The Internal and External Loading Differences Between Part-Time (U16) and Full-Time (U18) Elite English Academy Footballers

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Abstract

The aim of this study was to quantify and compare total loading (TL) of part and full- time elite English academy footballers over a 10-week period. Nineteen male youth players were categorised into their age groups; U18's (17.7 ± 0.6 years) and U16's (16.1 ± 0.4 years). Global Positioning Systems (GPS) and Session-Rate of Perceived Exertion (SRPE) were used to assess the external and internal measures of TL. The U18's participated in 45 sessions as opposed to 30 for the U16's. The U16's (n = 48) had 22% more unexplained absences compared to the U18's (n = 0). The TL was greater for the U18's over a 10-week period. For the U18's, Total Distance Covered was *likely* greater (54%; *Moderate* ES; ± 90% CL) and *possibly* greater for HSR (160%; *Large* ES; ± 90% CL) and SRPE (50%; *Large* ES; ± 90% CL). It was *unclear* if there was a difference in ACC and DEC between the ages. This study also assessed the intensities of two separate drills, session 1 (TS1) in respective age groups and session 2 (TS2) in mixed age groups. During TS1 and TS2 it was difficult to distinguish whether there were external loading differences between the age groups. Whereas, internal load was *very likely* greater (TS1, 18%; TS2, 22%; *Large* ES; 90% CL) suggesting that the U16's perceived the drills to be harder than the U18's. The main finding was that the U16's had less compliance to sessions, indicating a variability in TL, which could put them at greater risk of injury. Practitioners must ensure that appropriate loading strategies are in place so that part-time players are prepared to step up to the demands of a full-time environment.

Key Words: Load; GPS; SRPE; Compliance; Injury

Introduction

Practitioners are constantly looking to increase the physical capabilities of footballers, to ensure that they are prepared to cope with the increased physical and technical demands of a game (Bush et al. 2015). This task has been shown to be extremely difficult to ensure players get the appropriate training stimulus and can have detrimental effects if this is too much or too little (Sawczuk et al. 2018). The simple training principles of progression and overload are vital for the development of these physical capacities (Zatsiorsky & Kraemer 2006), however pushing these boundaries too much has been shown to be associated with injury (Bowen et al. 2016). Adverse load, which is expressed on the body through training and match play (Hulin et al. 2015), has been shown to be a large contributor to injuries in team sports (Gabbett & Jenkins 2011; Rogalski et al. 2013). Bowen et al., (2016) suggest that an acute increase, or a spike, in training load in football is associated with greater risk of injury. Often there has been a focus on pushing athletes too much, thus possibly leading to injury but it is also important to recognise that low or variable physical loads followed by normal or high physical loads could be deemed a 'spike'(Sawczuk et al. 2018). These 'spikes' in physical load may not just due to significantly harder training weeks (Bowen et al. 2016) but could also occur from training variability or load being too low due to lack of game time or low training exposure (Bowen et al. 2016). This complex dilemma of the appropriate training prescription is a modern-day paradox, training too much or too little could lead to injury but finding that optimum level has become ever more difficult and varies for each individual (Gabbett 2016).

The implementation of the Elite Player Performance Plan (EPPP; The Premier League, 2011), led English academies to increase the number of training hours for their youth players (Premier

League 2011). The on-pitch football exposure was recommended to incrementally increase from 6,600 to 8,500 hours through the ages of 9-21's (Premier League 2011). Recent literature investigated the injury incidence in English category 1 football academies (Read et al. 2018) and found since this plan the injury incidence in elite youth male footballers trebled (Read et al. 2018). They found that the biggest injury incidence was in the U18s with 2.14 injuries per player per season (Read et al. 2018). This suggests that there could be an association between an increase of football training exposure and injuries (Read et al. 2018). The increase in on pitch training exposure subsequently increases the total load expressed on the players (Wrigley et al. 2012), therefore if this is not managed appropriately it could lead to adverse loading problems, which has been shown to increase risk of injury (Drew & Finch 2016).

This football exposure increases when youth footballers transition from a part-time program, into a full-time model at professional academies (Wrigley et al. 2012), which could be hypothesized as a spike in physical load (Abade et al. 2014). This transitional period from part to full time could be viewed as a vulnerable period, due to growth and maturation statuses (Balyi & Hamilton 2004; Meylan et al. 2010). Meylan et al., (2010) suggest that players who are close to their peak height velocity (PHV), corresponding to the adolescent growth spurt, have been shown to be extremely vulnerable to injury. In this period, there is heightened sensitivity to mechanical stress, as youths are still adapting to their body following periods of rapid growth, typically associated with adolescent awkwardness (Lloyd & Oliver 2013). Maturation statuses have been shown to be completely individual and although PHV occurs approximately at the age of 14 (Malina et al. 2004), it has been shown to occur earlier or later (Malina et al. 2004). This is important, as although typically footballers come into a full-time environment at the age of 16, some players may still be within this 2-year period post PHV. This vulnerable period combined with an acute increase in physical load could be hypothesized as an extremely critical period; which if not managed correctly, could lead to injury (Meylan et al. 2010; Wrigley et al. 2012; Bowen et al. 2016).

Although the football exposure has increased since the EPPP, there is a lack of research quantifying the differences in physical load in elite English football academies between part and full-time players. Quantifying total physical load in football has been shown to be a difficult task with the multifaceted demands of the sport (Bush et al. 2015). Researchers have previously looked to quantify total physical load through many different internal and external measures (Viru & Viru 2000; Impellizzeri et al. 2004; Kelly et al. 2016). Global positioning systems (GPS), Session Rate of Perceived Exertion (SRPE) and Heart Rate (HR) monitoring have all become popular methods in quantifying total training load in sport (Coutts & Duffield 2010; Rampinini et al. 2015; McLaren et al. 2017), although often they are used exclusively and not in combination (McLaren et al. 2017).

Researchers have previously regarded GPS as the most accurate monitoring tool of external physical demands in sport (Aughey & Falloon 2010; Coutts & Duffield 2010). Previous literature has recognised that total distance covered (TDC) and distance covered at high-speed (HSR) ($>19.8 km.h^{-1}$) are valid measures of physical demands in elite football (Bangsbo et al. 2006; Di Salvo et al. 2009). Usually a combination of these arbitrary GPS measures are used to quantify physical load (Mohr et al. 2003; Di Salvo et al. 2009) and that to the best of the authors' knowledge there has been no single definitive GPS metric that quantifies physical load within football. A recent study suggested that when using GPS, there has been a potential for the physical load in football to be under estimated, due to the positional, tactical and individual characteristics of a game (Coutts & Duffield 2010; Dalen et al. 2016).

Research has suggested that there are differences in speed thresholds between players and that HSR thresholds should be set relative to the individual (Abt & Lovell 2009). This is important to recognise as when working with youth athletes, some players may have developed at a greater rate, enabling them to run at higher speeds, meaning that although the absolute HSR was the same the relative HSR may not be a fair representation of the load (Bradley et al. 2010; Lloyd & Oliver 2013).

In football, changes in direction accounts for 18% of TDC (Dalen et al. 2016). The accelerations (Acc) and decelerations (Dec) are significant contributors to the players physical load, due to their high energetic costs, highlighted by concentric and eccentric peak torque of the knee extensors decreasing in performance following a match (Rahnama et al. 2003; Akenhead et al. 2013; Dalen et al. 2016). Eccentric and concentric force production and regulation is extremely important during a Dec and Acc, and failure to produce the appropriate force may hinder physical performance (Smith et al. 2009). Akenhead et al., (2013) also suggested that Acc and Dec at higher speeds during matches (Typical Error; TE, = 12–25%) may be a more sensitive measure than HSR (TE = 25–45%) and sprint (TE = 30–47.5%) distance. Therefore, suggesting ACC and DEC are a greater representation of physical load than at lower speeds (Akenhead et al. 2013). Akenhead et al., (2014) showed that ACC/DEC reliability depended on the speed of the movement with its TE ranging from 1–12% (Varley et al. 2012; Akenhead et al. 2014). A different study showed that a 10Hz GPS device measures TDC and HSR with a low TE of 1.9% and 4.7%, respectively (Rampinini et al. 2015). Whereas, Varley et al., (2012) suggested that GPS is an acceptable tool to measure the characteristics of TDC, HSR, ACC and DEC in team sports but to be aware that reliability varies depending on the speed of ACC or DEC (Akenhead et al. 2014). However, it must be noted that these studies all consisted of adult subjects and therefore GPS's limitations of GPS for youth players are unknown.

Although GPS metrics have been extremely useful in quantifying external loads, it is also important to recognise the internal loading of the players. SRPE has been shown to be a good predictor for global internal loading in football and is measured by multiplying the duration of the physical activity by its perceived score (Borg 1998; Impellizzeri et al. 2004). Recent literature also supported this, showing that SRPE highly correlates (CI 0.71-0.88) to heart rate load, suggesting that it was a simple and a practical method of quantifying training load in elite footballers (Kelly et al. 2016; McLaren et al. 2017). Other research indicated that SRPE is a good method to quantify internal load in youth sport, as again it correlated *very highly* with HR (Scantlebury et al. 2017). Although SRPE has been shown to be useful in quantifying internal load, it does not take into consideration the mental and tactical demands of the game (Brink et al. 2010; Bush et al. 2015; Sawczuk et al. 2018). Research has also indicated that following stepping up a level, the tactical and technical demands also increase (Bush et al. 2015). This is important for practitioners to recognise and this may also influence the mental demands placed on players (Cumming et al. 2018).

The majority of the literature has used a single measure to quantify total load, although some researchers combined different variables, attempting to give a clearer representation of total training and match load (McLaren et al. 2017). Wrigley et al., (2012) previously have used SRPE and HR in combination to investigate the difference in load in an elite English football academy. Although, these are both measures of global internal loads, which correlate highly with each other (Kelly et al. 2016). However, to gain a greater understanding of the total load expressed it has been suggested to take a holistic approach and investigate the internal and external loads (McLaren et al. 2017). Combining measures could give a clearer representation of training and match loads (McLaren et al. 2017) Abade et al., (2014) previously used GPS and HR to show that physical load varies between different age groups in Portuguese youth footballers (Abade et al. 2014). They showed that the older age groups expressed greater external loading although differences in the internal loads were unclear due to the nature of the games investigated (Abade et al. 2014). This is an area with limited research particularly in the elite English football academies.

Currently, to the knowledge of the author, no previous research has objectively quantified the difference in total load using combined internal and external measures in an elite English soccer academy. Previous literature identified that older academy footballers had greater physical demands during matches (Harley et al. 2010; Hulse 2010; Rampinini et al. 2015). Possibly as a result of increased playing times, pitch sizes and tactics (Clemente et al. 2017). However, this was only in respect to matches and not in relation to training and matches combined, which has been suggested to be associated with injury (Bowen et al. 2016). Previous research has also investigated the difference in load between different small sized games (SSG), a common method of physical conditioning (Hill-Haas et al. 2011). Although, the research has indicated the different intensities following SSG, there has been no comparison looking at the difference between part and full-time elite English academy footballers. This could also have an impact on physical load when a part-time player steps up into a full time environment and is required to work at a different intensity in specific drills (Bradley et al. 2010).

Being able to quantify the difference in total load across a period of time and of individual training sessions, would allow a greater understanding of the result of the increased training exposure and why the U18's have the greatest injury incidence (Read et al. 2018). This could enable practitioners to appropriately prescribe specific training interventions to their part-time players before they begin full time as an U18, with the aim of reducing injuries. The first aim of this study was to quantify and compare the differences in total physical loading, over a 10-week period, using internal and external measures, between part-time (U16's) and full-time (U18's) academy players from a category 1 football club. The second aim was to compare the differences in intensity, when performing specific football training drills typical of an U18.

Hypothesis 1: U18's experienced greater total load than the U16's over a 10-week period.
Hypothesis 2: U18's trained at greater intensities than the U16's when completing drills typical to the U18's training.

Methods:

Participants

Thirty elite male youth footballers from the Under 16's (N=13) and Under 18's (N=17) at an English category 1 football club were recruited for this study. However, the sample was reduced to nineteen as any players who did not participate in over 50% of training sessions and matches were excluded from the study. This accounted for injuries, illnesses, absences, selection for older age groups/internationals, *see Table 1*. The U16's and U18's were selected as they were the corresponding ages for the transition from part to full-time. All players or guardians provided consent to partake in this study (*see information sheet*). Participants under the age of 18 provided a signed consent form by their legal guardian before participating in the study (*see information sheet*). Ethics approval was granted by St Mary's ethics committee.

Table 1: The Characteristics of Players and the Days of Training and Matches (Mean; SD)

	U16	**U18**
Player Characteristics		
No. Players	13	17
No. Players (included for analysis)	7	12
Age (Years)	16.1 ± 0.4	17.7 ± 0.6
Mass (Kg)	67.7 ± 7.8	70.8 ± 5.5
Height (cm)	180.4 ± 4.1	178.6 ± 5.4
Maturity Offset (Years from PHV)	2.14 ± 0.3	3.55 ± 0.8
Training/ Match Characteristics		
Total No. Football Training/ Match Days	30	45
Average No. Football Training/ Match Days Attended	22 ± 4	34 ± 5
No. Resistance Training Sessions	20	22

Experimental Design

This study used a prospective longitudinal cohort design to investigate the internal and external loading of training, on and off field, match play and any external activity of the U16's and the U18's teams over a period of 10 weeks. Similar research has previously investigated physical loading from a range 2 weeks to 9 weeks (Wrigley et al. 2012; Abade et al. 2014). A typical week for both ages was presented in *Figure 1*.

Age	U16							U18						
Day	M	T	W	T	F	S	S	M	T	W	T	F	S	S
AM	School	School	School	School	School	Game	OFF	Football Training ~90mins	Football Training ~90mins	Education	Football Training ~90mins	Football Training ~90mins	Game	OFF
PM	Gym ~30mins + Football Training ~90mins		Football Training ~90mins	Gym ~30mins + Football Training ~90mins			OFF	Education	Gym ~45mins	Education	Gym ~45mins	Education		OFF

Figure 1: A Typical Weekly Schedule for U16's and U18's

GPS (Viper V.2, StatSports, Ireland) data was used to look at the external loading on the players. For the purpose of this study, Total Distance Covered (TDC; m), High Speed Running (HSR; 25.2 $km.h^{-1}$>19.8 $km.h^{-1}$; m) and Total High Accelerations (ACC; >3 $m.s^{-1}$; m) and Total High Decelerations (DEC; > 3$m.s^{-1}$; m) were the metrics selected to quantify external load, as they have previously provided a holistic overview of football respective to football demands (Bangsbo et al. 2006; Di Salvo et al. 2009; Akenhead et al. 2013; Dalen et al. 2016). GPS metrics were set to standardised speed thresholds as individual speed thresholds had not been established prior to the study. The reliability of GPS measures have been shown to vary with the Coefficient of Variation (CV) of HSR the greatest (24%-45%) and ACC/DEC the lowest

(1%-12%; Varley et al. 2012; Akenhead et al. 2013). However, it must be noted that these reliability studies all used adult subjects.

Internal training and match loads were collected using SRPE. SRPE was calculated by multiplying the RPE by the duration of the activity, using the Borg CR10 Scale (Borg 1998). The SRPE was also used to account for the loading of the resistance training and any external activity, away from the academy football program. SRPE has a *very large* correlation (CV = 0.6-0.8) with HR in youth footballers (Scantlebury et al. 2017).

Procedures

To assess the differences in total load between the two groups, internal and external (SRPE and GPS) data was collected during and following every U16 and U18 weekly training and competitive matches over a 10-week period.

To assess differences in total load of individual training drills, internal and external (SRPE and GPS) data was collected during and following two different training sessions. Session 1 (TS1) consisted of drills which the players completed in their individual age groups (U18 and U16). Session 2 (TS2) consisted of drills completed in combined age groups. TS1 consisted of 6 repetitions of 4 mins (2 min rest) 5v5 small sided games (SSG) with a pitch of 30 x 40 yards. TS2 consisted of 8 repetitions of 2 mins (1min rest) 3v3 SSG with a pitch of 15 x 25 yards.

GPS was used to assess external load for every football-based training session. The GPS was placed in a vest in between the scapula on the back of the player prior to every training session or match. The GPS was then collected and the data was downloaded. After each training session and match, all GPS data was downloaded onto the manufacturer's software (Viper V.2, StatSports, Ireland). Once downloaded, all data was cropped so that only the sessions content was included. TDC, HSR, ACC and DEC were the metrics used to assess the load. For HSR a standardized speed threshold was used, a recognised measure of HSR (Mohr et al. 2003). Weekly group means were used to compare the two groups. Relative measures of Meters Per Minute ($m \cdot min^{-1}$) were used to assess the intensity of the different drills. Internal measures were collected using SRPE following every training session and match, including resistance training sessions. External activity was logged by players accounting for any activity participated in away from standard training or matches by completing a weekly diary.

Statistics

All Comparisons between the U16's and U18's total weekly load, the same drill, the same session and external activity were made using a customised Compare Two Groups spreadsheet (Hopkins 2007). All data was presented as means with standard deviations (SD). Between-group outcome measures were first log-transformed to reduce bias arising from non-uniformity (Batterham & Hopkins 2006). This was expressed as percentage changes and as effect sizes (ES) with 90% confidence limit (CL). Probabilities were also calculated to establish whether the true differences were lower than, similar to or higher than the smallest worthwhile changes (SWC). Standardized thresholds for small, moderate, and large changes (0.2, 0.6, and 1.2, respectively), were used to assess the magnitude of all effects (Batterham & Hopkins 2006). These were used to make a qualitative probabilistic mechanistic inference about the true effect, which were based upon the disposition of the CL for the mean difference to these standardized thresholds and calculated as per the magnitude-based inference (MBI) approach (Batterham & Hopkins 2006). The effect was classified as unclear when the CL overlapped both positive and negative thresholds of >5%. Whereas clear inferences were made using the following scale:

<1%, almost certainly not; 25–75%, possible; 75–95%, likely; 95–99%, very likely; >99%, almost certain (Batterham & Hopkins 2006).

Results

For the players included for analysis, there was similar compliance of football training/match days with 73% and 76% for the U16's and U18's, respectively. All absences for U18's were accounted for due to injury, illness or being selected for an older age group/international duty. Whereas, in the U16's only 5% of absences were accounted for by injury, illness or being selected for an older age group, the remaining were due to not attending training and matches.

The total training and match load data for both groups across 10 weeks, along with between-group comparisons were displayed in *Table 2*. All training load measures were higher for the U18's. For the U18's, TDC was *likely* greater (0.6 ES) and *possibly* greater for HSR and SRPE (1.2 ES) than for the U16's. It was *unclear* if there was a difference of ACC and DEC between the U18's and U16's.

Table 2: Overall Between-Groups Differences in Total Load Over a 10 Weeks Period (Mean ± SD)

Load Metrics	U16	U18	Difference Between Groups (U18-U16; %; 90% CL)
TDC (m)	13854 ± 5493	20103 ± 4137	54 ± 42 Moderate [a]
HSR (m)	422 ± 254	975 ± 469	160 ± 146 Large [b]
ACC (m)	214 ± 67	240 ± 68	13 ± 30 Unclear
DEC (m)	248 ± 85	269 ± 104	8 ± 35 Unclear
SRPE (AU)	1734 ± 569	2490 ± 327	50 ± 31 Large [b]

Abbreviations: SRPE = Session Rate of Perceived Exertion; TDC = Total Distance Covered; HSR = High Speed Running; ACC = Accelerations; Dec = Decelerations; [a] = 75–95%, Likely; [b] = 25–75%, Possibly.

The training load data from both groups completing the same drill but in their respective groups were displayed in *Table 3*. For the U18's, HSR was *possibly* greater (54 ± 116%; 0.6 ES) than the U16's. Whereas, for the U16's, SRPE was *very likely* to be greater (18 ± 10%; 1.2 ES) than the U18's. The U18's had higher TDC (3 ± 7%) but lower ACC (-11 ± 24) and DEC (-10 ± 30) than the U16's from TS1, although it was *unclear* if there was a true difference.

Table 3: Between-Groups Differences in Total Load when Completing The Same Drill (TS1) in Individual Age Groups (Mean ± SD)

	Distance ($m.min^{-1}$)	HSR ($m.min^{-1}$)	ACC ($m.min^{-1}$)	DEC ($m.min^{-1}$)	sRPE (AU)
U16	73.6 ± 4.0	0.6 ± 0.4	1.2 ± 0.4	1.0 ± 0.4	705.0 ± 23.2
U18	75.7 ± 5.6	0.8 ± 0.4	1.0 ± 0.1	0.9 ± 0.2	591.4 ± 70.8
Qualitative Inference (90% CL)	Unclear	Moderate [b]	Unclear	Unclear	Large [c]

Abbreviations: SRPE = Session Rate of Perceived Exertion; TS1 = Same training drill in individual age groups; TDC = Total Distance Covered; HSR = High Speed Running; ACC = Accelerations; Dec = Decelerations; [b] = 25–75%, Possibly; [c] = 95–99%, Very Likely.

The training load data from both groups completing the same session was displayed in *Table 4*. For the U16's, HSR was *possibly* greater (45 ± 49%; 1.2 ES) and SRPE was *very likely* greater (22 ± 8%; 1.2 ES) than the U18's. The U16's had higher TDC (11 ± 21%) but lower ACC (21± 34) and DEC (3± 58) than the U18's from TS2, although it was *unclear* if there was a true difference.

Table 4: Between-Groups Differences in Total Load when Completing The Same Drill (TS2) in Mixed Age Groups (Mean ± SD)

	Distance ($m.min^{-1}$)	HSR ($m.min^{-1}$)	ACC ($m.min^{-1}$)	DEC ($m.min^{-1}$)	sRPE (AU)
U16	64.8 ± 8.6	0.3 ± 0.2	1.3 ± 0.4	1.1 ± 0.5	543.8 ± 37.5
U18	71.1 ± 0.2	0.2 ± 0.3	1.3 ± 0.5	1.3 ± 0.5	420.0 ± 38.7
Qualitative Inference (90% CL)	Unclear	Large [b]	Unclear	Unclear	Large [c]

Abbreviations: SRPE = Session Rate of Perceived Exertion; TS2 = Same training drill in mixed age groups; TDC = Total Distance Covered; HSR = High Speed Running; ACC = Accelerations; Dec = Decelerations; [b] = 25–75%, Possibly; [c] = 95–99%, Very Likely.

The U16's (963 ± 175 AU) external activity was *likely* to be greater (47% ± 23%; 1.2 ES;) than the U18's (355 ± 152 AU).

Discussion

Recent research has indicated that the U18's had the greater injury incidence within elite English football academies, suggesting that these players were not physically prepared to cope with the demands of the game at that level (Reed et al., 2018). This was the first study to compare the differences in physical load between part-time (Under 16's) and full-time (Under 18's) footballers from a category 1 English academy. As such, the first aim was to quantify and compare the differences in total load between U16's and U18's over a 10-week period. The second aim was to compare the differences in intensities between U16's and U18's, when performing football training drills typical of an U18.

The external and internal load, expressed through GPS metrics and SRPE, respectively, were as expected, greater for the U18's as opposed to the U16's (TDC, 54%; HSR, 160%; ACC, 13%; DEC, 8%; SRPE, 50%), across a 10-week period. For the U18s, TDC was likely to be greater (0.6 ES) and HSR and SRPE were both possibly greater (1.2 ES) than the U16's. However, it was unclear if there were differences between ACC and DEC. The training frequency was clearly a contributor to this, with the U18's completing more training and matches compared to the U16's (45 and 30 sessions, respectively). This represents the difference between a full-time program as opposed to a part-time program, although this may not be as great as expected (Wrigley et al. 2014) with the U18's only completing 1.5 per week more.

Despite the initial aim of investigating the external and internal load, it became apparent following this study that in fact the main finding was the compliance of attending training and matches. Although the overall compliance of the U18's (76%) and U16's (73%) was similar, there were 22% more unexplained absences for training and matches in the U16's. All absences were accounted for in the U18's as it was mandatory for players to attend their full-time role, as opposed to the U16's where it was not their full-time role. All authorised absences from the U18's were explained through injury, illness or due to older age group/international commitments; this only represented 5% of authorised absences for the U16's. The full-time academy model aims to cater for absences, as even if players were absent through injury or other age group commitments, practitioners can carefully monitor and adjust the load appropriately, although there have still been occurrences of injury (Brink et al. 2010; Bowen et al. 2016). On the other hand, the U16's are still in full-time education, subsequently incurring supplementary homework and other sporting commitments (Reeves & Roberts 2018). Additionally, parents were often required to transport the U16's to and from academies, which led to difficulties depending on their professions, home location and financial situation. Whereas, education and transport were catered for as part of the full-time program for the majority of the U18's. This could explain why the U16's were less compliant as opposed to the U18's.

The physical load of the U18's was more consistent as opposed to the variability in load in the U16's. Missing training sessions as opposed to consistent training could lead to spikes in weekly training load, thus resulting in adverse loading (Bowen et al. 2016; Gabbett 2016). This could have a knock-on effect in players not being appropriately prepared for the step up from a part to a full-time model. The U16's stepping up, will not only have to cope with the overall physical load being greater through increased training frequency but they will also be unfamiliar with the consistent training throughout the year. This could result in each intake of new U18's having adverse loading when they start the full-time program, potentially leading to injury through fatigue mechanisms (Drew & Finch 2016).

The variability in training load could result in the U16's not being physically prepared for when they step-up but another factor could be due to not being prepared to cope with the intensity of training sessions. This study also investigated the intensity differences when completing typical drills of the U18's in two different scenarios. In TS1, both groups completed the same drill but in their individual age groups and in TS2, players completed the same drills but in combined age groups. The internal measures were *very likely* (1.2 ES) to be greater in both TS1 and TS2 between the U16's and the U18's. Whereas it was *unclear* if there were true differences in external metrics between the ages, apart from HSR, which was *possibly* (0.6 ES) greater for the U18's in the TS1 but *possibly* (1.2 ES) greater for the U16's in the TS2. This could suggest that the intensities of the sessions were similar between the two groups. One reason for this could be due to the small area sizes of the drill, so players were limited to covering similar distances to the same space (Casamichana & Castellano 2010; Hill-Haas et al. 2011).

Previous literature has also used HSR as an indicator of the intensity of demands in the game (Mohr et al. 2003). In TS1, HSR was *possibly* (0.6 ES) greater for the U18's than the U16's, indicating that there was greater intensity when the U18's completed the drill with their respective age. Although this was only one metric and could be a result of the U18's having a greater capacity to run at the higher speeds (Bradley et al. 2010). Previous research has suggested that HSR varies between individuals, especially older players needing higher thresholds (Abt & Lovell 2009). This study used a standardised threshold for HSR which is well recognised as a valid measurement, although there are clearly limitations. In contrast, the U16's *possibly* (1.2 ES) had greater HSR intensity when in mixed ages in TS2. Although conflicting to TS1, a possible reason could be due to the U16's having greater intrinsic motivation to impress whilst competing with the superior age group, therefore attempting to do extra work (Meylan et al. 2010; Deci & Ryan 2011).

The internal loading for TS1 and TS2 were *likely* to be a greater (1.2 ES) in the U16's compared to the U18's, indicating that although they completed the same drill, they perceived it to be harder. Although speculative, one possible reason for this could be that as this was a typical drill for the U18's they were familiar to similar conditioning drills, whereas the U16's were not familiar to this type of conditioning as it was not part of their typical program. This could be due to a paradoxical reason of the U16's perceiving the session to be harder due to competing with their superior counterparts in conjunction with the U18's not perceiving the session to be as hard due to training with inferior players (Landers & Boutcher 1986). This would also link back to possibly explain why HSR was greater for U16's in TS2 in contrast to TS1 but this could be because the U18's are competing against their respective age not inferior players (Landers & Boutcher 1986). This suggests that although players are completing the same drill, individual players may perceive the session to be harder, subsequently resulting a greater overall load for that player. This emphasizes the importance of using internal loading measures as players may be completing the same activity but experience completely different stressors. In addition to this the U16's could also perceive the session to be harder due to the tactical differences stipulated from the U18's drills (Clemente et al. 2017). Previous research has indicated that there are different tactical demands whilst performing at higher levels (Clemente et al. 2017).

Previous literature (McLaren et al. 2017) has suggested that TDC was a good indicator of SRPE in team sports, however in this current study it was unclear if there were differences in the intensity of a drill between ages using TDC, ACC and DEC as external measures. However, there were clear differences between U18's and U16's in the SRPE. This indicates the importance of measuring a range of internal and external measures, as single variables may not give the full picture. Practitioners must be aware of when players step up, although the session may not show that it is externally harder, there could be extra internal psychological or physiological stressors which must be accounted for, such as the associated pressures of stepping up (Landers & Boutcher 1986). As indicated above its important to recognise that total load expressed on the players is not just the external factors measured by GPS but there are a variety of other stressors on the body during training and matches, which contribute to total loading profile (McLaren et al. 2017).

Growth and maturation factors can also have an influence on the players loading through physical and mental differences. Although the maturation statuses of the U16's and U18's were 2 and 3 years, respectively, past PHV, which was greater than the initially reported 6-12 month vulnerable period, indicating that the players in this study may not be at a significant risk of injury (Lloyd & Oliver 2013). However, previous research has shown that these periods can differ between individuals and that players could still have been adjusting to bodies, resulting in adolescent awkwardness, and weight changes (Lloyd & Oliver 2013). Therefore, although players could be competing in the same session, individuals could experience greater loads than others (Lloyd & Oliver 2013). The majority of the U18's would have had longer time than the U16's to adjust to their new stature and mass. Therefore, an U16 player, who has not adjusted to his new mass, has to do greater work to move their body, resulting in the players perceiving the session to be harder (Cumming et al. 2018). It is important that practitioners are aware of these growth and maturation factors and that players are given sufficient recovery and specific programs to aid their development. Further research would need to be carried out to investigate the impact of growth and maturation on part-time and full-time players and if they differ.

Players who are not yet in the full-time academy model often partake in extra activities as part of their schooling curriculum, such as physical education lessons or school clubs (Reeves & Roberts 2018).This study attempted to assess all factors that could contribute to the loading profiles of part and full-time footballers. Therefore, the external activity log looked to quantify the physical load incurred away from the training or matches. The players used the CR-10 scale (Borg 1998) to record their weekly activities. This showed that U16's were *likely* (1.2 ES) to have done greater activity away from the academy. The majority of this was due to physical education in the curriculum, as opposed to the U18's who are enrolled on the full-time program, who just partake in football training (Reeves & Roberts 2018). Although speculative, this could suggest that although the overall weekly external physical loading of football is greater for the U18's, the U16's receive activity in other forms which could close the gap between the loading differences.

There are clear differences in internal and external loading between the part and full-time programs, which could be associated with the greater injury incidence reported in the U18's (Read et al. 2018). The U16's about to start a new full-time program would be exposed to a greater volume of consistent training, resulting in players having to manage greater external factors as well as greater internal psychological and physiological stressors following stepping up (Emery 2003). Players who are placed under many novel stressors and if not managed appropriately could experience fatigue due to overtraining or insufficient recovery, associated with injury (Drew & Finch 2016). Rather than a single load measurement being responsible for the injury, it is thought that a cascade of problems is related to injury (Drew & Finch 2016). Practitioners must be aware of several loading factors to give a better picture of what is going on with the player and protect them. Well-being questionnaires are a current popular tool in elite sport and can be used to highlight players who would be at risk of injury based on the players perceived readiness. This can be used with other tools such as SRPE and GPS to provide a holistic view of the total load placed on the player.

Limitations

Although this study managed to quantify the differences in physical loading of part-time and full-time academy footballers, there were also several limitations. Firstly, the reliability of all external measures differs as mentioned in the methods (Varley et al. 2012; Akenhead et al. 2014). It is important to recognise that HSR has been shown to be a good predictor of the physical demands of the game, however this has mainly been done with adult athletes and not youth athletes (Varley et al. 2012; Akenhead et al. 2014). This study used a recognised standardised threshold for the HSR, (Rampinini et al. 2015), however this may not be a fair relative representation of the HSR demands in youths. This could account for the differences whilst U16's and U18's completed the same drills. Therefore, individualised speed thresholds would be appropriate for future research. Secondly throughout the study there were *unclear* differences shown when using ACC and DEC as external measures of load. As mentioned previously at higher speed accelerations and decelerations, there is less reliability (Akenhead et al. 2014), therefore this could be a factor affecting these measures. Further research needs to be done on the use of high speed ACC and DEC in youth athletes. Finally, another limitation could be the understanding of the Borg RPE Scale (Borg 1998; Impellizzeri et al. 2004). Previous literature has suggested that younger athletes have difficulty in distinguishing their perceived effort of a session (Impellizzeri et al. 2004). The athletes of this study had previously used the SRPE scale, however a familiarisation period prior to this study could have ensured that this was not a limitation.

Conclusion

Overall this study aimed to quantify and compare differences in total physical load over a 10-week period and individual training drills between part and full-time academy players. This study showed that total load was greater for the U18's compared to the U16's, however this was mainly due to an increase in training frequency. This study also showed that it was difficult to distinguish whether there were external loading differences between the age groups when completing training drills, although HSR inferred differences in intensity between age groups whilst doing the drills. Whereas, there were clear internal loading differences when completing these drills, suggesting that the U16's perceived the drills to be harder than the U18's. This highlights the importance of the use of a combination of measures to assess the total loading profile of training sessions. Although the aims were met, the main finding was highlighted as a result of carrying out the research. This was that the compliance to training differs between the two age groups, with the U16's not attending as many sessions as the U18's, which could possibly attribute to a variability in total load for the U16's (Bowen et al. 2016; Gabbett 2016). These were all factors which could contribute to injury if not managed appropriately when an U16 steps up into a full-time role (Bowen et al. 2016). The limitations of the GPS metrics must be considered when assessing the total load, as well as ensuring athletes are familiarised with the internal SRPE scale. Further research is needed to assess the reliability of internal and external measures in youth athletes.

Practical Applications

The complex dilemma of the appropriate training prescription is a modern-day paradox. Training too much or too little could lead to injury but finding that optimum level has become ever more difficult and varies for each individual (Gabbett 2016). This study will hopefully provide a guide to the physical load differences between part-time and full time elite English academy footballers, to enable appropriate loading strategies to be prescribed to players to aid in development, whilst also reducing the risk of injury. From this study practitioners must work closely with technical staff to ensure the U16's continue to train at the same rate throughout season, with an aim to increase the frequency of training towards the end of the season. When planning the U16's training, practitioners should consider similar training session to the U18's, to prepare them for the full-time environment. To further reduce the gap, practitioners could create contingency plans for when sessions are missed at clubs, for example simple running or resistance programs, to monitor the variability of training load more carefully. This could also provide a platform for players off-season programs which are vital to prepare them for the increased demands of the full-time environment. At the start of the full-time program, practitioners need to be aware that although players may be completing the same session, some players may experience greater internal loading stressors, therefore they may consider using SRPE to monitor the load of their players. The combination of a variety of monitoring tools such as wellbeing questionnaires, GPS and SRPE can be used together to provide a holistic view of the total load placed on the player, highlighting potential risks. These recommendations will all aid in reducing the loading gap and subsequent injuries in a full-time environment.

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Appendices

Ethics Forms

St Mary's Ethics Application Checklist

The checklist below will help you to ensure that all the supporting documents are submitted with your ethics application form. The supporting documents are necessary for the Ethics Sub-Committee to be able to review and approve your application.

Please note, if the appropriate documents are not submitted with the application form then the application will be returned directly to the applicant and may need to be re-submitted at a later date.

	Enclosed? (delete as appropriate)		Version No
Document	Yes	Not applicable	
1. Application Form	YES		
2. Participant Invitation Letter		NA	
3. Participant Information Sheet(s)	YES		
4. Participant Consent Form(s)	YES		
5. Parental Consent Form	YES		
6. Participant Recruitment Material - e.g. copies of Posters, newspaper adverts, website, emails		NA	
7. Letter from host organisation (granting permission to conduct the study on the premises)	YES		
8. Research instrument, e.g. validated questionnaire, survey, interview schedule		NA	
9. DBS if required (to be provided separately)	YES		
10. Other Research Ethics Committee application (e.g. NHS REC form)		NA	
11. Certificates of training (required if storing human tissue)		NA	

I can confirm that all relevant documents are included in order of the list and in one document (any DBS check to be sent separately) named in the following format: ***Full Name, School, Supervisor.***
Signature of Applicant: Ben Thorne

Signature of Supervisor:

St Mary's University Twickenham London

Ethics Application Form

1) Name of proposer(s)	Ben Thorne
2) St Mary's email address	166723@live.stmarys.ac.uk
3) Name of supervisor	Stephen Patterson

4) Title of project "The Difference in Physical Loading Between Youth Development Phase (U16) and Professional Development Phase (U18) Elite English Academy Football players"

5) School or service	School of sport, health and applied science
6) Programme (whether undergraduate, postgraduate taught or postgraduate research)	Postgraduate MSc Research (Distance)
7) Type of activity/research (staff/undergraduate student/postgraduate student)	Postgraduate MSc Student

8) Confidentiality	
Will all information remain confidential in line with the Data Protection Act 1998?	YES

9) Consent	
Will written informed consent be obtained from all participants/participants' representatives?	YES

10) Pre-approved protocol	
Has the protocol been approved by the Ethics Sub-Committee under a generic application?	NO

11) Approval from another Ethics Committee	
a) Will the research require approval by an ethics committee external to St Mary's University?	NO
b) Are you working with persons under 18 years of age or vulnerable adults?	YES

12) Identifiable risks	
a) Is there significant potential for physical or psychological discomfort, harm, stress or burden to participants?	NO
b) Are participants over 65 years of age?	NO
c) Do participants have limited ability to give voluntary consent? This could include cognitively impaired persons, prisoners, persons with a chronic physical or mental condition, or those who live in or are connected to an institutional environment.	NO
d) Are any invasive techniques involved? And/or the collection of body fluids or tissue?	NO
e) Is an extensive degree of exercise or physical exertion involved?	YES
	NO

f) Is there manipulation of cognitive or affective human responses which could cause stress or anxiety?	
g) Are drugs or other substances (including liquid and food additives) to be administered?	NO
h) Will deception of participants be used in a way which might cause distress, or might reasonably affect their willingness to participate in the research? For example, misleading participants on the purpose of the research, by giving them false information.	NO
i) Will highly personal, intimate or other private and confidential information be sought? For example sexual preferences.	NO
j) Will payment be made to participants? This can include costs for expenses or time.	NO
k) Could the relationship between the researcher/ supervisor and the participant be such that a participant might feel pressurised to take part?	NO
l) Are you working under the remit of the Human Tissue Act 2004?	NO

13) Proposed start and completion date
Please indicate: • When the study is due to commence. • Timetable for data collection. • The expected date of completion. Please ensure that your start date is at least 4 weeks after the submission deadline for the Ethics Sub-Committee meeting.
➢ 08.01.18

➢ 8 weeks ➢ 12.03.18

14)Sponsors/Collaborators
Please give names and details of sponsors or collaborators on the project. This does not include your supervisor(s) or St Mary's University. • Sponsor: An individual or organisation who provides financial resources or some other support for a project. • Collaborator: An individual or organisation who works on the project as a recognised contributor by providing advice, data or another form of support.
Middelsbrough Football Club

15. Other Research Ethics Committee Approval
• Please indicate whether additional approval is required or has already been obtained (e.g. an NHS Research Ethics Committee). • Please also note which code of practice / professional body you have consulted for your project. • Whether approval has previously been given for any element of this research by the University Ethics Sub-Committee.
Not Applicable

16. Purpose of the study
In lay language, please provide a brief introduction to the background and rationale for your study. *[100 word limit]*

As young football players transition from part-time to full-time at professional academies, their physical load increases. This transitional period is also a vulnerable period, due to growth and maturation statuses of the players. This vulnerable period combined with an acute increase in physical load could be hypothesized as a critical period; which if not managed correctly, could lead to injury. There is a lack of research quantifying the differences in physical load in elite English football academies in this transitional period. Being able to quantify this difference would enable appropriate prescription and training measures to be put in place, with the aim of reducing injuries.

17. Study Design/Methodology

In lay language, please provide details of:

a) The design of the study (qualitative/quantitative questionnaires etc.)
b) The proposed methods of data collection (what you will do, how you will do this and the nature of tests).
c) You should also include details regarding the requirement of the participant i.e. the extent of their commitment and the length of time they will be required to attend testing.
d) Please include details of where the research/testing will take place, including country.
e) Please state whether the materials/procedures you are using are original, or the intellectual property of a third party. If the materials/procedures are original, please describe any pre-testing you have done or will do to ensure that they are effective.

A)

- A quantitative prospective longitudinal cohort design.

B)

- This study will investigate the Under 18 and Under 16 training and match load data over a period of 12 weeks by collecting Global Positioning System (GPS) and Heart Rate (HR) data daily.
- Additional external loading (Gym and other sports clubs) will be also monitored through using session Rate of Perceived Exertion (RPE) load data.
- This study will also investigate the relative intensity of the U18 and U16 in different small, medium and large sided games (SSG, MSG and LSG).

<u>GPS</u>

- Global Positioning System (GPS) (Stat Sports Apex Units, 10Hz) data will used to look at the external loading on the players.
- The GPS variables that will be measured are:

- Total Distance Covered (TDC)
- High Speed Running (HSR)(19.8km.h^{-1}< HSR < 25.2 km.h^{-1})
- Total Accelerations (ACC) and Decelerations (DEC).
- All values will be calculated in a relative value per minute
- GPS devices will be fitted between the scapulae on each player in bespoke vests before and following training and matches.

Heart Rate

- Heart Rate (HR) monitoring (Polar Team System, Finland) will be used to investigate the internal loading
- Total time spent in the Red Zone (Duration spent at over 85% of HR_{max})
- HR_{max} of players would be established through previous YOYO intermittent recovery test level 2 data, previous training data and competitive matches.
- The HR monitors will be fitted just under the chest of the players at the same time as the GPS.

Additional Activity

- All additional activity will be calculated
- This will be measured using Borgs RPE scale (0-10, with 10 max), multiplied by duration
- This will produce a session RPE load value

Small, Medium and Large Sided Games

- Small sized games will be classed as: 1v1- 4v4 (1 player verses 1 player)
- Medium sized games will be classed as: 5v5-7v7
- Large sized games will be classed as: 8v8 +
- Each sized game will be repeated 3 times at U18 and at U16 level on separate training sessions
- GPS, HR and RPE load data will be measured during each game
- GPS parameters will be the same as mentioned above and will be calculated relative to minutes

C)

- Each participant will be required to wear a GPS and HR monitor during every training session and match for a period of 12 weeks
- They will also be required to complete a home activity diary to account for any physical activity in addition to normal training (sports clubs) using session RPE load data
- They will also be required to complete session RPE load for each gym session they complete.
- Following the SSG, MSG and LSG, players will be required to give an RPE score

D)

- Research taken place at: Middlesbrough Football Club, Hurworth, Darlington DL2 2DU
- Away fixtures will also occur at various English academies

E)

- The pprocedures and equipment have been utilized in previous research and have been shown to be reliable

References

GPS
Aughey, R. J., & Falloon, C. (2010). Real-time versus post-game GPS data in team sports. *Journal of Science and Medicine in Sport*, *13*(3), 348–349.

RPE Load
Impellizzeri, F. M., Rampinini, E., Coutts, A. J., Sassi, A. L. D. O., & Marcora, S. M. (2004). Use of RPE-based training load in soccer. *Medicine & Science in sports & exercise*, *36*(6), 1042-1047.

Heart Rate
Wrigley, R., Drust, B., Stratton, G., Scott, M., & Gregson, W. (2012). Quantification of the typical weekly in-season training load in elite junior soccer players. *Journal of Sports Sciences*, *30*(15), 1573–1580.

18. Participants

Please mention:

a) The number of participants you are recruiting and why. For example, because of their specific age or sex.
b) How they will be recruited and chosen.
c) The inclusion/exclusion criteria.
d) For internet studies please clarify how you will verify the age of the participants.
e) If the research is taking place in a school or organisation then please include their written agreement for the research to be undertaken.
f) Please state any connection you may have with any organisation you are recruiting from, for example, employment.

A)

- The full training squats from the U18 age group (n=17) and the U16 age group (n=18)
- This is the amount of GPS available and the amount of players that will be consistently measured

B)

- They will be selected due to players that are consistently available and are not injured

C)

- All data will be included, unless there is a clear error in the data, suggesting the GPS or HR monitor was not working correctly, this data will be excluded.
- If players are absent for a session due to illness or injury, average data from that session will be used as a substitute

D)

- Not applicable

E)

- Written agreement attached separately

F)

- Currently employed by Middlesbrough Football Club

19. Consent

If you have any exclusion criteria, please ensure that your Consent Form and Participant Information Sheet clearly makes participants aware that their data may or may not be used.

a) Are there any incentives/pressures which may make it difficult for participants to refuse to take part? If so, explain and clarify why this needs to be done

b) Will any of the participants be from any of the following groups?

- Children under 18
- Participants with learning disabilities
- Participants suffering from dementia
- Other vulnerable groups.

c) If any of the above apply, does the researcher/investigator hold a current DBS certificate undertaken within the last 3 years? A copy of the DBS must be supplied **separately from** the application.

d) How will consent be obtained? This includes consent from all necessary persons i.e. participants and parents.

A) There are no incentives or pressures to take part. Players are free to withdraw or refuse to take part at any time.
B) Yes, Children U18
C) DBS will be provided
D) Written informed consent will be attained with the use of an information sheet and a consent form (see attached)

20. Risks and benefits of research/ activity

a) Are there any potential risks or adverse effects (e.g. injury, pain, discomfort, distress, changes to lifestyle) associated with this study? If so please provide details, including information on how these will be minimised.

b) Please explain where the risks / effects may arise from (and why), so that it is clear why the risks / effects will be difficult to completely eliminate or minimise.

c) Do you have an approved risk assessment form relating to this research?

d) Does the study involve any invasive procedures? If so, please confirm that the researchers or collaborators have appropriate training and are competent to deliver these procedures. Please note that invasive procedures also include the use of deceptive procedures in order to obtain information. e) Will individual/group interviews/questionnaires include anything that may be sensitive or upsetting? If so, please clarify why this information is necessary (and if applicable, any prior use of the questionnaire/interview). f) Please describe how you would deal with any adverse reactions participants might experience. Discuss any adverse reaction that might occur and the actions that will be taken in response by you, your supervisor or some third party (explain why a third party is being used for this purpose). g) Are there any benefits to the participant or for the organisation taking part in the research?
A) A potential risk may be due to getting injured during training or match play. All players will undergo appropriate warm up prior to all exercise carried out by a sport scientist who is also UKSCA accredited. Qualified medical staff will attend all training and match play, to supervise if this problem does arise. A qualified first aider will be at every training session and match. B) A potential injury may occur from non-contact or contact from other players. Warm ups will be done prior to exercise to minimise the risks, however these cannot be completely avoided due to the nature of the game. C) YES D) NO E) NO F) If a player gets injured In training they will be looked after by a qualified first aider or team doctor. G) The players and team will get a good understanding of the steps needed in loading between different age groups which will improve programming in the future.

21. Confidentiality, privacy and data protection
• What steps will be taken to ensure participants' confidentiality? • Please describe how data, particularly personal information, will be stored (please state that all electronic data will be stored on St Mary's University servers).

- *If there is a possibility of publication, please state that you will keep the data for a period of 10 years.*
- Consider how you will identify participants who request their data be withdrawn, such that you can still maintain the confidentiality of theirs and others' data.

- *Describe how you will manage data using a data a management plan.*

- *You should show how you plan to store the data securely and select the data that will be made publically available once the project has ended.*
- *You should also show how you will take account of the relevant legislation including that relating data protection, freedom of information and intellectual property.*

- Who will have access to the data? Please identify all persons who will have access to the data (normally yourself and your supervisor).

- Will the data results include information which may identify people or places?

- Explain what information will be identifiable.
- Whether the persons or places (e.g. organisations) are aware of this.
- Consent forms should state what information will be identifiable and any likely outputs which will use the information e.g. dissertations, theses and any future publications/presentations.

- ➢ All data will be kept anonymous and is averaged, there is no way to distinguish individual data
- ➢ Data will be stored on a St. Mary's, University servers and a Middlesbrough FC authorized laptop and can only be accessed by researchers and the supervisory team.
- ➢ In the case of publication all data will be held for at least 10 years and stored on St Marys University servers.
- ➢ All data will be kept anonymous and is averaged, there is no way to distinguish individual data
- ➢ The data will belong to Middlesbrough FC so they will own the right to disseminate relevant data if required
- ➢ Data can only be accessed by researchers or authorized staff from Middlesbrough FC
- ➢ Data will not include information regarding people or places
- ➢ The information identifiable will be average relative values of training and match play of U18 and U16 at Middlesbrough football club
- ➢ Middlesbrough are aware that I am researching and will write up a paper
- ➢ Consent forms state what information will be identifiable

22. Feedback to participants
Please give details of how feedback will be given to participants: • As a minimum, it would normally be expected for feedback to be offered to participants in an acceptable to format, e.g. a summary of findings appropriately written. • Please state whether you intend to provide feedback to any other individual(s) or organisation(s) and what form this would take.
➢ A summary of findings will be given to all participants ➢ Summary of the findings will be given to Middlesbrough Football Club

The proposer recognises their responsibility in carrying out the project in accordance with the University's Ethical Guidelines and will ensure that any person(s) assisting in the research/ teaching are also bound by these. The Ethics Sub-Committee must be notified of, and approve, any deviation from the information provided on this form.

Signature of Proposer(s) Ben Thorne	Date:29.11.17
Signature of Supervisor (for student research projects)	Date:29.11.17

Approval Sheet

Name of applicant: Ben Thorne Name of supervisor: Stephen Patterson Programme of study: MSc Strength and Conditioning Title of project: “The Difference in Physical Loading Between Youth Development Phase (U16) and Professional Development Phase (U18) Elite English Academy Football players”

Supervisors, please complete section 1 or 2. If approved at level 1, please forward a copy of this Approval Sheet to the School Ethics Representative for their records.

SECTION 1 Approved at Level 1 Signature of supervisor (for student applications).. Date..
SECTION 2 Refer to School Ethics Representative for consideration at Level 2 or Level 3 Signature of supervisor........ [signature] .... Date...........29.11.17..

SECTION 3 To be completed by School Ethics Representative Approved at Level 2   Signature of School Ethics Representative... Date...
SECTION 4 To be completed by School Ethics Representative. Level 3 consideration is required by the Ethics Sub-Committee.   Signature of School Ethics Representative... Date... Level 3 approval – confirmation will be via correspondence from the Ethics Sub-Committee

St Mary's University Twickenham London

Participant Information Sheet

You are being invited to participate in a research study investigating the training demands, between the Youth Development Phase (U16) and the Professional Development Phase (U18).

What is the purpose of the study?

With the increasing demands require on the players when progressing from part-time to full time at the academy, it's imperative that we can understand and quantify the difference enabling us to ensure that the players are prepared in the best way possible, to give them the best chance they can get of making it to the first team or to prevent them from getting injured.

Why have you been asked and do you have to take part?

All players in the U16's and U18's at Middlesbrough Football Club are invited to participate in the study. If you have any questions regarding the information sheet, do not hesitate in asking using the email addresses below. If you agree to take part, please complete the consent form. If you are below 18 years of age, a parent/guardian must complete a consent form. You are free to decide whether you opt out of the study without any consequence or questions being asked.

What will you have to do?

Data collection will take place during matches being played through January 2018 – March 2018. You will be asked to wear the GPS unit that you wear for every training session. It will be located between the two scapulae in a securely designed vest to track your movement throughout the match. Before data is collected for each training session, you will be required to complete a normal warm up routine 45 minutes before training or kick-off, led by the coaching staff. The GPS unit will be turned on manually before this warm up routine. At the end of the game GPS units will be collected.

What are the benefits from you participating in the study?

Coaches will also be able to gain a wider understanding of training and match demands in the long term. Thus, your individual development may be improved as strengthened strategies and approaches could be implemented. If you decide not to take part, your relationship with the club and coaches will not be affected and you will not be asked to provide further reasons for not participating.

Do I need to take part in the study?

Your participation is this study is voluntary. However, by giving consent, you will be part of a study making a significant contribution to existing research. Not only will this study improve an understanding of individual performance profiles across different age groups, it may benefit coaches in constructing training programmes, to further enhance your performance.

Can you withdraw from the study?

During the study you are free to withdraw at any time, without giving any explanation. You may also request your data to be withdrawn and deleted by the investigator.

What will happen to the results?

All the data will be handed with full confidentiality. Participants will be given an ID number that will remain the same throughout the study.

Further information and contact details:

It has been made clear to me that, should I feel that these regulations are being infringed or that my interests are otherwise being ignored, neglected, or denied, I should inform Dr Stephen Patterson, St Mary's University, Twickenham Stephen.patterson@live.stmarys.ac.uk who will undertake to investigate my complaint.

For further information, please contact:

Name: Ben Thorne

E-mail: 166723@live.stmarys.ac.uk

Tel: 07907813323

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I confirm that the participant or the guardian of the participant (if under 18) …………………has read and fully understood the investigation.

Signature of Participant or Parent/Guardian: ……………………….Date: …………………

St Mary's University Twickenham London

Informed Participant Consent Form

Project Title: "The Difference in Physical Loading Between Youth Development Phase

(U16) and Professional Development Phase (U18) Elite English Academy Football players"

Investigator: Ben Thorne
Supervisor: Dr. Stephen Patterson

Please tick where applicable

I have carefully read and understood the Participant Information Sheet.	
I have been given the opportunity to ask questions with the investigator and have gained satisfactory answers.	
I understand I am allowed to withdraw from the study at any time.	
I agree to participate in the study.	
I would like to receive a short report on my individual performance once the study is completed.	
It has been made clear to me that, should I feel that these regulations are being infringed or that my interests are otherwise being ignored, neglected, or denied, I should inform the Dr. Stephen Patterson, St Mary's University, Twickenham who will undertake to investigate my complaint.	

Name of Participant (IN BLOCK LETTERS):…..………………...

DOB of Participant (DD/MM/YY):…..………………………………………………………

Signature of Participant: ………………………………………………… Date: ………………

E-mail address (If Applicable): …………………………………………………………………

If the participant is under 18 years of age, a parent/guardian signature is required.

Name (IN BLOCK LETTERS):

...…………………………………………………...................

Signature of Parent/Guardian: …………………..………………….. Date:

……………………

Signature of Investigator: ………………………………………… Date: …… ………………

CONFIDENTIAL MEDICAL HISTORY / PHYSICAL ACTIVITY READINESS QUESTIONNAIRE (PAR-Q) FORM

This screening form must be used in conjunction with an agreed Consent Form.

Full Name: ______ Date of Birth: ______

Height (cm): ______ Weight (kg): ______

Have you ever suffered from any of the following medical conditions? If yes please give details:

	Yes	No	Details
Heart Disease or attack	☐	☐	______
High or low blood pressure	☐	☐	______
Stroke	☐	☐	______
Cancer	☐	☐	______
Diabetes	☐	☐	______
Asthma	☐	☐	______
High cholesterol	☐	☐	______
Epilepsy	☐	☐	______
Allergies	☐	☐	______
Other, please give details	☐	☐	______

Do you suffer from any blood borne diseases? If yes please give details;

Please give details of any **medication** you are currently taking or have taken regularly within the last year:

Please give details of any **musculoskeletal injuries** you have had in the **past 6 months** which have affected your capacity to exercise or caused you to take time off work or seek medical advice:

Other Important Information

During a typical week approximately how many hours would you spend exercising?

If you **smoke** please indicate how many per day:

If you drink **alcohol** please indicate how many units per week:

Are you currently taking any **supplements or medication?** Please give details:

Is there any reason not prompted above that would prevent you from participating within the relevant activity?

By signing this document I agree to inform the relevant individual(s) of any change(s) to my circumstances that would prevent me from participating in specific activities.

Signature (Participant): ______ **Date:** ______

Signature (Test Coordinator*): ______ **Date:** ______

**Test coordinator: The individual responsible for administering the test(s)/session and subsequent data collection*