NORWEGIAN SCHOOL OF SPORT SCIENCES

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# What is the extent of growth-related injuries in the lower extremities in boys' academy football players?

A one-season prospective cohort study

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# Abstract

**Introduction:** Youth academy football players have high injury rates and are prone to growth-related injuries, known as "apophysitis," which are unique to youth sports. These injuries affect the immature skeleton and commonly manifest as Osgood-Schlatter disease, Sinding-Larsen-Johansson syndrome, Sever's disease, pubic apophysitis, and other growth-related injuries at the pelvic. These injuries impact the health and performance of young players, resulting in absence from training and matches. Intensive training during periods of rapid growth may contribute to increased injury rates. This master project aims to investigate the prevalence, incidence, and characteristics of these injuries.

**Method:** This project is a prospective cohort study conducted in a Norwegian high-level youth football academy during the 2022 season, involving 58 players from the U-14, U-16, and U-19 teams. Weekly monitory of health problems, including injuries and illnesses, was recorded using the Oslo Sports Trauma Research Center Questionnaire on Health Problems 2$^{nd}$ version, to obtain responses from the players.

**Results:** During the 42-week study period, data collection was completed by 52 players, with a weekly response rate of 91.4%. The average weekly prevalence of self-reported health problems was 37%, and clinically diagnosed growth-related injuries had an average weekly prevalence of 12%. Overall injury incidence for growth-related injuries was 4.6 injuries per 1000 training and match hours. Pubic apophysitis was the most common injury, with a total of 31 growth-related injuries diagnosed. Among these injuries, 77.4% had a gradual onset, and 81% occurred during training. The U-14 group exhibited the highest increases in stature, body mass, and body mass index, and they also had the highest number growth-related injuries throughout the study period.

**Conclusion:** This project explored the prevalence, incidence, and characteristics of growth-related injuries in high-level boys' academy football players. Pubic apophysitis was the most commonly observed injury. Targeting younger age groups is recommended for further investigation. Standardized guidelines and reporting methods would facilitate future research.

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# Foreword

I have reached the end of my journey as a master student at the Norwegian School of Sports Science (NIH), and I am deeply grateful for the opportunity to graduate from such an excellent school.

First and foremost, I would like to express my sincere appreciation to my supervisors, Thor Einar Andersen, and Joar Harøy. Your guidance and support throughout this project are deeply appreciated. I am also grateful for providing me with the opportunity to represent the Norwegian national youth teams, fulfilling a lifelong dream.

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*Simen Rygh*

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# 1. Introduction

Youth academy football players experience injury rates similar to high level senior players (Jones et al., 2019). However, growth-related injuries in the lower extremities are unique to youth sports, including football (Caine et al., 2014; Materne et al., 2021). Common lower extremity injuries in youth football players include apophysitis such as Osgood-Schlatter disease (Laudenhauf et al., 2020) and Sinding-Larsen-Johansson syndrome (Valentino et al., 2012) in the knee, Sever´s disease (Belikan et al., 2022) in the heel, pubic apophysitis (Sailly et al., 2015), and other growth-related injuries, located at the pelvic (Materne et al., 2022).

Growth-related injuries have a pronounced impact on the health and performance of adolescent football players, leading to absence from training and matches (Jones et al., 2019). Reducing injuries in youth football can improve their development (Jones et al., 2019). Young players in academies experience intensive training loads during periods of rapid growth, which may explain the high injury incidence (Wik et al., 2021). These injuries primarily affect skeletal immature athletes (Caine et al., 2014). They are referred to as "apophysitis", which is an overuse injury resulting from traction on skeletal growth plates where muscle tendons attach and is regularly seen in young players (Achar & Yamanca, 2019).

A recent prospective cohort study by Wik et al. (2021) recorded 1111 high level male youth football time-loss injuries and described different age group patterns for injury incidence, burden, and severity. The identification of these factors is crucial for the optimization of prevention programs and players` development (Wik et al., 2021). The study included 301 academy footballers, with an overall incidence of 12.0 and an injury burden of 255 days per 1000 hours. The incidence and burden of apophyseal injuries were higher in younger athletes (Wik et al., 2021). However, Bahr (2009) recommends that prospective studies on overuse symptoms in sports should focus on prevalence when reporting injury risk rather than incidence. Using the time-loss definition, an overuse injury could be rated as having a low incidence, regardless of a high injury prevalence (Bahr, 2009). There is limited research on the frequency and characteristics of growth-related overuse injuries in youth football, including studies on their prevalence.

## 1.1 Research question

The aim of this master thesis is to investigate the characteristics, prevalence, and incidence of growth-related injuries in a group of boys´ academy football players over one full season. To answer the aim, the following research question was developed: *What is the extent of growth-related injuries in the lower extremities in boys` academy football players?*

# 2. Theory

## 2.1 Norwegian boys' academy football

Football is the most popular sport in Norway, with approximately 346.000 active players, as reported by the Norwegian Sports Federation (Idrettsforbundet, 2022). Among all sports, football stands out with its remarkable number of participants.

In Norway's football landscape, the male adult football league system is the "Eliteserien", (Norwegian Premier League) followed by the "OBOS-ligaen" (Norwegian First Division). These two leagues contain a total of 32 football clubs, with each league consisting of 16 clubs. Notably, 26 of these clubs have established professional academies specifically dedicated to developing young male talents, with the ultimate goal of producing future football stars.

To ensure a systematic approach to player development and the academies within Norwegian boys' football, the concept of the academy classification was introduced (Torjusen, 2023). This classification system sets comprehensive standards for youth football development, encompassing 11 key areas and 207 criteria. The Norwegian Top Football organization (NTF) took the lead in creating this academy classification, drawing insights from a systematic review of similar youth football programs implemented in top leagues such as the Premier League (England), Bundesliga (Germany), Eredivisie (Netherlands), Jupiler Pro-League (Belgium), Superligaen (Denmark), and Tipselite (Sweden). Furthermore, NTF also examined performance environments in various sports to inform their criteria selection process.

As part of the academy classification, NTF annually conducts evaluations of clubs by sending their employees to assess their performance against these established criteria. Moreover, significant funding amounting to a total of 90 million Norwegian kroner is allocated to support clubs, with higher amounts granted to those that demonstrate good numbers in meeting the criteria. The implementation of the Norwegian academy classification has yielded positive outcomes, including improved results for the national youth teams and a 617% increase in the market value of the top 20 players from 2017 to 2022 (Torjusen, 2023). This growth exceeds the performance of neighboring countries like Sweden and Denmark, underscoring the effectiveness of the Norwegian approach (Torjusen, 2023).

By embracing the academy classification, Norwegian boys' football has taken steps in the development of young talents, ultimately raising the standard of football in the country.

## 2.2 Growth and maturation

Physical growth refers to the constant and irreversible increase in body size (Balasundaram & Avulakunta, 2022). During adolescence, the pubertal growth spurt causes a rapid increase in stature and body mass (Soliman et al., 2014). Biological maturation is the stage of skeletal or pubertal development (Swain et al., 2018).

Academy football players is exposed to high match- and training loads during periods of rapid growth, which may explain the higher rate of growth injuries to the immature skeletal system (Wik et al., 2021). Rapid growth and maturation are individual and vary in tempo and timing (Parr et al., 2020). Anthropometric measures such as stature, body mass, and leg length can be monitored over time to track a player´s growth (Wik, 2022). It becomes especially important to track these measures along with the exposure to physical load in the growth spurt occurs during puberty (Johnson et al., 2022a). This allows for identification of youth players who may be at a greater risk of sustaining an injury (Johnson et al., 2022a).

The adolescent growth spurt during puberty usually set off between the ages of 8-10 years in girls and 10-12 years in boys (Wik, 2022). Peak height velocity (PHV) is the period of maximal acceleration during growth (Pitlovic et al., 2013). Girls typically grow around 7.9 cm in stature during one year at the age between 11-13 years, while boys grow 8-10 cm between the ages of 13-15 years during the same period (Wik, 2022). The debut age in PHV is individual and differs between sexes (Wik, 2022). This may lead to variation in biological age (BA) within the same chronological age (CA) group (Ford et al 2011; Malina et al., 2016).

Kemper et al. (2015) recommended regular individual monitoring of anthropometric data because a higher risk of injury was identified when a youth high-level football player grew more than 0.6 cm in one month. This information is valuable and can help determine a player's risk of injury (Kemper et al., 2015; Johnson et al., 2022a).

## *2.3 Link between maturation, growth, performance, and injuries*

The selection of athletes for training and competition in youth sports is traditionally based on CA (Parr et al., 2020). However, youth athletes at the same CA may wary in maturation status, with differences of up to 5-6 years in skeletal age (Malina et al., 2004; Malina et al., 2016). This variation coincides with the growth spurt, which was investigated in a longitudinal study of youth football players by Malina et al. (2016), where the age of take-off growth spurt varied from 8.2 years to 12.7 years in boys.

Previous studies have suggested that advancing CA in youth football is associated with an increased risk of injury (Price et al., 2004; Le Gall et al., 2006). However, a study by Swain et al., (2018) reported that injury incidence does not increase with higher CA. Studies from youth football clubs have also indicated a higher injury incidence per 1000 hours in younger teams compared to older teams within the same club (Tourney et al., 2014; Renshaw & Goodwin., 2016). It is important to note that injury rates may be affected by the age of opponents, as players who train and compete against older athletes may be at higher risk of injury (Renshaw & Goodwin., 2016). The strength of these studies is limited by variations in injury definitions, research design, number of participants, and each club´s preferences regarding training and match selection (Jones et al., 2019).

There are conflicting indications regarding age and injury rates in youth sports (Wik, 2022). While some research suggest that injury rates increase with age (McKay et al., 2016), others indicate that the severity and burden of injuries seem to peak in the U-15 to U-16 teams (Rinaldo et al., 2021). As players grow older, they become stronger, heavier, and faster, while the intensity of training and match play increases (Wik, 2022). Players who have been involved in football for a longer time may have a higher probability of having sustained an earlier injury (Wik, 2022). A previous injury is also a risk factor for new injuries in football, which may explain why injury rates appear to increase with age in some studies (Wik, 2022). During periods of accelerated growth, such as peak height velocity (PHV), there is a higher activity within the apophysis, which may explain the higher injury burden and severity during this time (Caine et al., 2006). The consequences of injuries in youth football, such as decreased performance and limited development, can be significant (Materne et al., 2021; Wik, 2022).

Youth football players are susceptible to different types of injuries during growth (Wik, 2022). Apophyseal injuries to the skeleton are common during growth spurts in puberty, but growth disturbances due to these injuries are rare (Longo et al., 2016). However, if a player fractures a physeal area, complications during growth may arise if not treated correctly (Caine et al., 2022). Youth football players with fewer growth-plate injuries are more likely to be near skeletal maturity and are more susceptible to injuries related to joints, ligaments, and muscles (Materne et al., 2021; Wik et al., 2021).

## 2.4 Injury incidence and prevalence in youth football

In sports medicine, incidence is defined as the number of new injuries or illnesses in a population that occur during a specific defined period, and prevalence is a snapshot of how many existing injuries or illnesses there is from one point in time (Bahr et al., 2020). Incidence analyses how often new cases occur, while prevalence measures the total number of existing cases in a population (Bahr et al., 2020).

Jones et al., (2019) conducted the first comprehensive study that systematically reviewed relevant literature on incidence, prevalence, severity, and probability in high-level male youth football. The study reported a total incidence of 3.7 per 1000 hours for the U-9 to U-16 groups, and 7.9 per 1000 hours for the U-17 to U-19 groups. Of all injuries, 18% were classified as severe, resulting in an absence from football for more than 28 days. Muscle injuries accounted for 37% of all injuries. However, other studies have suggested that growth-related injuries are often misdiagnosed as muscle injuries (Carl, 2012; DiFiori et al., 2014).

Robles-Palazon et al., (2022) studied both female and male youth football players and found injury incidence rates of 6.77 per 1000 hours for females and 5.70 per 1000 hours for males. Match injury incidence was significantly higher in both sexes compared to training injury incidence, with 14.97 and 2.62 per 1000 hours in females and 14.43 and 2.77 in males, respectively. Lower extremity injuries were more prevalent than upper extremity injuries. Joint and ligament injuries were the most common injuries for female players, while muscle and tendon injuries were more prevalent in male players. Robles-Palazon et al., (2022) also compared different levels of play in youth football and found a higher injury incidence rate in high level male players compared to lower level players. However, the study did not report any prevalence rates.

Materne et al., (2022) conducted a four-season prospective study on 551 youth football academy players between the U-9 to under U-19 teams. The study recorded 2204 injuries and compared them across different age groups. The results showed that the U-16 age group had the highest injury incidence, with 59 injuries per squad season, consistent with other similar studies (Bult et al., 2018; Jones et al., 2019). Contusions, sprains, and growth-related injuries were the most common reasons for time-loss across all academy players. The study found that injury incidence peaked during early middle adolescence, with growth-related conditions affecting the knee and hip/pelvic being the most prevalent. The incidence of growth-related injuries was higher in this study at 4.8 per squad season, compared to other studies (Price et al., 2004; Le Gall et al., 2006; Read et al., 2018), where it was between 0.8 to 2.1. The prevalence of growth-related injuries in this study was also higher with 19% of all severe injuries (time loss of more than 4 weeks from football) compared to other studies (Faude et al., 2013; Jones et al., 2019), where it was reported at 5% to 7%. In previous studies, muscle tears accounted for 15% to 46% of all injuries diagnosed in English football academies (Price et al., 2004; Read et al., 2018). In contrast, this study reported a prevalence of only 6% regarding muscle tears.

## *2.5 Types of growth-related injuries in academy youth football*

Growth-related injuries often occur in the growth centers of the skeleton, known as apophyses or traction epiphyses (Caine et al., 2016; Longo et al., 2016; Materne et al., 2022). Apophyses are soft bony growth ossification centers that fuses at different ages during adolescence (Longo et al., 2016; Brukner et al., 2017). They act as attachments for tendons and ligaments and are designed to allow skeletal growth without affecting these attachments (Caine et al., 2006; Longo et al., 2016).

However, a growing skeleton is less resilient compared to mature bone (Materne et al., 2022), and excessive tractions by repetitive microtrauma from a powerful muscle, tendon, or ligament can cause small avulsion fractures followed by inflammation. This can lead to damage of the apophysis during growth (Brukner et al., 2017; Belikan et al., 2022; Materne et al., 2022).

The most reported apophyseal under-extremity injuries in the literature are Osgood-Schlatter disease, Sinding Larsen-Johansson syndrome, and Sever´s disease (Arnold et al., 2017). Although pubic apophysitis is another growth-related injury that occurs in young athletes, it has rarely been mentioned in the literature as a diagnosis in the past (Sailly et al., 2015). Additionally, pelvic apophyseal injuries have been reported regularly in the literature, with a high injury burden for this area (Materne et al., 2022).

### 2.5.1 Osgood-Schlatter disease

Osgood-Schlatter disease is a common condition that affects the growth plate of the tibia tuberosity in the knee (Brukner et al., 2017). It is highly prevalent among adolescents, with approximately one in ten experiencing knee pain associated with this condition (Ladenhauf et al., 2020; Rathleff et al., 2020). In fact, it accounts for a significant portion of overuse injuries in this age group, along with Sever's disease, contributing to around 18% of such injuries (Arnold et al., 2017).

The development of Osgood-Schlatter disease is often attributed to repeated contractions of the quadriceps muscle, which inserts at the tibial tuberosity via the patella tendon, leading to stress on the growth plate (Arnold et al., 2017; Brukner et al., 2017). Studies have found a correlation between the presence of Osgood-Schlatter disease, and a high number of Doppler signals detected through ultrasound examination in this area (Sailly et al., 2013). While it can affect both genders, it is more frequently observed in boys aged 10 to 15 years (de Lucena et al., 2011; Brukner et al., 2017).

The condition involves inflammation and a partial avulsion of the secondary ossification center, which can be attributed to the repetitive forces exerted during activities that involve running and jumping, such as football, handball, basketball, and gymnastics (Brukner et al., 2017). It's important to note that rest alone does not necessarily promote the healing process, but reducing painful activities can help alleviate the symptoms (Brukner et al., 2017). In some cases, when the pain decreases, rehabilitation programs may incorporate strength training of the muscles surrounding the tibiofemoral joint (Brukner et al., 2017).

Adolescents with Osgood-Schlatter disease may experience pain for an extended period, and therefore, close monitoring is recommended to ensure proper management (Holden et al., 2021). By understanding the nature of this condition and implementing appropriate interventions, healthcare professionals can support young athletes in effectively managing their symptoms and promoting their overall well-being.

### 2.5.2 Sinding-Larsen-Johansson syndrome

Sinding-Larsen-Johansson syndrome is a knee injury that primarily affects the growth plate at the lower border of the kneecap, known as the apex patella (Arnold et al., 2017). This condition is commonly observed in young boys between the ages of 10 and 14, making it prevalent during a period of growth and development (Iwamoto et al., 2009; Valentino et al., 2012). One of the primary characteristics of Sinding-Larsen-Johansson syndrome is the presence of pain in the lower pole of the patella, particularly during flexion of the tibiofemoral joint (Valentino et al., 2012). Additionally, individuals with this syndrome may experience sub-patellar edema, indicating inflammation in the affected area.

Despite sharing similarities with Osgood-Schlatter disease, Sinding-Larsen-Johansson syndrome has received relatively less attention in the scientific literature (Arnold et al., 2017). However, it is beneficial to address this syndrome comprehensively to ensure the optimal management and well-being of affected individuals. Young athletes diagnosed with Sinding-Larsen-Johansson syndrome may also be prone to developing patellar tendinopathy, highlighting the potential long-term implications of this condition

(Brukner et al., 2017). Although the pain associated with Sinding-Larsen-Johansson syndrome typically diminishes as the patella fully ossifies, proper treatment and rehabilitation strategies are essential during the active phase of the condition (Valentino et al., 2012).

### 2.5.3 Sever’s disease

Sever´s disease is the most common cause of posterior heel pain during childhood and adolescence (Ramponi & Baker, 2019; Belikan et al., 2022). It´s also known as calcaneal apophysitis and is a growth-related overuse injury with an inflammatory process similar to Osgood-Schlatter disease (Belikan et al., 2022). The condition occurs due to excessive traction from the calf muscles, through the Achilles tendon, and into the calcaneal apophysis (Arnold et al., 2017; Belikan et al., 2022). Tightness of the Achilles tendon or the plantar fascia, flatfoot, overpronation, and improper footwear are reported as risk factors for developing Sever´s disease (Belikan et al., 2022).

The patient complains of heel pain during activity and sports in growth spurts (Brukner et al., 2017; Belikan et al., 2022). Clinically, palpation on the bony Achilles insertion at the calcaneus aggravates the patients´ symptoms (Belikan et al., 2022). Pain at rest and avoidance in loading the heel in the gait cycle may also be observed (Belikan et al., 2022). Other findings could be swelling at the Achilles insertion, tightness of the soleus or gastrocnemius muscle, and weakness in ankle dorsiflexion (Brukner et al., 2017; Belikan et al., 2022).

Radiographic examination is rarely necessary in Sever´s disease (Brukner et al., 2017). However, magnetic resonance imaging (MRI) may be indicated to rule out differential diagnoses like infections or tumors, depending on the patient’s history (Ceylan & Caypinar, 2018). Sever´s disease is often seen in younger athletes, compared to Osgood-Schlatter disease and Sinding-Larsen-Johansson syndrome, with onset of symptoms from the ages of eight to twelve (Arnold et al., 2017). The calcaneal apophysis emerges between seven to nine years of age and fuses around 15 to 17 years of age (Belikan et al., 2022).

The treatment for Severs disease is similar to Osgood-Schlatter disease and Sinding-Larsen-Johansson syndrome in the form of activity modification and strength training when pain allows it, but the literature also recommends heel raises in the shoes and stretching of the calf muscle (Brukner et al., 2017). If strength training is indicated, the clinician should implement exercises for the ankle plantar flexors (Brukner et al., 2017). Symptoms due to Sever´s disease may exist for two years but usually subside within six to 12 months (Brukner et al., 2017).

### 2.5.4 Pubic apophysitis

Pubic apophysitis, a condition that can result in persistent groin pain among adolescent football players, is a topic of increasing interest in sports medicine research (Sailly et al., 2015). The pubic apophysis, located at the anteromedial corner of the pubic bone, serves as the attachment site for the adductor longus muscle tendon and the symphysial joint capsule (Sailly et al., 2015). It is worth noting that pubic apophysitis can manifest in both the superior and inferior pubic bone, with the inferior border being the more common site, probably due to the origin of the adductor brevis and gracillis muscles (Koh & Boyle, 2020). Previous studies have overlooked pubic apophyseal injuries as a potential cause of groin pain in young athletes (Materne et al., 2022).

The maturation of the pubic apophysis is a complex process and occurs later compared to other skeletal structures (Sailly et al., 2015). In males, the apophysis begins to develop around the age of 16 and typically fuses between 20 to 25 years of age (Koh & Boyle, 2020). To evaluate sports-related apophyseal injuries, the use of volumetric interpolated breath-hold examination (VIBE) MRI has been suggested and shows promise as a non-invasive imaging technique (Koh et al., 2018). This approach is particularly advantageous as it eliminates the need for exposure to ionizing radiation, which is a concern when using CT scans (Sailly et al., 2015).

In terms of treatment, conservative management is generally recommended for pubic apophysitis, similar to other types of apophyseal injuries (Sailly et al., 2015). This typically involves a combination of rest, physical therapy, and targeted exercises to strengthen the surrounding muscles (Sailly et al., 2015). The goal is to reduce pain and allow the affected area to recover gradually. It is important to closely monitor the progress of pubic apophysitis, as this condition can persist for a significant duration and require ongoing care (Sailly et al., 2015).

### 2.5.5 Iliac crest apophysitis

Iliac crest apophysitis refers to inflammation and pain at the superior border of the pelvic, where several muscles including the tensor fascia latae, sartorius, gluteus medius and abdominal muscles insert (Hebert et al., 2008; Arnaiz et al., 2011). The fusion of the apophysis in this area occurs around the age of 15 and can continue up until the age of 25 (Arnaiz et al. 2011; Materne et al., 2022). Apophyseal injuries at the pelvic are becoming more prevalent (Hebert et al., 2008). Symptoms of iliac crest apophysitis have been reported in athletes aged 15.5 years (Materne et al., 2022). Avulsion fractures to this area are typically seen in young athletes with an incidence rate of 5% and a mean age of 14.6 years (Li et al., 2014; Chan et al., 2021). Iliac crest apophysitis is also observed in the same age group (Le Gall et al., 2006). Young athletes may present with hip, pelvic or back pain as a result of iliac crest apophysitis (Hebert et al., 2008; Achar & Yamanka, 2020). Treatment for iliac crest apophysitis typically includes activity modification, and some literature recommend anti-inflammatory medication (Kivel et al., 2011).

### 2.5.6 Anterior inferior iliac spine (AIIS) apophysitis

AIIS apophystits is a common injury in youth football players as reported by Gudelis et al. (2022) and Materne et al. (2022). Girls aged 14.0 to 14.9 years and boys aged 13.6 to 16.3 years are most commonly affected (Weel et al., 2022). The AIIS apophysis fuses between the ages of 16 to 18 years old (Anduaga et al., 2020). Boys are more commonly affected than girls (Schuett et al., 2015). According to Gudelis et al. (2022), who studied 173 young football players for over seven season, AIIS apophyseal injuries accounted for 43.3% of 210 apophyseal injuries. The AIIS is the origin of the rectus femoris muscle, which is frequently used during football (Materne et al., 2022 & Weel et al., 2022). Kicking, sprinting, or jumping are most common injury mechanisms (Anduaga et al., 2020). Avlusion of this area is common, and conservative treatment is often effective in helping players recover (Weel et al., 2022). Reduced strength in the abdominal muscles may increase the risk of developing this injury (Lasky-McFarlin et al., 2020). Conservative treatment with load management is the treatment for growth-related injuries to the AIIS (Eberbach et al., 2017).

### 2.5.7 Ischium apophysitis

Ischium apophysitis is a common injury among youth academy football players, characterized by pain in the ischial tuberosity (Papastergiou et al., 2019), which is the insertion of the hamstring muscle group (van der Made et al., 2022). This injury typically occurs between the ages of 13 and 16 years old (Ferlic et al., 2014). Activity in the secondary ossification center of the ischial apophysis is seen from the age of 12 to 18 years old in boys (Grissom et al., 2018). The reported time-loss for this injury is about 18 days (Wik et al., 2020). Avulsion fractures to the ischial apophysis may occur, with the mechanism often reported as powerful contractions of the hamstring muscles, including hip flexion (Rossi et al., 2001). The injury is often caused by excessive tension from the hamstring muscles (Papastergiou et al., 2019). Correct treatment and early diagnosis are important for these players, as many are undiagnosed and develop chronic irritation which may cause severe loss of function (Papastergiou et al., 2019).

## *2.6 Age group differences*

In a study conducted by Wik et al., (2021), which followed 301 high-level male youth football players for four years, it was found that younger players had a higher injury burden, while older players had a greater mean incidence of overall injuries. Growth-related physis injuries were more common in younger age groups, and the U-16 group had the lowest player availability and highest overall injury burden. Time-loss injuries were greatest for the U-16 group, with the U-13 and U-14 groups having the highest rates of injury that occurred gradually.

Le Gall et al., (2006) observed French youth football players over 10 season and found the highest number of training injuries in the U-14 group, while a study in English Premier League football academy players during one season found training injuries were most common in the U-12, U-13, and U-14 groups (Renshaw et al., 2016). Similarly, another study on English professional youth football academies concluded that the U-14 and U-15 groups had the greatest time-loss per injury and highest severity rate, respectively (Read et al., 2018). In a Dutch Eredivisie youth football academy study by Bult et al. (2018), the U-16 group had the highest injury burden.

However, a confounder in these studies is the exposure in training and match load between age groups, which can impact the epidemiological studies on sport injuries (Brooks et al., 2006).

## 2.7 Injury definitions

The International Olympic Committee (IOC) has defined injury as *"tissue damage or other derangement of normal physical function due to participation in sports, resulting from rapid or repetitive transfer of kinetic energy"*. However, for football-specific research, the definition was revised to include health problems as well (Walden et al., 2023).

Different injury definitions can affect the results of injury reports (Bahr, 2009). Therefore, researchers must consider the definitions they use for their studies (Clarsen & Bahr, 2014). To detect a higher injury rate, the *"any physical complaint"* definition from Fuller et al. (2006) should be used. However, time-loss is often used as the primary injury definition in sports surveillance studies to determine the time lost due to injury (Fuller et al., 2006). This type of definition may not capture the full impact of overuse injuries, as athletes often continue to train despite such injuries (Bahr, 2009).

To address this issue, Clarsen et al. (2020) proposed a new definition for health problems, which includes *"any condition that you consider to be a reduction in your normal state of full health, irrespective of its consequences on your sports participation or performance, or whether you have sought medical attention. This may include, but is not limited to, injury, illness, pain, or mental health conditions*". This broader definitions are suitable for collecting data on sports with high rates of overuse injuries and illness (Bahr et al., 2020). Health problems that receive medical attention are classified as "medical attention" health problems, while those that prevent an athlete from participating in training sessions or matches are classified as "time-loss" health problem (Bahr et al., 2020). Using a broader injury definition can help detect more health problems for athletes (Bahr et al., 2020).

## *2.8 The Oslo Sports Trauma Research Center (OSTRC) Questionnaires*

OSTRC has developed questionnaires to monitor and document the epidemiology of injury and illness in sports for the past decade (Clarsen et al., 2020). The first questionnaire created by Clarsen et al., (2013) was the OSTRC Overuse Injury Questionnaire (OSTRC-O), as they suspected that the burden of overuse injuries was underestimated. Shortly after, Hammond et al. (2014) suggested using the same method to collect data from acute injuries and illnesses. In response, a modified version of the OSTRC-O was created, capable of monitoring both injuries and illnesses (Clarsen et al., 2014). This new method, called OSTRC Questionnaire on Health Problems (OSTRC-H), was designed to document acute injuries, overuse injuries, and illnesses. The OSTRC-H questionnaire has been utilized in several research papers and clinical settings, including evaluating the health of athletes in different sports (Jorgensen et al., 2016; Harøy et al., 2017; Pluim et al., 2018; Bahr et al., 2020).

To optimize the quality of both the OSTRC-O and OSTRC-H questionnaires, a review panel meeting was held with the original developers and a panel of international researchers (Clarsen et al., 2020). Changes in regarding, wording, structure, and logic were made to both questionnaires, resulting in updated versions referred to as OSTRC-O2 and OSTRC-H2 (Clarsen et al., 2020). Clarsen et al. (2020) specifically made changes in word alternations and questions to improve the quality of the data collected from the questionnaire. The updated version of the OSTRC-H questionnaire is now known as the OSTRC Questionnaire on Health Problems 2$^{nd}$ version (OSTRC-H2). These questionnaires have become valuable tools for monitoring and documenting injury and illness in sports and have undergone pronounced improvements to enhance their accuracy and effectiveness.

## *2.9 Injury mechanism and risk factors for developing a growth-related injury*

During the period of rapid growth, academy football players are at greater risk of injury compared to other stages of development (Wik, 2020). It has been found that there is a higher incidence of injury in the six months following peak height velocity (PHV), which marks the peak of growth spurt (Bult et al., 2018).

As the body undergoes rapid growth, the apophyseal growth plates, which are responsible for bone growth, experience increased mechanical stress due to changes in limb length and the rapid development of muscles (Wik, 2021). These changes can result in traction forces exerted on the growth plates by the muscle tendons, potentially leading to injury.

The growth plates, being less developed and more vulnerable, are prone to damage from repetitive or acute trauma (Materne et al., 2022). Factors such as reduced flexibility, compromised neuromuscular control, lower bone mineral density, increased muscular strength, and skeletal lengthening have been identified as risk factors for developing growth-related injuries (Wik et al., 2020). Additionally, individuals with a history of apophyseal injuries or those with a genetic predisposition to certain types of mechanical load may be at a higher risk of experiencing similar injuries (Watanabe et al., 2018).

The climate can also play a role in the development of injuries in youth football (Jones et al., 2019). Countries located in the northern hemisphere with colder weather conditions may present tougher playing surfaces, which can be unpredictable and vary in quality. Such conditions increase the risk of injury during matches and training sessions (Jones et al., 2019). Moreover, teams from northern Europe have been found to exhibit a higher overall injury incidence, potentially influenced by longer periods of winter breaks before the start of pre-season. This extended period of inactivity followed by a rapid increase in training load can put players at a higher risk of injury (Ekstrand et al., 2019b).

To reduce the incidence of growth-related injuries, targeted interventions for the U-15, U-16, and U-17 age groups have been recommended (Bult et al., 2018). Collecting detailed information from players regarding injury mechanisms and the onset of symptoms can help in identifying specific risk factors associated with growth-related injuries (Materne et al., 2022). By understanding the underlying mechanisms and risk factors, strategies can be implemented to reduce the occurrence of these injuries and ensure the well-being of young football players (Materne et al., 2022).

## *2.10 Load exposure in academy youth football*

An essential aspect of load exposure measurement is the assessment of intensity and workload during training sessions (Bowen et al., 2017). Studies by Schmikli et al. (2011) and Bowen et al. (2017) have shown that increased intensity and load, as measured by the acute chronic workload ratio (ACWR), may correlate with higher injury rates in youth football. The ACWR is a valuable tool used to evaluate the risk of injury based on training load (Hulin et al., 2016). Additionally, the risk of injury may be elevated when young players engage in full-time training and specialize in a sport before the onset of puberty, as reported by Jones et al. (2019).

There are several ways to monitor load exposure in football (Dalen-Lorentsen et al., 2021). However, the methods employed for load monitoring can vary depending on the philosophy of each football club (Akenhead & Nassis, 2016). Several studies focusing on English academy youth football have demonstrated a 20% to 50% increase in training exposure as players progress in age (Salter et al., 2021; Johnson et al., 2022b). These findings suggest differences in daily training load and weekly periodization across various age groups (Johnson et al., 2022b). It's also worth considering factors outside of monitored football practice, such as younger players participating in other sports or being involved in multiple teams (Johnson et al., 2022b).

## *2.11 Injury prevention*

In recent years, there has been a significant increase in adolescent participation in sports, highlighting the need for effective strategies to prevent growth-related injuries in this population (Longo et al., 2016). The lack of knowledge about growth, symptoms, and biological maturation of the apophyseal growth centers among athletes, coaches, and parents further emphasizes the importance of education in injury prevention (Longo et al., 2016; Fares et al., 2021). By increasing awareness and understanding, it becomes possible to develop targeted prevention programs and facilitate early diagnosis (Longo et al., 2016).

Comprehensive injury prevention programs should include a range of training drills that address various aspects, including proprioception, strengthening, range of motion, physical conditioning, and avoidance of repetitive movements that may lead to symptoms (Longo et al., 2016). These programs should be designed with regular monitoring of individual growth to detect any increased risk of injury (Kemper et al., 2015). Coaches play a crucial role in the monitoring process, being attentive to the periods of rapid growth in their players (Longo et al., 2016). Additionally, proper periodization of training should be implemented to manage workload and minimize the risk of overuse injuries (Longo et al., 2016).

When athletes report pain, it is important that they stop training and seek a comprehensive examination (Longo et al., 2016). By promptly addressing symptoms and providing appropriate medical attention, the prognosis can be improved, and the risk of further injury to the apophyseal growth plates can be reduced (Longo et al., 2016). Active injury management has been shown to decrease re-injury rates and enhance overall player performance in sports (Maffulli et al., 2011).

## *2.12 Summary*

In Norway, football stands out as the most popular sport (Idrettsforbundet, 2022). To increase the quality of Norwegian football, the concept of football academy classification has been introduced to professionalize youth football at a higher level. However, within these academies, there exists a wide variation in the biological age of selected players within the respective teams (Malina et al., 2004; Malina et al., 2016; Parr et al., 2020). Youth football players are at risk for developing growth-related injuries that frequently occur in the immature skeletons' apophyses, leading to apophysitis (Caine et al., 2006). Despite four decades of research, these specific injuries have received limited attention in the field of youth sports (Materne et al., 2022). It is recommended to report the prevalence of such injuries in prospective studies (Bahr, 2009).

Academy youth football players face a higher risk of developing growth-related injuries during periods of rapid growth and increased load exposure (Bowen et al., 2017; Wik, 2020). Regular monitoring of players' growth can offer valuable insights into assessing their injury risk (Kemper et al., 2015). Importantly, injury prevention programs and knowledge about growth and injuries among coaches and staff play a crucial role in reducing growth-related injuries (Longo et al., 2016). The OSTRC-H2 questionnaire proves to be a valuable tool for documenting and monitoring sport-related injuries, as well as detecting various types of health problems (Clarsen et al., 2020).

This master project is a one-season prospective cohort study, investigating growth-related injuries in a youth football academy, examining their characteristics, prevalence, and incidence.

# 3. Methods

## 3.1 Study design and participants

This master thesis presents a prospective cohort study on growth-related injuries, also in some literature referred to as apophyseal injuries (Materne et al., 2022), in Norwegian youth academy football players during the 2022 season. We invited 66 players from the academy to participate, of whom 58 accepted the invitation. We recorded the player`s health problems on a weekly basis for one consecutive season. Data was collected over a period of 42 weeks, starting on February 7$^{th}$, and ending on December 1$^{st}$, 2022.

## 3.2 Playing level

The term “elite” is commonly used in sports research, but is often undefined and varies across countries, associations, and confederations (McAuley et al., 2022; Walden et al., 2023). In accordance with recommendations for football epidemiological studies by Walden et al., (2023), this master thesis describes the level of play and age groups of the participants instead of the term “elite”.

The participants played at different levels. The U-14 team participated in the National Under-14 Club Series, the U-16 team played National Under-16 Series Section B and the Norwegian Football Under-16 “Telenor Cup”, while the U-19 players competed in the National Under-19 Champions League, the Norwegian Football Under-19 “Telenor Cup” and “Norsk Tipping-ligaen”, which is the national adult fourth tier. Additionally, four of the participants played matches for the men`s senior team in the “Eliteserien” (Norwegian Men`s Premier League).

## 3.3 Injury and health problem definition

Fuller et al., (2006) defined an injury as *“any physical complaint sustained by a player that results from a football match or football training, irrespective of the need for medical attention or time-loss from football activities”.* When a player receives medical attention, it is referred to as a medical attention injury (Fuller at al., 2006). If a scheduled training session or a match is missed by a player, or he/she cannot participate fully in all training activities, it is defined as time-loss (Dompier et al., 2007). According to Bahr et al., (2009), the any physical complaint definition by Fuller et al., (2006) will produce a higher injury rate, compared to other definitions. Additionally, onset of injury can be categorized as sudden onset, gradual onset, or both modes of onset combined as repetitive sudden onset (Bahr et al., 2020).

To define health problems, which include both injury and illness, we used *"any condition that reduces a player´s normal state of complete physical, mental and social well-being, irrespective of its consequences on the player´s football participation or performance or whether a player sought medical attention"*, from Walden et al., (2023).

## 3.4 Questionnaire

We administered the OSTRC-H2 questionnaire to gather data on health problems experienced by the players, with the objective of obtaining information regarding growth-related injuries (Clarsen et al., 2020). The questionnaire was originally developed in English, and later translated into Norwegian. The players in this master project all used the Norwegian version (Appendix 1). It comprised 11 questions in total and enabling us to obtain information on participation, training and competition, modifications, performance, and symptoms from the preceding week. To ensure ease of navigation, we used the gatekeeper logic outlined by Clarsen et al. (2020), which enabled respondents who indicated no health problems in question one to skip the remaining questions. This logic improved the quality of the study results by reducing response burden and identifying only relevant health problems. We collected data using the Excellent Performance System (XPS), which is a program that routinely records health, injury, training, and match exposure data on all academy players in the club. Participants in this master project answered the questions using their mobile phones though an XPS application.

## 3.5 Data Collection

All players who reported a health problem from the pelvic, buttocks, hip, groin, thigh, knee, ankle, and heel were examined.

The data were collected from the football club where the master student is employed as the head academy physiotherapist. The club routinely collects data on injuries, any health problem and training and match exposure. Each academy player´s stature and body mass were measured individually once every month, and the club´s medical staff collected information from the OSTRC-H2 questionnaire once a week. Players who reported symptoms from the hip, groin, knee, or heel in the OSTRC-H2 underwent a standardized clinical examination protocol, containing medical history and clinical tests. The protocol was developed by the master-student in partnership with the supervisors and the club. The protocol contains questions about medical history and clinical tests to ensures consistency when examining players for hip, knee, and ankle injuries (Appendix 2). We collected information on the players´ pain level related to their growth-related injury, which was rated on a visual analog scale (VAS) ranging from one (“no pain”) to ten (“worst pain possible”) (Delgado et al., 2018). During the clinical examination the players indicated symptoms from the right, left or from both sides. After filling out the protocols, questionnaires were stored in a locked drawer, which only the master student could access. Each protocol file contained no personal data about the participants, and their names were replaced with a unique Player-ID, which only the supervisor had access to. The master student requested the ID from the supervisor after the protocols were filled out. In addition, the information from the clinical examination was stored in Physica, a medical journal system used by the club.

Participants received a weekly notification from the XPS app reminding them to fill out the questionnaire. A second notification was sent out the following day to the participants who did not fill out the questionnaire. The master student monitored weekly reports of injuries and sent individual text messages to non-responders every Tuesday after school at 3:00 pm, requesting that they fill out the questionnaire.

## *3.6 Analysis*

To prepare for the analysis, the following information was entered into a Microsoft Excel sheet: Player-ID, number of injuries, baseline data (including age, stature, body mass, playing position, and dominant leg), clinical examination protocol, the OSTRC-H2 questionnaire and training and match exposure. To ensure data accuracy, a quality check was manually performed on six different participants by the master student. We also developed a dummy variable in the Excel sheet to mark for any "not relevant data", which facilitated the use of the gatekeeper logic from Clarsen et al., (2020) during the analysis process.

## *3.7 Diagnostic criteria and follow-up of growth-related injuries*

The criteria used for diagnosing a growth-related injury while clinically examine the players included pain during and after football activity, pain subsiding at rest, pain upon muscle contractions, and pain in ADL, before, during and after training, and pain when palpating the relevant apophysis. If there was any doubt, players underwent an X-ray or MRI-scan, to rule out any other diagnosis.

We monitored players who reported pain due a clinically diagnosed growth-related injury weekly in OSTRC-H2. If a player reported symptoms in the subsequent weeks from the area where a growth-related injury had been clinically diagnosed, it was registered as a growth-related injury. In cases where symptoms were absent for more than one week and reappeared in the same area, players were scheduled for a new clinical examination. The growth-related injury was only documented once in the clinical examination protocol.

## *3.8 Prevalence and incidence calculations*

We performed two separate calculations on average weekly prevalence of all health problems. Firstly, we assessed new self-reported health problems from XPS. Secondly, we calculated the prevalence of new growth-related injuries, diagnosed by one of the researchers and registered in the clinical examination protocol. The formula used was: "*the number of new health problems or new growth-related injuries, divided by the number of completed OSTRC-H2 questionnaires",* for each respective week. Both prevalence calculations were performed with guidance of a statistician (LKBM) from Norwegian School of Sports Sciences (NIH).

To calculate the incidence of growth-related injuries, we followed the recommendations outlined in the IOC consensus statement (Bahr et al., 2020) and the football-specific extension provided by Walden et al. (2023). Regarding clinical examinations, we calculated the number of new diagnosed growth-related injuries per 1000 hours of exposure in training sessions and matches.

## *3.9 Ethics*

The study was conducted in compliance with ethical standards, and approval was obtained from the local ethics committee at the NIH on January $28^{th}$, 2022 (Appendix 3) and the Norwegian Centre for Research Data (NSD) on February $4^{th}$, 2022 (Appendix 4). Written informed consent (Appendix 5) was obtained from participants over the age of 16, and from the guardians of the younger participants, following the instructions from NIH and NSD. Personal data from the participants and their unique personal ID-number was anonymized and stored using a secure database at NIH.

# 4. Results

## 4.1 Participants

The invitation to participate was sent to 66 academy players and their guardians, which 58 accepted and were included in the study. During the 42-week study period, five of the players went on transfer to another football club, while one player withdrew from the study. The reason for withdrawal was complaints about the time spent filling in the weekly OSTRC-H2 questionnaire. This player left the project in March. The five remaining players transferred to another football club in February (1), May (2), and June (2). We included all player data before the transfers/withdrawal. A total of 52 players completed the data collection in the full study period. Demographic data regarding the players are presented in **table 1**.

***Table 1*** *Demographic characteristics at baseline and weekly training exposure for each player group. Age; mean (minimum-maximum). Stature, body mass and body mass index; mean (±SD). Weekly training exposure; mean (minimum-maximum).*

| Group | Number of players (n) | Age (years) | Stature (cm) | Body mass (kg) | Body mass index | Weekly training exposure (hours) |
|---|---|---|---|---|---|---|
| U-14 | 16 | 12.8 (12-14) | 160.9 ± 7.0 | 48.0 ± 8.2 | 18.4 ± 1.8 | 58.0 (0.0-130.5) |
| U-16 | 20 | 14.5 (14-16) | 167.6 ± 10.1 | 58.1 ± 13.4 | 20.8 ± 2.9 | 80.3 (0.0-120.0) |
| U-19 | 22 | 16.9 (16-19) | 178.1 ± 6.3 | 72.7 ± 6.7 | 22.9 ± 1.0 | 98.7 (15.0-192.0) |

## 4.2 Response to the questionnaire

During the study period, we received 2011 responses from the OSTRC-H2 questionnaires, resulting in an average weekly response rate of 91.4%.

## 4.3 Prevalence and incidence

The average weekly prevalence of self-reported health problems was 37%, while clinically diagnosed growth-related injuries had an average weekly prevalence of 12%. The overall injury incidence for growth-related injuries was calculated to be 4.6 injuries per 1000 training and match hours.

## 4.4 Growth-related injuries

A total of 37 examinations, with a clinical suspicion of a growth-related injury were performed. After the examinations, 31 injuries were classified as a growth-related injury, distributed among 21 (36,2%) players. Twelve players were diagnosed with one, eighth players with two and one player with three different growth-related injuries during one season.

We found seven different growth-related injuries in the cohort over the study period. Pubic apophysitis emerged as the most common injury, with a total of 10 diagnosed players (32.2%). Iliac crest apophysitis and ischium apophysitis were observed in two players each (6.4%), while AIIS apophysitis occurred in one player (3.4%). Osgood-Schlatter disease was affecting five players (16.1%), and Sinding-Larsen-Johansson syndrome was present in three players (9.7%). Sever´s disease was found in eight players (25.8%). Key numbers from each growth-related injury are illustrated in **figure 1** and **figure 2**.


***Figure 1.*** *Overview of growth-related injuries, categorized by diagnosis, number of cases (n=), player age at the onset of injury (mean ± range) and pain level during training measured by VAS-scale (mean ± SD). This figure was modified by the master student with permission from Thomas Brekke Sæteren, the Football Association of Norway.*

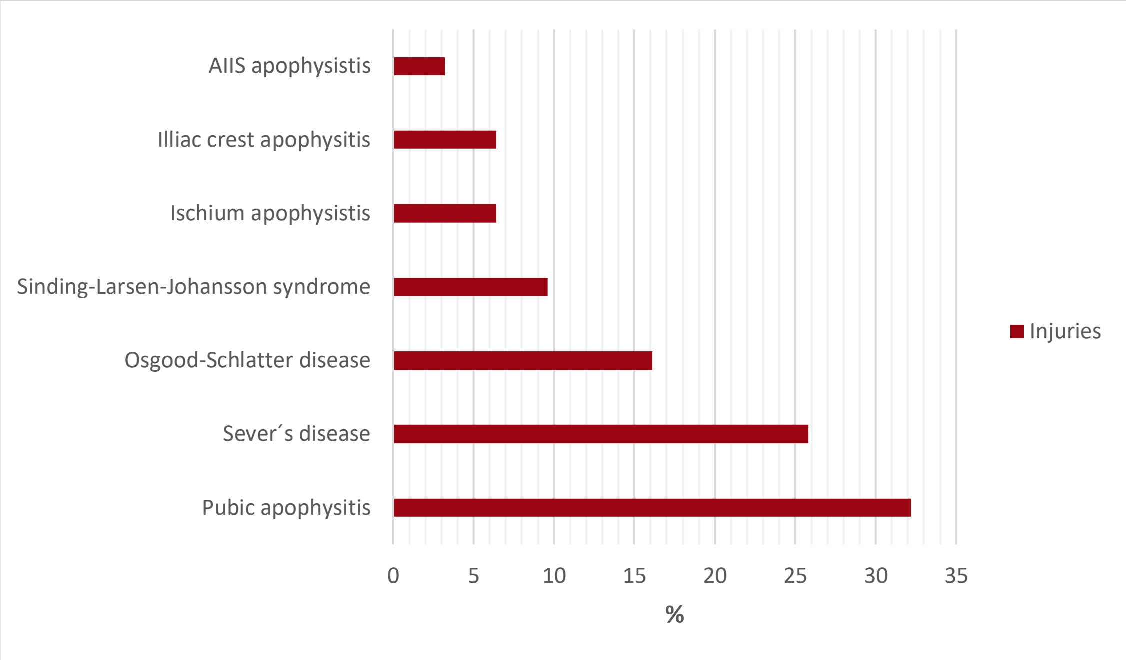


***Figure 2.*** *An overview of the percentage of the growth-related injuryies (n=31).*

## 4.5 Mode of onset

Among the growth-related injuries, 77.4% experienced gradual onset, 13% acute onset and 9.6% repetitive sudden onset. The mode of injury onset varied among the players, with 81% of the cases occurring during training, 13% during matches, and 6% not related to football activities.

During the study period, the onset of 22 of the growth-related injuries was recorded, whereas nine players experienced the onset of symptoms prior to the start of the study. In the U-14 group, the highest number of onset of symptoms occurred in March, with four growth-related injuries emerging within a single month. The U-16 and U-19 groups each had a maximum of one growth-related injury onset per month throughout the entire study period. An overview of the onset of growth-related injuries during the season is presented in **figure 3**. Players mean age at the onset of symptoms are illustrated for each diagnosed growth-related injury is illustrated in **figure 4**.

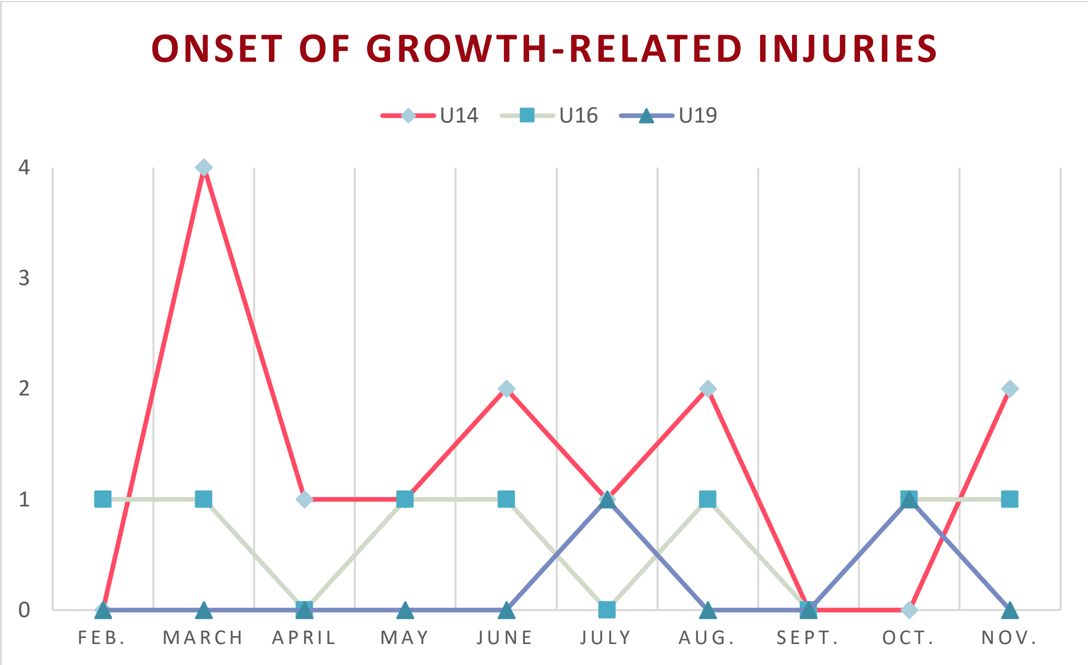


***Figure 3.*** *Monthly onset of growth-related injuries in each age group, represented by colored lines.*

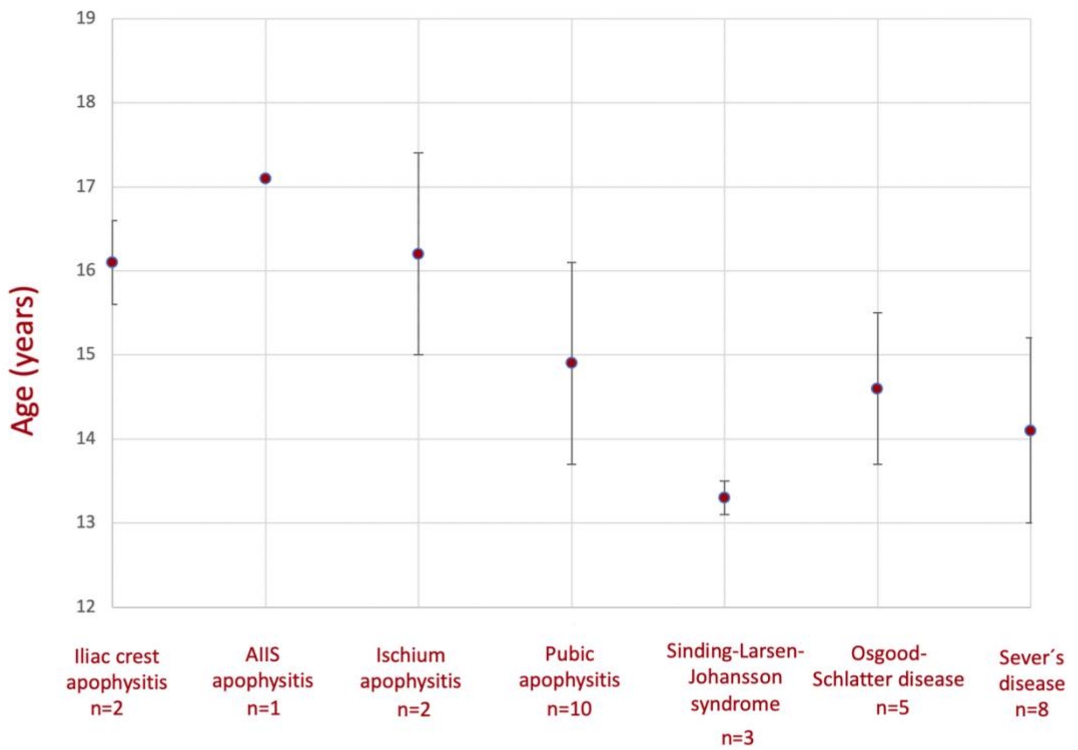


***Figure 4.*** *The plot shows chronological mean age when onset of symptoms. The error bars represent the standard deviation (SD).*

## 4.6 Growth

During the study period, the U-14 group experienced the greatest increase in average stature (7.9 cm) and body mass (6.2 kg), resulting in an increased body mass index (BMI) from 18.5 to 19.2. The U-14 group had the most pronounced increase in stature and body mass during the period from July to August, with an increase of 2.6 cm in stature and 2.3 kg in body mass. The U-19s had significantly lower monthly physical development characteristics and incidence of growth-related injuries than the younger age groups. Their stature increased by 1.0 cm and the body mass by 0.4 kg. See **figure 5** and **figure 6** for an overview of all age groups regarding monthly stature and body mass.

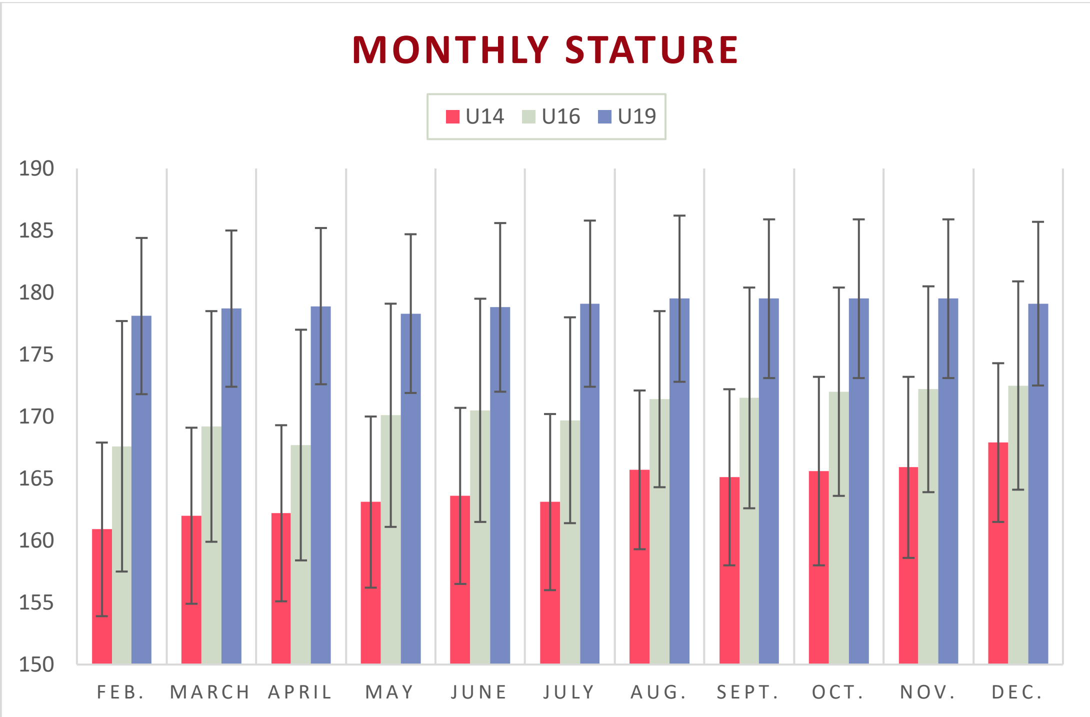


***Figure 5.*** *Stature of all age-groups presented in monthly mean stature in centimeters (cm) through one season. The colored lines represent each age-group, and the error bars represent the standard deviation (SD).*

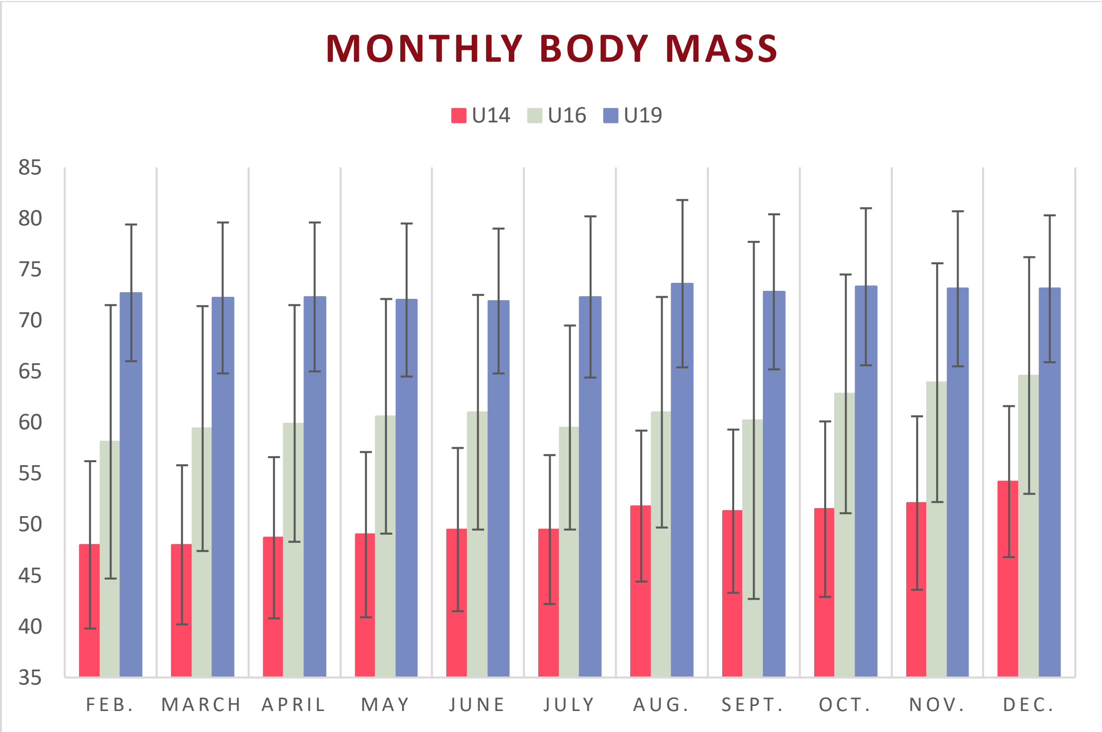


***Figure 6.*** *All age-groups presented with monthly mean body mass in kilograms (kg) through one season. The colored lines represent each age-group and the vertical error bars represent the standard deviation (SD).*

Regarding players diagnosed with a growth-related injury, the U-14 group had an overall growth of 5.3 cm during the study period. March was the month of the most rapid growth 1.0 $\pm$ 0.8 cm. The U-16s grew 4.6 cm, with the peak of growth in July of 0.9 $\pm$ 1.4 cm. The growth for the U-19s during the study period was 0.9 cm, with the period of most rapid growth during March, with 0.5 $\pm$ 0.8 cm. Monthly growth during the entire study period is presented in **Figure 7**.

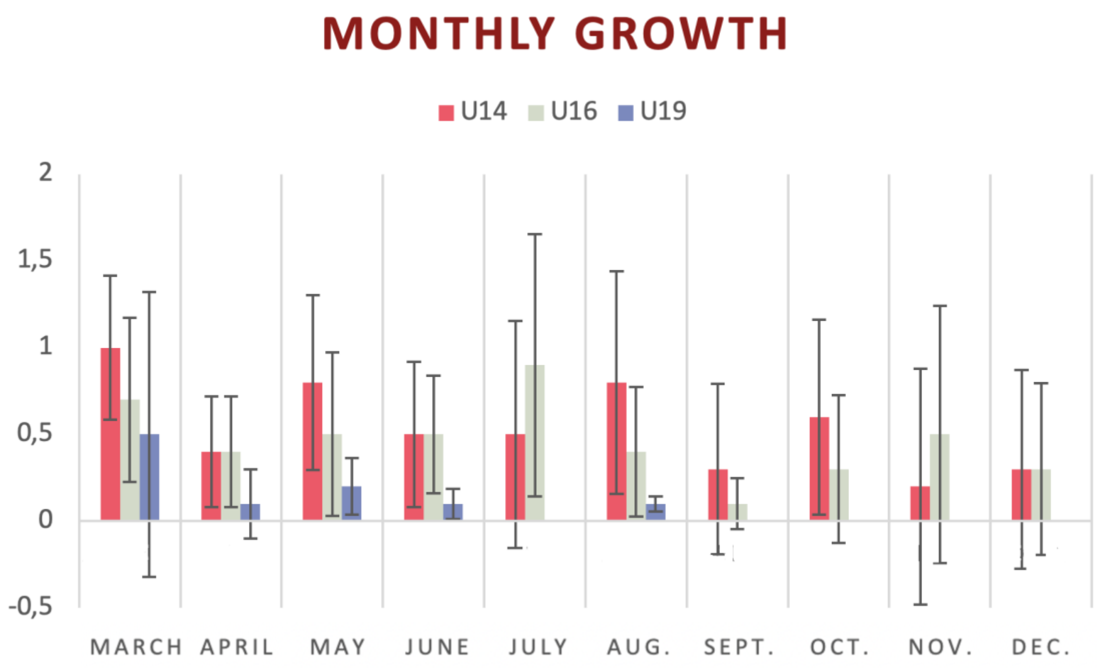


***Figure 7.*** *Monthly mean growth for all players diagnosed with a growth-related injury during the study period, separated into age-groups. The y-axis shows the players´ monthly mean growth in centimeters (cm), while the x-axis represents the months of the study period. The colored bars represent the players monthly mean growth, while the vertical error bars illustrate the standard deviation (SD).*

At baseline, players who were diagnosed with a growth-related injury during the season had a mean chronological age of 14.2 ± 1.4 years (ranging from 11.8 to 17.6), a stature of 166.4 ± 10.0 cm (ranging from 149.1 to 187.6), and a body mass of 55.2 ± 13.1 kg (ranging from 34.6 to 81.7).

## 4.7 Pain

Among the seven growth-related injury diagnosis, AIIS apophysitis was reported as the most painful, with a VAS score of 5.6. Iliac crest apophysitis followed with an average VAS score of 3.8. Players experiencing Sinding-Larsen-Johansson syndrome and Osgood-Schlatter disease reported average VAS score of 3.7 and 2.5, respectively. The average VAS score for pubic apophysitis was 2.4, while Sever´s disease scored 1.7. Ischium apophysitis was reported as the least painful growth-related injury, with an average VAS score of 1.6. **Figure 8** provides an overview of the players´ pain levels using the VAS.

The standardized examination protocol used in the study showed that most players reported “sharp” or “stabbing” pain (45.1%) as their main symptom describing growth-related injuries.

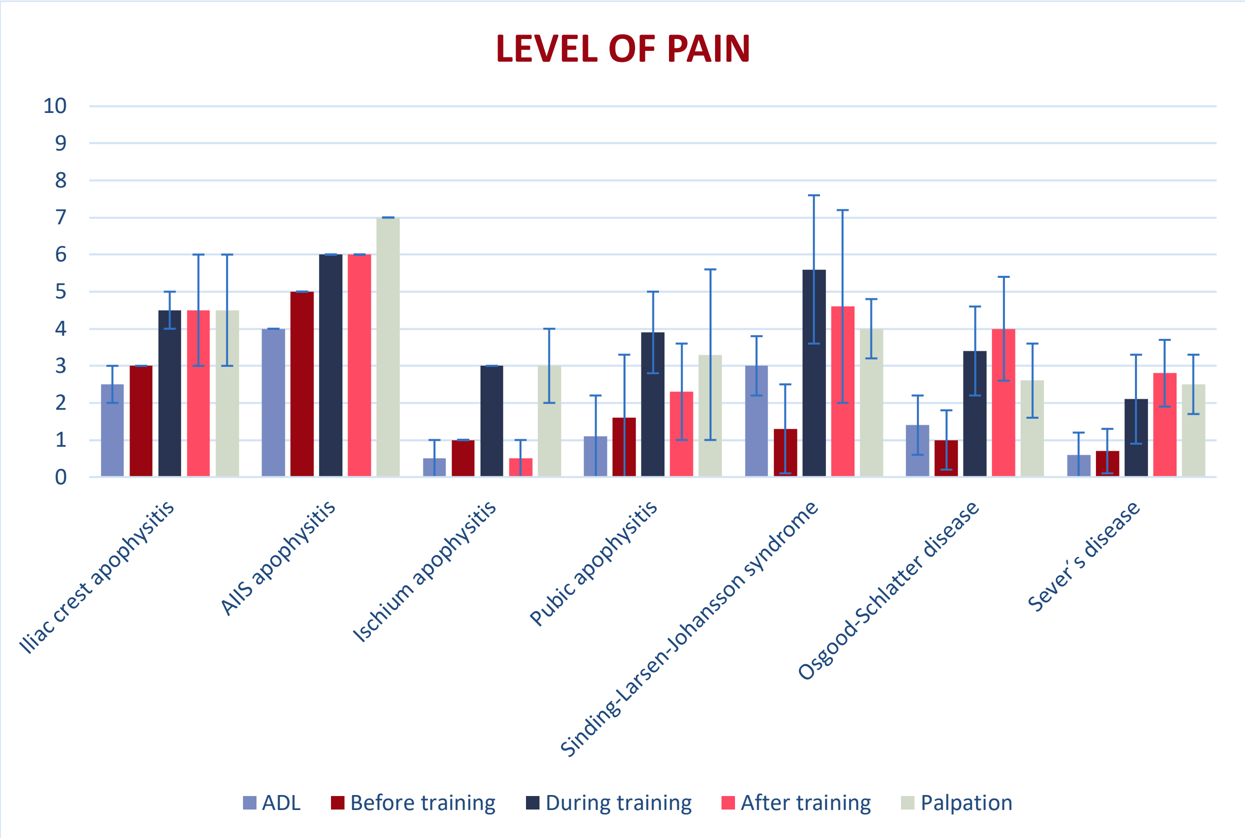


***Figure 8.*** *The colored bars represent the players self-reported mean level of pain for each diagnosis from the VAS-scale, scored from 0 to 10 in ADL, before-, during- and after football training and clinical palpation. The vertical error bars represent the standard deviation.*

## 4.8 Leg dominance

The right leg was dominant in 90.3% of the players with a growth-related injury, while the left leg was dominant in 9.7% of the cases. **Table 2** provides data on the affected side for all growth-related injuries.

***Table 2.*** *Dominant vs. Non-dominant vs. Bi-lateral sides of symptoms for all growth-related injuries.*

| Diagnosis | Dominant | Non-dominant | Bi-lateral |
|---|---|---|---|
| **Iliac crest apophysitis** | 1 | 0 | 1 |
| **AIIS apophysitis** | 1 | 0 | 0 |
| **Ischium apophysitis** | 0 | 1 | 1 |
| **Pubic apophysitis** | 5 | 2 | 3 |
| **Sinding-Larsen-Johansson syndrome** | 2 | 1 | 0 |
| **Osgood-Schlatter disease** | 2 | 0 | 3 |
| **Sever´s disease** | 2 | 2 | 4 |

# 5. Discussion

This master thesis aimed to investigate the characteristics, prevalence, and incidence of growth-related injuries in the lower extremities of boys' academy football players. The key findings revealed an average weekly prevalence of clinically diagnosed growth-related injuries of 12%, as well as an overall injury incidence of 4.6 injuries per 1000 training and match hours. Another noteworthy finding was the high number of diagnosed pubic apophysitis cases, accounting for 32.2% of all growth-related injuries.

## *5.1 Prevalence and incidence*

In our study, we reported clinically diagnosed growth-related injuries with an average weekly prevalence of 12%. However, comparing these findings to other research papers is challenging due to the lack of specificity regarding the type of physis injuries in most literature (Materne et al., 2022). Nevertheless, Materne et al. (2022) investigated various physis injuries, including apophyseal, physeal, epiphyseal, and others, in youth football academy players. They observed that apophyseal injuries accounted for 85% of the cases. It is worth noting that their study recorded apophyseal injuries in both upper and lower limbs, while our focus was only on the lower extremities. However, the majority (90%) of apophyseal injuries in their study affected the lower limbs, making the investigation of upper limb apophyseal injuries in football academy players less relevant.

Materne et al. (2022) revealed a prevalence of 84% for apophyseal injuries, which is notably higher than the prevalence reported in our and other studies (Price et al., 2004; Le Gall et al., 2006; Read et al., 2018; Hall et al., 2020). The reason our results differed from Materne et al. (2022) may be attributed to the larger sample size and a longer period of data collection in their study. The other studies reported a range of 4.5% to 14% for overall prevalence of time-loss growth-related injuries. Our findings align more closely with these studies, indicating an average weekly prevalence of 12%. Similarly, in a study by Leppanen et al. (2019) focusing on youth football, a similar prevalence of 12.8% was reported, although their study included both genders and encompassed all overuse problems. Another reason higher prevalence reported by Materne et al. (2022)

may be attributed to their inclusion of all types of non-time loss injuries, which were not considered in the other studies. Additionally, Materne et al. (2022) specifically examined a broader spectrum of apophyseal injuries, whereas previous studies focused on a more limited number of specific apophyseal injuries. Moreover, the increasing professionalism in youth football over the past decade, leading to greater physical demands in terms of speed and strength (Hostrup & Bangsbo, 2023), could contribute to increased stress on the apophyseal growth plates (Jones et al., 2019). Additionally, the combination of full-time training and early sports specialization before the onset of puberty may contribute to higher injury rates in youth football (Jones et al., 2019). This may help explain the higher prevalence observed in Materne et al. (2022) compared to other earlier studies (Longo et al., 2016; Jones et al., 2019).

Regarding injury incidence, it is recommended by the IOC consensus statement and football extensions to report it as "per 1000 player hours" and distinguish between training, match, and total exposure (Bahr et al., 2020; Walden et al., 2023). In our study, we observed an overall injury incidence of 4.6 growth-related injuries per 1000 training and match hours. This aligns with Materne et al. (2022), who reported a similar incidence of 4.5 per 1000 hours for lower limb apophyseal injuries. However, they did not include individual exposure time, which makes it challenging to compare incidence with other studies, who have reported incidence as “per 1000 players hours”, as recommended (Bahr et al., 2020; Walden et al., 2023). Furthermore, our study did not further break down the incidence by diagnosis, body sections, or age groups, as done in their project. Compared to earlier research papers, our study reported a higher injury incidence. Previous papers have reported injury rates ranging from 0.4 to 4.7 (Price et al., 2004; Le Gall et al., 2006; Read et al., 2018).

The varying prevalence rates highlight the importance of the methodology and research focus when studying growth-related injuries in youth football. Standardizing the calculation of injury incidence rates as “per 1000 player hours” (Bahr et al., 2020; Walden et al., 2023) is important for facilitating comparisons with other studies and ensuring consistency in reporting.

### 5.1.1 Health problems

The average weekly prevalence of self-reported health problems in our study was 37%. However, we did not categorize the severity or analyze the characteristics of these health problems, as the main focus of this master's thesis was on the prevalence of clinically diagnosed growth-related injuries. It´s worth noting that Moseid et al. (2017) described a prevalence of 43% in high-level youth athletes, which is comparable to our findings. It´s also important to acknowledge the limitations associated with self-reported health problems (Steene-Johannessen et al., 2018). These limitations were present in our study as well, including potential misinterpretation of questions and recall bias reported by the players. For instance, some players were unsure about the exact date of onset of their health problems, while others reported symptoms in the pelvic, whereas clinical examination revealed pain only in the groin.

### 5.1.2 Growth-related injuries

We identified pubic apophysitis as the most occurring growth-related injury among the cases detected in our study, with a total of 10 (32.2%) players affected. Similar studies have also reported high rates of this diagnosis (Materne et al., 2022). However, pubic apophysitis has often been overlooked as a potential cause of groin pain in athletes (Sailly et al., 2015). The mean age of onset for pubic apophysitis in our study was 14.9 years (13.1-17.1), which is relatively young compared to the peak incidence reported by Materne et al. (2022) in the U-17 age group. Moreover, the characteristics of the study populations, including the geographical location and ethnicity (Sakai et al., 2010), may have influenced the observed age differences, as Materne et al. (2022) collected data from a Middle Eastern country, while our study collected data from a country in Northern Europe. Considering the biomechanical demands placed on the apophyseal growth plates in the groin area, further investigation of groin pain in young footballers is warranted (Weel et al., 2022).

Iliac spine apophysitis, the most common growth-related injury reported in a group of 178 male youth athletes over five seasons (Martinez-Silvan et al., 2021), was diagnosed in only two players in our study. Ischium apophysitis was detected on two occasions, representing 6.4% of all growth-related injuries, while Wik et al. (2021) reported an occurrence of 0.5%. AIIS apophysitis and avulsion fractures have been frequently reported in youth footballers (Materne et al., 2022). This is not surprising considering the proximal attachment of the rectus femoris muscle, which is regularly engaged during kicking and running activities (Materne et al., 2022). In our study, we identified one player with AIIS apophysitis during the season. AIIS was the most frequently avulsed apophysis and the second most diagnosed apophysitis in the study by Materne et al. (2022). While our results differ from the literature, this divergence may be due to the shorter duration of our study compared to multi-season studies. Ideally, data collection regarding injury occurrence should span a longer period, as recommended by Nielsen et al. (2019). Changes in training methods and increased physical demands in football, such as higher intensity, could also contribute to variations in the characteristics and frequency of injuries (Hostrup & Bangsbo, 2023; Martins et al., 2023).

Osgood-Schlatter disease being the most common growth-related knee injury in both our study (62.5%) and Materne et al.'s (2022) study (78%) suggests a similarity in the prevalence of this condition. The mean age of players diagnosed with Osgood-Schlatter disease in our study (14.6 years) aligns closely with the findings of de Lucena et al. (2011), who reported a mean age of 13.7 years. The slightly lower results in de Lucena et al. (2011) could be attributed to the inclusion of both sexes in their study, as girls tend to receive the diagnosis at an earlier age (Laudenhauf et al., 2020). Furthermore, the peak incidence of Osgood-Schlatter disease in the U-14 age group reported by Materne et al. (2022) corresponds well with our findings. These similarities in age distribution and peak incidence suggest consistency among the studies regarding the onset and prevalence of Osgood-Schlatter disease. Additionally, we noted a higher number of injuries for Sinding-Larsen-Johansson syndrome, accounting for 37.5% of the cases, compared to Materne et al. (2022), who reported a lower percentage of 16%. The age range for Sinding-Larsen-Johansson syndrome is typically between 10 and 15 years (Arnold et al., 2017). In our study, the mean age of occurrence for this condition was 13.3 years, which falls within the reported age span. This difference from Materne et al. (2022) and our study could be attributed to the difference in player sample size in between the studies.

In our study, eight players were diagnosed with Sever's disease, and it was interesting to note that 50% of the cases exhibited bilateral symptoms during the season. All players reported experiencing pain in the medial aspect of the calcaneus during running activities. A long-term observation conducted at a German youth football academy by Belikan et al. (2022) reported 22 cases of Sever's disease, with 90.1% being unilateral and only 9.9% being bilateral. The reasons for these differences may be due to variations in diagnostic criteria. It's worth mentioning that Belikan et al. (2022) did not provide specific details about all the clinical examination tests, except for the "squeez test" involving medial and lateral compression of the heel. In our clinical examination protocol (Appendix 2), we included palpation of both the medial and lateral aspects of the calcaneus but did not incorporate the "squeez test”. In contrast, a review conducted by Micheli & Ireland (1987) on 85 youth athletes with Sever's disease found that 61% reported pain in both heels, which aligns more closely with our findings. Furthermore, we observed a lower mean age of 14.1 years (range: 12.4-16.1) for Sever's disease, which is consistent with findings from other studies such as Martinez-Silvan et al. (2021), Belikan et al. (2022) and Materne et al. (2022).

The U-14 players in our study were the youngest group, and they accounted for the highest number of growth-related injuries, with a total of 17 (54.8%) injuries during the study period. This percentage surpasses the combined number of growth-related injuries in the U-16 and U-19 groups, which were ten (32.2%) and four (12.9%) respectively. These findings align with existing literature that has examined age groups ranging from U-9 to U-23, indicating a higher occurrence of growth-related injuries in younger age groups (Hall et al., 2022). It´s important to highlight that growth-related injuries are less commonly observed in age groups from U-15 and older, where muscle injuries tend to be more prevalent (Hall et al., 2020). If our study had included younger teams, there would have been a higher likelihood of detecting a greater number of growth-related injuries. However, it's worth noting that growth-related injuries may still occur at older ages, as evidenced by the findings of Sailly et al. (2015), who detected apophyseal immaturity up to the age of 26 years.

In our study, out of a total sample size of 58 players, 37 players (64%) were not diagnosed with a growth-related injury. This lower injury rate may be due to the club's implementation of load management strategies, which are critical in preventing injuries in sports (Gabbett, 2016; Soligard et al., 2016; Dalen-Lorentsen et al., 2021). High-level football academies should employ progressive training methods and gradually expose players to intense training sessions and high intensity matches over the course of a season (Hostrup & Bangsbo, 2023). This approach appears to have a protective effect against injuries (Soligard et al., 2016). The club's load management strategies, including training volume and intensity, may have played a role in reducing the numbers of growth-related injuries among the players. Further research on the specific load management strategies employed by the club would provide valuable insights.

Several findings from our study on growth-related injuries differ from the literature, possibly due to methodological factors such as study population characteristics, sample size, duration of the study period, clinical examination methods, and diagnostic criteria.

### 5.1.3 Mode of onset and pain

For sports clinicians involved in injury prevention, it is crucial to have knowledge of injury mechanisms and the mode of onset for various types of injuries (Bahr & Krosshaug, 2005). Gradual onset is particularly common in growth-related injuries (Jacobsson et al., 2013; Sailly et al., 2015). In our study, 77.4% of all growth-related injuries were reported by the players as having gradual onset, indicating the use of prevalence calculations for this group (Bahr, 2009).

The onset of growth-related injuries was higher during the first months of the study period in our research. This finding aligns with earlier studies that have observed a higher incidence of injuries and increased injury risk in football during the pre-season (Woods et al., 2002; Walden et al., 2005). Additionally, the risk of re-injury is greater during the pre-season (Walden et al., 2005). This could be attributed to higher training intensity during pre-season and reduced training intensity during the competitive season, where the focus shifts towards tactics and recovery after matches (Walden et al., 2005). Coaches should anticipate a higher occurrence of injuries during the pre-season (Brito et al., 2011). It is important for coaches, alongside the medical staff, to play a significant role in reducing the injury risk in football players (Owoeye et al., 2020). However, there is often a gap between coaches' understanding of injuries and prevention in youth football (McKay et al., 2014). Therefore, effective internal communication between coaches and medical staff within teams is crucial for injury prevention (Ekstrand et al., 2019a). Moreover, reduced aerobic fitness among players during the off-season is common, which increases the risk of injury at the start of the pre-season (Watson et al., 2017). Implementing interventions to promote aerobic fitness during the off-season may help reduce the injury risk among football players during the pre-season (Watson et al., 2017).

To our knowledge, the level of pain in growth-related injuries according to the VAS scale is not documented in research papers, possibly due to individual variability in scoring pain intensity and the vagueness of the score (Elfving et al., 2016). These findings suggest that pain level may not provide superior information for football players with growth-related injuries. However, in our study, 45.1% of the players experiencing a growth-related injury described the pain as "sharp" or "stabbing." This aligns with previous studies that categorized pain originating from a bony structure as "deep" and "sharp" (El-Tallaway et al., 2021).

Coaches and medical staff within youth football academies should closely monitor players who report a gradual onset of symptoms, ¨characterized as "sharp" pain, particularly during the pre-season (Walden et al., 2005). This type of pain may indicate the presence of underlying growth-related injuries and requires appropriate medical attention.

### 5.1.4 Leg dominance

The leg dominance of players has been associated with an increased risk of injury in sports, attributed to the higher demands placed on the dominant leg during activities such as kicking, running, and jumping (Murphy et al., 2003). However, the relationship between leg dominance and injury risk appears to vary across different sports and types of injuries (Murphy et al., 2003). In the context of apophysitis, Doral et al. (2005) proposed that the dominant kicking leg could be an underlying factor. In our study, 13 players (41.9%) experienced symptoms in their dominant leg, while 6 players (19.3%) experienced symptoms in their non-dominant leg. Furthermore, 12 players (38.7%) had symptoms in both legs. This pattern differs for different diagnoses. Ceylan & Caypinar

(2018) reported Sever's disease to be dominant both legs, which aligns with our findings with 25% in the dominant leg, 25% in the non-dominant leg and 50% in both legs. Nonetheless, the relationship between leg dominance and the development of growth-related injuries in youth football remains unclear.

## 5.2 Growth and maturation

The term "growth" refers to changes in stature, body mass, and BMI (Wik, 2021). Monitoring growth and injuries is crucial for developing effective prevention programs in youth sports (Wik, 2021). Studies have suggested that a growth rate exceeding 0.6 cm in stature per month increases the risk of injury in young athletes (Kemper et al., 2015). Rapid growth and skeletal maturation in youth athletes are associated with a higher risk of growth plate injuries (Wik et al., 2020; Wik, 2021). This explains the lower number of growth-related injuries observed in the U-16 and U-19 age groups in our study. We found that the U-14 group experienced both the highest number of growth-related injuries and a period of rapid growth during the first month of the study. On average, they grew 1.0 cm during the period from February to March, indicating an increased risk of injury on group level during that time (Kemper et al., 2015). There is no association between the risk of injury and changes in body mass or BMI (Wik, 2021). However, a correlation has been found between growth spurt and apophyseal injuries in sports (DiFiori et al., 2014). Peak height velocity (PHV), which represents the period of maximal growth during adolescence, is followed by a deceleration in growth rates (Wik, 2021). This period varies among individuals (Wik, 2021). Girls usually attain their adult stature height around the age of 16, while boys reach it around the age of 18 (Wik, 2021). However, some individuals may not reach their adult height until the age of 20 (Wik, 2021).

Young high-level football players often compete against stronger, faster, and older opponents (Jones et al., 2019). This was a regular for players in our research project and may have influenced the injury rates. When a player is proposed to play against older opponents, the medical and technical staff within a youth football academy should discuss the player's growth phase and the players ability to cope with the physical demands (Jones et al., 2019).

The monitoring of growth and injuries is vital in youth sports, as rapid growth and skeletal maturation increase the risk of apophyseal injuries. Coaches of young football players facing older opponents should consider the player's growth phase and their capacity to manage the physical demands.

## 5.3 Treatment

In our study, all players with growth-related apophyseal injuries received conservative treatment, including individualized training programs and activity modification, which is typically effective (Longo et al., 2016). We provided comprehensive guidance on injury mechanisms, prognosis, growth, and pain management to players, coaches, and guardians. However, an important limitation was observed in player compliance to treatment, as two players with pubic apophysitis sought acupuncture treatment based on recommendations from their guardians. There is no evidence supporting this treatment for growth-related injuries to our knowledge. This uncontrolled treatment approach and lack of compliance and communication may result in increased time loss for the players (Belikan et al., 2022). It is important to address this issue to ensure better control and management of growth-related injuries among players.

## 5.4 Response to the questionnaire

We achieved a high average weekly response rate of 91.4% from 58 academy youth football players in relation to the OSTRC-H2 questionnaire. This indicates a strong compliance from the players in participating in the study. Our findings align with Leppanen et al. (2019), who used the OSTRC-O questionnaire to assess overuse injuries in a similar population and achieved a response rate of 95%. We believe that our approach of weekly monitoring and sending individual text messages to non-respondents has played a significant role in achieving such a high response rate. It is worth mentioning that one player withdrew from the study early on, due to time spent filling in the questionnaire as the reason. However, the majority of players reported that the questionnaire was not time-consuming, especially when they had no health problems to report, thanks to the gatekeeper logic implemented from Clarsen et al.

(2020). This logic likely contributed to the overall high response rate, and we recommended to use it for the OSTRC-H2 questionnaire.

## *5.5 Methodological considerations*

### 5.5.1 Injury definition

Using the "all health problems" definition for injury reporting presents certain limitations. It may cause minor issues, such as players reporting regular muscle soreness as a health problem, which is a normal consequence of high training loads (Clarsen et al., 2013). Players may have reported such instances as health problems, leading to an overestimation of the prevalence of injuries in our study and introducing a source of systematic bias. Conducting physical examinations to confirm or rule out health problems could have provided a solution. However, due to limited resources, it was not feasible within the scope of our study.

Another limitation of this definition is the importance of detecting a high response rate from participants (Clarsen et al., 2013). Motivating players to fill in the questionnaire can be time-consuming. Nonetheless, in our study, we achieved a high response rate, with 91.4% of players actively participating in the data collection process.

### 5.5.2 Exposure

According to Walden et al. (2023), it is recommended to record the exact exposure time for each player, rather than just the number of sessions in training and matches. In this study, we collected data on the exact exposure time during matches, which allowed us to calculate the incidence per 1000 player hours. However, for training, we only collected the number of sessions, which is a limitation. Additionally, we only collected data on organized activity, but ideally, all exposure aimed at improving physical condition, skill, and performance should have been monitored (Walden et al., 2023). Another limitation is that we did not use any objective tracking technology, which is recommended in professional football (Walden et al., 2023).

During the pre-season, friendly matches within the same club occasionally took place when opponent`s clubs canceled the matches. The exposure hours from these matches should have been removed from the data analysis (Walden et al., 2023). Some players also had international team duties, and the Norwegian national youth teams used XPS for data collection. We included these data in the analysis, following the recommendations by Walden et al. (2023). However, exposure from one player who was called up and played for another foreign national youth team was not included, which is a weakness regarding the injury overview.

Furthermore, it is recommended to subcategorize training exposure into football-specific training, pre-match warm-up, strength and conditioning, and other training (Walden et al., 2023). In our study, we did not categorize training exposure according to these recommendations. However, we did follow the recommendations by not including rehabilitation sessions as training exposure since they are part of the injury or illness duration (Walden et al., 2023).

In our study, there were five players who were regular hosts at the football academy and owned by a broadside club. The remaining 53 players were part of the football club at full-time. The hosts did not train regularly with the youth football academy during the study period. The five hosts were part of the U-14 group. The training and match exposure from the broadside clubs were not registered in XPS for these players, which created a gap in the data collection and made the exact exposure data incomplete.

The academy coaches routinely register training and match exposure data in XPS during the season. However, during the data analysis, we detected some errors in the registration of exposure by the coaches. For example, an injured player who was not participating in training with his team was registered in team training sessions. The staff reported that this may have been due to reporting errors by the coaches, which could affect the results of our study. These reporting errors by the coaches were acknowledged, and efforts were made to exclude obvious mistakes during data analysis in order to minimize their impact on the study results.

These methodological considerations highlight both the strengths and limitations of our study's approach to capturing exposure data and the challenges encountered in data collection and analysis.

### 5.5.3 Stature and body mass measurements

Stature and body mass measurements were conducted for all academy players and hosts on a monthly basis, immediately after football practice. Planning these measurements were challenging, as coaches occasionally changed the practice time and location on the same day as the scheduled session. However, the club had invested in portable measurement tools, allowing flexibility to collect data at alternative locations. During each measurement session, some players were absent. Efforts were made to schedule them for a new session, but some were unable to attend due to reasons such as vacation, illness, national team commitments, or hosts playing with other football clubs. Nevertheless, a majority of the missing players who were initially absent during the measurement sessions were able to attend a new session when requested.

### 5.5.4 Clinical examination protocol

The clinical examination protocol (Appendix 2) was developed before the study period to ensure consistency in player examinations. We adapted a protocol example from a previous study on groin injuries and adjusted it, making it to suitable our project. A meeting was conducted with the research team to review the protocol for quality assurance before implementation. One notable strength of the protocol was the agreement among all authors regarding the medical history questions to be asked and the clinical tests to be performed.

However, during the study period, several weaknesses were identified. We encountered difficulties in capturing data on organized team training, school training, and individual training, as the protocol didn’t differ between them. Additionally, several players questioned whether games were included in organized team training or not. To address this, we recommend adding a dedicated section for recording the number of games per week when collecting data on training and match exposure in the clinical assessment protocol.

The protocol provided two options for indicating the onset of symptoms: “during training” or “during match”. However, these options did not fit all types of injuries, and it would have been beneficial to include an additional option, titled “other”. Furthermore, a question in the protocol asking about previous diseases should be more specific, as players or their guardians were uncertain about the question's objective concerning the severity of the disease.

In several cases, players experienced bilateral symptoms following a growth-related injury, with varying levels of pain on the VAS between the right and left sides. The most symptomatic side was recorded, as the examination protocol only allowed for reporting of one side. To address this limitation, we suggest providing separate boxes for the right and left sides on each clinical test or filling out two examination protocols, one for each symptomatic side. Additionally, the palpation of the trochanter minor should not have been included in the protocol due to its anatomical locations.

The clinical examination protocol was completed only once for each growth-related injury. However, if a player reported a longer period of absence from growth-related injury symptoms according to the OSTRC-H2 questionnaire and later experienced a recurrence in the same area, we summoned the player for a new clinical examination to determine whether it was the same earlier diagnosed growth-related injury or not. We did not fill out a new examination protocol for players with a recurrence of the same growth-related injury. Occasionally, players initially diagnosed with a unilateral growth-related injury later reported bilateral symptoms. In such cases, they were summoned for a new clinical examination as well. Although we did not fill out a new examination protocol for cases of bilateral growth-related injury, we made a note in the data analysis. However, this approach has limitations, as other symptoms and clinical findings may have changed in the period from a unilateral to bilateral growth-related injury. To address this weakness, a new clinical examination protocol should have been completed on both occasions. Nonetheless, the anamnesis and clinical findings were documented in Physica, the journal system used in the football academy. One potential solution would be to extract data from Physica and incorporate it into the data analysis before performing calculations.

To facilitate data analysis, we initially filled out the examination protocol using pen and paper, as it was easy to implement. When the data collection was completed, we transcribed the information into an electronic Microsoft Excel sheet, which proved more efficient for analysis but was time-consuming.

As mentioned, there are several weaknesses to the clinical examination protocol. However, these weaknesses give the opportunity to learn from it and corrugate them if the protocol will be used again if future projects. The reproducibility of the gathered data is high, since only one of the researchers performed all the clinical examinations. This would have been lower if more researchers were involved.

### 5.5.5 Lack of female players

When planning the research project, it´s important to note that there was no female academy at the club, which explains the absence of female football players in our study. Unfortunately, high-level female youth football players are underrepresented in sports medicine research, despite the fact that they face significant injury rates, particularly concerning the lower extremities (Costello et al., 2014; Wik, 2022; Horan et al., 2023). In fact, there are higher rates of injuries among girls in younger age groups (Le Gall et al., 2008). One possible explanation is the earlier growth spurt experienced by girls compared to boys (Carrascosa et al., 2018).

The lack of representation of women in sports science, along with the higher occurrence of physeal injuries in boys, may be contributing factors to the limited evidence available (Perron et al., 2002; Horan et al., 2023). It´s worth noting that research on injury rates and age-related patterns is primarily focused on boys (Wik, 2022). However, a recent study by Beech et al. (2022) revealed that injury incidence and burden in female youth football players were highest among the U-16 group and increased with age. This finding differs between studies, as another study reported a higher injury incidence among U-15 girls compared to U-19 girls (Le Gall et al., 2008).

Injuries have a greater impact on performance and participation in girls` sports compared to boys` sports (Richardson et al., 2017). Shockingly, injuries occur to almost half of all female players within a week (Richardson et al., 2017).

The absence of female players in our study underscores the underrepresentation of high-level female youth football players in sports medicine research, despite their significant injury rates. Limited evidence and research focus on injury rates and age-related patterns in girls' football further contribute to the knowledge gap, emphasizing the need for more comprehensive studies to address the challenges faced by female athletes in sports medicine.

### 5.5.6 The student´s role in the club

This research project focuses on youth football players who are part of an academy in a club from the "Eliteserien" (Norwegian Men`s Premier League). It is important to note that the master student is also an employee within the club`s academy, working as a head academy physiotherapist, responsible for the U-14, U-16, and U-19 teams. As a result, the student has a dual role as a researcher and a professional clinician, which indicate responsibilities in project planning, ethics, data collection, analysis, and obtaining consent from players and guardians (Hay-Smith et al., 2016).

Engaging in research while being involved in the same organization can present challenges when aiming to improve the health of a specific population (Trondsen & Sandaunet, 2009). These challenges apply to both qualitative and quantitative research projects (Hay-Smith et al., 2016). However, informed consent (Appendix 5) was obtained from the guardians of players under the age of 16 and directly from the older players themselves, following approval from ethical committees (Appendix 3 & 4). Moreover, when sending the informed consent via email, the researchers emphasized that participation was voluntary and would not affect the player`s clinical follow-up during the season, regardless of their decision to participate in the project or not.

It has been observed that research conducted by staff involved in data monitoring can result in an increased reporting of milder injuries compared to non-researchers (Wik et al., 2019). In this particular research project, there is a potential risk of bias in data collection, as the master student, may report higher numbers of injuries as a clinician. However, the master student made efforts to remain impartial and neutral during clinical examinations when diagnosing growth-related injuries. It is crucial to recognize and alleviate these potential biases when interpreting the collected data in this study.

### 5.5.7 The Excellent Performance System (XPS)

During the study period, we encountered several limitations in the data collection process using XPS. Technical challenges were occasionally experienced, with players encountering difficulties in filling out the OSTRC-H2 questionnaire due to app-related issues. Some players reported symptoms in the wrong location, such as a player diagnosed with pubic apophysitis reporting symptoms from the hip or pelvic instead of the groin, indicating a lack of knowledge. To address this issue, we could have provided education to players and guardians before the start of our project, to ensure more accurate reporting.

Furthermore, there were occasions where players did not report health problems in the OSTRC-H2 questionnaire when they were absent from training due to health issues. This compromised the quality of data calculations and could be attributed to low compliance, reduced precision, and potential bias in self-reported data. Notably, the response rate was lower during holiday periods, highlighting the challenges of players engagement despite a high response rate generally observed with electronic solutions (Tabben et al., 2020). Additionally, there was a decline in response rate among players with long-term health problems or extended periods without health issues. It is also important to consider the possibility of recall bias in all players filling out the OSTRC-H2 questionnaire, as well as the potential for accidental registration of health problems. To minimize these errors, conducting interviews with players and guardians after the study period to assess their answers from the questionnaire could have been beneficial. However, the XPS app included a chat function, which facilitated easy communication between the players and researchers in case of any challenges or problems.

Moreover, the XPS system itself posed challenges during the research project, with extended loading times for pages and data analysis. These technical issues consumed additional time during the research process and impacted the effectiveness.

The XPS system has both strengths and limitations that need to be considered when deciding whether to use it for data collection or not.

## 5.6 Future directions

To prevent growth-related injuries, it is crucial to enhance knowledge and education among medical staff, coaches, players, and guardians in youth football (Longo et al., 2016), enabling them to recognize and be observant for common signs like gradual onset, common locations, and symptoms. Monitoring of growth in this group is easily implementable and can provide valuable insights, as an increase in stature over 0.6 cm in one month has been associated with a higher risk of injury (Kemper et al., 2015).

Further research is needed to explore growth-related injuries, particularly in youth female football, where little research has been conducted on this subject (Wik, 2022). Additionally, investigating the interaction between growth, maturity, and injury in this group should be a priority in future studies (Beech et al., 2022).

Pubic apophysitis, a diagnosis with high injury rates but limited literature, warrants further research and attention (Sailly et al., 2015; Materne et al., 2022).

Furthermore, this project has collected a substantial amount of data on growth-related injuries that can be further utilized in future analysis. This master project may work as a pilot, and therefore its limitation could be methodically valuable in planning of future research projects on growth-related injuries.

# 6. Conclusion

In conclusion, our study sheds light on the characteristics, prevalence, and incidence of growth-related injuries among high level boys' academy football players. We found pubic apophysitis as the most common injury. This finding highlights the importance in further investigation and research into this diagnosis. The U-14 group had the greatest numbers of growth-related injuries, indicating that awareness should be prioritized in younger age groups. The establishment of a consensus agreeing on guidelines and methods for reporting data on growth-related injuries in sports would facilitate future research efforts.

Overall, our findings indicate that growth-related injuries are a common issue for young football players and need to be closely monitored and managed. Future multi-season studies with larger sample sizes should focus on prevalence to provide a more comprehensive understanding of the occurrence and impact of growth-related injuries. By doing so, we can develop targeted injury prevention strategies and promote the long-term health and development of young football players.

# References


Achar, S., & Yamanaka, J. (2019, May 15). Apophysitis and Osteochondrosis: Common Causes of Pain in Growing Bones. *Am Fam Physician, 99*(10), 610-618. https://www.ncbi.nlm.nih.gov/pubmed/31083875

Akenhead, R., & Nassis, G. P. (2016, Jul). Training Load and Player Monitoring in High-Level Football: Current Practice and Perceptions. *Int J Sports Physiol Perform, 11*(5), 587-593. https://doi.org/10.1123/ijspp.2015-0331

Anduaga, I., Seijas, R., Perez-Bellmunt, A., Casasayas, O., & Alvarez, P. (2020, Feb). Anterior Iliac Spine Avulsion Fracture Treatment Options in Young Athletes. *J Invest Surg, 33*(2), 159-163. https://doi.org/10.1080/08941939.2018.1483447

Arnaiz, J., Piedra, T., de Lucas, E. M., Arnaiz, A. M., Pelaz, M., Gomez-Dermit, V., & Canga, A. (2011, Mar). Imaging findings of lower limb apophysitis. *AJR Am J Roentgenol, 196*(3), W316-325. https://doi.org/10.2214/AJR.10.5308

Arnold, A., Thigpen, C. A., Beattie, P. F., Kissenberth, M. J., & Shanley, E. (2017, Mar/Apr). Overuse Physeal Injuries in Youth Athletes. *Sports Health, 9*(2), 139-147. https://doi.org/10.1177/1941738117690847

Bahr, R., & Krosshaug, T. (2005, Jun). Understanding injury mechanisms: a key component of preventing injuries in sport. *Br J Sports Med, 39*(6), 324-329.

Bahr, R. (2009, Dec). No injuries, but plenty of pain? On the methodology for recording overuse symptoms in sports. *Br J Sports Med, 43*(13), 966-972. https://doi.org/10.1136/bjsm.2009.066936

Bahr, R., Clarsen, B., & Ekstrand, J. (2018, Aug). Why we should focus on the burden of injuries and illnesses, not just their incidence. *Br J Sports Med, 52*(16), 1018-1021. https://doi.org/10.1136/bjsports-2017-098160

Bahr, R., Clarsen, B., Derman, W., Dvorak, J., Emery, C. A., Finch, C. F., Hagglund, M., Junge, A., Kemp, S., Khan, K. M., Marshall, S. W., Meeuwisse, W., Mountjoy, M., Orchard, J. W., Pluim, B., Quarrie, K. L., Reider, B., Schwellnus, M., Soligard, T., Stokes, K. A., Timpka, T., Verhagen, E., Bindra, A., Budgett, R., Engebretsen, L., Erdener, U., & Chamari, K. (2020, Apr). International Olympic Committee consensus statement: methods for recording and reporting of epidemiological data on injury and illness in sport 2020 (including STROBE

Extension for Sport Injury and Illness Surveillance (STROBE-SIIS)). *Br J Sports Med, 54*(7), 372-389. https://doi.org/10.1136/bjsports-2019-101969

Balasundaram, P., & Avulakunta, I. D. (2022). Human Growth and Development. In *StatPearls*. https://www.ncbi.nlm.nih.gov/pubmed/33620844

Beech, J., Jones, B., King, R., Bennett, P., Young, S., Williams, S., Stokes, K., & Emmonds, S. (2022, Dec 1). The incidence and burden of injuries in elite English youth female soccer players. *Sci Med Footb, 6*(5), 605-615. https://doi.org/10.1080/24733938.2022.2051730

Belikan, P., Farber, L. C., Abel, F., Nowak, T. E., Drees, P., & Mattyasovszky, S. G. (2022, Feb 9). Incidence of calcaneal apophysitis (Sever's disease) and return-to-play in adolescent athletes of a German youth soccer academy: a retrospective study of 10 years. *J Orthop Surg Res, 17*(1), 83. https://doi.org/10.1186/s13018-022-02979-9

Bowen, L., Gross, A. S., Gimpel, M., & Li, F. X. (2017, Mar). Accumulated workloads and the acute:chronic workload ratio relate to injury risk in elite youth football players. *Br J Sports Med, 51*(5), 452-459. https://doi.org/10.1136/bjsports-2015-095820

Brito, J., Rebelo, A., Soares, J. M., Seabra, A., Krustrup, P., & Malina, R. M. (2011, May). Injuries in youth soccer during the preseason. *Clin J Sport Med, 21*(3), 259-260. https://doi.org/10.1097/JSM.0b013e31821a6025

Brooks, J. H., & Fuller, C. W. (2006). The influence of methodological issues on the results and conclusions from epidemiological studies of sports injuries: illustrative examples. *Sports Med*, *36*(6), 459-472. https://doi.org/10.2165/00007256-200636060-00001

Brukner, P., Clarsen, B., Cook, J., Cools, A., Crossley, K., Hutchinson, M., McCrory, P. Bahr, R., & Khan, K. (2017). *Clinical Sports Medicine Volume 1* (5th edition). McGraw-Hill Education (Australia) Pty Ltd

Bult, H. J., Barendrecht, M., & Tak, I. J. R. (2018, Dec). Injury Risk and Injury Burden Are Related to Age Group and Peak Height Velocity Among Talented Male Youth Soccer Players. *Orthop J Sports Med, 6*(12), 2325967118811042. https://doi.org/10.1177/2325967118811042

Caine, D., DiFiori, J., & Maffulli, N. (2006, Sep). Physeal injuries in children's and youth sports: reasons for concern? *Br J Sports Med, 40*(9), 749-760. https://doi.org/10.1136/bjsm.2005.017822

Caine, D., Purcell, L., & Maffulli, N. (2014). The child and adolescent athlete: a review of
three potentially serious injuries. *BMC Sports Sci Med Rehabil, 6*, 22. https://doi.org/10.1186/2052-1847-6-22

Caine, D., Meyers, R., Nguyen, J., Schoffl, V., & Maffulli, N. (2022, Apr). Primary Periphyseal Stress Injuries in Young Athletes: A Systematic Review. *Sports Med*, *52*(4), 741-772. https://doi.org/10.1007/s40279-021-01511-z

Carrascosa, A., Yeste, D., Moreno-Galdo, A., Gussinye, M., Ferrandez, A., Clemente, M., & Fernandez-Cancio, M. (2018, Sep). [Pubertal growth of 1,453 healthy children according to age at pubertal growth spurt onset. The Barcelona longitudinal growth study]. *An Pediatr (Engl Ed), 89*(3), 144-152. https://doi.org/10.1016/j.anpedi.2017.11.018 (Crecimiento puberal de 1.453 ninos sanos segun la edad de inicio de la pubertad. Estudio longitudinal de Barcelona.)

Carl R. (2012) Apophysitis and Apophyseal avlusion of the pelvis. *International Journal of Athletic Therapy & Training, 17(2)*, 5–9. https://doi.org/10.1123/ijatt.17.2.5

Ceylan, H. H., & Caypinar, B. (2018, Jul 27). Incidence of calcaneal apophysitis in Northwest Istanbul. *BMC Musculoskelet Disord*, *19*(1), 267. https://doi.org/10.1186/s12891-018-2184-6

Chan, C., Sohail, M. Z., & Buddhdev, P. (2021, Dec). Case report of combined iliac crest and ASIS apophysis avulsion fracture in an adolescent footballer. *J Surg Case Rep*, *2021*(12), rjab573. https://doi.org/10.1093/jscr/rjab573

Clarsen, B., Myklebust, G., & Bahr, R. (2013, May). Development and validation of a new method for the registration of overuse injuries in sports injury epidemiology: the Oslo Sports Trauma Research Centre (OSTRC) overuse injury questionnaire. *Br J Sports Med*, *47*(8), 495-502. https://doi.org/10.1136/bjsports-2012-091524

Clarsen, B., & Bahr, R. (2014). Matching the choice of injury/illness definition to study setting, purpose and design: one size does not fit all! *Br J Sports Med*, *48*(7), 510-512. doi:10.1136/bjsports-2013-093297

Clarsen, B., Ronsen, O., Myklebust, G., Florenes, T. W., & Bahr, R. (2014, May). The Oslo Sports Trauma Research Center questionnaire on health problems: a new approach to prospective monitoring of illness and injury in elite athletes. *Br J Sports Med, 48*(9), 754-760. https://doi.org/10.1136/bjsports-2012-092087

Clarsen, B., Bahr, R., Myklebust, G., Andersson, S. H., Docking, S. I., Drew, M., Finch, C. F., Fortington, L. V., Haroy, J., Khan, K. M., Moreau, B., Moore, I. S., Moller, M., Nabhan, D., Nielsen, R. O., Pasanen, K., Schwellnus, M., Soligard, T., & Verhagen, E. (2020, Apr). Improved reporting of overuse injuries and health problems in sport: an update of the Oslo Sport Trauma Research Center questionnaires. *Br J Sports Med, 54*(7), 390-396. https://doi.org/10.1136/bjsports-2019-101337

Dalen-Lorentsen, T., Bjorneboe, J., Clarsen, B., Vagle, M., Fagerland, M. W., & Andersen, T. E. (2021, Jan). Does load management using the acute:chronic workload ratio prevent health problems? A cluster randomised trial of 482 elite youth footballers of both sexes. *Br J Sports Med, 55*(2), 108-114. https://doi.org/10.1136/bjsports-2020-103003

de Lucena, G. L., dos Santos Gomes, C., & Guerra, R. O. (2011, Feb). Prevalence and associated factors of Osgood-Schlatter syndrome in a population-based sample of Brazilian adolescents. *Am J Sports Med, 39*(2), 415-420. https://doi.org/10.1177/0363546510383835

Delgado, D. A., Lambert, B. S., Boutris, N., McCulloch, P. C., Robbins, A. B., Moreno, M. R., & Harris, J. D. (2018, Mar). Validation of Digital Visual Analog Scale Pain Scoring With a Traditional Paper-based Visual Analog Scale in Adults. *J Am Acad Orthop Surg Glob Res Rev, 2*(3), e088. https://doi.org/10.5435/JAAOSGlobal-D-17-00088

DiFiori, J. P., Benjamin, H. J., Brenner, J. S., Gregory, A., Jayanthi, N., Landry, G. L., & Luke, A. (2014, Feb). Overuse injuries and burnout in youth sports: a position statement from the American Medical Society for Sports Medicine. *Br J Sports Med, 48*(4), 287-288. https://doi.org/10.1136/bjsports-2013-093299

Dompier, T. P., Powell, J. W., Barron, M. J., & Moore, M. T. (2007, Jul-Sep). Time-loss and non-time-loss injuries in youth football players. *J Athl Train, 42*(3), 395-402. https://www.ncbi.nlm.nih.gov/pubmed/18059996

Eberbach, H., Hohloch, L., Feucht, M. J., Konstantinidis, L., Sudkamp, N. P., & Zwingmann, J. (2017, Apr 19). Operative versus conservative treatment of apophyseal avulsion fractures of the pelvis in the adolescents: a systematical review with meta-analysis of clinical outcome and return to sports. *BMC Musculoskelet Disord, 18*(1), 162. https://doi.org/10.1186/s12891-017-1527-z

Ekstrand, J., Lundqvist, D., Davison, M., D'Hooghe, M., & Pensgaard, A. M. (2019a). Communication quality between the medical team and the head coach/manager is associated with injury burden and player availability in elite football clubs. *Br J Sports Med, 53*(5), 304-308. https://doi.org/10.1136/bjsports-2018-099411

Ekstrand, J., Spreco, A., & Davison, M. (2019b). Elite football teams that do not have a winter break lose on average 303 player-days more per season to injuries than those teams that do: a comparison among 35 professional European teams. *Br J Sports Med, 53*(19), 1231-1235. https://doi.org/10.1136/bjsports-2018-099506

El-Tallawy, S. N., Nalamasu, R., Salem, G. I., LeQuang, J. A. K., Pergolizzi, J. V., & Christo, P. J. (2021, Jun). Management of Musculoskeletal Pain: An Update with Emphasis on Chronic Musculoskeletal Pain. *Pain Ther, 10*(1), 181-209. https://doi.org/10.1007/s40122-021-00235-2

Elfving, B., Lund, I., C, L. B., & Bostrom, C. (2016, Nov). Ratings of pain and activity limitation on the visual analogue scale and global impression of change in multimodal rehabilitation of back pain - analyses at group and individual level. *Disabil Rehabil, 38*(22), 2206-2216. https://doi.org/10.3109/09638288.2015.1116618

Fares, M. Y., Salhab, H. A., Khachfe, H. H., Fares, J., Haidar, R., & Musharrafieh, U. (2021, Sep). Sever's Disease of the Pediatric Population: Clinical, Pathologic, and Therapeutic Considerations. *Clin Med Res, 19*(3), 132-137. https://doi.org/10.3121/cmr.2021.1639

Faude, O., Rossler, R., & Junge, A. (2013, Sep). Football injuries in children and adolescent players: are there clues for prevention? *Sports Med, 43*(9), 819-837. https://doi.org/10.1007/s40279-013-0061-x

Ferlic, P. W., Sadoghi, P., Singer, G., Kraus, T., & Eberl, R. (2014, Apr). Treatment for ischial tuberosity avulsion fractures in adolescent athletes. *Knee Surg Sports Traumatol Arthrosc, 22*(4), 893-897. https://doi.org/10.1007/s00167-013-2570-4

Ford, P., De Ste Croix, M., Lloyd, R., Meyers, R., Moosavi, M., Oliver, J., Till, K., & Williams, C. (2011, Feb). The long-term athlete development model: physiological evidence and application. *J Sports Sci, 29*(4), 389-402. https://doi.org/10.1080/02640414.2010.536849

Fuller, C. W., Ekstrand, J., Junge, A., Andersen, T. E., Bahr, R., Dvorak, J., Hagglund, M., McCrory, P., & Meeuwisse, W. H. (2006, Apr). Consensus statement on injury definitions and data collection procedures in studies of football (soccer) injuries. *Scand J Med Sci Sports, 16*(2), 83-92. https://doi.org/10.1111/j.1600-0838.2006.00528.x

Gabbett, T. J. (2016, Mar). The training-injury prevention paradox: should athletes be training smarter and harder? *Br J Sports Med, 50*(5), 273-280. https://doi.org/10.1136/bjsports-2015-095788

Gudelis, M., Perez, L. T., Cabello, J. T., Leal, D. M., Monaco, M., & Sugimoto, D. (2022, Jan). Apophysitis Among Male Youth Soccer Players at an Elite Soccer Academy Over 7 Seasons. *Orthop J Sports Med, 10*(1), 23259671211065063. https://doi.org/10.1177/23259671211065063

Hall, E. C. R., Larruskain, J., Gil, S. M., Lekue, J. A., Baumert, P., Rienzi, E., Moreno, S., Tannure, M., Murtagh, C. F., Ade, J. D., Squires, P., Orme, P., Anderson, L., Whitworth-Turner, C. M., Morton, J. P., Drust, B., Williams, A. G., & Erskine, R. M. (2020, Jul). An injury audit in high-level male youth soccer players from English, Spanish, Uruguayan and Brazilian academies. *Phys Ther Sport, 44*, 53-60. https://doi.org/10.1016/j.ptsp.2020.04.033

Haroy, J., Clarsen, B., Thorborg, K., Holmich, P., Bahr, R., & Andersen, T. E. (2017, May). Groin Problems in Male Soccer Players Are More Common Than Previously Reported. *Am J Sports Med, 45*(6), 1304-1308. https://doi.org/10.1177/0363546516687539

Hay-Smith, E. J. C., Brown, M., Anderson, L., & Treharne, G. J. (2016, Aug 9). Once a clinician, always a clinician: a systematic review to develop a typology of clinician-researcher dual-role experiences in health research with patient-participants. *BMC Med Res Methodol, 16*, 95. https://doi.org/10.1186/s12874-016-0203-6

Hebert, K. J., Laor, T., Divine, J. G., Emery, K. H., & Wall, E. J. (2008, Jun). MRI appearance of chronic stress injury of the iliac crest apophysis in adolescent athletes. *AJR Am J Roentgenol, 190*(6), 1487-1491. https://doi.org/10.2214/AJR.07.3399

Horan, D., Buttner, F., Blake, C., Hagglund, M., Kelly, S., & Delahunt, E. (2023, Apr). Injury incidence rates in women's football: a systematic review and meta-analysis of prospective injury surveillance studies. *Br J Sports Med, 57*(8), 471-480. https://doi.org/10.1136/bjsports-2021-105177

Hostrup, M., & Bangsbo, J. (2023, Mar). Performance Adaptations to Intensified Training in Top-Level Football. *Sports Med, 53*(3), 577-594. https://doi.org/10.1007/s40279-022-01791-z

Hulin, B. T., Gabbett, T. J., Lawson, D. W., Caputi, P., & Sampson, J. A. (2016, Feb). The acute:chronic workload ratio predicts injury: high chronic workload may decrease injury risk in elite rugby league players. *Br J Sports Med, 50*(4), 231-236. https://doi.org/10.1136/bjsports-2015-094817

Huxley, D. J., O'Connor, D., & Healey, P. A. (2014). An examination of the training profiles and injuries in elite youth track and field athletes. *Eur J Sport Sci, 14*(2), 185-192. https://doi.org/10.1080/17461391.2013.809153

Idrettsforbundet (2022, Sep). *Nøkkeltall fra norsk idrett i 2021*. Norges idrettsforbund. https://www.idrettsforbundet.no/nyheter/2022/ny-sidenokkeltallsrapport-for-norsk-idrett-i-2021/

Iwamoto, J., Takeda, T., Sato, Y., & Matsumoto, H. (2009, Mar). Radiographic abnormalities of the inferior pole of the patella in juvenile athletes. *Keio J Med, 58*(1), 50-53. https://doi.org/10.2302/kjm.58.50

Jacobsson, J., Timpka, T., Kowalski, J., Nilsson, S., Ekberg, J., Dahlstrom, O., & Renstrom, P. A. (2013, Oct). Injury patterns in Swedish elite athletics: annual incidence, injury types and risk factors. *Br J Sports Med, 47*(15), 941-952. https://doi.org/10.1136/bjsports-2012-091651

Johnson, D. M., Cumming, S. P., Bradley, B., & Williams, S. (2022a). The influence of exposure, growth and maturation on injury risk in male academy football players. *J Sports Sci, 40*(10), 1127-1136. https://doi.org/10.1080/02640414.2022.2051380

Johnson, D. M., Cumming, S. P., Bradley, B., & Williams, S. (2022b). How much training do English male academy players really do? Load inside and outside of a football academy. *International Journal of Sports Science & Coaching, 0*(0). https://doi.org/10.1177/17479541221101847

Jones, S., Almousa, S., Gibb, A., Allamby, N., Mullen, R., Andersen, T. E., & Williams, M. (2019, Dec). Injury Incidence, Prevalence and Severity in High-Level Male Youth Football: A Systematic Review. *Sports Med, 49*(12), 1879-1899. https://doi.org/10.1007/s40279-019-01169-8

Jorgensen, J. E., Rathleff, C. R., Rathleff, M. S., & Andreasen, J. (2016, Dec). Danish translation and validation of the Oslo Sports Trauma Research Centre questionnaires on overuse injuries and health problems. *Scand J Med Sci Sports, 26*(12), 1391-1397. https://doi.org/10.1111/sms.12590

Kemper, G. L., van der Sluis, A., Brink, M. S., Visscher, C., Frencken, W. G., & Elferink-Gemser, M. T. (2015, Nov). Anthropometric Injury Risk Factors in Elite-standard Youth Soccer. *Int J Sports Med, 36*(13), 1112-1117. https://doi.org/10.1055/s-0035-1555778

Kivel, C. G., d'Hemecourt, C. A., & Micheli, L. J. (2011, Mar). Treatment of iliac crest apophysitis in the young athlete with bone stimulation: report of 2 cases. *Clin J Sport Med, 21*(2), 144-147. https://doi.org/10.1097/JSM.0b013e31820ebcef

Koh, E., Walton, E. R., & Watson, P. (2018, Jul). VIBE MRI: an alternative to CT in the imaging of sports-related osseous pathology? *Br J Radiol, 91*(1088), 20170815. https://doi.org/10.1259/bjr.20170815

Koh, E., & Boyle, J. (2020, Apr). Pubic apophysitis in elite Australian Rules football players: MRI findings and the utility of VIBE sequences in evaluating athletes with groin pain. *Clin Radiol, 75*(4), 293-301. https://doi.org/10.1016/j.crad.2019.12.022

Ladenhauf, H. N., Seitlinger, G., & Green, D. W. (2020, Feb). Osgood-Schlatter disease: a 2020 update of a common knee condition in children. *Curr Opin Pediatr, 32*(1), 107-112. https://doi.org/10.1097/MOP.0000000000000842

Lasky-McFarlin, C., Thomas, M., Newman, J., & Thorpe, D. (2021, Jan 1). Lack of Abdominal Stability and Control as a Possible Contributor to Rectus Femoris Avulsion Fracture in the Adolescent Soccer Player: A Case Report. *Pediatr Phys Ther, 33*(1), E15-E22. https://doi.org/10.1097/PEP.0000000000000773

Le Gall, F., Carling, C., Reilly, T., Vandewalle, H., Church, J., & Rochcongar, P. (2006, Jun). Incidence of injuries in elite French youth soccer players: a 10-season study. *Am J Sports Med, 34*(6), 928-938. https://doi.org/10.1177/0363546505283271

Le Gall, F., Carling, C., & Reilly, T. (2008, Feb). Injuries in young elite female soccer players: an 8-season prospective study. *Am J Sports Med, 36*(2), 276-284. https://doi.org/10.1177/0363546507307866

Leppanen, M., Pasanen, K., Clarsen, B., Kannus, P., Bahr, R., Parkkari, J., Haapasalo, H., & Vasankari, T. (2019, Feb). Overuse injuries are prevalent in children's competitive football: a prospective study using the OSTRC Overuse Injury Questionnaire. *Br J Sports Med, 53*(3), 165-171. https://doi.org/10.1136/bjsports-2018-099218

Li, X., Xu, S., Lin, X., Wang, Q., & Pan, J. (2014, Apr). Results of operative treatment of avulsion fractures of the iliac crest apophysis in adolescents. *Injury, 45*(4), 721-724. https://doi.org/10.1016/j.injury.2013.10.005

Longo, U. G., Ciuffreda, M., Locher, J., Maffulli, N., & Denaro, V. (2016, Dec). Apophyseal injuries in children's and youth sports. *Br Med Bull, 120*(1), 139-159. https://doi.org/10.1093/bmb/ldw041

Maffulli, N., Longo, U. G., Spiezia, F., & Denaro, V. (2011). Aetiology and prevention of injuries in elite young athletes. *Med Sport Sci, 56*, 187-200. https://doi.org/10.1159/000321078

Malina, R. M., Bouchard, C., & Bar-Or, O. (2004). *Growth, maturation, and physical activity* (2nd ed.). Human Kinetics.

Malina, R. M., Choh, A. C., Czerwinski, S. A., & Chumlea, W. C. (2016, Aug). Validation of Maturity Offset in the Fels Longitudinal Study. *Pediatr Exerc Sci, 28*(3), 439-455. https://doi.org/10.1123/pes.2015-0090

Martinez-Silvan, D., Wik, E. H., Alonso, J. M., Jeanguyot, E., Salcinovic, B., Johnson, A., & Cardinale, M. (2021, Sep). Injury characteristics in male youth athletics: a five-season prospective study in a full-time sports academy. *Br J Sports Med, 55*(17), 954-960. https://doi.org/10.1136/bjsports-2020-102373

Martins, F., Marques, A., Franca, C., Sarmento, H., Henriques, R., Ihle, A., de Maio Nascimento, M., Saldanha, C., Przednowek, K., & Gouveia, E. R. (2023, Jan 8). Weekly External Load Performance Effects on Sports Injuries of Male Professional Football Players. *Int J Environ Res Public Health, 20*(2). https://doi.org/10.3390/ijerph20021121

Materne, O., Chamari, K., Farooq, A., Weir, A., Holmich, P., Bahr, R., Greig, M., & McNaughton, L. R. (2021, May). Injury incidence and burden in a youth elite football academy: a four-season prospective study of 551 players aged from under 9 to under 19 years. *Br J Sports Med, 55*(9), 493-500. https://doi.org/10.1136/bjsports-2020-102859

Materne, O., Chamari, K., Farooq, A., Tabben, M., Weir, A., Holmich, P., Bahr, R., Greig, M., & McNaughton, L. R. (2022, Jan). Shedding light on incidence and burden of physeal injuries in a youth elite football academy: A 4-season prospective study. *Scand J Med Sci Sports, 32*(1), 165-176. https://doi.org/10.1111/sms.14059

McAuley, A. B. T., Baker, J., & Kelly, A. L. (2022, Mar). Defining "elite" status in sport: from chaos to clarity. *German Journal of Exercise and Sport Research, 52*(1), 193-197. https://doi.org/10.1007/s12662-021-00737-3

McKay, C. D., Steffen, K., Romiti, M., Finch, C. F., & Emery, C. A. (2014, Sep). The effect of coach and player injury knowledge, attitudes and beliefs on adherence to the FIFA 11+ programme in female youth soccer. *Br J Sports Med, 48*(17), 1281-1286. https://doi.org/10.1136/bjsports-2014-093543

McKay, D., Broderick, C., & Steinbeck, K. (2016, Nov). The Adolescent Athlete: A Developmental Approach to Injury Risk. *Pediatr Exerc Sci, 28*(4), 488-500. https://doi.org/10.1123/pes.2016-0021

Micheli, L. J., & Ireland, M. L. (1987, Jan-Feb). Prevention and management of calcaneal apophysitis in children: an overuse syndrome. *J Pediatr Orthop, 7*(1), 34-38. https://doi.org/10.1097/01241398-198701000-00007

Moseid, C. H., Myklebust, G., Fagerland, M. W., Clarsen, B., & Bahr, R. (2018, Apr). The prevalence and severity of health problems in youth elite sports: A 6-month prospective cohort study of 320 athletes. *Scand J Med Sci Sports, 28*(4), 1412-1423. https://doi.org/10.1111/sms.13047

Murphy, D. F., Connolly, D. A., & Beynnon, B. D. (2003, Feb). Risk factors for lower extremity injury: a review of the literature. *Br J Sports Med, 37*(1), 13-29. https://doi.org/10.1136/bjsm.37.1.13

Nielsen, R. O., Bertelsen, M. L., Ramskov, D., Moller, M., Hulme, A., Theisen, D., Finch, C. F., Fortington, L. V., Mansournia, M. A., & Parner, E. T. (2019, Jan). Time-to-event analysis for sports injury research part 1: time-varying exposures. *Br J Sports Med, 53*(1), 61-68. https://doi.org/10.1136/bjsports-2018-099408

Owoeye, O. B. A., VanderWey, M. J., & Pike, I. (2020, Sep 21). Reducing Injuries in Soccer (Football): an Umbrella Review of Best Evidence Across the Epidemiological Framework for Prevention. *Sports Med Open, 6*(1), 46. https://doi.org/10.1186/s40798-020-00274-7

Papastergiou, S., Grammatikopoulou, D., Iosifidou, E., Manika, C., Metaxiotis, D., Romanidis, R., & Tsitouridis, K. (2019). Apophysitis of the Ischial Tuberosity: A Case Report. *J Orthop Case Rep, 10*(1), 82-85. https://doi.org/10.13107/jocr.2019.v10.i01.1648

Parr, J., Winwood, K., Hodson-Tole, E., Deconinck, F. J. A., Parry, L., Hill, J. P., Malina, R. M., & Cumming, S. P. (2020, Jun). Predicting the timing of the peak of the pubertal growth spurt in elite male youth soccer players: evaluation of methods. *Ann Hum Biol, 47*(4), 400-408. https://doi.org/10.1080/03014460.2020.1782989

Perron, A. D., Miller, M. D., & Brady, W. J. (2002, Jan). Orthopedic pitfalls in the ED: pediatric growth plate injuries. *Am J Emerg Med, 20*(1), 50-54. https://doi.org/10.1053/ajem.2002.30096

Pitlovic, V., Saric, G., Pitlovic, H., Jovanovic, S., & Jurisic, D. (2013, Dec). A correlation of peak height velocity and olecranon apophysis ossification assessed by ultrasound. *Coll Antropol, 37*(4), 1285-1289. https://www.ncbi.nlm.nih.gov/pubmed/24611346

Pluim, B. M., Clarsen, B., & Verhagen, E. (2018, May). Injury rates in recreational tennis players do not differ between different playing surfaces. *Br J Sports Med, 52*(9), 611-615. https://doi.org/10.1136/bjsports-2016-097050

Price, R. J., Hawkins, R. D., Hulse, M. A., & Hodson, A. (2004, Aug). The Football Association medical research programme: an audit of injuries in academy youth football. *Br J Sports Med, 38*(4), 466-471. https://doi.org/10.1136/bjsm.2003.005165

Ramponi, D. R., & Baker, C. (2019, Jan/Mar). Sever's Disease (Calcaneal Apophysitis). *Adv Emerg Nurs J, 41*(1), 10-14. https://doi.org/10.1097/TME.0000000000000219

Rathleff, M. S., Winiarski, L., Krommes, K., Graven-Nielsen, T., Holmich, P., Olesen, J. L., Holden, S., & Thorborg, K. (2020, Apr). Activity Modification and Knee Strengthening for Osgood-Schlatter Disease: A Prospective Cohort Study. *Orthop J Sports Med, 8*(4), 2325967120911106. https://doi.org/10.1177/2325967120911106

Raya-Gonzalez, J., Suarez-Arrones, L., Navandar, A., Balsalobre-Fernandez, C., & Saez de Villarreal, E. (2020, Aug 1). Injury Profile of Elite Male Young Soccer Players in a Spanish Professional Soccer Club: A Prospective Study During 4 Consecutive Seasons. *J Sport Rehabil, 29*(6), 801-807. https://doi.org/10.1123/jsr.2019-0113

Read, P. J., Oliver, J. L., De Ste Croix, M. B. A., Myer, G. D., & Lloyd, R. S. (2018, Jul). An audit of injuries in six english professional soccer academies. *J Sports Sci, 36*(13), 1542-1548. https://doi.org/10.1080/02640414.2017.1402535

Renshaw, A., & Goodwin, P. C. (2016). Injury incidence in a Premier League youth soccer academy using the consensus statement: a prospective cohort study. *BMJ Open Sport Exerc Med, 2*(1), e000132. https://doi.org/10.1136/bmjsem-2016-000132

Richardson, A., Clarsen, B., Verhagen, E., & Stubbe, J. H. (2017). High prevalence of self-reported injuries and illnesses in talented female athletes. *BMJ Open Sport Exerc Med, 3*(1), e000199. https://doi.org/10.1136/bmjsem-2016-000199

Rinaldo, N., Gualdi-Russo, E., & Zaccagni, L. (2021, Mar 18). Influence of Size and Maturity on Injury in Young Elite Soccer Players. *Int J Environ Res Public Health, 18*(6). https://doi.org/10.3390/ijerph18063120

Sailly, M., Whiteley, R., & Johnson, A. (2013, Jan). Doppler ultrasound and tibial tuberosity maturation status predicts pain in adolescent male athletes with Osgood-Schlatter's disease: a case series with comparison group and clinical interpretation. *Br J Sports Med, 47*(2), 93-97. https://doi.org/10.1136/bjsports-2012-091471

Sailly, M., Whiteley, R., Read, J. W., Giuffre, B., Johnson, A., & Holmich, P. (2015, Jun). Pubic apophysitis: a previously undescribed clinical entity of groin pain in athletes. *Br J Sports Med, 49*(12), 828-834. https://doi.org/10.1136/bjsports-2014-094436

Sakai, T., Sairyo, K., Suzue, N., Kosaka, H., & Yasui, N. (2010, May). Incidence and etiology of lumbar spondylolysis: review of the literature. *J Orthop Sci, 15*(3), 281-288. https://doi.org/10.1007/s00776-010-1454-4

Salter, J., De Ste Croix, M. B. A., Hughes, J. D., Weston, M., & Towlson, C. (2021, Mar 1). Monitoring Practices of Training Load and Biological Maturity in UK Soccer Academies. *Int J Sports Physiol Perform, 16*(3), 395-406. https://doi.org/10.1123/ijspp.2019-0624

Schmikli, S. L., de Vries, W. R., Inklaar, H., & Backx, F. J. (2011, May). Injury prevention target groups in soccer: injury characteristics and incidence rates in male junior and senior players. *J Sci Med Sport, 14*(3), 199-203. https://doi.org/10.1016/j.jsams.2010.10.688

Schuett, D. J., Bomar, J. D., & Pennock, A. T. (2015, Sep). Pelvic Apophyseal Avulsion Fractures: A Retrospective Review of 228 Cases. *J Pediatr Orthop, 35*(6), 617-623. https://doi.org/10.1097/BPO.0000000000000328

Soligard, T., Schwellnus, M., Alonso, J. M., Bahr, R., Clarsen, B., Dijkstra, H. P., Gabbett, T., Gleeson, M., Hagglund, M., Hutchinson, M. R., Janse van Rensburg, C., Khan, K. M., Meeusen, R., Orchard, J. W., Pluim, B. M., Raftery, M., Budgett, R., & Engebretsen, L. (2016, Sep). How much is too much? (Part 1) International Olympic Committee consensus statement on load in sport and risk of injury. *Br J Sports Med, 50*(17), 1030-1041. https://doi.org/10.1136/bjsports-2016-096581

Soliman, A., De Sanctis, V., Elalaily, R., & Bedair, S. (2014, Nov). Advances in pubertal growth and factors influencing it: Can we increase pubertal growth? *Indian J Endocrinol Metab, 18*(Suppl 1), S53-62. https://doi.org/10.4103/2230-8210.145075

Swain, M., Kamper, S. J., Maher, C. G., Broderick, C., McKay, D., & Henschke, N. (2018, Oct). Relationship between growth, maturation and musculoskeletal conditions in adolescents: a systematic review. *Br J Sports Med, 52*(19), 1246-1252. https://doi.org/10.1136/bjsports-2017-098418

Tabben, M., Whiteley, R., Wik, E. H., Bahr, R., & Chamari, K. (2020, Mar). Methods may matter in injury surveillance: "how" may be more important than "what, when or why". *Biol Sport, 37*(1), 3-5. https://doi.org/10.5114/biolsport.2020.89935

Torjusen, T. (2023, Jan). *Akademiklassifiserings-Rapporten 2022*. Eliteserien. https://www.eliteserien.no/nyheter/akademiklassifiserings-rapporten-2022

Tourny, C., Sangnier, S., Cotte, T., Langlois, R., & Coquart, J. (2014, Aug). Epidemiologic study of young soccer player's injuries in U12 to U20. *J Sports Med Phys Fitness, 54*(4), 526-535. https://www.ncbi.nlm.nih.gov/pubmed/25034555

Trondsen, M., & Sandaunet, A. G. (2009, Feb). The dual role of the action researcher. *Eval Program Plann, 32*(1), 13-20. https://doi.org/10.1016/j.evalprogplan.2008.09.005

van der Made, A. D., Peters, R. W., Verheul, C., Smithuis, F. F., Reurink, G., Moen, M. H., Tol, J. L., & Kerkhoffs, G. (2022, Mar). Proximal hamstring tendon avulsions: comparable clinical outcomes of operative and non-operative treatment at 1-year follow-up using a shared decision-making model. *Br J Sports Med, 56*(6), 340-348. https://doi.org/10.1136/bjsports-2021-104588

Valentino, M., Quiligotti, C., & Ruggirello, M. (2012, Jun). Sinding-Larsen-Johansson syndrome: A case report. *J Ultrasound, 15*(2), 127-129. https://doi.org/10.1016/j.jus.2012.03.001

Walden, M., Hagglund, M., & Ekstrand, J. (2005, Apr). Injuries in Swedish elite football--a prospective study on injury definitions, risk for injury and injury pattern during 2001. *Scand J Med Sci Sports, 15*(2), 118-125. https://doi.org/10.1111/j.1600-0838.2004.00393.x

Walden, M., Mountjoy, M., McCall, A., Serner, A., Massey, A., Tol, J. L., Bahr, R., D'Hooghe, M., Bittencourt, N., Della Villa, F., Dohi, M., Dupont, G., Fulcher, M., Janse van Rensburg, D. C. C., Lu, D., & Andersen, T. E. (2023, Jan 6). Football-specific extension of the IOC consensus statement: methods for recording and reporting of epidemiological data on injury and illness in sport 2020. *Br J Sports Med*. https://doi.org/10.1136/bjsports-2022-106405

Watanabe, H., Fujii, M., Yoshimoto, M., Abe, H., Toda, N., Higashiyama, R., & Takahira, N. (2018, Aug). Pathogenic Factors Associated With Osgood-Schlatter Disease in Adolescent Male Soccer Players: A Prospective Cohort Study. *Orthop J Sports Med, 6*(8), 2325967118792192. https://doi.org/10.1177/2325967118792192

Watson, A., Brickson, S., Brooks, M. A., & Dunn, W. (2017, Sep). Preseason Aerobic Fitness Predicts In-Season Injury and Illness in Female Youth Athletes. *Orthop J Sports Med, 5*(9), 2325967117726976. https://doi.org/10.1177/2325967117726976

Weel, H., Joosten, A. J. P., & van Bergen, C. J. A. (2022, Jul 8). Apophyseal Avulsion of the Rectus Femoris Tendon Origin in Adolescent Soccer Players. *Children (Basel), 9*(7). https://doi.org/10.3390/children9071016

Weiss, J. M., Jordan, S. S., Andersen, J. S., Lee, B. M., & Kocher, M. (2007, Oct-Nov). Surgical treatment of unresolved Osgood-Schlatter disease: ossicle resection with tibial tubercleplasty. *J Pediatr Orthop, 27*(7), 844-847. https://doi.org/10.1097/BPO.0b013e318155849b

Wik, E. H., Materne, O., Chamari, K., Duque, J. D. P., Horobeanu, C., Salcinovic, B., Bahr, R., & Johnson, A. (2019, Jul). Involving research-invested clinicians in data collection affects injury incidence in youth football. *Scand J Med Sci Sports, 29*(7), 1031-1039. https://doi.org/10.1111/sms.13427

Wik, E. H., Martinez-Silvan, D., Farooq, A., Cardinale, M., Johnson, A., & Bahr, R. (2020, May). Skeletal maturation and growth rates are related to bone and growth plate injuries in adolescent athletics. *Scand J Med Sci Sports, 30*(5), 894-903. https://doi.org/10.1111/sms.13635

Wik, E. H. (2021, March). Injuries in elite male youth football and athletics: growth and maturation as potential risk factors (Doctor thesis). Dissertation from the Norwegian School of Sport Sciences.

Wik, E. H., Lolli, L., Chamari, K., Materne, O., Di Salvo, V., Gregson, W., & Bahr, R. (2021, Jul). Injury patterns differ with age in male youth football: a four-season prospective study of 1111 time-loss injuries in an elite national academy. *Br J Sports Med, 55*(14), 794-800. https://doi.org/10.1136/bjsports-2020-103430

Wik, E. H. (2022). Growth, maturation and injuries in high-level youth football (soccer): A mini review. *Front Sports Act Living, 4*, 975900. https://doi.org/10.3389/fspor.2022.975900

Woods, C., Hawkins, R., Hulse, M., & Hodson, A. (2002, Dec). The Football Association Medical Research Programme: an audit of injuries in professional football-analysis of preseason injuries. *Br J Sports Med, 36*(6), 436-441; discussion 441. https://doi.org/10.1136/bjsm.36.6.436

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*Appendix 1:*

# Oslo Sports Trauma Research Center Questionnaire on Health Problems 2nd version (OSTRC-H2)

## Translated into Norwegian

**Deltakelse**
Har du hatt problemer med å delta i din idrett på grunn av skader, sykdom eller andre helseproblemer i løpet av de siste 7 dager?

□ Deltar for fullt uten problemer
□ Deltar for fullt, men med skade/sykdom
□ Redusert deltakelse på grunn av skade/sykdom
□ Har ikke kunnet delta på grunn av skade/sykdom

**Treningsmodifisering**
I hvilken grad har du modifisert trening eller konkurranse på grunn av skade, sykdom eller andre helseproblemer i løpet av de siste 7 dager?

□ Ingen modifisering
□ I liten grad
□ I moderat grad
□ I stor grad

**Prestasjon**
I hvilken grad opplever du at skade, sykdom eller andre helseproblemer har påvirket prestasjonsevnen i din idrett i løpet av de siste 7 dagene?

□ Ingen effekt
□ I liten grad
□ I moderat grad
□ I stor grad

**Symptomer**
I hvilken grad har du opplevd symptomer/helseplager (f. eks. smerter, hoste, feber) i løpet av de siste 7 dagene?

□ Ingen symptomer/helseplager
□ I liten grad
□ I moderat grad

□ I stor grad

**Type helseproblem**
Er problemet du nevnte i de foregående spørsmålene en skade eller en sykdom?
□ Akutt skade
□ Belastningsskade
□ Sykdom

**Akutt/belastningsskade:**
Når skjedde det?
- Dato

Hva gjorde du?
- Fyll inn

Hvordan skjedde det?
- Fyll inn

**Skadeområde**
Vennligst velg alternativene som best beskriver området eller områdene til dine smerter.
□ Hode/ansikt
□ Nakke
□ Skulder (inkludert kragebein)
□ Overarm
□ Albue
□ Underarm
□ Håndledd
□ Hånd/fingre
□ Bryst/ribbein
□ Mage
□ Brystrygg
□ Korsrygg
□ Bekken/sete
□ Hofte/lyske
□ Lår
□ Kne
□ Legg
□ Ankel
□ Hæl
□ Føtter/tær
□ Annet

**Sykdom:**
**Sykdomssymptomer**
□ Feber
□ Slapphet/tretthet
□ Hovne lymfeknuter
□ Sår hals
□ Tett nese/snørrete/nysing
□ Hoste
□ Tungpustet/tetthet

- ☐ Hodepine
- ☐ Kvalme/uvelhet
- ☐ Oppkast/brekninger
- ☐ Diare
- ☐ Forstoppelse
- ☐ Besvimelse
- ☐ Kløe/utslett
- ☐ Uregelmessig puls/hjertebank
- ☐ Brystsmerter
- ☐ Magesmerter
- ☐ Smerte andre steder
- ☐ Nummenhet/prikking
- ☐ Angst/uro
- ☐ Tristhet/depresjon
- ☐ Irritabilitet
- ☐ Symptomer fra øyet
- ☐ Symptomer fra øret
- ☐ Symptomer fra urinveier eller kjønnsorganer
- ☐ Annen

Når oppdaget du symptomer for første gang?

- Dato

**For både skade og sykdom:**
**Fravær**
Hvor mange dager i løpet av de siste 7 dagene har du måttet stå over trening eller konkurranse på grunn av dette problemet?

- ☐ 0
- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6
- ☐ 7

*Appendix 2:*

NORGES IDRETTSHØGSKOLE

# Standardisert undersøkelsesprotokoll

**Masterprosjekt ved Norges Idrettshøgskole:**
*«Hvordan er omfanget av vekst-relaterte skader i underekstremiteter hos elitefotballspillere i et ungdomsakademi?»*

## Klinisk undersøkelse

**Undersøker**:
_______________________________________________________________

**Spiller-ID:**
_______________________________________________________________

**Dato for første undersøkelse** (DD/MM/ÅÅ): ______/______/_______

**Inspeksjon**:
□ Hydrops □ Rubor/farge □ Calor/varme □ Annet?
_____________________________

**Smertelokasjon:**
Hvor har du vondt?
□ Hofte/lyske □ Kne □ Hæl □ Annet? ____________________________

□ Høyre □ Venstre □ Begge □ Annet? ____________________________

**Hvilken dato oppsto skaden/forverring av symptomer?**

Siden (DD/MM/ÅÅ): ______/______/_______

**Har smertene kommet akutt eller gradvis over tid?**
□ Akutt □ Gradvis □ Akutt forverring av symptomer som kom gradvis

**Oppstod skaden/forverring av symptomer i:**
□ Fotballtrening □ Kamp

Hvilken kamp? (motstander og dato): ________________________________________

Hvilket minutt i kampen (cirka)? ____________________________________________

□ Annen aktivitet___________________________________________________________

**Beskriv nærmere hvordan skaden/forverring av symptomer oppstod?**

______________________________________________________________________________

______________________________________________________________________________

______________________________________________________________________________

**For ALLE typer skader. Hvordan beskriver spilleren smertene sine?**

□ Skarp/stikkende □ Bankende □ Murrende □ Kriblende

□ Elektrisk □ Nummen □ Brennende □ Annet:

**Hvilke bevegelser og aktiviteter provoserer smertene?**

______________________________________________________________________________

______________________________________________________________________________

______________________________________________________________________________

**Har spilleren skadet seg tidligere?**
□ Ja □ Nei
Hvilken skader?
_____________________________________________________________________

**Har spilleren blitt operert?**
□ Ja □ Nei
Hva ble operert?
__________________________________________________________________

**Har spilleren andre sykdommer?**

□ Ja □ Nei

Hvilke sykdommer?

_______________________________________________________________

**Har spilleren hatt tidligere sykdommer?**

□ Ja □ Nei

Hvilke sykdommer?

______________________________________________________________

**Går spilleren på faste medisiner?**

□ Ja □ Nei

Hvilke medisiner?

______________________________________________________________

**Antall ukentlig treningsøkter:**

Lagstrening: _____

Skoletrening: _____

Egentrening: _____

**Hvor mye smerter har spilleren på en skala fra 0-10?**

Hverdagen: _____

Før trening: _____

Under trening: _____

Etter trening: _____

Palpasjon av symptomgivende struktur: _____

## Spesifikke tester

Gå gjennom alle testene for høyre og venstre og sett et kryss der det passer ut ifra om det skal undersøkes hofte/lyske, kne og/eller ankel. Undersøk smertefri side først. Kategorier for tester som ikke er ute etter smerteprovokasjon markeres med positiv eller negativ.

**Smertekategorier**:

- **1** Sett et kryss ved **1** hvis testen reproduserer smerten spilleren kjenner til som **sin smerte**
- **0+** Sett et kryss ved **0+** hvis testen gir smerte, men hvor dette er **ikke** spillerens aktuelle smerte
- **0** Sett et kryss ved **0** hvis testen ikke gir smerter

| HOFTE/LYSKE | | HØYRE | VENSTRE |
|---|---|---|---|
| FUNKSJONELLE TESTER | Knebøy | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |
| | Knebøy med utover-rotasjon | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |
| | Dyp knebøy | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |
| | Dyp sittende knebøy med vektfordeling | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |
| | Ett beins knebøy | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |
| | Hopp på to bein | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |
| | Hopp på ett bein | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |
| | Liggende statisk benløft | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |
| | Liggende dynamisk benløft | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |
| | Rette sit ups | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |
| | Skrå sit ups | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |
| Kommentarer/annet: | | | |

| HOFTE/LYSKE | | HØYRE | VENSTRE |
|---|---|---|---|
| PASSIVE TESTER | **Fleksjon** | **Smerte** 1 ◯ 0+ ◯ 0 ◯ | **Smerte** 1 ◯ 0+ ◯ 0 ◯ |
| | **Utover-rotasjon** | **Smerte** 1 ◯ 0+ ◯ 0 ◯ | **Smerte** 1 ◯ 0+ ◯ 0 ◯ |
| | **Innover-rotasjon** | **Smerte** 1 ◯ 0+ ◯ 0 ◯ | **Smerte** 1 ◯ 0+ ◯ 0 ◯ |
| | **Abduksjon** | **Smerte** 1 ◯ 0+ ◯ 0 ◯ | **Smerte** 1 ◯ 0+ ◯ 0 ◯ |
| | **Adduksjon** | **Smerte** 1 ◯ 0+ ◯ 0 ◯ | **Smerte** 1 ◯ 0+ ◯ 0 ◯ |
| | **FABER test** | **Smerte** 1 ◯ 0+ ◯ 0 ◯ | **Smerte** 1 ◯ 0+ ◯ 0 ◯ |
| | **FADIR test** | **Smerte** 1 ◯ 0+ ◯ 0 ◯ | **Smerte** 1 ◯ 0+ ◯ 0 ◯ |
| Kommentarer/annet: | | | |

| HOFTE/LYSKE | | HØYRE | VENSTRE |
|---|---|---|---|
| ISOMETRISKE TESTER | Hoftefleksjon 90° | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |
| | 5 sec adductor squeeze test 0° | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |
| | 5 sec adductor squeeze test 45° | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |
| | 5 sec adductor squeeze test 90° | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |
| | Passiv abduksjon med isometrisk adduksjon | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |
| Kommentarer/annet: | | | |

| HOFTE/LYSKE | | HØYRE | VENSTRE |
|---|---|---|---|
| PALPASJON | **Superior pubis ramus** | **Smerte** 1 ◯ 0+ ◯ 0 ◯ | **Smerte** 1 ◯ 0+ ◯ 0 ◯ |
| | **Inferior pubis ramus** | **Smerte** 1 ◯ 0+ ◯ 0 ◯ | **Smerte** 1 ◯ 0+ ◯ 0 ◯ |
| | **Symfysen** | **Smerte** 1 ◯ 0+ ◯ 0 ◯ | **Smerte** 1 ◯ 0+ ◯ 0 ◯ |
| | **Crista iliaca** | **Smerte** 1 ◯ 0+ ◯ 0 ◯ | **Smerte** 1 ◯ 0+ ◯ 0 ◯ |
| | **Trochanter minor** | **Smerte** 1 ◯ 0+ ◯ 0 ◯ | **Smerte** 1 ◯ 0+ ◯ 0 ◯ |
| | **Trochanter major** | **Smerte** 1 ◯ 0+ ◯ 0 ◯ | **Smerte** 1 ◯ 0+ ◯ 0 ◯ |
| | **SIAI** | **Smerte** 1 ◯ 0+ ◯ 0 ◯ | **Smerte** 1 ◯ 0+ ◯ 0 ◯ |
| | **SIAS** | **Smerte** 1 ◯ 0+ ◯ 0 ◯ | **Smerte** 1 ◯ 0+ ◯ 0 ◯ |
| | **Tuber ischium** | **Smerte** 1 ◯ 0+ ◯ 0 ◯ | **Smerte** 1 ◯ 0+ ◯ 0 ◯ |
| | **Adduktor longus** | **Smerte** 1 ◯ 0+ ◯ 0 ◯ | **Smerte** 1 ◯ 0+ ◯ 0 ◯ |
| | **Adduktor magnus** Proksimale festet | **Smerte** 1 ◯ 0+ ◯ 0 ◯ | **Smerte** 1 ◯ 0+ ◯ 0 ◯ |
| | **Sartorius** Proksimale festet | **Smerte** 1 ◯ 0+ ◯ 0 ◯ | **Smerte** 1 ◯ 0+ ◯ 0 ◯ |
| | **Iliopsoas** Infrainguinalt | **Smerte** 1 ◯ 0+ ◯ 0 ◯ | **Smerte** 1 ◯ 0+ ◯ 0 ◯ |
| | **Rectus femoris** Proksimale festet | **Smerte** 1 ◯ 0+ ◯ 0 ◯ | **Smerte** 1 ◯ 0+ ◯ 0 ◯ |
| | **Rectus abdominis** Pubis festet | **Smerte** 1 ◯ 0+ ◯ 0 ◯ | **Smerte** 1 ◯ 0+ ◯ 0 ◯ |

Kommentarer/annet:

| KNE | | HØYRE | VENSTRE |
|---|---|---|---|
| FUNKSJONELLE TESTER | **Knebøy** | **Smerte** 1 ◯ 0+ ◯ 0 ◯ | **Smerte** 1 ◯ 0+ ◯ 0 ◯ |
| | **Dyp knebøy** | **Smerte** 1 ◯ 0+ ◯ 0 ◯ | **Smerte** 1 ◯ 0+ ◯ 0 ◯ |
| | **Ett beins knebøy** | **Smerte** 1 ◯ 0+ ◯ 0 ◯ | **Smerte** 1 ◯ 0+ ◯ 0 ◯ |
| | **Hopp på to bein** | **Smerte** 1 ◯ 0+ ◯ 0 ◯ | **Smerte** 1 ◯ 0+ ◯ 0 ◯ |
| | **Hopp på ett bein** | **Smerte** 1 ◯ 0+ ◯ 0 ◯ | **Smerte** 1 ◯ 0+ ◯ 0 ◯ |
| Kommentarer/annet: | | | |

| KNE | | HØYRE | VENSTRE |
|---|---|---|---|
| PASSIVE TESTER | Thessaly test | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |
| | Fleksjon | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |
| | Ekstensjon | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |
| | Valgus stresstest | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |
| | Varus stresstest | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |
| | Lachman test | Positiv ◯ Negativ ◯ | Positiv ◯ Negativ ◯ |
| | Tibia interal rotation test | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |
| | Tibia external rotation test | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |
| | Hoffas squeez test | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |
| | McMurray test | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |
| | PCL gravity sag test | Positiv ◯ Negativ ◯ | Positiv ◯ Negativ ◯ |
| | Apley's test | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |

Kommentarer/annet:

| KNE | | HØYRE | VENSTRE |
|---|---|---|---|
| ISOMETRISKE TESTER | Ekstensjon 0° | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |
| | Ekstensjon 90° | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |
| | Knefleksjon 90° | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |

Kommentarer/annet:

| KNE | | HØYRE | VENSTRE |
|---|---|---|---|
| PALPASJON | Tuberositas tibia | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |
| | Apex patella | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |
| | Basis patella | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |
| | Mediale femurkondyl | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |
| | Laterale femurkondyl | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |
| | Mediale tibiakondyl | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |
| | Laterale tibiakondyl | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |
| | Mediale leddspalte | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |
| | Laterale leddspalte | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |
| | Quadricepssene | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |
| | Patellasenen | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |
| | MCL | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |
| | LCL | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |
| | Pes anserinus | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |
| Kommentarer/annet: | | | |

| ANKEL | | HØYRE | VENSTRE |
|---|---|---|---|
| FUNKSJONELLE TESTER | **Knebøy** | **Smerte** 1 ◯ 0+ ◯ 0 ◯ | **Smerte** 1 ◯ 0+ ◯ 0 ◯ |
| | **Dyp knebøy** | **Smerte** 1 ◯ 0+ ◯ 0 ◯ | **Smerte** 1 ◯ 0+ ◯ 0 ◯ |
| | **Ett beins knebøy** | **Smerte** 1 ◯ 0+ ◯ 0 ◯ | **Smerte** 1 ◯ 0+ ◯ 0 ◯ |
| | **Hopp på to bein** | **Smerte** 1 ◯ 0+ ◯ 0 ◯ | **Smerte** 1 ◯ 0+ ◯ 0 ◯ |
| | **Hopp på ett bein** | **Smerte** 1 ◯ 0+ ◯ 0 ◯ | **Smerte** 1 ◯ 0+ ◯ 0 ◯ |
| Kommentarer/annet: | | | |

| ANKEL | | HØYRE | VENSTRE |
|---|---|---|---|
| PASSIVE TESTER | **Dorsalfleksjon** | **Smerte** 1 ◯ 0+ ◯ 0 ◯ | **Smerte** 1 ◯ 0+ ◯ 0 ◯ |
| | **Plantarfleksjon** | **Smerte** 1 ◯ 0+ ◯ 0 ◯ | **Smerte** 1 ◯ 0+ ◯ 0 ◯ |
| | **Eversjon** | **Smerte** 1 ◯ 0+ ◯ 0 ◯ | **Smerte** 1 ◯ 0+ ◯ 0 ◯ |
| | **Inversjon** | **Smerte** 1 ◯ 0+ ◯ 0 ◯ | **Smerte** 1 ◯ 0+ ◯ 0 ◯ |
| | **Syndemosis squeeze test** | **Smerte** 1 ◯ 0+ ◯ 0 ◯ | **Smerte** 1 ◯ 0+ ◯ 0 ◯ |
| | **Drawer test** | **Smerte** 1 ◯ 0+ ◯ 0 ◯ | **Smerte** 1 ◯ 0+ ◯ 0 ◯ |
| Kommentarer/annet: | | | |

| ANKEL | | HØYRE | VENSTRE |
|---|---|---|---|
| ISOMETRISKE TESTER | Dorsalfleksjon | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |
| | Plantarfleksjon | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |
| | Eversjon | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |
| | Inversjon | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |

Kommentarer/annet:

| ANKEL | | HØYRE | VENSTRE |
|---|---|---|---|
| PALPASJON | Mediale calcaneus | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |
| | Laterale calcaneus | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |
| | Achilles | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |
| | Medial malleole | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |
| | Lateral malleole | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |
| | Plantar fascien Calcaneus festet | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |
| | Membrana interossa | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |
| | Tibiofibulare anterior lig. | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |
| | Talofibulare anterior lig. | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |
| | Calcaneofibulare lig. | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |
| | Deltoideum lig. | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |
| | Naviculare | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |
| | Sesamben metatars 1 | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |
| | Tuberositas metatars 5 | Smerte 1 ◯ 0+ ◯ 0 ◯ | Smerte 1 ◯ 0+ ◯ 0 ◯ |

Kommentarer/annet:

***Appendix 3:***

Thor Einar Anderssen
Institutt for idrettsmedisinske fag

OSLO 28. januar 2022

## Søknad 217– 270122 – Hvordan er omfanget av vekst-relaterte skader i lyske, kne og hæl til enhver tid for elitefotballspillere i et ungdomsakademi

Vi viser til søknad, prosjektbeskrivelse, informasjonsskriv, innsendt melding til NSD og opplysning gitt til sekretariatet om masterstudentens stiling som fysioterapeut for deltakerne i prosjektet.

I henhold til retningslinjer for behandling av søknad til etisk komite for idrettsvitenskapelig forskning på mennesker, har komiteen i møte 27. januar 2022 konkludert med følgende:

**Vurdering**

Etter hva komiteen har fått bragt på det rene så er datagrunnlaget i masterprosjektet basert på gjenbruk av kliniske data med hjemmel i pasientjournalloven. Dette er kliniske data som studenten i egenskap av fysioterapeut og helsepersonell samler inn fra pasienter som ledd i helsehjelp. For masterprosjektet innebærer derfor dette en etterfølgende sekundær bruk av allerede innsamlede kliniske data med forskning som formål. Informasjonsskrivet til deltakerne må justeres slik at dette kommer tydelig frem. Det må også utarbeides et informasjonsskriv til de foresatte som skal samtykke for deltakerne under 16 år.

I lys av ovennevnte er komiteen enig med prosjektleders vurdering i meldeskjemaet til NSD om at det ikke er nødvendig med en databehandleravtale mellom XPS og NIH. Komiteen vil imidlertid anbefale at det formaliseres en avtale mellom klubben og NIH om utlevering av data og betingelser for denne.

**Vedtak**

*På bakgrunn av forelagte dokumentasjon finner leder av komiteen at prosjektet er forsvarlig og at det kan gjennomføres innenfor rammene av anerkjente etiske forskningsetiske normer nedfelt i NIHs retningslinjer. Til vedtaket har leder av komiteen lagt følgende forutsetning til grunn:*

- *Vilkår fra NSD følges*

NIH NORGES IDRETTSHØGSKOLE

Besøksadresse: Sognsveien 220, Oslo
Postadresse: Pb 4014 Ullevål Stadion, 0806 Oslo
Telefon: +47 23 26 20 00, postmottak@nih.no
**www.nih.no**

- *At justert informasjonsskriv sendes komiteen til orientering.*

Leder av komiteen forutsetter videre at prosjektet gjennomføres på en forsvarlig måte i tråd med de til enhver tid gjeldende ifbm Covid-19 pandemien.

Leder av komiteen gjør oppmerksom på at vedtaket er avgrenset i tråd med fremlagte dokumentasjon. Dersom det gjøres vesentlige endringer i prosjektet som kan ha betydning for deltakernes helse og sikkerhet, skal dette legges fram for komiteen før eventuelle endringer kan iverksettes.

Med vennlig hilsen

Jurist Peder Utne
Stedfordrende leder, Etisk komite, Norges idrettshøgskole

NIH NORGES IDRETTSHØGSKOLE

Besøksadresse: Sognsveien 220, Oslo
Postadresse: Pb 4014 Ullevål Stadion, 0806 Oslo
Telefon: +47 23 26 20 00, postmottak@nih.no
**www.nih.no**

*Appendix 4:*



NSD NORSK SENTER FOR FORSKNINGSDATA

# Vurdering

**Referansenummer**

734078

**Prosjekttittel**

Hvordan er omfanget av vekst-relaterte i lyske, kne og hæl til enhver tid for elitefotballspillere i et ungdomsakademi?

**Behandlingsansvarlig institusjon**

Norges idrettshøgskole / Institutt for idrettsmedisinske fag

**Prosjektansvarlig (vitenskapelig ansatt/veileder eller stipendiat)**

Thor Einar Andersen, t.e.andersen@nih.no, tlf: 90153928

**Type prosjekt**

Studentprosjekt, masterstudium

**Kontaktinformasjon, student**

Simen Rygh, simenryg@nih.no , tlf: 95151471

**Prosjektperiode**

07.02.2022 - 01.12.2022

**Vurdering (1)**

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**04.02.2022 - Vurdert**

BAKGRUNN
Prosjektet er vurdert og godkjent av NIH sin etiske komite (se under "Tilleggsopplysninger")

VURDERING
Det er vår vurdering at behandlingen vil være i samsvar med personvernlovgivningen, så fremt den gjennomføres i tråd med det som er dokumentert i meldeskjemaet den 04.02.2022 med vedlegg, samt i meldingsdialogen mellom innmelder og Personverntjenester. Behandlingen kan starte.

VURDERING AV BEHOV FOR DPIA
Prosjektet behandler særlige kategorier av personopplysninger (helseopplysninger) om en sårbar gruppe (barn), noe som kan utløse en plikt til å foreta personvernkonsekvensvurdering (DPIA).

Personverntjenester har vurdert at det ikke var behov for å gjøre en DPIA jf. personvernforordningen art. 35 nr. 1

for dette prosjektet. Dette var basert på en helhetsvurdering der følgende momenter ble vektlagt:

• De registrerte samtykker til bruk av sine personopplysninger
• De registrerte får god informasjon om behandlingen av personopplysningene og sine rettigheter
• Prosjektet har en ryddig og oversiktlig dataflyt
• Få personer har tilgang til personopplysningene
• NIH sin etiske komite har gjort en forskningsetisk vurdering av prosjektet og godkjent det
• Behandlingen har kort varighet
• Det behandles få personopplysninger

TYPE OPPLYSNINGER OG VARIGHET
Prosjektet vil behandle alminnelige personopplysninger og særlige kategorier av personopplysninger om helseforhold frem til 01.12.2022.

LOVLIG GRUNNLAG
Prosjektet vil innhente samtykke fra de registrerte til behandlingen av personopplysninger. Vår vurdering er at prosjektet legger opp til et samtykke i samsvar med kravene i art. 4 nr. 11 og 7, ved at det er en frivillig, spesifikk, informert og utvetydig bekreftelse, som kan dokumenteres, og som den registrerte kan trekke tilbake.

For alminnelige og særlige kategorier av personopplysninger vil lovlig grunnlag for behandlingen være den registrertes uttrykkelige samtykke, jf. personvernforordningen art. 6 nr. 1 a, jf. personvernforordningen art. 9 nr. 2 bokstav a, jf. personopplysningsloven § 10, jf. § 9 (2).

PERSONVERNPRINSIPPER
Personverntjenester vurderer at den planlagte behandlingen av personopplysninger vil følge prinsippene i personvernforordningen:

- om lovlighet, rettferdighet og åpenhet (art. 5.1 a), ved at de registrerte får tilfredsstillende informasjon om og samtykker til behandlingen
- formålsbegrensning (art. 5.1 b), ved at personopplysninger samles inn for spesifikke, uttrykkelig angitte og berettigede formål, og ikke viderebehandles til nye uforenlige formål
- dataminimering (art. 5.1 c), ved at det kun behandles opplysninger som er adekvate, relevante og nødvendige for formålet med prosjektet
- lagringsbegrensning (art. 5.1 e), ved at personopplysningene ikke lagres lengre enn nødvendig for å oppfylle formålet.

DE REGISTRERTES RETTIGHETER
Personverntjenester vurderer at informasjonen om behandlingen som de registrerte vil motta oppfyller lovens krav til form og innhold, jf. art. 12.1 og art. 13.

Så lenge de registrerte kan identifiseres i datamaterialet vil de ha følgende rettigheter: innsyn (art. 15), retting (art. 16), sletting (art. 17), begrensning (art. 18) og dataportabilitet (art. 20).

Vi minner om at hvis en registrert tar kontakt om sine rettigheter, har behandlingsansvarlig institusjon plikt til å svare innen en måned.

FØLG DIN INSTITUSJONS RETNINGSLINJER
Personverntjenester legger til grunn at behandlingen oppfyller kravene i personvernforordningen om riktighet (art. 5.1 d), integritet og konfidensialitet (art. 5.1. f) og sikkerhet (art. 32).

For å forsikre dere om at kravene oppfylles, må prosjektansvarlig følge interne retningslinjer/rådføre dere med behandlingsansvarlig institusjon.

MELD VESENTLIGE ENDRINGER

Dersom det skjer vesentlige endringer i behandlingen av personopplysninger, kan det være nødvendig å melde dette til Personverntjenester ved å oppdatere meldeskjemaet. Før du melder inn en endring, oppfordrer vi deg til å lese om hvilken type endringer det er nødvendig å melde: https://www.nsd.no/personverntjenester/fylle-ut-meldeskjema-for-personopplysninger/melde-endringer-i-meldeskjema

Du må vente på svar fra Personverntjenester før endringen gjennomføres.

OPPFØLGING AV PROSJEKTET
Personverntjenester vil følge opp ved planlagt avslutning for å avklare om behandlingen av personopplysningene er avsluttet.

Kontaktperson hos Personverntjenester: Jørgen Wincentsen

Lykke til med prosjektet!

***Appendix 5:***

NIH NORGES IDRETTSHØGSKOLE

## Samtykkeskjema – Vil du delta i et forskningsprosjekt om omfanget av vekst-relaterte skader hos fotballspillere i et eliteakademi?

Prosjektet vil pågå fra 07.02.2022 til 01.12.2022. Dette er en forespørsel til deltakere som er 16 år eller eldre, samt barn under 16 år og deres foresatte. Skjemaet vil gi innsikt i hva deltakelsen omhandler.

**Formål**
Forskningsprosjektet gjennomføres som en del av en masteroppgave ved Norges Idrettshøgskole (NIH). Hensikten er å kartlegge hvor hyppig unge fotballspillere plages av vekst-relaterte skader til enhver tid gjennom en sesong, og dermed kunne gi utøvere, trenere, foresatte og helsepersonell ny kunnskap.

**Ansvarlige**
NIH står som ansvarlige for prosjektet ved professor dr. med. Thor Einar Andersen.

**Hvorfor ønsker vi deg som deltager?**
Vekst-relaterte plager/skader fører til tap av mange treningstimer og kamper hver eneste sesong. Klubben din ønsker å forebygge slike skader. Simen Rygh, som er fysioterapeut i klubben, har som del av sitt helsearbeid derfor begynt å samle inn relevant helseinformasjon om deg. Denne informasjonen journalføres og lagres i klubbens journalsystem (Physica). Dette omfatter blant annet et ukentlig elektronisk spørreskjema, der du anmodes om å besvare relevante spørsmål for din behandling og oppfølgning av skader. Dersom du har spørsmål til klubbens innsamling og lagring av dataene kan du kontakte Simen Rygh.

Som ledd i Simens mastergradsprosjekt ved idrettsfysioterapi ved Norges idrettshøgskole (NIH) om omfanget av vekst-relaterte skader, ber NIH v/prosjektleder og veileder for Simen, Thor Einar Andersen om samtykke fra deg om å gjenbruke helseinformasjonen (spørreskjemadataene) som er lagret i klubbens journalsystem, i mastergradsprosjektet. Dataene som NIH mottar vil være avidentifiserte, dvs. at klubben fjerner navnet ditt og erstatter det med et nummer. Dette kalles koblingsnøkkel. Klubben din vil oppbevare koblingsnøkkelen på et trygt sted og den vil ikke være tilgjengelig for NIH. Det er ellers kun prosjektleder professor og lege Thor Einar Andersen, idrettsfysioterapeut, Ph.d. Joar Harøy og masterstudent Simen Rygh som vil ha tilgang til de avidentifiserte dataene, og alle tre er underlagt taushetsplikt.

**Frivillig deltagelse**
Deltagelsen i masterprosjektet er frivillig, og du kan trekke deg når som helst uten at du trenger å oppgi grunnen til dette. Avmelding skjer ved skriftlig eller muntlig beskjed til Simen Rygh.

**Personvern - Oppbevaring av dine besvarelser og målinger**
Det vil ikke være mulig å identifisere deltagere i masteroppgaven. Klubb og lag vil heller ikke bli oppgitt i prosjektet.

**Hva vil skje med dine opplysninger etter at prosjektet er gjennomført?**
Når sensur for masterprosjektet foreligger, vil klubben din slette koblingsnøkkelen.

**Hva vil gi oss rett til å behandle dine personopplysninger?**
Dine opplysninger vil bli behandlet basert på hva du samtykker til.

**Dine rettigheter**
Du har rett til innsikt i registrerte personopplysninger om deg, og få utlevert en kopi av disse. Disse kan korrigeres dersom det foreligger feil eller de er misvisende, samt fjernes dersom det er ønskelig. Dersom du mener at dine personopplysninger ikke er behandlet forsvarlig nok, kan det sendes en klage til Datatilsynet.

**Hvor kan du finne ut mer om prosjektet?**
Hvis du har spørsmål til prosjektet, eller ønsker å vite mer om eller benytte deg av dine rettigheter, ta kontakt med:

- Masterstudent Simen Rygh
  - Epost: simenryg@nih.no
  - Mobil: 95151471

- Professor Thor Einar Andersen
  - Epost: t.e.andersen@nih.no
  - Mobil: 90153928

- Vårt personvernombud
  - Epost: personvernombud@nih.no

Hvis du har spørsmål knyttet til NSD sin vurdering av prosjektet, kan du ta kontakt med:

- NSD – Norsk senter for forskningsdata AS på epost (personverntjenester@nsd.no) eller på telefon: 53 21 15 00.

Med vennlig hilsen

Thor Einar Andersen (Professor dr. med/hovedveileder)

Simen Rygh (Masterstudent)

**Samtykkeerklæring**
Ved å samtykke bekrefter du at du har mottatt og forstått informasjonen om prosjektet, at du har fått anledning til å stille spørsmål, og at dine opplysninger behandles frem til prosjektet er avsluttet.

- Vennligst bekreft per epost dersom du vil være en del av forskningsprosjektet eller ikke.

(Deltagere som er 16 år eller eldre)

(Foresatt til deltagere under 16 år)