# CHAPTER I
# INTRODUCTION

## 1.1 Background

Golf is a globally popular sport enjoyed by people of various professions and ages. It features both amateur and professional competitions, with the player achieving the lowest score (fewest strokes) emerging as the winner. One of the most crucial skills in golf is the swing, a complex bodily movement utilizing the kinetic chain principle to transfer force, enhancing club head momentum and speed while controlling the clubface angle before impact, ensuring accurate ball trajectory towards the target (Bradshaw et al., 2009). Weight transfer during the golf swing is a mechanical concept that golf coaches consider a key indicator in golf swing training (Norman, 1995). The concept of weight transfer was first introduced as a buzzword among players and coaches in a Golf Digest magazine article (Nelson, 1980). This concept has been extensively studied, primarily through variables derived from force platforms, such as vertical force distribution (Chu et al., 2010), center of pressure (Ball and Best, 2011), and torque (Han et al., 2019). Developing a more efficient golf swing is vital for players to succeed in competitions. However, there is a lack of data regarding weight transfer based on pressure measurements between the feet and shoes. This gap in knowledge highlights the need for further research to understand the intricacies of weight transfer and its impact on golf swing performance.

Worsfold et al. (2009) investigated plantar pressure distribution in golfers, focusing on peak pressure rather than pressure fluctuations throughout the swing. Ball and Best (2007) identified two distinct weight transfer patterns ("Front Foot" and "Reverse Pivot") using center of pressure (CoP) analysis. The "Front Foot" pattern involves backward CoP movement during the backswing and forward movement during the downswing, while the "Reverse Pivot" pattern involves backward CoP movement during the backswing and maintaining that position throughout the downswing.

However, Pataky (2015) highlighted. The limitations of relying solely on CoP analysis, emphasizing the importance of considering foot pressure distribution for a comprehensive understanding of force transmission during the golf swing.

A key aspect of golf performance lies in the relationship between biomechanical variables. Chu et al. (2010) analyzed kinematic data and ground reaction forces in 308 golfers, revealing that upper body-pelvis separation (X-Factor), delayed arm and wrist release, forward and lateral body tilting, and weight transfer during the swing significantly correlated with ball speed. Ball and Best (2011) observed a connection between greater CoP displacement and higher club head speed in a sample of 5 players. Their earlier study (2007) found that increased distance and speed of CoP movement during the downswing correlated with higher club head speed in a "forefoot" stance. Pataky (2015) further explored the relationship between foot pressure and club head speed in 32 players with varying handicaps. The study discovered that players with higher club head speeds also generated higher pressure values on the lead foot's lateral side. These findings underscore the importance of biomechanical factors in optimizing golf performance, offering valuable insights for players and coaches seeking to improve their game.

Several studies have investigated the relationship between foot pressure and golf club type. Barrentine et al. (1994) found that ground reaction forces were greater when golfers used a driver compared to other clubs, while vertical torque remained similar (Worsfold et al., 2021). Ball and Best (2011) noted that the pattern of center of pressure (CoP) movement was similar between driver and iron swings. Navarro et al. (2022) observed significant differences in pressure distribution between the left and right feet for both driver and 5-iron swings, but this distribution remained consistent when switching between club types. Additionally, they found differences in foot pressure patterns between professional and amateur golfers, particularly in the medial and lateral areas of the foot throughout the swing.

The study of energy flow is crucial for understanding efficient golf swing mechanics and injury prevention. Takagi (2018) highlighted the importance of coordinated joint movements in transferring energy to the golf club. Proximal joints, like the lumbar and shoulder, play a key role in power generation, and the timing of

their movement is essential for optimal energy transfer. Kenny et al. (2008) investigated kinetic energy (KE) transfer in golf swings, finding a strong correlation between peak KE and its timing for both driver and iron shots. This suggests similar trunk and arm velocities for both types of shots. Peak KE consistently increases from proximal to distal body segments during the swing, but the timing of peak KE does not follow this sequence. The arms peak first, followed by the hips, torso, and club, indicating coordinated movement for optimal energy transfer. These findings contribute to understanding KE transfer in golf and can inform swing technique development and equipment design. Nesbit and Serrano (2005) examined the relationship between work and energy in golf swings, revealing that the primary factors influencing club head kinetic energy are the work done by the golfer, club head speed, and club head mass. An efficient swing maximizes energy transfer from the golfer to the club head, and regular practice can help golfers develop a more efficient swing.

Investigating foot pressure patterns in professional and amateur golfers to reveal their correlation with energy flow during the golf swing. This research aims to enhance golf instruction and training methodologies, enabling the development of tailored teaching techniques, drills, and equipment that cater to golfers of all levels. By understanding the intricacies of foot pressure and energy transfer, we can empower players to refine their skills and elevate their overall performance on the course.

## 1.2 Research objective

1.2.1 To investigate how foot pressure patterns vary during the golf swing when using different club head

1.2.2 To compare foot pressure distribution patterns during the golf swing between professional and amateur golfers.

1.2.3 To analyze the correlation between foot pressure distribution and energy transfer during the golf swing.

1.2.4 To utilize data collected from studying foot pressure and energy flow to develop advanced golf swing analysis tools.