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Anthropometry and Biomotor of Various position Young Football Athletes: Does It Affect Performance?

Mohamad Annas[1]✉, Soegiyanto[1], Taufiq Hidayah[1], Mugiyo Hartono[1], Heny Setyawati[1], Adi S
[1]Universitas Negeri Semarang, Indonesia, Semarang, Indonesia

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Abstract

The research background was the importance of anthropometry and biomotors for soccer players. This study aims to analyze the relationship between anthropometry and bio-motoric on the performance of SSB KU-12 players in Central Java. The population in this study was 700 players. The sample in this study was 201 players. Samples were drawn using the Purposive Sampling technique. There were nine anthropometric components and six bio-motoric components. Player performance was measured through performance in each position in the match. The data obtained were processed and tested using descriptive statistics using SPSS version 22. The results of the research showed that the anthropometric components of height and Body Mass Index had a positive effect on player performance. The biomotor components of the 20-meter run, leg strength, and coordination also influence player performance. Meanwhile, the components of body weight, 12-minute running, flexibility, and aerobic endurance do not have a positive effect on player performance. The conclusion was the components of height, Body Mass Index, speed, leg strength, and coordination contribute positively to the performance of SSB KU-12 players in Central Java.

Introduction

Recreational sports activities, particularly for urban communities, could be used as a lifestyle because they may considered balanced individual conditions between physical, spiritual, and social needs (Hanani, 2021). Currently, the game of football is developing very rapidly. The number of football academies to develop the talents, interests, and potential of early childhood so that later they can make the country proud to excel in the world of football domestically and abroad. For a football team, many critical factors for the success of anthropometric and physiological characteristics are essential factors in sports performance (Sutton *et al.*, 2009). However, evaluating body composition in soccer players helps improve their performance and evaluate the results of the implemented training plan (Sutton *et al.*, 2009).

In addition to the association with injury risk, it is also possible to find an association between fat mass and some physiological performance characteristics, such as speed (Lago-Peñas *et al.*, 2011)C, Casais, L, Dellal, A, Rey, E, and Domínguez, E. Anthropometric and physiological characteristics of young soccer players according to their playing positions: relevance for competition success. J Strength Cond Res 25(12. In connection with this, we know that body fat percentage (% BF) is a crucial determinant variable in the performance of soccer players (Nikolaidis *et al.*, 2016). However, body composition assessment incorporates several difficulties. Each technique presents advantages but also has limitations (Ackland *et al.*, 2012)but especially so in gravitational, weight class and aesthetic sports wherein the tissue composition of the body profoundly affects performance or adjudication. Over

✉ Correspondence Address:
UNNES Sekaran Campus, Gunungpati Semarang 50229 Central Java, Indonesia
Email: syakhustiani@mail.unnes.ac.id

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the past century, a myriad of techniques and equations have been proposed, but all have some inherent problems, whether in measurement methodology or in the assumptions they make. To date, there is no universally applicable criterion or 'gold standard' methodology for body composition assessment. Having considered issues of accuracy, repeatability and utility, the multi-component model might be employed as a performance or selection criterion, provided the selected model accounts for variability in the density of fat-free mass in its computation. However, when profiling change in interventions, single methods whose raw data are surrogates for body composition (with the notable exception of the body mass index. We know that a wide variety of methods without standardization (Meyer *et al.*, 2013) including demographic and content questions related to BC assessment. The survey was electronically distributed among international sporting organisations. Frequencies and χ(2 leads to quite different results (Leão *et al.*, 2017), so it is often impossible to compare samples from other studies. Despite the validity of using an equation based on skin folds (Skin Fold Caliper) to assess body composition, one of the assumptions is that the choice of the formula used validates in the same population (Meyer *et al.*, 2013)including demographic and content questions related to BC assessment. The survey was electronically distributed among international sporting organisations. Frequencies and χ(2.

In Football, one of the most prominent sports worldwide, coaches are part of a highly professional talent identification and development system (Mills *et al.*, 2012). The author sees various ways of identifying talent in the age group of 12. The age group 12 chooses the beginning of the athlete's career development. In previous research (Burhanuddin *et al.*, 2021; kholil & Reo, 2019; Mulyawan, 2019; Rusiawati & Wijana, 2022) the study used a single anthropometric or motor data. They did not examine the relationship between anthropometry and bio-motoric or measure performance. This study specifically examines position classification. This research develops the weaknesses of previous research. This study aims to determine the relationship between anthropometry and bio-motory on the performance of young soccer athletes.

Method

The sample is football academy athletes from Central Java. The sample is 221 Football Academy Athletes. This research uses purposive sampling. The selected sample is the 12-year-old group. Researchers directly collected data on the subject. All samples have filled the willingness to be studied. In anthropometry, researchers collected data on height, weight, head circumference, arm circumference, abdominal circumference, thigh circumference, chest circumference, arm length, and leg length. Biomotor components were measured using flexibility, leg strength, agility, coordination, and a 12-minute and 20-meter run. Performance was measured by observation from the researcher. Researchers see the appearance of players in a match. Observations included forwards, centers, backs, and goalkeepers made by football experts (lecturers) in the field directly and supported by match documents, namely match videos. Performance assessment is carried out with two observations for each player, so the performance value here is the average player's appearance in each position. The evaluation is based on how many complete indicators each player can display in their role in the game. Data collection is carried out during the match. The data obtained is processed using descriptive statistics, which include: minimum, maximum, mean, and std. Deviation. Researchers processed the data using normality, homogeneity, and correlation tests—statistical tests using SPSS version 22.

Result and Discussion

There is an anthropometric and bio-motor relationship to the performance of young soccer athletes. Athletes' anthropometric and physical characteristics are factors influencing their performance and health condition (Ackland *et al.*, 2012) but especially so in gravitational, weight class and aesthetic sports wherein the tissue composition of the body profoundly affects performance or adjudication. Over the past century, a myriad of techniques and equations have been proposed, but all have some inherent problems, whether in measurement

Table 1. Description of Biomotoric and Anthropometric Data

Items	Categories	Min	Max	Avg	StDev
Antropometric	Height (Cm)	1,2	1,69	1,4	0,10
	Weight (Kg)	20	105	38,3	11,6
	BMI	11,1	51,4	18,6	4,44
	Head Circumference (Cm)	49	62	53,27	1,99
	Arm circumference (Cm)	13	36	22,1	3,3
	Abdominal circumference (Cm)	52	103	64,9	9,3
	Thigh circumference (Cm)	28	65	40,3	5,4
	Chest circumference (Cm)	51	110	68,9	9,3
	Arm length (Cm)	49	79	61,4	5,2
	Leg length (Cm)	19	104	82,6	7,9
Bio-motoric	20-meter run (Sec)	1,61	6,1	4,1	0,5
	12-minute Run (Km)	0,99	2,97	2,0	0,3
	Flexibility (Cm)	-20	18	5,8	5,6
	Leg strength	20,5	144	61,2	24,5
	Agility	6	11,59	7,9	0,9
Performance		5	8	6,5	0,7

Table 2. Normality and Corelation Research

Position	Corelation	Data Normality	Conclusion
Fowards	0,000	Normal	There's a Relationship
Backs	0,000		
Goalkeepers	0,000		
Centers	0,000		

Source: Primary Data, 2023

methodology or in the assumptions they make. To date, there is no universally applicable criterion or 'gold standard' methodology for body composition assessment. Having considered issues of accuracy, repeatability and utility, the multi-component model might be employed as a performance or selection criterion, provided the selected model accounts for variability in the density of fat-free mass in its computation. However, when profiling change in interventions, single methods whose raw data are surrogates for body composition (with the notable exception of the body mass index. Adolescent growth follows a typical age trend (Canhadas *et al.*, 2011)282 male soccer players ranging in age from 10 to 13 years were evaluated. The athletes participated in a formal soccer training program 3 times per week, with each training lasting 3 hours. Anthropometric and physical fitness parameters were obtained. The boys were divided into age classes and prevalence data were analyzed using Pearson's chi-square test. Parametric data were compared by one-way ANOVA or the Kruskal-Wallis test, when necessary. The results are expressed as the mean ± standard deviation and a p value <0.05 was considered to be significant. Growth, development, body adiposity and physical fitness characteristics were adequate and proportional to age among the boys studied (p<0.05. Differences in height, weight, and body fat mass regarding playing position (Pantelis Theodoros Nikolaidis & Vassilios, 2011)these parameters of physical fitness were not well-studied in adolescent players. Aim of this study was to investigate physique and body composition across adolescence. METHODS: Male adolescents (N=297 aged 12.01-20.98 y.

However, nothing that significant differences during the development process affect the show's playing position. The maturation of young players' selection factors results in higher weight and height of selected players compared to unselected players (Gil *et al*., 2007)limb circumferences and joint diameters. VO(2max, giving salients to the discussion of relative age and potential future impact (Arnason *et al*., 2004; Carling *et al*., 2012; Carling & Orhant, 2010; Dellal *et al*., 2015; Milanese *et al*., 2015; Peñas *et al*., 2014; Sutton *et al*., 2009; Towlson *et al*., 2017)and to test for differences in physical fitness between different player positions. METHODS: Participants were 306 male soccer players from 17 teams in the two highest divisions in Iceland. Just before the start of the 1999 soccer season, the following variables were tested: height and weight, body composition, flexibility, leg extension power, jump height, and peak O2 uptake. Injuries and player participation in matches and training were recorded through the 4-month competitive season. Team average physical fitness was compared with team success (final league standing. These sportspeople. This review of the literature found substantial differences in anthropometric measures across playing positions and age groups (Canhadas *et al*., 2011; Deprez *et al*., 2015; Lago-Peñas *et al*., 2011; le Gall *et al*., 2010)pubertal soccer players with high, average and low yo-yo intermittent recovery test level 1 (YYIR1. Athletes' anthropometric characteristics are critical success elements in sports (Brunkhorst & Kielstein, 2013).

A wide age range (16-41 years, 1.48-1.87 m, 46-88 kg) supports the heterogeneity among top-level soccer players (Datson *et al*., 2014). As a result, coaches, players, and practitioners must acknowledge that adopting particular anthropometric and body composition targets is unjustified. Positional differences in elite players have been studied in a few investigations (Fields *et al*., 2018; Ingebrigtsen *et al*., 2011; Sedano *et al*., 2009; Vescovi *et al*., 2006). There have been reports of similarities between stature and body mass locations (Ingebrigtsen *et al*., 2011; Vescovi *et al*., 2006). Nonetheless, the average stature difference of 4-5 centimeters between goalkeepers (tallest) and forwards (shortest) and the average body mass difference of 4-6 kg between defenders (heaviest) and midfielders (lightest) are notable (Ingebrigtsen *et al*., 2011; Vescovi *et al*., 2006). Recently, it was discovered that goalkeepers have a more significant body fat percentage, body mass, and fat mass than other positions in players, with no differences between outfielder positions (Fields *et al*., 2018). A survey of Spanish players (Sedano *et al*., 2009) found anthropometric differences across all playing positions. Future studies should examine whether particular anthropometric profiles evolve to characterize specific positions in the field. This research has provided a solution to that revolution. Although not specific to soccer, the study offers best practice protocols and guidance on safety standards for assessing and disseminating findings (Ackerman *et al*., 2020; Meyer *et al*., 2013) including demographic and content questions related to BC assessment. The survey was electronically distributed among international sporting organisations. Frequencies and χ(2. Ensuring that all procedures are standardized, including methods, examiners, frequency, hydration testing, processes for requesting body composition assessments, and data dissemination (Meyer *et al*., 2013)including demographic and content questions related to BC assessment. The survey was electronically distributed among international sporting organisations. Frequencies and χ(2.

The bio-motor component results are both excellent and variable. The different methodologies/technologies used to collect data cause variations in measurement accuracy (Mara *et al*., 2017). However, recent publications by (Park *et al*., 2019; Scott & Lovell, 2018) imply that methodological approaches may impact data differently than previously suggested. Regardless of their contribution to overall activity, high-intensity running and sprinting are critical components (22-28% of total match distance covered (Vescovi & Favero, 2014)) of the sport's physiological demands (due to their involvement in important actions of match and ball running) and will necessitate the involvement of additional metabolic and physiological resources (e.g., anaerobic energy systems). The athlete's chance of injury is reduced when bio motor components are vital. Injuries caused by soccer are frequently complex and influenced by the interaction of multiple risk factors (Bittencourt *et al.*, 2016). Risk factors can be intrinsic (athlete-related) or extrinsic (environment-related), modifiable, or non-modifiable (Bahr & Holme, 2003). Identifying risk factors and injury mechanisms is critical to developing potential prevention strategies (Faude *et al.*, 2006). Previous injury is widely acknowledged as a significant intrinsic risk factor for future injury in youth (Hägglund & Waldén, 2016; Lilley *et al.*, 2002; Steffen *et al.*, 2008) and senior players (Del Coso *et al.*, 2018; Jacobson & Tegner, 2007; Nilstad *et al.*, 2014; Niyonsenga & Phillips, 2013; Söderman *et al.*, 2001a). Young athletes with a history of at least one prior injury have a 74% higher chance of injury (Emery *et al.*, 2005). Similarly, senior players who had previously sustained an ACL injury had a nine-fold increase in knee injuries (Nilstad *et al.*, 2014). Furthermore, the likelihood of suffering a new injury rises with the number of prior injuries (Steffen *et al.*, 2008). Although previous injury history appears significant in predicting future risk, changeable risk factors are more appealing because steps can be taken to reduce their effect, reducing the number of original injuries. Injury rates were reduced among athletes who progressed from U12 to U14. All players who advanced from the U12 to the U14 squad to the first team had a match availability rate greater than 84% and no anterior cruciate ligament (ACL) injuries or injuries that needed more than 200 (+200) days to heal before returning to play (Larruskain *et al.*, 2022). Human contact should be incorporated into all aspects of the injury monitoring system, focusing on its active involvement in guiding the injury management process (Vella *et al.*, 2022). The in-depth study on exercise burden and injury risk (Bache-Mathiesen *et al.*, 2022).

Reduced knee alignment, i.e., more significant dynamic valgus, elevated abduction loads (Hewett *et al.*, 2005; O'Kane *et al.*, 2017), and diminished knee and hip flexion angles (Yu *et al.*, 2005) during landing, were found as modifiable inherent risk factors in participants. Furthermore, decreased lower body strength (O'Kane *et al.*, 2017), lower hamstring/hips ratio during progressive action (Söderman *et al.*, 2001b), generalized joint hypermobility (laxity) (Östenberg & Roos, 2000; Söderman *et al.*, 2001b), and knee hyperextension particularly (Söderman *et al.*, 2001b) have all been linked to an increased chance of lower limb injury. Other modifiable and non-modifiable risk factors include increased age (Del Coso *et al.*, 2018; Emery *et al.*, 2005; Hägglund & Waldén, 2016; Jacobson & Tegner, 2007; Östenberg & Roos, 2000; Sugimoto *et al.*, 2018), increased body mass index (Faude *et al.*, 2006; Nilstad *et al.*, 2014; Sugimoto *et al.*, 2018), increased height (Faude *et al.*, 2006), playing position (Faude *et al.*, 2006; O'Kane *et al.*, 2017) (forwards and defenders are at higher risk), high training/competition (O'Kane *et al.*, 2017; Söderman *et al.*, 2001b), participation in a single sport (O'Kane *et al.*, 2017), time in season (Giza *et al.*, 2005; Jacobson & Tegner, 2007; Le Gall *et al.*, 2008), increased playing history (Steffen *et al.*, 2008), increased competitive level (Emery *et al.*, 2005), hormonal fluctuations (Hewett *et al.*, 2007), (Le Gall *et al.*, 2008). Because the prior injury is regarded as the most significant risk factor for injury (Crossley *et al.*, 2020), it is fair to conclude that total healing is required to help avoid re-injury (Haxhiu *et al.*, 2015). A devoted recovery program will typically treat the damaged portion while also focusing on changes in muscle, proprioception, and movements that may have happened due to the injury or time missed from training/competition (Fulton *et al.*, 2014). It is critical to realize that incorporating sports psychology and sports nutrition can support a return-to-play strategy guided by medical physicians and physical therapists (Rollo *et al.*, 2021). As a result, a multidisciplinary approach is advised.

Due to the high-intensity motions, training methods should emphasize the development of players' powerful strength (Martínez-Hernández *et al.*, 2023). The average soccer tournament success outcomes are favorable. The overall distance covered during a match shows the amount of action done by the players, and while there is some variance, top players typically cross 10 km during a game (Hewitt *et al.*, 2014; Jagim *et al.*, 2020; Martínez-Lagunas *et al.*, 2014; Ramos *et al.*, 2019; Sausaman *et al.*, 2019). While these values may help approximate total mobility needs worldwide, the vigor with which these activities are performed is far more essential. More precisely, the amount of exercises performed at a high and maximum sprinting pace is critical (Datson *et al.*, 2014); these activities may be more linked with team success. The distance traversed in high-intensity actions is typically calculated by adding a specific speed benchmark to the player's moves and then tallying the number of activities that surpass the applicable limit (Mara *et al.*, 2017). Both the methods for establishing speed limits (individual vs. generic, e.g. (Scott & Lovell, 2018) and (Datson *et al.*, 2017) and performance vs. statistics (Bradley & Vescovi, 2015; Park *et al.*, 2019) result in uncertainty in this area and make it challenging to produce comprehensive agreement data (Bradley & Vescovi, 2015).

The trend of high-intensity activity completion is a critical element in the total metabolic expense of exercise. This has led to an interest in the assessment of repetitive acceleration exercises. Although the meaning of repetitive sprint exercise varies, most studies use a comprehensive categorization encompassing multiple instances of high-speed jogging and sprinting within a specified recuperation time (Datson *et al.*, 2019). According to the literature, the number of such encounters in games ranges between 1 and 25 bouts (Datson *et al.*, 2019; Gabbett *et al.*, 2013; Nakamura *et al.*, 2017), implying that the capacity to finish this high-intensity exercise with a brief recovery is not a key component of game demands. This variance is mainly due to weather circumstances (Benjamin *et al.*, 2020; Trewin *et al.*, 2018), playing position (Datson *et al.*, 2017; Vescovi & Favero, 2014), the standard of play (Andersson *et al.*, 2010; Mohr *et al.*, 2008; Ramos *et al.*, 2019), and other external variables such as opponent caliber (Hewitt *et al.*, 2014), court surface (Vescovi & Falenchuk, 2019), and team strategies, which appear to affect a player's overall activity profile.

Soccer athletes, on the other hand, require dietary information, instruction, and remedies (McGuire *et al.*, 2023). Some corroborating study on sports is required. "Hype Energy Drink" can hasten muscular and liver healing and enhance recovery in soccer players (AdibSaber *et al.*, 2023). Isokinetic power in soccer players requires clinical examination (Van Der Horst & Denderen, 2022). The Institute of Direction of Elite Youth Soccer Match Play offers practitioners advice to prepare soccer players for the rigors of professional matches (Morgan *et al.*, 2022). The bulk of young athletes slumber less than is suggested, and those who sleep longer have superior academic outcomes (Merayo *et al.*, 2022). Inter-individual variations in development status, but not relative age, are linked with athletic success in juvenile soccer schools, independent of trainers' standards (Peña-González *et al.*, 2022). Teachers should promote growth during infancy to improve actual ability performance (Duncan *et al.*, 2022). The caliber of opponents and squad achievement can impact competition performance in a top junior event. When evaluating match performance, these environmental variables should be examined and used to influence team tactics, selection strategies, and replacements (Varley *et al.*, 2017). An upcoming study on the interoperability of a 10-Hz multi-GNSS GPS device (Vector®) and two visual tracking systems (TRACAB® and Second Spectrum®) is required (Ellens *et al.*, 2022).

This research has made a positive contribution to football academy coaches. The researcher suggested that other groups accomplish further research with a broader range of subjects. This research only uses quantitative instruments, and further research is recommended to use qualitative research to produce holistic knowledge. Efforts to advance the football sector are expected to continue to be pursued to promote sports development.

Conclusion

There is an anthropometric and bio-motor relationship to the performance of young soccer athletes. They are positively correlated in all positions (Forwards, Backs, Goalkeepers, Centers). The researcher suggested that other groups accomplish further research with a broader range of subjects. Efforts to advance the football sector are expected to continue to be pursued to promote sports development.

Reference

Ackerman, K.E., Stellingwerff, T., Elliott-Sale, K.J., Baltzell, A., Cain, M., Goucher, K., Fleshman, L., & Mountjoy, M.L., 2020. # REDS (Relative Energy Deficiency in Sport): Time for a Revolution in Sports Culture and Systems to Improve Athlete Health and Performance. *British Journal of Sports Medicine*, 54(7), pp.369–370.

Ackland, T.R., Lohman, T.G., Sundgot-Borgen, J., Maughan, R.J., Meyer, N.L., Stewart, A.D., & Müller, W., 2012. Current Status of Body Composition Assessment in Sport: Review and Position Statement on Behalf of the Ad Hoc Research Working Group on Body Composition Health and Performance, Under the Auspices of the I.O.C. Medical Commission. *Sports Medicine*, 42(3), pp.227–249.

AdibSaber, F., Ansari, S., Elmieh, A., & Rajabzadeh, H., 2023. Effect of an Energy Drink On Muscle and Liver Damage Enzymes, And Cardiovascular Indices in Soccer Players. *Science and Medicine in Football*, 7(1), pp.8–14.

Andersson, H.Å., Randers, M.B., Heiner-Møller, A., Krustrup, P., & Mohr, M., 2010. Elite Female Soccer Players Perform More High-Intensity Running When Playing in International Games Compared with Domestic League Games. *The Journal of Strength & Conditioning Research*, 24(4), pp.912–919.

Arnason, A., Sigurdsson, S.B., Gudmundsson, A., Holme, I., Engebretsen, L., & Bahr, R., 2004. Physical Fitness, Injuries, and Team Performance in Soccer. *Medicine and Science in Sports and Exercise*, 36(2), pp.278–285.

Bache-Mathiesen, L.K., Andersen, T.E., Clarsen, B., & Fagerland, M.W., 2022. Handling and Reporting Missing Data in Training Load and Injury Risk Research. *Science and Medicine in Football*, 6(4), pp.452–464.

Bahr, R., & Holme, I., 2003. Risk Factors for Sports Injuries—A Methodological Approach. *British Journal of Sports Medicine*, 37(5), pp.384–392.

Benjamin, C.L., Hosokawa, Y., Curtis, R.M., Schaefer, D.A., Bergin, R.T., Abegg, M.R., & Casa, D.J., 2020. Environmental Conditions, Preseason Fitness Levels, and Game Workload: Analysis of a Female NCAA DI National Championship Soccer Season. *The Journal of Strength & Conditioning Research*, 34(4), pp.988–994.

Bittencourt, N.F.N., Meeuwisse, W.H., Mendonça, L.D., Nettel-Aguirre, A., Ocarino, J.M., & Fonseca, S.T., 2016. Complex Systems Approach for Sports Injuries: Moving from Risk Factor Identification to Injury Pattern Recognition—Narrative Review and New Concept. *British Journal of Sports Medicine*, 50(21), pp.1309–1314.

Bradley, P.S., & Vescovi, J.D., 2015. Velocity Thresholds for Women's Soccer Matches: Sex Specificity Dictates High-Speed-Running and Sprinting Thresholds—Female Athletes in Motion (FAiM). *International Journal of Sports Physiology and Performance*, 10(1), pp.112–116.

Brunkhorst, L., & Kielstein, H., 2013. Comparison of Anthropometric Characteristics Between Professional Triathletes and Cyclists. *Biology of Sport/Institute of Sport*, 30, pp.269–273.

Burhanuddin, S., Ihsan, A., Jumareng, H., & Anugrah, B.A., 2021. Biomotor, Psychomotor, and Anthropometry As Determiners of Sport Talent Scouting At Secondary Schools: Analysis of Dominant Determinants of Sports Talent At Secondary Schools in Indonesia. *PalArch's Journal of Archaeology of Egypt/Egyptology*, 18(4), pp.3426–3444.

Canhadas, I., Silva, R., Chaves, C., & Portes, L., 2011. Características Antropométricas e de Aptidão Física de Meninos Atletas de Futebol. *Revista Brasileira de Cineantropometria e Desempenho Humano*, 12.

Carling, C., Le Gall, F., & Malina, R.M., 2012. Body Size, Skeletal Maturity, and Functional Characteristics of Elite Academy Soccer Players on Entry Between 1992 and 2003. *Journal of Sports Sciences*, 30(15), pp.1683–1693.

Carling, C., & Orhant, E., 2010. Variation in Body Composition in Professional Soccer Players: Interseasonal and Intraseasonal Changes and the Effects of Exposure Time and Player Position. *Journal of Strength and Conditioning Research*, 24(5), pp.1332–1339.

Crossley, K.M., Patterson, B.E., Culvenor, A.G., Bruder, A.M., Mosler, A.B., & Mentiplay, B.F., 2020. Making Football Safer for Women: A Systematic Review and Meta-Analysis of Injury Prevention Programmes in 11 773 Female Football (Soccer) Players. *British Journal of Sports Medicine*, 54(18), pp.1089–1098.

Datson, N., Drust, B., Weston, M., & Gregson, W., 2019. Repeated High-Speed Running in Elite Female Soccer Players During International Competition. *Science and Medicine in Football*, 3(2), pp.150–156.

Datson, N., Drust, B., Weston, M., Jarman, I.H.,

Lisboa, P.J., & Gregson, W., 2017. Match Physical Performance of Elite Female Soccer Players During International Competition. *The Journal of Strength & Conditioning Research*, 31(9), pp.2379–2387.
Datson, N., Hulton, A., Andersson, H., Lewis, T., Weston, M., Drust, B., & Gregson, W., 2014. Applied Physiology of Female Soccer: An Update. *Sports Medicine*, 44, pp.1225–1240.
Del Coso, J., Herrero, H., & Salinero, J.J., 2018. Injuries in Spanish female soccer players. *Journal of Sport and Health Science*, 7(2), pp.183–190.
Dellal, A., Lago-Peñas, C., Rey, E., Chamari, K., & Orhant, E., 2015. The Effects of a Congested Fixture Period on Physical Performance, Technical Activity and Injury Rate During Matches in a Professional Soccer Team. *British Journal of Sports Medicine*, 49(6), pp.390–394.
Deprez, D., Buchheit, M., Fransen, J., Pion, J., Lenoir, M., Philippaerts, R.M., & Vaeyens, R., 2015. A Longitudinal Study Investigating the Stability of Anthropometry and Soccer-Specific Endurance in Pubertal High-Level Youth Soccer Players. *Journal of Sports Science & Medicine*, 14(2), pp.418–426.
Duncan, M., Eyre, E.L.J., Noon, M., Morris, R., Thake, D., & Clarke, N., 2022. Fundamental Movement Skills and Perceived Competence, but not Fitness, are the Key Factors Associated with Technical Skill Performance in Boys who Play Grassroots Soccer. *Science and Medicine in Football*, 6(2), pp.215–220.
Ellens, S., Hodges, D., McCullagh, S., Malone, J.J., & Varley, M.C., 2022. Interchangeability of Player Movement Variables from Different Athlete Tracking Systems in Professional Soccer. *Science and Medicine in Football*, 6(1), pp.1–6.
Emery, C.A., Meeuwisse, W.H., & Hartmann, S.E., 2005. Evaluation of Risk Factors for Injury in Adolescent Soccer: Implementation and Validation of an Injury Surveillance System. *The American Journal of Sports Medicine*, 33(12), pp.1882–1891.
Faude, O., Junge, A., Kindermann, W., & Dvorak, J., 2006. Risk Factors for Injuries in Elite Female Soccer Players. *British Journal of Sports Medicine*, 40(9), pp.785–790.
Fields, J.B., Merrigan, J.J., White, J.B., & Jones, M.T., 2018. Body Composition Variables by Sport and Sport-Position in Elite Collegiate Athletes. *The Journal of Strength & Conditioning Research*, 32(11), pp.3153–3159.
Fulton, J., Wright, K., Kelly, M., Zebrosky, B., Zanis, M., Drvol, C., & Butler, R., 2014. Injury Risk is Altered by Previous Injury: A Systematic Review of the Literature and Presentation of Causative Neuromuscular Factors. *International Journal of Sports Physical Therapy*, 9(5), pp.583.
Gabbett, T.J., Wiig, H., & Spencer, M., 2013. Repeated High-Intensity Running and Sprinting in Elite Women's Soccer Competition. *International Journal of Sports Physiology and Performance*, 8(2), pp.130–138.
Gil, S., Ruiz, F., Irazusta, A., Gil, J., & Irazusta, J., 2007. Selection of Young Soccer Players in Terms of Anthropometric and Physiological Factors. *The Journal of Sports Medicine and Physical Fitness*, 47(1), pp.25–32.
Giza, E., Mithöfer, K., Farrell, L., Zarins, B., & Gill, T., 2005. Injuries in Women's Professional Soccer. *British Journal of Sports Medicine*, 39(4), pp.212–216.
Hägglund, M., & Waldén, M., 2016. Risk Factors for Acute Knee Injury in Female Youth Football. *Knee Surgery, Sports Traumatology, Arthroscopy*, 24(3), pp.737–746.
Hanani, E., 2017. The Study on Value of Recreational Sports Activity of Urban Communities. *Jurnal Kesehatan Masyarakat*, 12(2), pp.286-291.
Haxhiu, B., Murtezani, A., Zahiti, B., Shalaj, I., & Sllamniku, S., 2015. Risk Factors for Injuries in Professional Football Players. *Folia Medica*, 57(2), pp.138.
Hewett, T.E., Myer, G.D., Ford, K.R., Heidt Jr, R.S., Colosimo, A.J., McLean, S.G., Van den Bogert, A.J., Paterno, M.V., & Succop, P., 2005. Biomechanical Measures of Neuromuscular Control and Valgus Loading of the Knee Predict Anterior Cruciate Ligament Injury Risk in Female Athletes: A Prospective Study. *The American Journal of Sports Medicine*, 33(4), pp.492–501.
Hewett, T.E., Zazulak, B.T., & Myer, G.D., 2007. Effects of the Menstrual Cycle on Anterior Cruciate Ligament Injury Risk: A Systematic Review. *The American Journal of Sports Medicine*, 35(4), pp.659–668.
Hewitt, A., Norton, K., & Lyons, K., 2014. Movement Profiles of Elite Women Soccer Players During International Matches and the Effect of Opposition's Team Ranking. *Journal of Sports Sciences*, 32(20), pp.1874–1880.
Ingebrigtsen, J., Dillern, T., & Shalfawi, S.A.I., 2011. Aerobic Capacities and Anthropometric Characteristics of Elite Female Soccer Players. *The Journal of Strength & Conditioning*

Research, 25(12), pp.3352–3357.

Jacobson, I., & Tegner, Y., 2007. Injuries among Swedish Female Elite Football Players: A Prospective Population Study. *Scandinavian Journal of Medicine & Science in Sports*, 17(1), pp.84–91.

Jagim, A.R., Murphy, J., Schaefer, A.Q., Askow, A.T., Luedke, J.A., Erickson, J.L., & Jones, M.T., 2020. Match Demands of Women's Collegiate Soccer. *Sports*, 8(6), pp.87.

Kholil, W., & Reo, P.H., 2019. Studi Biomotorik Cabang Olahraga Sepakbola Pada SSB Semen Gresik Tuban Usia 17 Tahun. *Journal of Chemical Information and Modeling*, *53*(9), pp.1689–1699.

Lago-Peñas, C., Casais, L., Dellal, A., Rey, E., & Domínguez, E., 2011. Anthropometric and Physiological Characteristics of Young Soccer Players According to Their Playing Positions: Relevance for Competition Success. *Journal of Strength and Conditioning Research*, 25(12), pp.3358–3367.

Larruskain, J., Lekue, J.A., Martin-Garetxana, I., Barrio, I., McCall, A., & Gil, S.M., 2022. Injuries are Negatively Associated with Player Progression in an Elite Football Academy. *Science and Medicine in Football*, 6(4), pp.405–414.

Le Gall, F., Carling, C., & Reilly, T., 2008. Injuries in Young Elite Female Soccer Players: An 8-Season Prospective Study. *The American Journal of Sports Medicine*, 36(2), pp.276–284.

le Gall, F., Carling, C., Williams, M., & Reilly, T., 2010. Anthropometric and Fitness Characteristics of International, Professional and Amateur Male Graduate Soccer Players from an Elite Youth Academy. *Journal of Science and Medicine in Sport*, 13(1), pp.90–95.

Leão, C., Simões, M., Silva, B., Clemente, F.M., Bezerra, P., & Camões, M., 2017. Body Composition Evaluation Issue among Young Elite Football Players: DXA Assessment. *Sports*, 5(1).

Lilley, K., Gass, E., & Locke, S., 2002. A Retrospective Injury Analysis of State Representative Female Soccer Players. *Physical Therapy in Sport*, 3(1), pp.2–9.

Mara, J.K., Thompson, K.G., Pumpa, K.L., & Morgan, S., 2017. Quantifying the High-Speed Running and Sprinting Profiles of Elite Female Soccer Players During Competitive Matches Using an Optical Player Tracking System. *The Journal of Strength & Conditioning Research*, 31(6), pp.1500–1508.

Martínez-Hernández, D., Quinn, M., & Jones, P., 2023. Linear Advancing Actions Followed by Deceleration and Turn are the Most Common Movements Preceding Goals in Male Professional Soccer. *Science and Medicine in Football*, 7(1), pp.25–33.

Martínez-Lagunas, V., Niessen, M., & Hartmann, U., 2014. Women's Football: Player Characteristics and Demands of the Game. *Journal of Sport and Health Science*, 3(4), pp.258–272.

McGuire, A., Warrington, G., & Doyle, L., 2023. Energy Availability and Macronutrient Intake in Elite Male Gaelic Football Players. *Science and Medicine in Football*, 7(1), pp.1–7.

Merayo, A., Gallego, J.M., Sans, O., Capdevila, L., Iranzo, A., Sugimoto, D., & Rodas, G., 2022. Quantity and Quality of Sleep in Young Players of a Professional Football Club. *Science and Medicine in Football*, 6(4), pp.539–544.

Meyer, N.L., Sundgot-Borgen, J., Lohman, T.G., Ackland, T.R., Stewart, A.D., Maughan, R.J., Smith, S., & Müller, W., 2013. Body Composition for Health and Performance: A Survey of Body Composition Assessment Practice Carried Out by the Ad Hoc Research Working Group on Body Composition, Health and Performance Under the Auspices of the IOC Medical Commission. *British Journal of Sports Medicine*, 47(16), pp.1044–1053.

Milanese, C., Cavedon, V., Corradini, G., De Vita, F., & Zancanaro, C., 2015. Seasonal DXA-Measured Body Composition Changes in Professional Male Soccer Players. *Journal of Sports Sciences*, 33(12), pp.1219–1228.

Mills, A., Butt, J., Maynard, I., & Harwood, C., 2012. Identifying Factors Perceived to Influence the Development of Elite Youth Football Academy Players. *Journal of Sports Sciences*, 30.

Mohr, M., Krustrup, P., Andersson, H., Kirkendal, D., & Bangsbo, J., 2008. Match Activities of Elite Women Soccer Players at Different Performance Levels. *The Journal of Strength & Conditioning Research*, 22(2), pp.341–349.

Morgan, O.J., Drust, B., Ade, J.D., & Robinson, M.A., 2022. Change of Direction Frequency Off the Ball: New Perspectives in Elite Youth Soccer. *Science and Medicine in Football*, 6(4), pp.473–482.

Mulyawan, R., 2019. Profil Antropometri Atlet Sepakbola Profesional Pada Masa Transisi. *Medikora*, 18(1), pp.17–26.

Nakamura, F.Y., Pereira, L.A., Loturco, I., Rosseti, M., Moura, F.A., & Bradley, P.S., 2017. Repeated-Sprint Sequences During Female Soccer Matches Using Fixed and Individual Speed Thresholds. *The Journal of Strength & Conditioning Research*, 31(7), pp.1802–1810.

Nikolaidis, P.T., Ruano, M.A.G., de Oliveira, N.C., Portes, L.A., Freiwald, J., Leprêtre, P.M., & Knechtle, B., 2016. Who Runs the Fastest? Anthropometric and Physiological Correlates of 20m Sprint Performance in Male Soccer Players. *Research in Sports Medicine (Print)*, 24(4), pp.341–351.

Nikolaidis, P.T., & Vassilios, K.N., 2011. Physique and Body Composition in Soccer Players Across Adolescence. *Asian Journal of Sports Medicine*, 2(2), pp.75–82.

Nilstad, A., Andersen, T.E., Bahr, R., Holme, I., & Steffen, K., 2014. Risk Factors for Lower Extremity Injuries in Elite Female Soccer Players. *The American Journal of Sports Medicine*, 42(4), pp.940–948.

Niyonsenga, J.D., & Phillips, J.S., 2013. Factors Associated with Injuries Among First-Division Rwandan Female Soccer Players. *African Health Sciences*, 13(4), pp.1021–1026.

O'Kane, J.W., Neradilek, M., Polissar, N., Sabado, L., Tencer, A., & Schiff, M.A., 2017. Risk Factors for Lower Extremity Overuse Injuries in Female Youth Soccer Players. *Orthopaedic Journal of Sports Medicine*, 5(10).

Östenberg, A., & Roos, H., 2000. Injury Risk Factors in Female European Football. A Prospective Study of 123 Players During One Season. *Scandinavian Journal of Medicine & Science in Sports*, 10(5), pp.279–285.

Park, L.A.F., Scott, D., & Lovell, R., 2019. Velocity Zone Classification In Elite Women's Football: Where do We Draw The Lines?. *Science and Medicine in Football*, 3(1), pp.21–28.

Peña-González, I., Javaloyes, A., Cervelló, E., & Moya-Ramón, M., 2022. The Maturity Status but not the Relative Age Influences Elite Young Football Players' Physical Performance. *Science and Medicine in Football*, 6(3), pp.309–316.

Peñas, C., Rey, E., Casais, L., & Gómez, L.M., 2014. Relationship Between Performance Characteristics and the Selection Process in Youth Soccer Players. *Journal of Human Kinetics*, 40, pp.189–199.

Ramos, G.P., Nakamura, F.Y., Penna, E.M., Wilke, C.F., Pereira, L.A., Loturco, I., Capelli, L., Mahseredjian, F., Silami-Garcia, E., & Coimbra, C.C., 2019. Activity Profiles in U17, U20, and Senior Women's Brazilian National Soccer Teams During International Competitions: are There Meaningful Differences? *The Journal of Strength & Conditioning Research*, 33(12), pp.3414–3422.

Rollo, I., Carter, J.M., Close, G.L., Yangüas, J., Gomez-Diaz, A., Medina Leal, D., Duda, J.L., Holohan, D., Erith, S.J., & Podlog, L., 2021. Role of Sports Psychology and Sports Nutrition in Return to Play from Musculoskeletal Injuries in Professional Soccer: An Interdisciplinary Approach. *European Journal of Sport Science*, 21(7), pp.1054–1063.

Rusiawati, R.T.H.D., & Wijana, I.K., 2022. Analisis Hasil Pengukuran Antropometri pada Atlet Cabang Olahraga Sepak Bola. *Jurnal Ilmu Keolahragaan Undiksha*, 9(3), pp.198–203.

Sausaman, R.W., Sams, M.L., Mizuguchi, S., DeWeese, B.H., & Stone, M.H., 2019. The Physical Demands of NCAA Division I Women's College Soccer. *Journal of Functional Morphology and Kinesiology*, 4(4), pp.73.

Scott, D., & Lovell, R., 2018. Individualisation of Speed Thresholds Does Not Enhance the Dose-Response Determination in Football Training. *Journal of Sports Sciences*, 36(13), pp.1523–1532.

Sedano, S., Vaeyens, R., Philippaerts, R.M., Redondo, J.C., & Cuadrado, G., 2009. Anthropometric and Anaerobic Fitness Profile of Elite and Non-Elite Female Soccer Players. *Journal of Sports Medicine and Physical Fitness,* 49(4), pp.387.

Söderman, K., Adolphson, J., Lorentzon, R., & Alfredson, H., 2001a. Injuries in Adolescent Female Players in European Football: A Prospective Study Over One Outdoor Soccer Season. *Scandinavian Journal of Medicine & Science in Sports*, 11(5), pp.299–304.

Söderman, K., Alfredson, H., Pietilä, T., & Werner, S., 2001b. Risk Factors for Leg Injuries in Female Soccer Players: A Prospective Investigation During One Out-Door Season. *Knee Surgery, Sports Traumatology, Arthroscopy*, 9(5).

Steffen, K., Myklebust, G., Andersen, T.E., Holme, I., & Bahr, R., 2008. Self-Reported Injury History and Lower Limb Function As Risk Factors for Injuries in Female Youth Soccer. *The American Journal of Sports Medicine*, 36(4), pp.700–708.

Sugimoto, D., Howell, D.R., Tocci, N.X., & Meehan III, W.P., 2018. Risk Factors Associated with Self-Reported Injury History in Female Youth Soccer Players. *The Physician and*

Sportsmedicine, 46(3), pp.312–318.

Sutton, L., Scott, M., Wallace, J., & Reilly, T., 2009. Body Composition of English Premier League Soccer Players: Influence of Playing Position, International Status, and Ethnicity. *Journal of Sports Sciences*, 27, 1019–1026.=

Towlson, C., Cobley, S., Midgley, A.W., Garrett, A., Parkin, G., & Lovell, R., 2017. Relative Age, Maturation and Physical Biases on Position Allocation in Elite-Youth Soccer. *International Journal of Sports Medicine*, 38(3), pp.201–209.

Trewin, J., Meylan, C., Varley, M.C., Cronin, J., & Ling, D., 2018. Effect of Match Factors on the Running Performance of Elite Female Soccer Players. *The Journal of Strength & Conditioning Research*, 32(7), pp.2002–2009.

Van Der Horst, N., & Denderen, R.V., 2022. Isokinetic Hamstring and Quadriceps Strength Interpretation Guideline for Football (Soccer) Players with ACL Reconstruction: A Delphi Consensus Study in the Netherlands. *Science and Medicine in Football*, 6(4), pp.434–445.

Varley, M.C., Gregson, W., McMillan, K., Bonanno, D., Stafford, K., Modonutti, M., & Di Salvo, V., 2017. Physical and Technical Performance of Elite Youth Soccer Players During International Tournaments: Influence of Playing Position and Team Success and Opponent Quality. *Science and Medicine in Football*, 1(1), pp.18–29.

Vella, S., Bolling, C., Verhagen, E., & Moore, I.S., 2022. Perceiving, Reporting and Managing an Injury – Perspectives from National Team Football Players, Coaches, and Health Professionals. *Science and Medicine in Football*, 6(4), pp.421–433.

Vescovi, J.D, Brown, T.D., & Murray, T.M., 2006. Positional Characteristics of Physical Performance in Division I College Female Soccer Players. *Journal of Sports Medicine and Physical Fitness*, 46(2), pp.221.

Vescovi, J.D., & Falenchuk, O., 2019. Contextual Factors on Physical Demands in Professional Women's Soccer: Female Athletes in Motion Study. *European Journal of Sport Science*, 19(2), pp.141–146.

Vescovi, J.D., & Favero, T.G., 2014. Motion Characteristics of Women's College Soccer Matches: Female Athletes in Motion (FAiM) Study. *International Journal of Sports Physiology and Performance*, 9(3), pp.405–414.

Yu, B., McClure, S.B., Onate, J.A., Guskiewicz, K.M., Kirkendall, D.T., & Garrett, W.E., 2005. Age and Gender Effects on Lower Extremity Kinematics of Youth Soccer Players in a Stop-Jump Task. *The American Journal of Sports Medicine*, 33(9), pp.1356–1364.