance, comparing the activation patterns of compound archers to those of recurve archers can provide valuable insights into the differences in technique and muscle engagement between these two disciplines. This knowledge also can then be used to tailor training programs and techniques for compound archers, ultimately enhancing their performance and reducing the risk of injury (Hamdan et al., 2022).

Adding on, archery is a long duration sports which takes up to 3 to 4 hours for a single tournament. Archery is about the art of repetition. It is known that over the course of a tournament, archers using the different muscle and inconsistently could affect the physiology and psychology of an archer, and this may cause performance fluctuations. Many studies showed on physical training on the recurve archers. Physical fitness plays a crucial role in the target shooting discipline. Having good physical fitness levels can

directly impact an archer's performance by improving their muscular and cardiovascular endurance (Susanto et al., 2021). This allows them to maintain control and stability while standing for extended periods during competitions (Kim et al., 2021).

Other than that, psychology has a significant impact on many facets of an archer's performance in the sport. Archers can improve their overall performance in archery by integrating psychological elements into their mental preparation tactics, such as physical awareness, facilitating emotions, optimistic expectations, focus, and technical preparation. (Sobko et al., 2019). Therefore, determining a specific physical conditioning training program for compound archers will help in understanding optimal muscle, physiological and psychological use for archers. Apart from that, it can also give an overview and idea to archery enthusiasts (athletes, coaches, researchers, sports science experts, sport performance) in comparing the requirements of those parameters to recurve and compound events that may contribute and provide advantages for archery performance in future.

With that, this study will focus on factors such as muscles activation, physiological, psychological, and shooting performance in each compound archers. These factors differentiate between the level of archers' performance.

1.3 The Study's Objective

The objective of this research has been classified into two categories: main and specific.

a) Main Objective

The main objective of this study is to examine how an upper body resistance training program affects muscle activation, psychophysiology, and shooting performance among compound archers.

b) Specific Objective

The following objectives have been used to carry out the specific aims of the current study:

1) To evaluate the effects of upper body resistance training program on muscle activation among compound archers.

2) To evaluate the effects of upper body resistance training program on psychophysiological among compound archers.

3) To evaluate the effects of upper body resistance training program on shooting performance among compound archers.

4) To compare the effects of specific upper body resistance training program and general upper body resistance training program on muscle activation, psychophysiological and shooting performance among compound archers.

5) To determine the relationship between athletes characteristics (age, race, height, weight, BMI, sports involvement, years of experience) and psychophysiological aspects (heart rate, cognitive anxiety, somatic anxiety, self-confidence) towards shooting performance among compound archers after the 12 weeks of intervention.

1.4 Research Questions

The following are the study's research questions:

1) Does the upper body resistance training program effective in regulating muscle activation among compound archers?

2) Does the upper body resistance training program effective in regulating psychophysiological among compound archers?

3) Does the upper body resistance training program effective in regulating shooting performance among compound archers?

4) Do difference types of upper body resistance training program effects the muscle activation, psychophysiology and shooting performance outcomes?

5) What is the level of relationship between athletes characteristics (age, race, height, weight, BMI, sports involvement, years of experience) and psychophysiological aspects (heart rate, cognitive anxiety, somatic anxiety, self-confidence) toward shooting performance among compound archers after the 12 weeks of intervention?

1.5 Operational Definitions

The terminologies of this study are conceptualized as follows:

a) Upper Body Resistance Training Program

The upper body is an essential part of the human anatomy, consisting of various muscles and structures that are essential to carrying out daily tasks and maintaining overall health and functionality (Alshammari & Bordoni, 2021; Plantz & Bordoni, 2021; Forro et al., 2019; Anatomy, Skeletal Muscle, 2022). A specific kind of conditioning named resistance training uses increasing resistance to improve a person's capacity to apply or resist force (Fleck & Kraemer, 2004). One definition of a training program is an organized series of

exercises and resources aimed at developing specific skills, knowledge, or competencies in individuals or groups with the goal of improving performance or achieving organizational objectives (Kumar & Siddika, 2020). In this study, the researcher gave the experimental group a 12-week intervention program that included upper body resistance training. The American College of Sports Medicine's (ACSM) and the National Strength and Conditioning Association's (NSCA) recommendations and resistance training guidelines served as the foundation for the resistance training regimen. Every intervention program was broken down into three distinct stages (Table 3.1).

b) Muscle Activation

Muscle activation refers to the process by which skeletal muscles receive signals from the nervous system and generate force or tension. This process involves the transmission of electrical signals called action potentials from the central nervous system's motor neurones to the muscle fibres, causing the muscle to contract and relax. (Kuo & Ehrlich, 2015). Electromyography (EMG) is a method utilised in this study to measure muscle activation. The EMG collection system (Trigno Avanti Sensor, Delsys, Natick, MA, USA) EMG was used to the collecting the EMG data acquisition device. We employed a Trigno Avanti sensor (Delsys, Natick, MA, USA; 3.7 cm × 2.7 cm) to acquire the EMG signal. With an EMG acquisition frequency of 1200 Hz, Motive (OptiTrack, Natural Point, Inc., Corvallis, OR, USA) synchronised all EMG sensors (Trigno Avanti Sensor) with kinematic and kinetic data, and all sensors had a common-mode rejection ratio of 80 dB. Surface electrodes were chosen from the triceps, anconeus, medial trapezius, lower trapezius,

posterior deltoid, and medial deltoid muscles. Marco Barbero et al. (2012) served as the foundation for all EMG reference standards. Numerous factors affect EMG signal amplitude, which varies greatly between people and usually needs to be normalized for comparisons between subjects or between sessions (Cronin et al., 2015). The reading of maximum voluntary concentration (MVC) percentage was representing in the data analysis of this study. For all muscles and ruptured/uninjured circumstances, the raw peak MVC coefficient of variation varied between 31.2-41.7 percent.

c) Psychophysiological

According to Bertollo et al. (2021), psychophysiological refer to the dynamic interplay between an individual's psychological processes and physiological responses, illustrating the intricate interaction between the physical and mental realms. In the realm of sports science and athletic performance, these factors encapsulate the comprehensive influence of mental states and physiological indicators on an athlete's holistic well-being, training adaptations, and competitive outcomes. In this study, physiology refers to the physiological aspects encompassing an athlete's bodily functions, including parameters such as heart rate (HR) using Polar S710 heart rate monitor. It involves the objective measurement and analysis of these physiological markers to gain insights into an athlete's physical condition and capabilities. On the other hand, psychology in this context pertains to the mental dimensions influencing an athlete's performance, encompassing factors like anxiety using competitive state anxiety inventory-2R (CSAI-2R). This questionnaire measured cognitive anxiety, somatic anxiety and self-confidence. Hence, this study investigates how an upper

body resistance training regimen affects psychological and physiological responses. This study also aiming to discern patterns and correlations of psychophysiological among compound archers.

d) Shooting Performance

Shooting performance in archery refers to the overall quality and effectiveness of an archer's shot. It encompasses factors such as accuracy, consistency, and the ability to hit the target consistently (Park, 2009). In this study, the double 50-meter round's total scores were used to evaluate shooting performance. The double 50m scoring format is based on the World Archery Federation's standard international outdoor target archery (Book 2, Chapter 4; 4.2.3) from 1931. The compound target face has six ring points and is 80 cm in diameter. A total of 72 arrows were launched by the archers, 36 of which were shot in the first round and another 36 in the second. The scores were recorded by the athletes and written on the score sheet.

e) Compound Archer

A compound archer is a type of archer who utilizes a compound bow, which is a technologically advanced bow that incorporates pulleys and cables to provide a mechanical advantage in drawing and holding the bowstring (Park, 2011). Thirty compound archers were recruited from the state team (15 compound archers for intervention group and 15

compound archers for control group). The participants ages were between 13 and 21 and base on the criteria for the participants. By focusing on this specific category, the study aims to provide a detailed analysis of the effect of upper body resistance training program on muscle activation, psychophysiological and shooting performance among compound archers.

1.6 Delimitations

The delimitation of the study refers to the explicit boundaries and limitations that are established by the researcher in order to narrow down and focus on a specific research topic or area of investigation (Paré & Kitsiou, 2017). In this study, the participants are, a) based on compound archers only b) It will be conducted at a large area and outdoor and c) All the athletes from the age range of thirteen to forty years old only will be considered.

1.7 Significance of The Study

The study of muscle activation in archery holds significant importance in understanding the biomechanics and physiological aspects involved in this sport. This study intends to clarify how muscle activity affects the arrow shot quality by examining the relationships between physiological and mechanical dynamics during arrow release. This understanding can help coaches and athletes optimize training techniques, improve performance, and

decrease the possibility of getting injured. This study can assist in establishing a relationship between muscular exhaustion and the final score attained by analysing the contraction of muscles during endurance archery shooting. Additionally, studying muscular activation patterns of elite archers compared to beginners can provide valuable insights into optimal muscular strategies during archery shooting. Measuring biomechanical factors applicable to professional archers is the objective of this preliminary research. Overall, the study of muscle activation in archery can provide valuable information for improving technique, enhancing performance, and preventing injuries in this sport.

Besides that, the study of psychophysiological factors in archery has gained significant attention in recent years (Wang et al, 2022). Researchers have recognized the importance of understanding how the mind and body interact during the process of shooting an arrow. By investigating the relationships between physiological and mechanical dynamics. The researchers look at body posture, balance, heart rate, and muscle activity to determine the main elements that affect an arrow shot's quality. This knowledge can then be applied to enhance the performance of professional archers. Furthermore, The research's conclusions may potentially have applications for athletes, coaches, trainers, physical education teachers who design archery programs. By addressing the psychophysiological aspects of archery, future researchers can provide insights into the techniques used for mental preparation during competition. These techniques which include body awareness, facilitating emotions, concentration, and optimistic expectations are essential for proficient archery performance.

For the shooting performance, the study's findings can provide valuable insights into the variables and factors that impact archery success. By understanding the biomechanics parameters, physical fitness variables, and mental aspects associated with shooting performance, coaches and athletes can develop targeted training programs to improve accuracy and consistency in archery shooting. These findings can also inform talent identification programs, helping coaches and team managers select archers with the physical characteristics that are positively correlated with shooting scores, such as basic characteristic like weight, height, longer arm span and other related parameters.

1.8 Conceptual Framework

A conceptual framework's introduction gives the research investigation a rational argument and background information (Jabareen, 2009). The anticipated link between the variables is depicted in a conceptual framework (Figure 1.1). It outlines the pertinent objectives for the investigation and shows how they are combined to produce logical findings.

Figure 1.1

Conceptual Framework of The Study