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HEADING A SOCCER BALL AND THE CHARACTERIZATION OF PARAMETERS THAT INFLUENCE ITS PEAK IMPACT FORCE

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10.1136/bjsports-2021-IOC.285

Background As participation in soccer increases in the United States, with an estimated 16 million registered players, the possibility of athletes being exposed to injuries, more specifically traumatic brain injuries, increases as well. All levels of soccer play have been associated with a high risk of TBI, predominantly through the mechanism of injury known as heading.

Objective This study aims to model impacts between a soccer ball and head to determine what factors are most influential during a heading action.

Design Dimensional analysis was utilized as a means to construct a model that would define the peak impact force as a function of four variables of interest: pressure inflation, incoming ball velocity, mass and diameter of a soccer ball. To characterize the model, a soccer ball was kicked at a force platform, while varying the ball size (size 4, 4.5 and 5) and pressure at which it was inflated (4, 8, 12 and 16 PSI).

Main Outcome Measurements A Cotter's method sensitivity analysis was used to determine which factors were most influential under the constructed model.

Results Velocity and inflation pressure were found to be the most influential factors affecting peak impact force. In addition, a direct relationship was found between the force and velocity; the force and ball size and; the force and inflation pressure. Moreover, by controlling these parameters it is possible to reduce the amount of cumulative impacts a player receives in-game to a range at which the risk of TBI is much lower. These include lowering the pressure from 16–8 PSI, utilizing a smaller sized ball and reducing the number of impacts per season.

Conclusions The model proposed determined that a reduction of injury risk due to TBI in soccer is possible through the control of specific in-game factors such as ball inflation pressure and controlling the number of impact events.

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STUDYING OF SELECTED PERFORMANCE AND SKILL TEST BATTERIES FOR PREDICTION OF SEVERITY OF INJURY IN IRAN PREMIER LEAGUE FOOTBALL PLAYERS AGED 16–21 YEARS OLD

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10.1136/bjsports-2021-IOC.286

Background Football is the most popular sport in the world, including in Iran. Muscular injuries has 31 percent of all

injuries and due to this injury, 27 percent of athletes couldn't contribute at sport sessions.

Objective To predict selected performance and skill test batteries of severity of injury in Iran premier league football players.

Design Prospective cohort study, purposeful sampling method for selecting football players.

Setting Youth male football players of Iran premier league.

Patients (or Participants) A total of 79 premier league football players aged 16–21 years old who were member of two professional football clubs were selected for the study.

Interventions (or Assessment of Risk Factors) At the pre-season time of league, five performance tests including Standing Long Jump Test, Change of Direction and Acceleration Test (CODAT), Illinois Agility Test, Yoyo Intermittent Recovery Test and Y-Balance Test (YBT), and one skill test including Loughborough Soccer Shooting Test were performed. The pre-season medical assessment forms including the number of players injuries were collected by the club medical staff. This information were gathered weekly and were sent to the researcher.

Results Logistic regression analysis results showed that, of performance and skill tests, just Yoyo Intermittent Recovery Test could predicted the severity of injury ($P < 0.05$). Investigation of predictive variable index was showed that the Wald test of performance and skill test was significant just for Yoyo Intermittent Recovery Test and was able to predict injury severity.

Conclusions None of the performance and skill tests could predict the severity of injury, except the Yoyo intermittent recovery test. This test were designed for measurement of aerobic capacity of athletes. We suggest that coaches use this test to identify at-risk athletes.

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AN INVESTIGATION INTO ADHERENCE TO REHABILITATION AND PERFORMANCE PROGRAMS IN PROFESSIONAL FOOTBALL PLAYERS

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10.1136/bjsports-2021-IOC.287

Background Adherence is a multi-faceted concept and poorly understood in professional football in relation to rehabilitation and performance programs. To offer best practice to players, an understanding of why players are undertaking such programs (adherence) is important. No research to date has examined adherence in professional football.

Objective This study aimed to examine adherence in both men's and women's professional football players in order to better inform practice and program design.

Design Qualitative research design - focus groups and questionnaires.

Setting One English professional Football Club - men's U23 team and women's first team.

Patients (or Participants) 10 men's U23 players and 11 women's first team players from one English professional football club.

Interventions (or Assessment of Risk Factors) 10 men's players and 11 women's players answered a questionnaire adapted from the Sports Injury Rehabilitation Adherence Scale (SIRAS) to provide an overview of adherence rates. 9 men's players and 4 women's players took part in follow-up focus groups to gain a deeper understanding of the players perspectives of

their adherence. Thematic analysis was conducted to examine any common themes.

Main Outcome Measurements Adapted Sports Injury Rehabilitation Adherence Scale (SIRAS) with follow up focus groups.

Results This study found that men's players had a better attendance to their performance programs than women's players. However, men's players felt they had less input into their rehabilitation sessions compared to women's players, despite having a better understanding of the exercises given. Common themes that emerged from focus groups that influenced adherence were financial pressures, experience, perceptions of pain, self-determination and staff relationship – these themes were common in both men's and women's players.

Conclusions Despite differences in funding and infrastructure, both men's and women's professional football players identify broadly the same factors that influence adherence. Particularly, both groups felt a greater understanding of financial pressures and self-determination would allow for the fostering of an adherence culture and should be considered in future program design.

314 ABSTRACT WITHDRAWN

315 RECTUS FEMORIS AND ILIOPSOAS CONTRACTURE AS A RISK FACTORS FOR OSGOOD-SCHLATTER DISEASE IN HIGH PERFORMANCE YOUTH ATHLETES

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10.1136/bjsports-2021-IOC.288

Background Osgood-Schlatter disease (OSD) of the knee in youth is one of the most frequent of anterior knee pain in athletes. There are several risk factors that contribute to this disease.

Objective Rectus femoris and iliopsoas contracture is a specific risk factor for the development of OSD in high performance youth athletes which come to the Centre of Applied Sciences at the sports in Jalisco.

Design The study design was cross-sectional, observational and descriptive. Participants were patients under 16 years of age who had an orthopedic consult during 2017 and 2018 and who had clinical and radiologic diagnosis of OSD. Measurement of the contracture was completed with the patient in recumbent prone position and with the quadriceps in a stretched position: the knee was flexed until the heel touched the gluteus. The epidemiological and quantitative results were calculated using excel with a significance level of $\alpha = 5\%$.

Setting Centre of Applied Sciences for Sports in Jalisco.

Patients (or Participants) 30 patients, members of the representative teams of Jalisco

Main Outcome Measurements Knee flexion and touching the gluteus with the heel.

Results 30 patients of ages 10 to 16 years old were included in the data analysis (male = 16, female = 14; $M_{age} = 14$). The spread of sports played by the patients were as follows: trampolines gymnastics=3, weightlifting=7, diving=4, artistic gymnastics=3, basketball=4, wrestling=2, judo=1, pentathlon=1, canoeing=1, softball=1, squash=1, waterpolo=1,

baseball=1. Only 30% of the patients were able to finish the maneuver: 70% were not able to touch the gluteus with their heel.

Conclusions Low elasticity of the rectus femoris and iliopsoas as a specific risk factor for the development of OSD in youth athletes was statistically significant ($p = 0.05$). General risk factors of this disease are described in the literature, the majority of which are non-modifiable. In contrast, contracture of the quadriceps and iliopsoas are modifiable risk factors for which preventative interventions could be implemented.

316 INJURIES ACCORDING TO THE PERCENTAGE OF ADULT HEIGHT IN AN ELITE FOOTBALL ACADEMY

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10.1136/bjsports-2021-IOC.289

Background Injuries have a negative impact on the development of young football players. The percentage of predicted adult height is being used as an indicator of maturity status for bio-banding, yet no study has investigated its association with injury risk in football.

Objective To establish the percentage of adult height at which the most relevant football injuries occur.

Design Prospective cohort study.

Setting Elite male football players from a Spanish LaLiga club's academy.

Patients (or Participants) 63 players were followed between 1998 and 2019, since they were on average 10.7 years old (80.8% of adult height) until they reached their final height (one full season at 100%).

Assessment of Risk Factors The medical staff recorded injuries following the FIFA consensus and measured height every 3–6 months.

Main Outcome Measurements The percentage of adult height at which each injury occurred was calculated using the player's closest height to the injury and his final adult height. Injuries were classified in maturity bands, Pre-peak height velocity (Pre-PHV) <88%, Peak height velocity (PHV) 88–95% and Post-peak height velocity (Post-PHV) >95%.

Results Sever's disease occurred at a median 87.8% of adult height (interquartile range: 82.3–91.5%, band with the highest frequency: 58.8% pre-PHV), Osgood-Schlatter disease at 87.2% (85.9–91.2%, 54.2% pre-PHV) and anterior inferior iliac spine injuries at 91.0% (88.9–93.8%, 69.2% PHV). Spondylolysis occurred at 98.7% of adult height (97.5–99.5%, 92.3% post-PHV). Similarly, muscle and joint/ligament injuries were more common Post-PHV: hamstring injuries at 98.4% (96.6–99.4%, 77.8% post-PHV), quadriceps injuries at 98.5% (94.8–99.5%, 72.4% post-PHV), knee joint/ligament injuries at 98.9% (98.0–99.9%, 87.5% post-PHV), anterior cruciate ligament ruptures at 98.6% (98.0–100%, 100% post-PHV) and ankle joint/ligament injuries at 98.3% (89.4–99.3%, 65.7% post-PHV).

Conclusions The percentage of predicted adult height could be determined to detect high-risk periods for specific injuries and guide preventive strategies in young footballers.