



**Effect of Small-Sided Games Verses High-Intensity Intermittent Running on
Acceleration and Repeated Sprint Ability in Gaelic Football**

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18th June 2017

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Acceleration and Repeated Sprint Ability in Gaelic Football**

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18th June 2017

This Research Project is submitted as partial fulfilment of the requirements for the
degree of Master of Science, St Mary`s University College

Declaration

I hereby certify that this material, which I now submit for assessment of the program of study leading to the award of Master of Science (MSc.) is entirely my own work, that I have exercised reasonable care to ensure that the work is original and, to the best of my knowledge, does not breach any law of copyright and has not been taken from the work of others save and to the extent that such work has been cited and acknowledged within the text of my work.

Signed: _____

Date _____

Mark O `Connell

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Abstract

Title: Effect of Small-Sided Games Verses High-Intensity Intermittent Running on Acceleration and Repeated Sprint Ability in Gaelic Football

Purpose: The purpose of this study was to investigate the effects of two training methods, Small-Sided Games (SSGs) and High-Intensity Intermittent Running (HIIR) on improving Acceleration and Repeated Sprint Ability (RSA) within Gaelic football players.

Methods: All participants conducted a pre-and post 10 m acceleration and RSA test, comprising of 7 x 30 m sprints with 25 seconds active recovery period in-between sprints. The study was conducted for a duration of 10 weeks, comprising of 20 intervention sessions. The SSGs protocol involved a 4 vs. 4 player format on an 80 m x 20 m pitch for a duration of 6 x 4 min. at above 85% HR_{max} , coupled with a 3-min. active recovery period of between 50-60% HR_{max} . Alternatively, the HIIR protocol involved participants completing a linear shuttle run at both the same duration and intensities as the SSGs. Thirty-two male club Gaelic football players (mean \pm *SD*; Age: 26.1 ± 3.7 years; height: 179.0 ± 5.3 cm; body mass: 82.0 ± 7.9 kg; Body fat percentage: 12.4 ± 2.3 %; YYIR1 performance: 1358 ± 487 m) volunteered for the study. Internal physiological responses were measured during SSGs and HIIR sessions using a combination of heart rate monitoring collected at 5 s intervals and session rate of perceived exertion (s-RPE) data collected during each active recovery period.

Results: Post intervention results found no significant difference within 10 m acceleration (SSGs; 2.18 ± 0.13 s vs. HIIR; 2.18 ± 0.19 s) or RSA performance as outlined by RSA total time (SSGs; 45.97 ± 3.84 s vs. HIIR; 45.40 ± 2.51 s). It may be suggested the current training protocols lack the appropriate intensity levels to provide an overload stimulus to improve both acceleration and RSA. However, both groups

noted an improvement within maximal aerobic capacity, with the SSGs group showing the greatest improvement.

Conclusion: This study suggests that both training protocols are a valid method to increase maximal aerobic capacity, with SSGs offering the added benefit of aiding in improving players technical Gaelic football skills in tandem to aerobic conditioning.

Key words: Gaelic football, Acceleration, Repeated Sprint Ability, Intermittent exercise

Introduction

The field sport of Gaelic football is the most widely played native Irish sport in Ireland and abroad, due to the travel of Irish immigrants to countries such as the United Kingdom, USA, Canada and Australia (45,54). Gaelic football may be defined as a high-intensity intermittent team-based invasion field sport (37,13), sharing similar physical, physical and movement demands to field sports such as soccer, rugby and its sister sport of Australian football (11,16,39). The sport is played with two teams of 15 players on a rectangular grass pitch with measurements of 145 m long x 90 m wide with two H-shaped goals positioned on each end of the pitch (13). The aim of the sport is to outscore their opponent. Players can kick, hand pass or solo the ball from their foot to hand when in possession and block, tackle and intercept the ball when not in possession, a team is awarded 1 point if the ball is placed over the crossbar the H-shaped goal and 3 points if placed into the goal (37,45,47). Gaelic football competition is divided into two classifications, intercounty and club Gaelic football, commonly known as elite and sub-elite respectively, while game rules and pitch dimensions remain unchanged between classes, intercounty competitive games are 70 minutes in duration compared to club competitive game of 60 minutes (32,43).

Important game activities involve the regular requirement to complete recurrent bouts of high-intensity activity that taxes the anaerobic energy systems, such as accelerating, sprinting, tackling for possession, evading opponents and blocking opponents from scoring, this is combined with periods of low to moderate aerobic activity (13,15). As previously outlined by Keane et al. (27) who investigated the work rate within intercounty Gaelic football utilising 16 participants ($n=16$) over 8 competitive matches, found a significant percentage of game effort to be completed within low intensity activity, classified as walking and jogging at 66%, with high speed activity accounting for 16.1% such as striding and high-speed running. Similar

findings using time-motion analysis was recorded within senior male Gaelic footballers ($n=55$) with high-intensity activity, classified as running, shuffling and game related activity composing of 14.3% of total match intensity with the remaining 85.7% considered low to moderate intensity and classified as standing, walking, backing and jogging (38). A recent study utilising Global Positioning Systems (GPS) by Malone et al. (32) reported on running performance within intercounty Gaelic football players ($n=50$) with the average total distance covered during competitive play at $8,160 \pm 1,482$ m, high-speed running ($\geq 17\text{km}\cdot\text{h}^{-1}$) $1,731 \pm 659$ m, sprint running ($\geq 22\text{km}\cdot\text{h}^{-1}$) 445 ± 269 m and the number of accelerations (≤ 6 s) at 184 ± 40 . In comparison to movement demands within Australian football (AF) and soccer using GPS and video analysis, reported player total distance covered on average $12,939 \pm 1145$ m vs. $10,714 \pm 991$ m, high speed running ($\geq 20 \text{ km}\cdot\text{h}^{-1}$) 881 ± 341 m vs. $2,492 \pm 625$ m, sprint running ($\geq 23\text{km}\cdot\text{h}^{-1}$) 571 ± 285 m vs. 650 ± 6 m and number of accelerations (≤ 6 s) at 150 ± 27 vs. 39.2 ± 2 (6,11,12,14,9).

Considering the travel demands of Gaelic football, players are required to have highly developed aerobic and anaerobic energy systems. The use of maximal aerobic capacity ($\dot{V}\text{O}_{2\text{max}}$) testing has been established as a valid and reliable indicator of aerobic fitness and cardiovascular endurance within field sports such as Gaelic football (50). As previously noted, maximal oxygen capacity levels for Gaelic footballers have been reported to be as large as $58.6 \text{ ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$ compared to soccer $60.0 \text{ ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$, rugby $50.0 \text{ ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$ and Australian football $57 \text{ ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$ (4,16,18,54). Due to the high intensity efforts required during match play, typical peak maximal heart rate (HR_{max}) for Gaelic football players can reach up to 205 beats per minute with an average work load intensity of $\geq 80\% \text{ HR}_{\text{max}}$, this can be compared to soccer where it is common for professional players to work at rate of $\geq 85\% \text{ HR}_{\text{max}}$ (22,7). A previous study investigating an 8-week sprint running protocol found a high

correlation ($r = 0.63$) between high aerobic capacity and match work rate within team sports, stating that players with high aerobic capacity can produce higher levels of effort during competitive play. It was also observed, team sports players with a high aerobic capacity can recover quicker during periods of high-intensity intermittent exercise (8). This outlines the importance for players to have highly developed aerobic and anaerobic energy systems to meet the competitive in game demands within club Gaelic football.

Within field sports such as soccer and rugby, the importance of the player's ability to accelerate has been shown to be crucial to match success (2,29). Acceleration may be described as the rate of change in velocity over time and is an important pre-cursor to high-speed and sprinting running (36,37). Within intercounty Gaelic football, published data has shown players to complete up to 96 high-intensity efforts, including acceleration lasting up to 7 seconds (sec), with less than 1.7% of total game time spent in high-intensity activities including acceleration (27,39). This is supported by published research within Gaelic football match position work rates, showing high-intensity activity accounting for the minority of in-play activity at between 12.8 ± 2.9 % to 19.8 ± 4.2 % and 16% total distance covered (27,39). Research in sprint activity within intercounty Gaelic football ($n=50$) found players on average covered 445 ± 169 m at sprint speed ($\geq 22 \text{ km}\cdot\text{h}^{-1}$) and completed 184 ± 40 accelerations per game, this equated to 2.6 ± 0.5 accelerations per minute. Yet, it is within this limited window of the game period is responsible for the most critical moments in match success including winning possession, scoring, creating scoring chances or blocking a shot (46). For this reason, acceleration has become an important performance variable within Gaelic football.

A limitation within current research in acceleration, is the difficulty of standardising the classification of acceleration within field sports. Acceleration classifications have

been offered by Malone et al. (32) as a change in velocity by $2 \text{ km}\cdot\text{h}^{-1}$ within 1 sec. and change triggered by a movement more than 2 sec. in duration. Akenhead et al. (1) investigated acceleration patterns using GPS analysis on professional soccer players ($n=36$) and classified acceleration speed as low ($1\text{-}2 \text{ m}\cdot\text{s}^{-2}$), moderate ($2\text{-}3 \text{ m}\cdot\text{s}^{-2}$) and high ($\geq 3 \text{ m}\cdot\text{s}^{-2}$), these values are supported by additional studies defining maximal acceleration at $2.78 \text{ m}\cdot\text{s}^{-2}$ within field sports (30).

Due to the unpredictable nature of Gaelic football, players are regularly challenged to undergo short durations of high-intensity activity coupled with brief periods of recovery at unspecified times (10,13). The ability for Gaelic football players to recover and maintain bouts of maximal effort sprints is known as repeated sprint ability (RSA) and deemed an important attribute within field sports (51,42). As previously noted, within competitive match play, Gaelic footballers spend up to 15.9% of total game in high-speed ($\geq 22 \text{ km}\cdot\text{h}^{-1}$) running with work-to-rest ratios ranging from midfielders (1:7), backs (1:11) and forwards (1:14), suggesting midfielders are most susceptible to repeated sprint activity with reduced recovery periods during competitive play. RSA is characterised by high-intensity sprints of less than $\leq 6 \text{ sec.}$ where peak power/velocity can be maintained through the activity coupled with recovery bouts of $\leq 30 \text{ sec.}$, this is consistent with the recovery period with a competitive Gaelic football match of $\leq 37 \text{ sec.}$ between bouts of activity (39,51).

Girard et al. (17) outlined two categories of RSA, Intermediate Sprint Exercise (ISE) described as short duration sprint running ($\leq 10 \text{ sec}$) paired with a recovery period of between 60-300 sec. for full recovery. Alternatively, Repeated Sprint Exercise (RSE) which is characterised also by short duration sprint running ($\leq 10 \text{ sec}$) paired with a recovery period of $\leq 60 \text{ sec}$. Due to the intermittent nature and positional demands of Gaelic football match play, both types of RSA are important with the ISE more

prominent due to the work-to-rest differences within positions. The need to produce repeated sprints within competitive play taxes the primary energy system of the adenosine triphosphate-phosphocreatine (ATP-PCr), this system is characterised by the breakdown of phosphocreatine (PCr) stored in the skeletal muscle for energy to use for high-intensity activity for a maximal duration of ≤ 10 seconds due to the low available stores within skeletal muscle ranging from 70-80 mmol kg dry muscle (34). Owing to the low level of PCr. stores, PCr recovery periods can range from 70% in 30 sec. to 100% between 3-5 min (46). In a previous review on RSA tests by Spencer et al. (49) it was reported that within field sports mean sprint time (2-3 sec.) and sprint distance (10-12 m) remained reliable for the duration of the test, with a protocol of 6-7 sprints optimal to provide the desired intensity for RSA within field sports. This underpins the importance of RSA within club Gaelic football match success.

Anecdotal reports on Gaelic football physical preparation, commented on the primary training focus on aerobic conditioning with extensive steady state training of low to moderate intensity ($\leq 75\%$ maximal aerobic capacity) over long durations ≥ 45 minutes, the rationale was superior aerobic capacity resulted in players deemed as competition ready. Limitations of such methods is that low steady state training is not representative of the requirements for players to interchange between aerobic and anaerobic energy systems, movement and exercise intensity demands required within competitive match play (44,50). Additional negative aspects include increased likelihood of overtraining injuries, due to the repetitive nature of steady state running and the prolonged duration of steady state training sessions (54).

With a view of replicating the match play demands within soccer and rugby, researchers have proposed the implementation of Small-Sided Games (SSGs) as a valid and reliable method to improve aerobic training while also allowing players to improve technical skills simultaneously (21,28). Physiological responses during

match play has shown typical peak maximal heart rate (HR_{max}) for Gaelic football players reaching up to 205 beats·min⁻¹ with an average work load intensity of $\geq 80\%$ HR_{max} , this can be compared to soccer where it is common for professional players to work at rate of $\geq 85\%$ HR_{max} (22,10). Preceding research has outlined the use of High-Intensity Intermittent Running (HIIR) methods to replicate these intensities. Baker, 2011 (3) proposed a linear shuttle running method based on participants completing a maximal effort sprint for 15 sec. with a work-to-rest ratio of 1:1 at 100% - 120% Maximal Aerobic Speed (MAS) for a duration of between 5-10 minutes with reported improvements in aerobic power. Helgerud et al. (19) proposed an interval running protocol for the duration of 4 x 4 minutes with intensity levels set between 90-95% HR_{max} with 3 minutes active recovery and reported improvements in sprint activity of between 11-50% following an 8-week training program. In comparison, SSGs research within Gaelic Hurling ($n=24$) found with a 4 vs.4 SSG with a pitch size of 80m length x 20m width to illicit a $\geq 98\%$ HR_{max} response, this is consistent with published values of 90-95% HR_{max} to improve maximal aerobic capacity (32,23). Within a recent study, researchers examined the effects of SSGs pitch size on performance variables within club hurling players ($n=24$) using a 4 vs. 4 player format by 6 x 4 minutes duration on a large pitch size (80m x 20m), reported results including number of total acceleration 35 ± 10 , high accelerations ($\geq 3 \text{ m}\cdot\text{s}^{-2}$) 15 ± 10 and acceleration distance $101 \pm 56\text{m}$. This supports the potential use of SSGs as a method to improve performance variables such as acceleration and RSA, that is vital to Gaelic football match success.

A current void exists within club Gaelic football research, one of the key reasons is the majority of Gaelic football studies have relied on intercounty participants. This has resulted in researchers having to rely on data from studies based on intercounty or university Gaelic football team or similar sporting codes such as soccer, rugby and Australian football (44, 53, 36). This results in the complex task of comparing

physical and physiological club Gaelic football match demands with published research of similar sporting codes, for example the duration of match play within Gaelic football differs between Intercounty and Club competition (70 vs. 60 min. respectively) compared to Soccer (90 min.) and Rugby (80 min.). Sporting codes differences also exist within pitch dimensions, number of players on the field at any one time and tactical strategies used by team management (7). This outlines the importance of the current research study into club Gaelic football to enhance current evidence based research and best practice in improving club Gaelic football performance.

To the best of our knowledge, there exists no research studies investigating the effect of SSGs and HIIR on improving acceleration and RSA within club Gaelic football players. Therefore, the aim of this study is to investigate the effects of SSGs vs. HIIR protocols on improvements in acceleration and RSA performance within club Gaelic football players.

Methods

Experimental Approach to the Problem

This longitudinal cohort study consisted of thirty-two club Gaelic football players recruited and separated into two equal experimental groups based on their aerobic fitness levels as estimated by conducting a Yo-Yo Intermittent Recovery Test 1 (YYIR1). The two experimental groups were divided into Group 1) Small-Sided Games (SSGs) consisting of 16 participants and were conducted using a 4 vs. 4 player format. The field dimensions were set at 80 x 20 m (length x width) as outlined by Collins et al. (10). Group 2) The High-Intensity Intermittent Running (HIIR) group consisting of 16 participants and undertaking a linear running protocol comprised of a sub-maximal aerobic sprint at $\geq 85\%$ HR_{max} for a duration of 7 seconds, finishing in a 5m deceleration zone at a work-to-rest ratio of 1:10 as previously noted by McErlean et al. (35). Internal and external training load data was collected during each training session using heart rate (HR) monitors (Team Polar System, Polar Electro Oy, Kempele, Finland) and session Rate of Perceived Exhaustion (s-RPE) based on Borg CR-10(11). Previous investigations by Lovell et al. (31) within professional rugby league players ($n=32$) reported a high correlation ($r=0.62$) between HR and s-RPE data in monitoring global training load, suggesting the use of s-RPE to be a useful tool to access players effort levels within intermittent field sports. Prior to the beginning of the study, all participants attended a familiarisation session to explain and demonstrate the physical and physiological data collection methods to be used. Physical and Physiological baseline measurements were collected one week prior to the research study. Each session was interspaced with a 24-hour rest period and players were requested to refrain from additional training away from the team.

Subjects

Thirty-two male club Gaelic football players (mean \pm *SD*; Age: 26.1 ± 3.7 years; height: 179.0 ± 5.3 cm; body mass: 82.0 ± 7.9 kg; Body fat percentage: 12.4 ± 2.3 %; YYIR1 performance: 1358 ± 487 m) from the same team volunteered for the study. Participants were accepted once they met the inclusion criteria of being a male, current club Gaelic footballer, physically active 2-3 times per week, aged between 18-35 years old, non-smoker and have passed the PAR-Q with no history of metabolic and musculoskeletal diseases. As part of the health screening process, all participants had both blood pressure and resting heart rate levels collected using a digital Omron M6 AC ME automatic blood pressure monitor (Omron, Japan). Each participant was requested to remain in a relaxed supine position for 5 minutes before resting heart rate was recorded, resting heart rate was recorded three times with the mean used as the final resting heart rate. Ethical approval was sought and obtained from St. Marys University, Twickenham, UK. Ethics committee. Prior to beginning the study, the researcher conducted an information evening outlining the aims, methods, risks and benefits of the research study with the participants and presented each subject with a participant information sheet of the research study. Participant informed consent and a pre-activity readiness questionnaire (PAR-Q) forms were completed and collected from each participant prior to the study, and each participant was advised they could leave the study at any time.

Procedures

The study proposed of 20 SSGs vs. HIIR training sessions conducted over a 10-week period. All participants completed a 15 minute standardised warm-up incorporating light aerobic activity coupled with dynamic stretching and central nervous activation exercises known as the “GAA 15” warm-up (40). SSGs and HIIR sessions were conducted directly after the warm-up on a 3G artificial grass pitch (PTS sport, Tralee, Co Kerry, Ireland). All participants were supplied with a Team Polar HR belt and instructed on the correct placing of the device. HR data was recorded at 5 second intervals and only data collected during the intervention session was used for analysis. s-RPE was collected and recorded from each participant during their recovery phase in each training session and collected data transferred to a customised Microsoft Excel spreadsheet (Microsoft, Redmons, WA, USA). Individual HR_{max} was determined using the heart rate reserve method as outlined by Karvonen et al. (26). The SSGs group was divided into 4 teams of 4 participants and SSGs duration set for 6 x 4 minutes with a 3-minute recovery in between using regular GAA rules with no restrictions, additional footballs were placed on the boundaries of the pitches to ensure a quick turnover when the ball went out of play. To ensure the competitiveness of the SSGs once a game was completed, teams would rotate pitches to play a new team. The HIIR group undertook a linear sprint protocol consisting of a 7 second sprint over a distance based on their maximal aerobic speed as outlined by Baker (3), a work to rest ratio of 1:10 was enforced for full ATP-PCr recovery before participants underwent a full sprint effort. The HIIR group continued for 6 x 4 minute with a 3-minute recovery. In addition, all SSGs and HIIR sessions were conducted on the same time on each training session to reduce any variations in circadian rhythms (19:00-20:00 hrs).

Anthropometry

Baseline anthropometric data was collected prior to testing as outlined in Table 1. Height data was collected using a portable stadiometer bare feet (Seca 213, SECA, Birmingham, United Kingdom) and measured to the nearest 0.1 cm, while body mass was collected to the nearest 0.1 kg using a calibrated digital flat scale (Seca 887, SECA, Birmingham, United Kingdom) with participants in bare feet and minimal clothing. Body fat percentage was obtained using a Harpenden skinfold caliper (Baty International, West Sussex, United Kingdom) to collect 3 skinfold measurements from the pectoral, abdominal and front thigh locations in agreement with the protocols utilised by Cullen et al. (13). The 3 skinfold measurements of each site were added and the mean of each site was used for analysis. Body density was calculated by means of the Jackson and Pollock equation (24) and body fat percentage determined using the Siri equation (13).

Table 1. Physical characteristics of research study participants.

Physical characteristics	Total (<i>n</i> =32)		SSGs (<i>n</i> =16)		HIIR (<i>n</i> =16)	
	Pre	Post	Pre	Post	Pre	Post
Age (yrs.)	26.1±3.7	26.1±3.7	27.3±3.9	27.3±3.9	24.9±3.2	24.9±3.2
Height (cm)	179±5.3	179±5.3	179±6.3	179±6.3	179.1±3.7	179.1±3.7
Weight (kg)	82.0±7.9	80.5±7.0	83.1±8.9	81.5±7.3	80.8±6.9	79.6±6.8
Body fat percentage (%)	12.4±2.3*	10.8±1.5*	13.3±1.7*	11.2±1.4*	11.5±2.5*	10.4±1.5*

Note. SSGs= Small-Sided Games, HIIR= High-Intensity Intermittent Running. Values are means ± SD, * $p < 0.05$.

Yo-Yo Intermittent Recovery Test Level 1 (YYIR1)

The YYIR1 has been proven to be a valid and reliable test to evaluate maximal aerobic capacity within intermittent field sports such as soccer (5). Participants were

required to complete a pre-and post-intervention YYIR1 test according to the procedures outlined by Bangsbo et al. (5) on a 3G artificial grass pitch with a shuttle distance of 20 m x 5 m in length measured out with a digital measuring wheel (Trumeter 5505E Digital Measuring Wheel, Trumeter, Bury, Lancashire, United Kingdom). Participants were divided into two separate groups to ensure the accurate recording of distances and participant control, group two underwent the test 5 minutes after group 1 finished. The test involves players performing a series of 2 x 20 m linear shuttle runs coupled with a 5-m recovery zone to the pace set by an audio compact disk (BangsboSport.com, Copenhagen, Denmark) with a rest period of 5 seconds between shuttles. The YYIR1 starting speed is set at 10 km·h⁻¹ and increases up to 19 km·h⁻¹, the test continues until participants fatigue and withdraw or dismissed due to been unable to maintain pace with the audio beep. The tester records the final distance completed by the participant and estimates participants maximal aerobic capacity ($\dot{V}O_{2max}$) using the Bangsbo et al. (5) formula of YYIR1 (m) x 0.0084 + 36.4 = $\dot{V}O_{2max}$ (ml·kg⁻¹·min⁻¹).

Maximal Aerobic Speed (MAS)

Maximal Aerobic Speed may be defined as the minimal running speed at which $\dot{V}O_{2max}$ occurs and is used as a measure of anaerobic power (3). To calculate participants MAS, all participants underwent a pre-and post one kilometre (1km) maximal effort time trial (33) wearing running trainers on an 800 m Conipur SP outdoor running track (Crawford Group, Co. Antrim, Northern Ireland). Participants were distributed into 4 groups of 8 participants for the testing to ensure correct recording of each participant's times. Data was collected using a digital Seiko SO51 100 Lap Memory Stopwatch (Seiko, Japan). As noted by Hezler et al. (20) the use of handheld stopwatches reported small mean errors and high intraclass correlations

against electronic timing gates, making them a viable method in collecting group data where the use of electronic timing gates is not feasible.

Acceleration Test

Acceleration is to be investigated using a 10-m linear sprint test as outlined by Little and Williams (29). Testing involved participants sprinting at maximal effort over a 10-m distance from a stationary start. A Brower TC motion sensor was placed at the start line and an electronic gate placed 10 m in front, set to a width of 2 m and height of 1 m. (Brower TC-Timing Systems, Salt Lake City, USA). Participants were instructed to place their front foot on the starting line with the TC motion sensor in line with their rear foot position, once ready the acceleration test begun when the participant's rear foot left the ground and activated the TC motion sensor. Each participant performed three sprints with a recovery period of 60 seconds between sprints to ensure full ATP-PCr recovery. The quickest sprint time was recorded and used for analysis.

Repeated Sprint Ability (RSA) Test;

The use of RSA testing has shown to be an important indicator for anaerobic fitness within intermittent field sports such as soccer (42). Within top-level soccer players, a significant correlation has been shown with mean RSA sprint test results and running distances during competitive play (42). Within the present study, participants completed an RSA test as outlined by Perroni et al. in figure 1 (41).

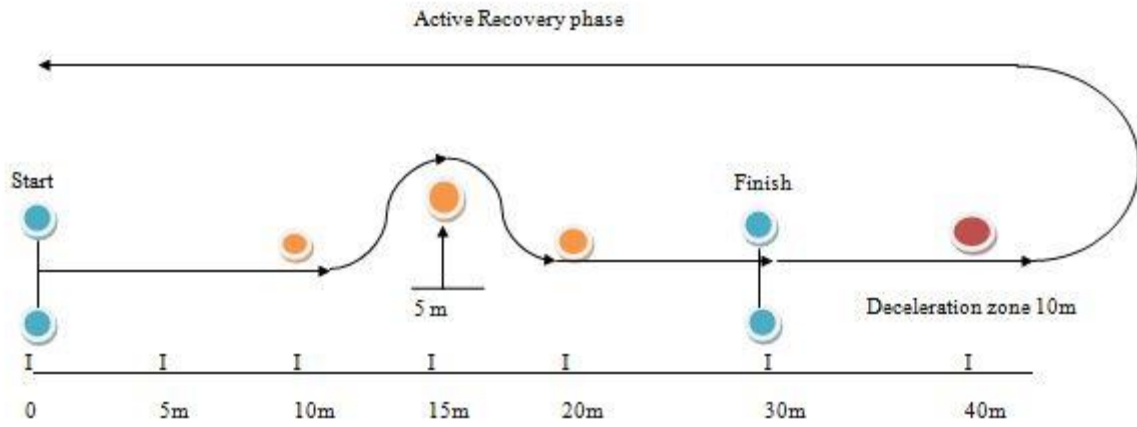


Figure 1. Design of the Repeated Sprint Ability test. Adapted from Perroni et al.(42).

To calculate RSA performance, a Brower TC motion sensor and electronic timing gates were used. The motion sensor was positioned at the start line to the same protocol as previously described. One electronic gate was placed at the finish line of the test (30m) using the same set up as previously described. Participants were instructed to complete 7 x 30 m sprints with a change of direction at the midway point at maximal effort, once crossing the finish line players decelerated as quickly as possible. The recovery phase was set at 25 sec. in duration with participants undertaking a light jog of 40 m to the starting line. Within the present study, the mean of RSA total sprint time, average sprint time and fatigue index percentage (FI %) results were considered representative of RSA performance. The FI % was calculated based on the difference in the slowest sprint time and the fastest sprint time $FI \% = ([S_{slowest} - S_{fastest}] / S_{fastest}) \times 100$ (17)

Small-sided Games (SSGs)

The SSGs group consisted on 16 participants divided into 4 teams of 4 players. Training consisted of a 4 vs. 4 game format with play duration of 6 x 4 min. (performed at 85-95% HR_{max}), with a 3-min. active recovery period (performed at 50-60% HR_{max}) on an 80 x 20 m pitch as reported by Collins et al. (10). Standard match rules apply and extra balls were placed onto the sidelines to ensure the continued flow of the game and limit the duration of stoppage when the ball is forced out of play.

High-Intensity Intermittent Running (HIIR)

The HIIR group consisted of 16 participants completing a series of maximal effort linear sprints of 7 seconds in duration coupled with a 70 second recovery period to ensure full ATP-PCr resynthesis (work-to-rest ratio of 1:10). Participants continued the protocol for the duration of 6 min. at $\geq 85\%$ HR_{max} with a 3-min. active recovery period completed between 50-60% HR_{max} to ensure similar workloads within groups. Participants exercise intensity zones were based on maximal aerobic guidelines of 100% MAS equal to 93-100% HR_{max} by Baker 2011 (3). Participants were set individual travel distances based on their 1 km time trial to calculate their MAS (m/s). Participants shuttle travel distances were calculated at 100% MAS x 7 sec. to engage the anaerobic energy systems. For example, if a participant runs a 1 km time trail in 250 seconds, then their 100% MAS equals 4.0 m/s. 4.0 m/s is multiplied by the sprint time of 7 sec. resulting in a participant sprint distance of 28 m. Both groups underwent a standardised active recovery comprising of a light jog and a series of dynamic stretches.

Statistical Analyses

Research data is exhibited as mean values and standard deviation (means \pm *SD*). Statistical analysis was performed using the statistical analysis software IBM SPSS (Version 24, IBM, New York, USA) with statistical significance was set at an alpha level of $p \leq 0.05$. Sample size was estimated using statistical power software, G*Power (version 3.0.10, Heinrich-Heine-University, Düsseldorf, Germany) showing a moderate/small/large effect size ($f = 0.1$). A Shapiro-Wilk test was conducted to test the normal distribution of the data and a 2-way analysis of variance (ANOVA) was conducted to compare differences in the dependent variables of acceleration, RSA and fatigue index with pre-post time as a factor. A least significant difference (LSD) test was employed to make multiple evaluations between the dependent outcomes. Finally, for results displaying statistical significance a Tukey HSD post hoc test was conducted to investigate interactions between significant outcomes.

Results

Physical and physiological responses to SSGs vs. HIIR are presented in Table 2 with performance differences presented in figure 2 and 3. Results show there was no significant difference for acceleration ($F(1,30) = 0.69, p = <0.794$), RSA total time ($F(1,30) = 0.078, p = <0.782$), RSA average sprint ($F(1,30) = 2.760, p = <0.107$), Fatigue index % ($F(1,30) = 0.012, p = <0.914$), YYIRL1 ($F(1,30) = 1.876, p = <0.18$), Maximal aerobic capacity ($F(1,30) = 1.872, p = <0.81$), 1km TT ($F(1,30) = 0.563, p = <0.853$), MAS ($F(1,30) = 0.129, p = <0.72$). A significant difference was recorded for body fat % ($F(1, 30) = 4.338, p = <0.046$) indicating a significant improvement for the research methods.

Table 2. Physical and physiological responses to SSGs vs. HIIR

	Total (<i>n</i> =32)		SSGs (<i>n</i> =16)		HIIR (<i>n</i> =16)	
	Pre	Post	Pre	Post	Pre	Post
10 m acceleration (s)	2.22 ± 0.15	2.18 ± 0.11	2.27 ± 0.33	2.18 ± 0.13	2.22 ± 0.14	2.18 ± 0.19
RSA total time (s)	45.16 ± 1.83	45.68 ± 3.23	45.60 ± 1.85	45.97 ± 3.84	44.73 ± 1.75	45.40 ± 2.51
RSA avg. sprint time (s)	6.45 ± 0.26	6.58 ± 0.39	6.55 ± 0.26	6.68 ± 0.4	6.39 ± 0.25	6.49 ± 0.36
Fatigue Index (%)	3.86 ± 1.58	4.41 ± 2.53	3.92 ± 1.46	4.28 ± 2.47	3.8 ± 1.74	4.55 ± 2.65
$\dot{V}_{O_2\max}$ (ml·kg ⁻¹ ·min ⁻¹)	47.8 ± 4.1	48.40 ± 3.7	47.80 ± 4.3	49.2 ± 3.7	47.80 ± 4.0	47.60 ± 3.7
Training intensity (bpm)	158.0 ± 9.26	163.0 ± 5.21	160.0 ± 8.4	169.0 ± 5.28	156.0 ± 10.12	157.2 ± 6.29
Perception of effort (s-RPE)	6.0 ± 0.72	5.0 ± 0.51	6.0 ± 0.63	5.0 ± 0.53	6.0 ± 0.84	5.0 ± 0.49

Note. SSGs= Small-Sided Games, HIIR= High-Intensity Intermittent Running. 10m acceleration results based on best sprint, RSA average sprint time is calculated from the mean of 7 completed RSA sprints. s-RPE= Session Rate of Perceived Exhaustion. Values are means ± SD, * $p < 0.05$.

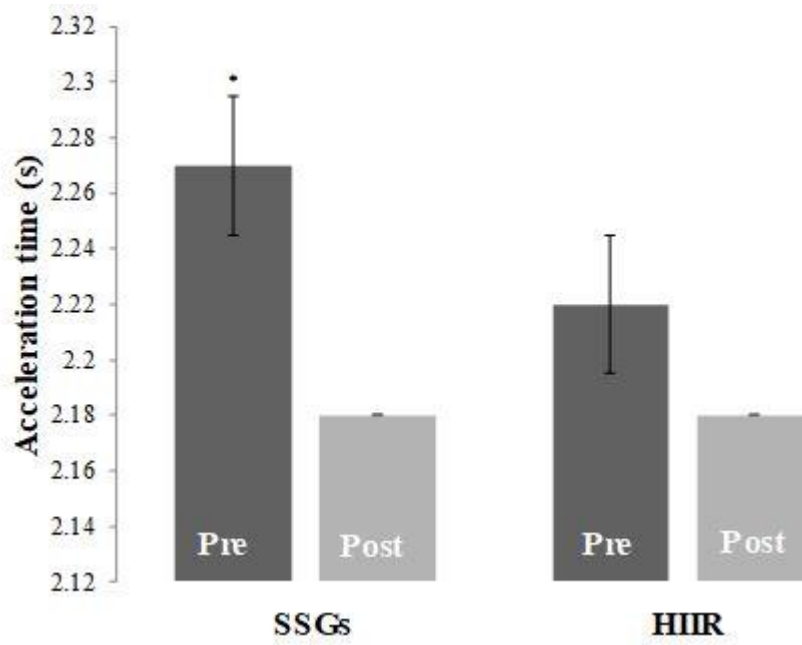


Figure 2. Changes in Acceleration for SSGs vs. HIIR groups Values are mean \pm SD,

* $p = <0.05$

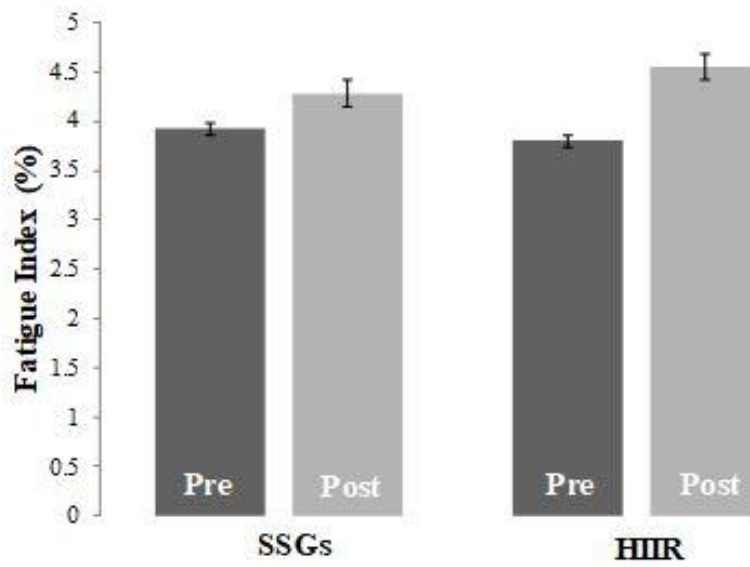


Figure 3. Changes in fatigue index (%) for SSGs vs. HIIR groups Values are mean \pm

SD, * $p = <0.05$

Discussion

The objective of the current study is to investigate the effect of SSGs vs. HIIR to improve acceleration and RSA within club Gaelic football players. Results from the 10-m acceleration test, showed minor improvements from pre to post analysis in both the SSGs and HIIR groups (SSGs; $2.27 \pm 0.33s$ - $2.18 \pm 0.13s$, HIIR; $2.22 \pm 0.14s$ - $2.18 \pm 0.19s$), these shared similar results to published data on 10 m sprint times within intercounty Gaelic footballers of $1.89 \pm 0.17s$ and $2.06 \pm 0.10s$ (10,39). This suggests the results are consistent with elite level players and any improvements by club players would be minimal. This may be explained by the demands of the sport, where players are needed to generate high levels of power, as described as the level of work a muscle or muscle group can create per unit of time (48). Since power is created in the neuromuscular system and affected by motor unit recruitment, players who undertake both strength and power based training as part of their physical preparation program can expect to develop Type 11a & Type 11x muscle fibers. Wisløff et al. (55) commented on the strong correlation between maximal half-squat strength and 10 m sprint performance within international soccer players ($n = 17$), this suggests the use of a high-intensity effort of $\geq 95\%$ 1RM to illicit a neuromuscular training effect and aid in producing explosive efforts over short periods.

With regards to RSA performance, both the SSGs and HIIR groups reported an increase in total RSA test times (SSGs; $45.60 \pm 1.85s$ - $45.97 \pm 3.84s$, HIIR; $44.73 \pm 1.75s$ - $45.40 \pm 2.51s$) these can be compared to 12 rugby league players RSA total test time of $41.5 \pm 3.2 s$ (25). Both groups also displayed an increase in RSA average sprint times (SSG; $6.55 \pm 0.26s$ - $6.68 \pm 0.4s$, HIIR; $6.39 \pm 0.25s$ - $6.49 \pm 0.36s$) compared to professional soccer players ($n = 41$) with an average RSA sprint time of $7.25 \pm 0.17 s$. Finally, results reported an increase in the fatigue index percentage of both groups, considering that the FI % is an indicator of players anaerobic capacity,

this increase indicated the players power output as declining and signifies the rate of fatigue during bouts of maximal sprint running (SSGs; 6.55 ± 0.26 s - 6.68 ± 0.4 s, HIIR; 6.39 ± 0.25 s - 6.49 ± 0.36 s). The use of three methods to measure RSA offers the researcher a global understanding on the effects of RSA on Gaelic football performance. Interestingly within this study, club Gaelic footballers compared favourably to similar fields sport and against results from professional athletes, considering club Gaelic football is considered sub-elite. Considerations should also be noted that due alternative methods of RSA testing and data collection, direct comparisons should be viewed with caution. Physiological effect of RSA within energy system as the need for additional bouts of high-intensity activity results in a decline acute decline in ATP and PCr stores. It is during this period that the aerobic system is required to aid in recovery. Turner and Stewart (50) discussed the effects of fatigue on RSA and noted the build up of hydrogen (H^+) ions the main factor in muscular fatigue due to a process of reducing intracellular pH balance and the inhabitation of binding enzymes to produce muscular contraction. This reduction in RSA may also be coupled with a reduction in the optimal functioning of the sodium potassium pump and with the reduction of calcium influencing the hydrolysis of ATP via the pump. It is also noted that player position affects the ability for players to fully re synthesis ATP-PCr stores, for example McErlean et al. (35) found work-top-rest ratios for back (1:16.6), forwards (1:11.6) and midfielders (1:7.4) within intercounty Gaelic footballers. This offers an insight to the limited recovery period for midfielders compared to back and forward players, this is supported by Malone et al. (32) within elite Gaelic footballers ($n = 43$), reporting an average total match distances of 9,523 m compared to full-backs of 6,892 m and full-forwards at 7,090, also noted was midfielders were responsible for a higher number of acceleration of 219 compared to full back and full forward positions of 152 and 152 respectively. It may be noted, that an alternative reason for the study recording minor improvements within acceleration

and RSA is the prescribed intensity levels, previous research with SSGs and club Gaelic football by Collins et al. (10) implemented a similar SSGs regime with HR_{max} set at between 85-95% HR_{max} , with results showing no improvement in 5 m sprint speed. This can be compared to Hill-Hass et al. (21) who implemented a similar SSG (4 vs. 4) method at $\geq 95\%$ HR_{max} with reported improvements in maximal aerobic capacity, this suggests the current research method to target intensity levels of 85% HR_{max} to be insufficient to illicit an overload training stimulus.

A noted limitation within the study is unavailability of time-motion analysis such as GPS to collect and categorise the number of accelerations conducted within the SSGs and HIIR groups. As described within the introduction, accelerations by distance may be described as low ($\geq 1-2 \text{ m}\cdot\text{s}^{-1}$), moderate ($\geq 2-3 \text{ m}\cdot\text{s}^{-1}$) and high accelerations ($\geq 3\text{m}\cdot\text{s}^{-1}$) and GPS analysis may offer more in-depth information of the types of acceleration more prominent with SSGs and may lead to developing appropriate SSGs to improve acceleration within Gaelic football. Yet, caution should be noted within applying GPS to monitor acceleration as a current study by Vardey et al. (52) commented on the limitations of GPS with sampling rates of $\leq 5\text{Hz}$ to correctly track and collect data within short duration activity, it was reported a 10Hz to be the optimal sampling frequency to collect acceleration data from.

In conclusion, the aim of the study was to compare SSGs against HIIR to investigate possible methods to improve acceleration and RSA within club Gaelic football players. No significance differences were shown between the SSGs and HIIR groups, with only minor improvements within 10 m acceleration and aerobic capacity. It is recommended future studies to implement and monitor a high-intensity SSGs and HIIR training program with real time HR analysis to investigate if RSA can be improved.

Practical applications

It is suggested for the Strength and Conditioning coach to implement the use of SSGs within a field sports team physical preparation, especially during the in-season, as benefits include; 1) Improvements in maximal aerobic capacity, 2) Improvements within ball control and handling skills due to the nature of SSGs. 3) Improved player response and training interest with the implementation of SSGs due to its similarity to competitive play.

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Appendices

Appendix 1

Ethics Submission form



**St Mary's
University
Twickenham
London**

St Mary's University

Ethics Sub-Committee

Application for Ethical Approval (Research)

This form must be completed by any undergraduate or postgraduate student, or member of staff at St Mary's University, who is undertaking research involving contact with, or observation of, human participants.

Undergraduate and postgraduate students should have the form signed by their supervisor, and forwarded to the School Ethics Sub-Committee representative. Staff applications should be forwarded directly to the School Ethics Sub-Committee representative. All supporting documents should be merged into one PDF (in order of the checklist) and clearly entitled with your Full Name, School, Supervisor.

Please note that for all undergraduate research projects the supervisor is considered to be the Principal Investigator for the study.

If the proposal has been submitted for approval to an external, properly constituted ethics committee (e.g. NHS Ethics), then please submit a copy of the application and approval letter to the Secretary of the Ethics Sub-Committee. Please note that you will also be required to complete the St Mary's Application for Ethical Approval.

Before completing this form:

- **Please refer to the University's Ethical Guidelines. As the researcher/supervisor, you are responsible for exercising appropriate professional judgment in this review.**
- **Please refer to the Ethical Application System (Three Tiers) information sheet.**
- **Please refer to the Frequently Asked Questions and Commonly Made Mistakes sheet.**
- **If you are conducting research with children or young people, please ensure that you read the Guidelines for Conducting Research with Children or Young People, and answer the below questions with reference to the guidelines.**

Please note:

In line with University Academic Regulations the signed completed Ethics Form must be included as an appendix to the final research project.

If you have any queries when completing this document, please consult your supervisor (for students) or School Ethics Sub-Committee representative (for staff).



**St Mary's
University
Twickenham
London**

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.

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

I can confirm that all relevant documents are included in order of the list and in one PDF document (any DBS check to be sent separately) named in the following format:

Mark O'Connell,

School of Sports, Health and Applied Science.

Dr. Stephen Patterson

Signature of Applicant:

Signature of Supervisor:



**St Mary's
University
Twickenham
London**

Ethics Application Form

1) Name of proposer(s)	Mark O`Connell
2) St Mary's email address	145615@live.smuc.ac.uk
3) Name of supervisor	Dr. Stephen Patterson

4) Title of project "The effects of Small-Sided Games Verses High-Intensity Intermittent Running on Acceleration and Repeated Sprint Ability in Gaelic Football"

5) School or service	Sports, Health and Applied Science
6) Programme (whether undergraduate, postgraduate taught or postgraduate research)	Postgraduate taught
7) Type of activity/research (staff/undergraduate student/postgraduate student)	Postgraduate student

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

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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?	NO

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
f) Is there manipulation of cognitive or affective human responses which could cause stress or anxiety?	NO
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
<p>Please indicate :</p> <ul style="list-style-type: none"> • When the study is due to commence. • Timetable for data collection. • The expected date of completion. <p>Please ensure that your start date is at least 3 weeks after the submission deadline for the Ethics Sub-Committee meeting.</p>
Recruitment for the study will begin January 2017 after ethical approval.

It is anticipated that data collection will begin in January 2017 and be completed by the 14th March 2017. It is expected that the study will be completed by 14th April 2017.

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.

N/A

15. Other Research Ethics Committee Approval

- **Please indicate whether additional approval is required or has already been obtained (e.g. the 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.**

N/A

16. Purpose of the study

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

- **Be clear about the concepts / factors / performances you will measure / assess / observe and (if applicable), the context within which this will be done.**
- **Please state if there are likely to be any direct benefits, e.g. to participants, other groups or organisations.**

The sport of Gaelic Football (GF) is an intermittent field sport (McIntyre and Hall, 2004). GF players share similar physical and physiological characteristics as similar field sports players

such as Australian Football League (AFL) and Soccer (Gray and Jenkins, 2010; Watson, 1995). An important factor in match success is the player's ability to accelerate quickly over short distances or undergo repeated sprints with limited recovery time while in and out of possession ((Florida-James and Reilly, 1995; Malone, Solan, Collins, and Doran, 2015).

The importance of acceleration and high-intensity running within GF has been highlighted by Malone et al.,(2015) within a study of 50 elite GF players, the average total distances to be $8,160 \pm 1,482$ m, yet this is subject to change with positional demands from between 6183 ± 11104 m as outlined by Collins, Solan, and Doran (2013). Yet, more interestingly Malone et al., (2015) reported that players travelled 445 ± 169 m at spring speed ($\geq 22 \text{ km} \cdot \text{h}^{-1}$) and underwent 184 ± 40 accelerations per game and this equated to 2.6 ± 0.5 accelerations per minute. This research supports the view that player's ability to quickly accelerate is of vital importance within successful GF performance.

Repeated Sprint Ability (RSA) as described by Girard, Mendez-Villanueva, and Bishop (2011) as the ability to produce submaximal efforts (<10 s) coupled with periods of low to moderate recovery couple with recovery of 60-300 seconds (s). As previously noted by Rampinini, Sassi, Morelli, Mazzoni, Fanchini, and Coutts (2009) improved RSA enables players to recovery more efficiently between bouts of high intensity activity such as acceleration and sprint activity.

The use of small sided games (SSGs) have long been researched within soccer as a method to improve performance, especially developing technical skills and improving maximal aerobic capacity (Gamble, 2013). Yet, the research of SSGs with GF is limited with a small number of recent studies investigating the physical and physiological effects of SSGs within the sports of GF (Malone et al.,2015; Malone, Solan, and Collins, 2016). Research within high-intensity intermittent running (HIIIR) methods has shown that HIIIR training programs with components of short interval bursts of $>100\%$ MAS with 10 sec. is an effective method in developing aerobic capacity while improving acceleration with field sports (Baker, 2011)

As of date, no research study has set to investigate the role of SSGs to improve acceleration and RSA within GF. Based on the previous analysis above, the purpose of this study is to investigate the effect of SSGs vs. HIIIR training on improving acceleration and RSA within club GF players. It is hypothesised that the SSGs protocol will result in greater improvements in both acceleration and RSA results compared to the HIIIR group.

It is suggested that benefits of the study includes both physical and educational training for the participants due to taking part in the study. It is proposed that the research study may aid in filling a void in current research and add valuable knowledge in the use of SSGs for on-field training, by offering valid and reliable training protocols.

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Watson, A. W. (1995). Physical and fitness characteristics of successful Gaelic footballers. British journal of sports medicine, 29(4), 229-231.

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 testing will take place.
- 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) This research study proposes to recruit 32 senior male sub-elite Gaelic football (GF) players to be distributed into two intervention groups consisting of one small sided games and one high-intensity interval running group, both groups will conduct 20 on field intervention sessions over a 10 week period lasting 1 hr. per session including warm-up and cooldown. Prior to beginning the research study, participants are to conduct a health screening, body composition analysis and a maximal aerobic capacity ($\dot{V}O_2\text{max}$) test four days before the research study begins.

Participants are to be distributed between both intervention groups based on their aerobic fitness testing results, this will ensure both groups are of even cardiovascular fitness levels prior to the beginning of the research study. All participants are to attend a familiarisation session two days prior to the beginning of the research study and made familiar with both the acceleration and repeat sprint ability tests. All intervention sessions will be conducted at the same time of the day (7:00pm) and separated by 48 hours. The research study is to be conducted on a 3G artificial grass pitch with the dimensions of length 100m by 80 m width.

On intervention day, quantitative data will be collected from each participant using a Team polar (Polar, Finland) heart rate monitor. Each participant will complete a standardised warm up including the R.A.M.P. (Jeffries, 2007) and GAA 15 method for 15 minutes. On completion each participant will collect into their agreed research group and undergo their intervention session on the researcher's command.

Intervention methods consist of two groups, group 1; Small Sided Games (SSGs) consisting of 16 participants (4 v 4) undertaking a 6 x 4 minute (completed at 85-95% HRmax), with 3 min active recovery (completed at 50-60% HRmax) on an 80 x 20 m pitch as outlined by Collins, Doran & Reilly (2013). Group 2; High-Intensity Intermittent Running (HIIR) consisting of 16 participants will undergo a liner running protocol based on the maximal aerobic speed (Baker, 2011) method at 95% maximal heart rate (HRmax). Participants are to undergo a 1 kilometre (km) time trial to access their maximal aerobic speed (MAS) per meter per second (m/s). Once m/s per player is accessed, the researcher sets the distance between two cones at > 95% HRmax, to be covered by the player in 7 sec. as outlined in figure 1 with the players rounding

the cone and coming to a full stop before their next run. HIIR group have a work to rest ratio of 1:10 to allow for full ATP-PCr recovery, HIIR continues for 6 minutes with 3 minute recovery period as consistent with SSGs intervention method.

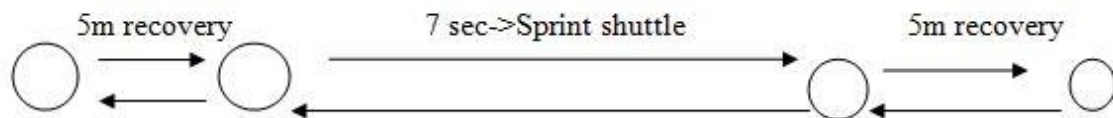


Figure 1: Diagram of HIIR shuttle

At the end of each 6 minute intervention block the researcher will collect both heart rate (H/R) and session rate of perceived exertion (s-RPE) from each participant as outlined by Impellizzeri et al., (2004), this information will be taken a total of 6 times. Participants will undergo a standardised cool-down consisting on light jogging and static stretching to ensure the body returns to pre-training intensity levels. On completion of the 10 week intervention, players will be retested on body composition analysis, acceleration and repeat sprint ability using the same methods utilised in pre-intervention testing.

b) Prior to beginning the research study all participants are required to under a health screening consisting of successful completion of a Physical Activity Readiness Questionnaire (PAR-Q) and participant consent form. This is to be followed by the researcher taking the measurement of resting heart rate (HR) and blood pressure (BP) using an Omron M3 Intellisense Upper Arm Blood Pressure Monitor (Omron Healthcare Europe B.V. Hoofddrop, Netherlands). Blood pressure will be measured by placing the omron inflatable cuff on the left brachial artery of participants and results recorded as systolic over diastolic blood pressure. Body composition analysis players height using a Seca 213 Portable Stadiometer (Seca, Hamberg, Germany) measured to the nearest 0.1 centimetre (cm). Player weight was recorded using a Seca 803 weighing scale with results recorded to the nearest 0.1 kilogram (kg). Participants skinfold measurements are to be collected using the 3 site method of chest, abdominal and thigh using a Harpenden skinfold caliper (Baty International, West Sussex, United Kingdom) and body fat percentage calculated using the Jackson and Pollock equation as outlined by Cullen et al.,(2013).

Participants maximal aerobic capacity is to be investigated using the field sport specific Yo-Yo Intermittent Recovery test 1 (Bangsbosport.com, Denmark) as previously validated by Bangsbo et al., (2008) (2008). (1994). This test involves participants to complete a sequence of 20 meter (m) shuttle runs coupled with a 5 m recovery zone, back and forth to the sound of an electronic beep. As the participant increase levels, this results in a quicker beep at a faster speed until either the player misses two beeps or fatigues and leaves the test. Maximal aerobic capacity is calculated using the Bangsbo et al.,(2008) formula of $YYIR1 (m) \times 0.0084 + 36.4 =$

$\dot{V}O_2$ max. This information is to be used to place participants into either the SSG or HIR group to ensure groups are of even cardiovascular levels before beginning the research.

Prior to undergoing the intervention, all participants are to have both acceleration and RSA tested. The location of testing will be conducted on an outdoor grass pitch, players acceleration is to be accessed using a 10m linear sprint test as outlined by Little & Williams (2005) from a stationary start. Acceleration times are to be collected using the Brower Timing TC-System electronic timing gates (Brower timing systems, Draper, Utah, USA). Participants start position is on a line 2 m apart and the second gate (2 photocells) placed 10m in front, also with gates placed 2 m apart. Players undertake three attempts with 60 seconds recovery between bouts with the best sprint used for analysis. Participants are required to undergo RSA testing on a separate training session as not to have residual effect of the sprint test comprising RSA results.

The RSA testing protocol as offered by Rampinini et al., (2009) consisting of a linear grid of cone markers set at the starting line and opposite cones set a 20m distance. Participants are to complete 6 x 40m sprints, broken into two 20m sprints with the participant touching the 20m marker with their hand and returning to the start line for a 20 second passive recovery, once completed RSA was accessed by the best sprint time.

The HIR groups will have their MAS calculated using a 1km time trial on a 400m athletic track. This continuous run is set of 1 km and the MAS calculated by $\text{distance(m)}/\text{completed time(s)} = 100\% \text{ MAS}$. Each HIR participant will have their MAS x 7 sec. (maximal acceleration time in GF) to calculate their HIR distance. Both intervention groups are to calculate maximal training intensity using the HR reserve equation of $\text{Maximal heart rate} = (\text{HR}_{\text{max}} - \text{HR}_{\text{resting}}) \times \% \text{Intensity} + \text{HR}_{\text{resting}}$. Resting HR is collected during the health screening process and HR and s-RPE collected as previously outlined. Post testing of both acceleration and RSA are to be completed at the end of week 10.

Once all pre-intervention testing is completed the researcher will begin his 10 week intervention protocol as described previously. On completion of intervention sessions, all participants will undergo a cool-down, to reduce the effects of the testing intensity of the body and bring the body back to a state of homeostasis using light movement and static stretching.

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Bangsbo, J. (1994) Energy demands in competitive soccer. Journal of Sports Sciences 12, 5-12.

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Little, T., & Williams, A. G. (2005). Specificity of acceleration, maximum speed, and agility in professional soccer players. The Journal of Strength & Conditioning Research, 19(1), 76-78.

Rampinini, E., Sassi, A., Morelli, A., Mazzoni, S., Fanchini, M., & Coutts, A. J. (2009). Repeated-sprint ability in professional and amateur soccer players. Applied Physiology, Nutrition, and Metabolism, 34(6), 1048-1054.

c) Participants are required to commit to a 12 week period, including pre and post intervention testing. Intervention period will consist of 10 weeks with two intervention sessions per week, each session consisting of 1 hour in duration including warm-up , intervention and cool down.

d) All research is to be conducted on a 3G artificial grass pitch with the dimensions of length 100m by 80 m width located at a Dublin based GAA club. The 1km time trial is to be conducted on an outdoor 400m athletics track located at a Dublin based sports centre.

e) Pre & post intervention testing and intervention protocols are based on previous research as listed above.

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.

a) 32 male club GF players are to be selected for this study, this is to have two even intervention groups of 16 participants. The SSGs group requires 4 teams of 4 participants. Players are to be part of the senior club football squad and all players are to be over 18 years old.

b) Participants are to be recruited by the researcher contacting Dublin based GAA clubs and presenting the research proposal to club administrators and club players using a poster presentation as attached in appendix A and meeting the inclusion/exclusion criteria as outlined below.

c) Participant inclusion and exclusion criteria.

Inclusion	Exclusion criteria
<ul style="list-style-type: none">• Senior club Gaelic footballers.• Males, physically active and currently training a minimal of twice per week.• Passed the health screening including PAR-Q.• Between 18-35 years old.• Non-smokers.	<ul style="list-style-type: none">• Physically inactive.• Answered yes to any question on the PAR-Q form.• Under 18 years old.
<ul style="list-style-type: none">• No current musculoskeletal injury.• No history of metabolic, musculoskeletal disease, viral or bacterial infections.	<ul style="list-style-type: none">• Smoker.• Previous or current history of metabolic, musculoskeletal disease, viral or bacterial infections.• Current musculoskeletal injury

d) N/A

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? 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) No

b) No

c) N/A

d) The participants will be given an information sheet and will provide written consent as described in appendix B

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) 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.
- d) 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).
- e) 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).

f) Are there any benefits to the participant or for the organisation taking part in the research (e.g. gain knowledge of their fitness)?

- a) Participants will experience a small degree of physical stress during the study due to the use of submaximal physical effort. Delayed onset of muscle soreness (DOMS) is expected to last between 12-24 hours after exercise and is a normal response to high effort exercise. Participants will undergo a structured cooldown to aid reduce DOMS at the end of each intervention session.**
- b) Risks may be from muscle soreness post intervention as outlined above, all intervention sessions will be supervised by the researcher.**
- c) No**
- d) No**
- e) No adverse reactions are expected as procedures have low risk; however, if they do occur, the researcher is a trained first aider and will have access to contact St. James Hospital, James Street, Dublin 8.**

21. Confidentiality, privacy and data protection

- a) What steps will be taken to ensure participants' confidentiality?**
- Please describe how data, particularly personal information, will be stored (all electronic data must be stored on St Mary's University servers).**
 - 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.**
- b) Describe how you will manage data using a data management plan.**
- You should show how you plan to store the data securely and select the data that will be made publicly 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.**
- c) Who will have access to the data? Please identify all persons who will have access to the data (normally yourself and your supervisor).**
- d) 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.**

- a) All participant information will be safeguarded and remain confidential during and after the research project in line with the data protection act 1998. All data will be collected and stored electronically on St Mary's University servers. All paper data will be locked in a cabinet in a locked office accessed only by the researcher and supervisor. All participants will have a code attached to their name only know to the researcher and supervisor, which can be used to identify data if it needs to be withdrawn. All data will be disposed securely after 5 years. Anyone who withdraws from the research project will have all information and data collected destroyed.**
- b) All participants will have a number code attached to their name and this code will be how data will be selected and made public when the research project is finished. All data will**

be collected and stored on a password-protected computer known only by the research group on St Mary's University servers. Data will be presented as group averages thus no allowing identification of individuals.

- c) Mark O'Connell and Dr Stephen Patterson
- d) No

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 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.

Feedback from this study will only be given in a summary of findings. Any individual data that can be provided on request will only relate to pre and post testing and will be provided in a comprehensive text.


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)	Date :
Signature of Supervisor (for student research projects)	Date :

Appendix 2

Participant information sheets

2.1 Research information poster



**St Mary's University
Twickenham
London**

Small Sided Games vs. High-Intensity Intermittent Running on Acceleration and Repeated Sprint Ability in GAA football.

Mark O'Connell
The School of Sport, Health & Applied Science,
St. Mary's University,
Twickenham,
UK.

Introduction:

- Within field sports, players are required to undergo high bursts of activity, including sprinting. This outlines the importance for players to be able to recover quickly from bouts of repeated sprinting given short recovery periods, also known as repeated sprint ability (RSA) (Girard, Mendez-Villanueva & Bishop, 2011).
- Players ability to be the first to the ball has been noted as an important component of gaining possession. Within GAA football it was found that players completed 184 ± 40 accelerations per game and this equated to 2.6 ± 0.5 accelerations per minute. (Malone and Collins, 2014).
- Small Sided Games (SSG) and High-Intensity Intermittent Running (HIIR) have been shown to improve both aerobic and anaerobic player qualities.
- Players with high aerobic and anaerobic fitness are important in the final 15 minutes of a match, the fitter the player the more chance they have of beating non-fit players in a match (Mohr et al, 2002).
- In summary, Players with high levels of aerobic & anaerobic fitness help win games.

What is involved?

- The research project will be conducted 2 times a week for a 10 week period from January-March 2016.
- Player data collection including height, weight, blood pressure and body fat % taking at the start and the end of the project.
- The players will conduct an aerobic, acceleration and repeat sprint ability tests at the start and end of the 10 week intervention.
- Players will be split into two groups: 1) SSG, and 2) HIIR.
- Groups 1 & 2 will undergo bouts of activity for 6 min x 4 sets with 3 min recovery (overall 16 min. of effort).
- The researcher will conduct all testing at the clubs training ground twice a week, over a 10 week period.
- The researcher will conduct and record all data from the testing sessions.



Fig 1. Example of a Running-Based Anaerobic Sprint Test used to calculate RSA (Bishop et al, 2001).

Practical outcome of research

- Interval training with high intensity workloads have been shown to improve aerobic capacity and maintain players fitness even after a 6 week period of maintenance training (Mohr et al, 2002).
- Small Sided Games also help players develop technical skills, including hand passing.
- High-Intensity Intermittent Running helps develop high levels of aerobic and anaerobic fitness levels.
- Players with higher fitness levels maintain the benefits over a longer period of time in-season (Baker, 2011).

Contact details:

- If your team or club is interested in being involved in this research project, Please contact:
• Mark O'Connell: 086-3742177 or twickenham@omail.com for more information.

References:

Baker, D. (2011). Recommendations in high-intensity aerobic training for field sports. *Professional Strength & Conditioning*, 22, 3-6.

Bishop, D., Spencer, M., Duffield, R., & Lawrence, S. (2001). The validity of a repeated sprintability test. *Journal of Science and Medicine in Sport*, 4(1), 19-22.

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Fig. 1. Example of a Small sided Games layout (GAA, 2014)

2.2 Participant Information sheet



**St Mary's
University
Twickenham
London**

Participant Information sheet

Effect of Small-Sided Games Verses High-Intensity Intermittent Running on Acceleration and Repeated Sprint Ability in Gaelic Football.

You are being invited to take part in a research study. Before you decide it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Please ask if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part. Thank you for reading this:

What is the purpose and aim of our research?

Within competitive Gaelic football games, it is important for players to have the ability to accelerate quickly and repeat sprints within periods of short recovery, also known as repeat sprint ability. The aim of the study is to compare two on field training methods (small sided games and high-intensity intermittent running) on improvements in both acceleration and repeat sprint ability.

Why have I been invited?

You have been chosen because you are healthy male, who regularly undertakes exercise and is over the age of 18 and under the age of 35.

Who is organising the research?

The research is being organised by Mark O`Connell (MSc. student) and Dr Stephen Patterson (Senior Lecturer Exercise Physiology).

What will happen to the results of the study?

The results will be given within a "summary of findings" document after the study is complete. You will only be given overall results and not the results of any other participant that took part. No further individuals or organisations will be given these findings.

Source of funding for the research

There are no external sources of funding for this study.

Contact for further information

Mark O`Connell (145615@live.smuc.ac.uk)

Do I have to take part?

No, participation is by invitation only. If you decide to take part you will be given this information sheet to keep and be asked to sign a consent form and PAR-Q. You will be given copies of these. You are still free to withdraw at any time with no questions asked and no penalty.

What will happen if you agree to take part?

This study will involve two testing groups undertaking either small sided games (SSGs) or high-intensity intermittent running (HIIR). The SSGs group will be involved in a 4 vs. 4 game, while the HIIR groups will undergo maximal effort sprints to a set distance. Both groups will undertake 6 bouts of below maximal activity for 4 minutes with a 3 minute recovery in between.

You will be needed on a total of 23 intervention sessions. The visits will comprise of one familiarization session, a pre- and post testing session and 20 intervention sessions across 10 weeks to be conducted at Clann Na Gael Fontenoy GAA club. Every session will take 1 hour at the same time of day. Your weight, height and skinfold measurements will be taken and you will complete necessary questionnaires and consent forms before beginning the research study. Your familiarisation will include an outline of both the SSGs and HIIR methods. Pre and post testing will include all participants undergoing an anaerobic fitness test, acceleration and repeat sprint ability tests. Only participants in the HIIR group will be required to undergo a 1 km time trial to assess maximal aerobic speed. Any final questions that you might have in regard to the procedures can be asked here or throughout the rest of the study. During the four experimental trials, you will follow the procedure provided below.

Whether there are any special precautions you must take before, during or after taking part in the study

Participants will be informed not to perform any vigorous exercise or consume any alcohol in the 24 h period before assessment.

On the day of the trial

The testing protocol will be the following the below structure;

Pre-testing warm-up; all participants undertake a 10-minute full body warm-up to increase blood flow, muscle temperature and mental readiness followed by the GAA 15 to aid in reducing incidence of injury during testing

Two testing protocols:

The two field testing methods used within this study are one Small sided games group and one high-intensity intermittent running group. Participants will break into their selected groups as instructed by the researcher.

Small sided games group:

Participants will play a small sided game of 4 vs. 4 on an 80 x 20-meter 3G artificial pitch for 4 minutes at high intensity followed by 3 minutes of low effort aerobic activity. This will be repeated 6 times also the researcher will collect both Heart rate and rate of perceived exhaustion data at the end of each high intensity bout.

High-intensity intermittent running group:

Each participant is assigned into a group that corresponds to their 100% maximal aerobic speed MAS, the participants run to their respective marker cones in 7 sec. rests for 70 sec. and repeats this protocol until the end of the 4 minutes, where you undergo 3 minutes of low intensity activity. This will be repeated 6 times also the researcher will collect both Heart rate and rate of perceived exhaustion data at the end of each high intensity bout

Cool down:

After field testing, all participants will undergo a cool-down protocol, to reduce the effects of the testing intensity of the body and bring the body back to a state of homeostasis using light movement and static stretching.

Post testing:

At the end of the study, participants will retest both field and body composition assessments to determine the most effective training method to improve acceleration and repeat sprint ability.

Are there any risks or side effects?

Any scientific investigate involving human participants carries an element of risk. You will be asked to undertake bouts of maximal effort during the testing. If you are not accustomed to high intensity interval training you may find this uncomfortable as you may get 'out of breath'. You will be fully supervised during all exercise, and will be free to stop exercising whenever you wish. You may experience muscle soreness from the testing also known as delayed onset of muscle soreness (DOMS) due to muscular fatigue, this is normal and normally dissipates within 48 hours.

Agreement to participate in this research should not compromise your legal rights if something goes wrong

Research can carry unforeseen risks and we want you to be informed of your rights in the unlikely event that any harm should occur as a result of taking part in this study. Every care will be taken to ensure that your well-being and safety are not compromised during the course of the study. St Marys University also has insurance arrangements in place in the unlikely event that something does go wrong and you are harmed as a result of taking part in the research study

What will happen to any information/data/samples that are collected from you?

Only the researchers will have access to the data collected during the study. However, your identity will not be revealed. All information which is collected about you during the course of the research will be kept strictly confidential. We will keep a record that you have taken part in the study but will not keep any other personal information about you. Professional standards of confidentiality will be adhered and the handling, processing, storage and destruction of data will be conducted in accordance with the Data Protection Act (1998).

Are there any benefits from taking part?

The participant may benefit from receiving individual feedback from data collected, and use the collected information to increase their education in their preparation for their sport. The participant may also benefit from increased aerobic capacity due to the protocols used and this may benefit their fitness levels.

How much time will I need to give up taking part in the project?

The total time commitment will be 23 hours over 13 weeks at Clann Na Gael Fontenoy GAA club

YOU WILL BE GIVEN A COPY OF THIS FORM TO KEEP TOGETHER WITH A COPY OF YOUR CONSENT FORM

2.3 Participant Consent form.



**St Mary's
University
Twickenham
London**

NAME OF PARTICIPANT: _____

Title of the project: The effects of Small-Sided Games Verses High-Intensity Intermittent Running on Acceleration and Repeated Sprint Ability in Gaelic Football

Main investigator and contact details: Mark O`Connell (145615@live.smuc.ac.uk)

Members of the research team: Dr Stephen Patterson

1. I agree to take part in the above research. I have read the Participant Information Sheet which is attached to this form. I understand what my role will be in this research, and all my questions have been answered to my satisfaction.
2. I understand that I am free to withdraw from the research at any time, for any reason and without prejudice.
3. I have been informed that the confidentiality of the information I provide will be safeguarded.
4. I am free to ask any questions at any time before and during the study.
5. I have been provided with a copy of this form and the Participant Information Sheet.

Data Protection: I agree to the University processing personal data which I have supplied. I agree to the processing of such data for any purposes connected with the Research Project as outlined to me.

Name of participant
(print).....Signed.....Date.....

If you wish to withdraw from the research, please complete the form below and return to the main investigator named above.

I WISH TO WITHDRAW FROM THIS STUDY

Name: _____

Signed: _____ **Date:** _____

Appendix D; PAR-Q form.

2.4 PAR-Q form.

**St Mary's
University
Twickenham
London**



**St. Mary's University, School of Sports, Health and Applied Sciences.
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	<input type="checkbox"/>	<input type="checkbox"/>	
High or low blood pressure	<input type="checkbox"/>	<input type="checkbox"/>	
Chest pain during physical activity	<input type="checkbox"/>	<input type="checkbox"/>	
Bone or joint pain during Physical activity	<input type="checkbox"/>	<input type="checkbox"/>	
Asthma	<input type="checkbox"/>	<input type="checkbox"/>	
Diabetic	<input type="checkbox"/>	<input type="checkbox"/>	
Allergies	<input type="checkbox"/>	<input type="checkbox"/>	
Other, please give details	<input type="checkbox"/>	<input type="checkbox"/>	

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 12 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/days would you spend exercising, and outline current exercise program?

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**

2.5 Risk Assessment form.

School of Sport, Health and Applied Science (SHAS) PRACTICAL ACTIVITY RISK ASSESSMENT FORM

The following Risk Assessment template may be used by any individual intending to undertake a research or practice activity. This should be completed in combination with a relevant activity approval or Ethics Application form where relevant. Referring to appropriate sources of information, including the HSE website and University Health and Safety Policy Guidelines, the relevant activity coordinator must complete the fields below to adequately address the stages of managing hazards in any working environment.

Section 1 – Activity and Coordinator details:

Activity coordinator name:	Marko O`Connell	Tutor / supervisor:	Dr. Stephen Patterson
Phone number:	00353863742177	Email address:	145615@live.smuc.ac.uk
Activity title:	The effects of Small-Sided Games versus High-Intensity Intermittent Running on Acceleration and Repeated Sprint Ability in Gaelic Football		
Activity location(s) full details:	Clanna Gael Fontenoy Gaelic Athletic Club (GAA), Sean Moore Park, Dublin 4, Rep. of Ireland		
Outline of activity (please specify the type of activity being undertaken):	No	Yes	If yes, please provide details:
1. Use of Human Subjects: demographic type, requirements, age/young persons?		X	Male, Age 18>35 years old, that meet the inclusion criteria.
2. Use of an intervention (either solely or in combination) including dosage or application: E.g. ingestion of food, liquids or supplement, diet, massage, occlusion, environmental exposure, physical activity or other. Outline of specific dosage or application where relevant E.g. mg per kilo of body weight		X	Research study is to use two intervention methods, one small sided games and one high-intensity intermittent running group. Participants undergo sub maximal intensity efforts for a period of 6 sets of 4 minutes activity with a recovery period of 3 minutes in between high intensity bouts. Heart rate and rate of perceived exertion (RPE) is collected by the researcher.

3. Use of data and/or sample collection (solely or in combination): E.g. questionnaire/survey, human tissue sampling (blood / urine / saliva / sweat or other), respiratory analysis, body composition, performance tests or other.		x	Body composition assessment includes height and weight data is collected using a weighing scale and stadiometer, skinfold measurement taken on three sites using a skinfold caliper. Pre and post acceleration data is collected using electronic speed gates. During the testing sessions, each participant is fitted with a heart rate (HR) monitor. Both HR and RPE data is collected by the researcher during recovery periods within testing.
4. Use of chemicals/gas cylinders: Type(s), hazardous or not, MSDS available?	X		N/A
5. Equipment to be used:			
Brower timing TC-system, Team polar heart rate monitors, Seca weighing scales, stadiometer and Harpenden skinfold calipers.			

Health and Safety Risk Assessments – continuation sheet

SECTION 2: Risk Controls - For each hazard identified in Section 1, complete Section 2. Please refer to the Risk Assessment Guidance notes on simmsCAPital folder for Risk Matrix. Please note that L refers to Likelihood; S refers to Severity and RS refers to Risk Score (L times S equals RS)

Outcome due to Hazard description (Substance / equipment / procedure)		Initial Risk Level High(13-25) Med (5-12) Low (0-4)	Necessary controls to eliminate or adequately reduce the Initial Risk Level of an associated hazard to a suitable Remaining risk level.	Remaining Risk Level High(13-25) Med (5-12) Low (0-4)
1	Access and usage of designated facility, site or location, including private or public.	High (20)	Permission received from board of management at facility and facility regularly inspected and regular maintenance carried out when required. The researcher is to inspect the facilities prior to each testing session and ensure a safe environment. All testing equipment is to be stored in a secure location by the researcher and inspected before each use. The researcher is a trained first aider and AED defibrillator qualified. An AED defibrillator and first aid kit will be present at each testing session.	Low (4)

2	Fire management and evacuation	Low (4)	Testing it to be conducted on field with no access to fire hazards. In case of emergency each participant is made aware of the pitch exits and designated emergency meeting location at facility.	Low (1)
3	Environmental exposure (internal and external) including temperature, humidity, lighting ventilation or relative weather conditions	High (13)	Participants are to be tested at the same location at the same time of day (7pm). Participants undergo a warm-up to increase body temperature before testing. Players are requested to wear thermal t-shirts/vest during evening testing. Participants will have rain jackets and tracksuits available if poor weather conditions exist.	Low (4)
4	Risks relating to layout, storage, space, obstructions including fall of objects, spillages, slips, trips & falls	High (16)	The researcher is to store all equipment in a secure location at the facility and inspect before each testing session. Maintain storage of all items in relevant cupboards / spaces. The researcher is to store all equipment in a designated safe area during on field during at least 10 meters away from participants. Spillage kits available and used immediately in the event of a spillage. Spillage signs available at location.	Low (3)
5	Manual handling, repetitive movements and working at heights	Med (5)	Only the researcher will handle testing equipment and is an experienced manual handler. Research equipment weights <5kg. No use of ladders is required within this study.	Low (2)
6	Use of Equipment including electrical	Low (4)	No electrical plugs or sockets are to be used in this study. Heart rate monitors are battery powered and comply with EU safety regulations. Pre-testing intervention tests are to use a rechargeable battery iPod and speaker and comply with EU safety regulations. Timing gates power is supplied using a rechargeable battery back and comply to US safety standards. Equipment inspected before the start of each session	Low (2)
7	Mechanical (machinery) and use of portable tools / equipment	Low (3)	The researcher will use a portable trundle wheel to set out field testing area and pre-testing using timing gates. The researcher has received adequate training use the equipment.	Low (1)

Health and Safety Risk Assessments – continuation sheet

SECTION 2: Risk Controls (continued) -
notes on

For each hazard identified in Section 1, complete Section 2. Please refer to the Risk Assessment Guidance
simmsCAPital folder for Risk Matrix.

Please note that L refers to Likelihood; S refers to Severity and RS refers to Risk Score (L times S equals RS)

Hazard No.	Outcome due to Hazard description (Substance / equipment / procedure)	Initial Risk Level High (13-25) Med (5-12) Low (0-4)	Controls needed to eliminate or adequately reduce risks	Remaining Risk Level High(13-25) Med (5-12) Low (0-4)
8	Exposure to sharps – use of razors, lancets or other sharp object	Low (0)	N/A	Low (0)
9	Human subject physical activity, manipulation, treatment or other including use of equipment where relevant.	High (16)	The researcher is to ensure the participant is aware of the testing protocol and the associated risks (a written protocol is provided). Each participant has completed and signed an approved St Mary's Informed consent form and Par-Q prior to commencing any testing protocol. The researcher is to ensure each participant completes an appropriate warm-up prior to the testing session and cooldown to reduce the effects of delayed onset of muscle soreness (DOMS) from testing.	Low (4)
10	Exposure and reaction to use of food, drinks or supplements	Low (0)		Low (0)
11	Biological hazards	Low (0)	N/A	Low (0)
12	Working at heights	Low (0)	N/A	Low (0)
13	Lone working, including out of hours	Med (10)	The researcher is to undertake testing at 7pm on Tuesday and Thursday evenings and testing facility.	Low (4)
14	Use of chemicals	Low (0)	N/A	Low (0)
15	Other (Please specify and attach a copy of the relevant methodology with associated safety notes):	Low (0)	N/A	Low (0)

SECTION 3: Arrangement for supervision and/or monitoring effectiveness of control

Monitoring achieved through pre and post checks, continual test supervision and/or a separately recruited individual where further supervision or monitoring is required. Even where students demonstrate high levels of competency, regular checks should be made by supervising staff that should also be readily available to assist with any questions or problems students might have. Any practice should be amended or stopped if an emerging hazard dictates such a response. This option should be adopted where any uncertainty occurs, seeking advice from suitable staff.

SECTION 4: Referral guidelines relevant to the intended activity (scanned PDF of hard copy, listed web link or other source):

Information source	Location	Areas of information
Student Information Folder	MyModules	Student Research Approval Form
University Ethics Committee	Student portal	Ethics Application process and associated forms
University Health and Safety portal	Student portal	Health and Safety Policy guidelines including Risk Management, Manual lifting.
The Health and Safety Executive	Website found through any web search engine	Well-presented sources of legally approved regulation and legislation covering COSHH, CHIP, RIDDOR, DSE and many other areas of health and safety at work
Further discipline specific sources of information may be relevant to the area of activity including accreditation bodies such as BASES and UKSCA		

Health and Safety Risk Assessments – continuation sheet

SECTION 5: Emergency response procedures

In the event of an emerging incident, engage the individual(s) who have been previously agreed as responsible for addressing an emergency incident. Assess and eliminate (where safe) hazards that might place the individual(s) needing care or carer(s) at risk. Apply up to date first aid and/or seek medical assistance where appropriate. Contact the University security team for assistance with any incident on or off campus. Contact relevant staff (tutor, Technical team or other) where relevant. Complete relevant reporting form (accident, medical emergency or near miss) available to staff on the University H&S portal page, passing to the Technical Services team for processing. Complete HSE RIDDOR form where relevant, which can be found on the HSE website.

Important contact details (including where activities are undertaken off campus):

-

- **St Mary's University Security – 0208 240 4335 or 4060 (advise in the event of calling the emergency services)**
- **St Mary's University main reception – 0208 240 4000**
- **Health and Safety Executive (HSE) Information line – 0845 345 0055 / www.HSE.gov.uk**
- **Clanna Gael Fontenoy GAA club house- +353 01 660 4064 / <http://clannagaelfontenoy.ie/who-are-we/>**
- **Emergency operator- 999**
- **St. James Hospital, Dublin- +353 01 410 3000 /<http://www.stjames.ie>**
- **Mark O'Connell- +353 86 3742177**

Please make note of any other relevant contacts here:

Health and Safety Risk Assessments – continuation sheet

SECTION 7: Period of cover – If a more complex assessment is required, continue below:

PERIOD OF COVER FOR TASK/EVENT		PRINT NAME OF TASK/EVENT LEADER(S)	SIGNATURE	DATE SIGNED	HAZARDS IDENTIFIED (mark with a tick or a cross)
FROM	TO				
		N/A			
		N/A			

SECTION 8: Student liability declaration:

By signing this risk assessment I confirm that I have read and understood the above information that is relevant to my activity, and will ensure adherence to appropriate practice at all times, based on completing formal competency training relevant to the activity I am planning to undertake. I understand that the above statements are intended to be generalised, being applicable to all forms of activity. Not all parts may apply to a specific activity, but it is my responsibility to outline any possible/further detail of necessary hazard management procedures as safety notes within the relevant activity methodology, as statements of intent within the associated Ethics Application Form and as associated Human Subject Consent Form and Information sheet.

SIGNATURE:		PRINT NAME:	Mark O`Connell	DATE COMPLETED:	14 th December 2016
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Appendix 3

Data collection sheets

3.1 Participant Pre-intervention data

#	Age	Hgt (cm)	Wgt (Kg)	B/P (mmHg)	Resting H/R (bpm)	Max H/R (bpm)	BF(avg)			BF%	1km TT (s)	MAS (m/s)	YO-YO IR1 (m)	Yo2 max (mL.kg ⁻¹ .min ⁻¹)	10 Acc (s)	RSA total (s)	RSA average (s)	FI (%)
							Pec	Abn	Quad									
1	21	182	80	136/87	77	199	14	10	12	9.9	267	3.75	1360	47.82	2.14	43.61	6.2	2.29
2	29	187.5	81.4	134/82	68	191	12	18	10	12.0	262	3.82	1400	48.16	2.46	47.36	6.8	2.84
3	19	175	64.5	124/85	83	201	10	10	12	8.5	270	4.16	1880	52.19	2.41	43.9	6.3	6.23
4	24	186	83	122/82	77	196	18	22	12	15.0	308	3.25	520	40.77	2.1	46.73	6.7	4.58
5	21	180	78.9	124/83	79	199	12	14	12	10.5	228	4.39	2240	55.22	2.27	48.17	6.9	4.17
6	29	192	87.1	125/87	70	191	12	18	16	13.8	280	3.57	1000	44.80	2.35	44.78	6.4	4.94
7	27	182	84	130/85	75	193	12	10	10	9.4	262	3.82	1400	48.16	2.17	43.32	6.2	1.46
8	26	175.5	70.4	117/79	79	194	12	20	12	12.9	270	3.7	1160	46.14	2.04	45.06	6.4	5.56
9	25	183	69	133/76	65	195	10	12	10	9.1	269	3.71	1240	46.82	2.15	43.98	6.3	2.91
10	27	175	87	129/87	82	193	14	16	10	11.8	275	3.63	1120	45.81	2.32	46.78	6.7	3.35
11	23	180	79	134/82	68	197	12	16	12	11.3	262	3.81	1380	47.99	2.19	43.47	6.2	2.61
12	25	180	75	126/85	77	195	12	22	12	13.4	235	4.25	2040	53.54	2.2	45.91	6.6	3.89
13	34	170	78	118/79	79	186	12	18	12	13.2	240	4.17	1920	52.53	2.09	43	6.1	2.13
14	29	177	84	124/85	83	191	16	16	12	13.2	240	4.17	1920	52.53	2.09	42.94	6.1	0.98
15	24	175	86	120/76	73	196	12	16	10	10.9	260	3.85	1440	48.50	2.46	47.33	6.8	3.15
16	28	177	82	122/82	77	192	12	18	12	12.5	252	4.05	1720	50.85	2.29	43.19	6.2	2.97
17	33	175	79	124/83	79	187	16	18	10	13.7	248	4.03	1720	50.85	1.94	42.17	6.0	3.01
18	23	179	83	130/82	75	197	12	16	10	10.7	280	3.57	1000	44.80	1.82	44.31	6.3	5.67
19	26	185	86	121/82	75	194	14	16	10	11.7	262	3.81	1360	47.82	2.35	43.58	6.2	5.24
20	25	178	84	121/82	65	195	16	18	8	12.2	239	4.18	1920	52.53	2.3	47.83	6.8	4.32
21	31	183	80	125/87	70	189	12	12	12	11.0	244	4.09	1800	51.52	2.31	44.09	6.3	3.55
22	28	188	80	130/85	75	192	12	12	12	10.7	247	4.05	1740	51.02	2.32	47.12	6.7	6.38
23	26	177	78	117/79	79	194	12	16	12	11.7	268	3.75	1280	47.15	2.27	46	6.6	5.73
24	26	180	90	133/76	65	194	10	18	16	12.9	255	3.93	1560	49.50	2.12	47.95	6.9	1.17
25	31	172	86	132/83	79	189	12	26	12	15.2	253	3.95	1560	49.50	2.42	46.81	6.7	4.74
26	25	170	78	136/87	77	195	8	12	8	7.8	267	3.75	1280	47.15	2.2	43.87	6.3	1.44
27	24	180	91	129/87	82	196	16	22	16	15.6	315	3.17	400	39.76	2.33	46.83	6.7	3.34
28	23	177	110	134/82	68	197	18	26	16	17.2	320	3.12	320	39.09	2.1	46.48	6.6	4.78
29	26	180	78	126/85	77	194	18	16	16	14.6	265	3.77	1320	47.49	2.17	43.52	6.2	5.61
30	20	170	75	118/79	79	200	20	22	10	14.5	270	3.7	1220	46.65	2.11	44.06	6.3	2.90
31	26	175.5	87	124/85	83	194	16	22	12	14.6	300	3.33	640	41.78	2.05	47.58	6.8	6.18
32	32	182	89	120/76	73	188	18	22	14	16.5	305	3.27	600	41.44	2.36	43.54	6.2	5.40
	26.1	179.0	82.0		75.4	193.9	13.5	17.2	11.9	12.4	266	3.80	1358	47.8	2.22	45.2	6.5	3.86
	3.7	5.3	7.9		5.5	3.7	2.9	4.4	2.2	2.3	23.1	0.3	487	4.1	0.2	1.8	0.3	1.58

Small-Sided Games (SSG's)

n	Age	Hgt (cm)	Wgt (Kg)	B/P (mmHg)	Resting H/R (bpm)	Max H/R (bpm)	BF%	1km TT (sec)	MAS (m/s)	YO-YO IRI (m)	Vo2 max (ml/kg-1-min-1)	Best Acc 10m (s)	RSA total sprint time (s)	RSA average sprint time (s)	FI (%)
1	34	170	78	118/79	79	186	13.2	240	4.17	1920	52.53	2.09	43	6.1	2.13
2	26	175.5	87	124/85	83	194	14.6	300	3.33	640	41.78	2.05	47.58	6.8	6.18
3	29	192	87.1	125/87	70	191	13.8	280	3.57	1000	44.80	3.35	44.78	6.4	4.94
4	28	177	82	122/82	77	192	12.5	252	4.05	1720	50.85	2.29	43.19	6.2	2.97
5	28	188	80	130/85	75	192	10.7	247	4.05	1740	51.02	2.32	47.12	6.7	6.38
6	25	180	75	126/85	77	195	13.4	235	4.25	2040	53.54	2.2	45.91	6.6	3.89
7	31	172	86	132/83	79	189	15.2	253	3.95	1560	49.50	2.42	46.81	6.7	4.74
8	23	177	110	134/82	68	197	17.2	320	3.12	320	39.09	2.1	46.48	6.6	4.78
9	26	175.5	70.4	117/79	79	194	12.8	270	3.7	1160	46.14	2.04	45.06	6.4	5.56
10	24	175	86	120/76	73	196	10.9	260	3.85	1440	48.50	2.46	47.33	6.8	3.15
11	31	183	80	125/87	70	189	11	244	4.09	1800	51.52	2.31	44.09	6.3	3.55
12	33	175	79	124/83	79	187	13.7	248	4.03	1720	50.85	1.94	42.17	6.0	3.01
13	26	180	90	133/76	65	194	12.9	255	3.93	1560	49.50	2.12	47.95	6.9	1.17
14	29	187.5	81.4	134/82	68	191	12.0	262	3.82	1400	48.16	2.46	47.36	6.8	2.84
15	23	186	83	122/82	77	196	15.0	308	3.25	520	40.77	2.1	46.73	6.7	4.58
16	20	170	75	118/79	79	200	14.5	270	3.7	1220	46.65	2.11	44.06	6.3	2.90
	27.3	170.0	82.1		74.0	181.7	12.2	265.2	3.8	1240.0	47.8	2.27	45.60	6.51	2.07
	3.9	6.7	8.9		5.2	3.8	1.7	25.0	0.3	513.5	4.3	0.33	1.85	0.26	1.46

High-Intensity Intermittent Running (HIIR)

n	Age	Hgt (cm)	Wgt (Kg)	B/P (mmHg)	Resting H/R (bpm)	Max H/R (bpm)	BF%	1km TT (sec)	MAS (m/s)	YO-YO IR1 (m)	Vo2 max (ml.kg-1.min-1)	Best Acc 10m (s)	RSA total sprint time (s)	RSA average sprint time(s)	FI (%)
1	32	182	89	120/76	73	188	16.5	305	3.27	600	41.44	2.36	43.54	6.2	5.40
2	26	177	78	117/79	70	194	11.7	268	3.75	1280	47.15	2.27	46	6.6	5.73
3	21	180	78.9	124/83	79	199	10.5	228	4.39	2240	55.22	2.27	48.17	6.9	4.17
4	19	175	64.5	124/85	83	201	8.5	270	4.16	1880	52.19	2.41	43.9	6.3	6.23
5	25	170	78	136/87	77	195	7.8	267	3.75	1280	47.15	2.2	43.87	6.3	1.44
6	26	185	86	121/82	75	194	11.7	262	3.81	1360	47.82	2.35	43.58	6.2	5.24
7	24	180	91	129/87	82	196	15.6	315	3.17	400	39.76	2.33	46.83	6.7	3.34
8	26	180	78	126/85	79	194	14.6	265	3.77	1320	47.49	2.17	43.52	6.2	5.61
9	27	175	87	129/87	82	193	11.8	275	3.63	1120	45.81	2.32	46.78	6.7	3.35
10	27	182	84	130/85	75	193	9.4	262	3.82	1400	48.16	2.17	43.32	6.2	1.46
11	23	179	83	130/82	75	197	10.7	280	3.57	1000	44.80	1.82	44.31	6.3	5.67
12	25	178	84	121/82	65	195	12.2	239	4.18	1920	52.53	2.3	47.83	6.8	4.32
13	23	180	79	134/82	68	197	11.3	262	3.81	1380	47.99	2.19	43.47	6.2	2.61
14	29	177	84	124/85	83	191	13.2	240	4.17	1920	52.53	2.09	42.94	6.1	0.98
15	25	183	69	133/76	65	195	9.1	269	3.71	1240	46.82	2.15	43.98	6.3	2.91
16	21	182	80	136/87	77	199	9.9	267	3.75	1360	47.82	2.14	43.61	6.2	2.29
	24.9	179.1	80.8		75.5	194.8	11.5	267.1	3.8	1356.3	47.8	2.22	44.73	6.39	3.80
	3.2	3.7	6.9		6.0	3.2	2.5	21.8	0.3	475.3	4.0	0.14	1.75	0.25	1.74

3.2 Participant Post-intervention data

n	Wgt (Kg)	BF (avg)			BF%	1km TT (s)	MAS (m/s)	VO-YO BFI (m)	Vo2 max (ml.kg-1.ml-1)	Best Acc 10m (s)	RSA total sprint time (s)	RSA average sprint time(s)	FI (%)
		Pec	Abs	Quad									
1	80	10	12	10	9.9	265	3.77	1320	47.49	2.11	43.42	6.20	6.05
2	79	10	14	10	10.2	258	3.88	1480	48.83	2.39	47.21	6.74	2.70
3	66	10	14	12	9.7	266	3.76	1310	47.40	2.21	49.04	7.01	11.70
4	79	16	16	12	12.7	304	3.29	600	41.44	2.25	49.67	7.10	4.76
5	76	10	12	10	8.7	222	4.50	560	41.10	2.35	49.95	7.14	7.49
6	91	12	14	12	11.4	272	3.68	1180	46.31	2.23	45.64	6.52	12.52
7	84	10	10	12	9.4	262	3.82	1400	48.16	2.23	50.48	7.21	1.96
8	71	12	16	10	11.1	266	3.76	1300	47.32	2.05	44.88	6.41	4.29
9	66	10	10	8	7.9	262	3.82	1400	48.16	2.11	43.78	6.25	2.60
10	85	12	12	12	10.6	269	3.72	1240	46.82	2.28	46.35	6.62	3.98
11	77	12	14	10	10.1	258	3.88	1488	48.90	2.15	43.33	6.19	2.45
12	77	12	18	10	11.6	232	4.31	2120	54.21	2.24	51.53	7.36	4.97
13	76	10	14	12	10.7	248	4.03	1700	50.68	2.07	49.75	7.11	4.61
14	86	14	14	10	11.4	236	4.24	2020	53.37	2.08	42.78	6.11	0.98
15	83	12	12	8	9.0	236	4.24	2020	53.37	2.35	39.99	6.67	3.04
16	78	12	14	8	10.1	248	4.03	1700	50.68	2.27	43.09	6.16	2.81
17	81	14	14	10	11.9	248	4.03	1700	50.68	1.90	42.48	6.07	2.00
18	81	12	14	10	10.3	278	3.60	1060	45.30	1.95	43.99	6.28	4.85
19	86	12	16	8	10.5	260	3.85	1440	48.50	2.18	43.42	6.20	4.91
20	81	14	14	12	11.6	228	4.39	2240	55.22	2.29	45.99	6.57	5.42
21	81	12	10	12	10.4	240	4.17	1920	52.53	2.31	44.09	6.30	3.55
22	78	10	12	8	8.8	243	4.12	1840	51.86	2.30	47.24	6.75	5.62
23	76	12	14	10	10.5	253	3.95	1580	49.67	2.18	45.89	6.56	6.25
24	89	12	16	12	11.7	252	3.97	1620	50.01	2.10	47.67	6.81	3.13
25	85	12	16	12	12.2	249	4.02	1700	50.68	2.09	51.58	7.37	5.00
26	79	10	12	8	7.9	261	3.83	1420	48.33	2.16	43.81	6.26	1.28
27	90	14	20	12	13.2	305	3.28	580	41.27	2.21	46.5	6.64	3.69
28	100	16	22	12	14.3	305	3.28	580	41.27	2.09	46.3	6.61	2.92
29	75	16	14	10	11.7	260	3.85	1440	48.50	2.15	43.32	6.19	4.63
30	72	14	16	10	11.0	261	3.83	1420	48.33	2.15	37.65	6.28	1.92
31	84	14	16	10	11.7	291	3.44	1420	48.33	2.06	46.71	6.67	4.60
32	85	14	16	12	12.9	292	3.42	800	43.12	2.25	44.3	6.33	4.53
mean=	80.5	12.3	14.3	10.4	10.8	260.3	3.9	1425	48.4	2.18	45.68	6.58	4.41
sd=	7.0	1.9	2.6	1.5	1.5	21.5	0.3	445.8	3.7	0.11	3.23	0.39	2.53

Small-Sided Games (SSG's)

<i>n</i>	Wgt (Kg)	BF%	1km TT (sec)	MAS (m/s)	YO-YOIR1 (m)	Vo2 max (ml·kg ⁻¹ ·ml ⁻¹)	Best:Acc 10m (sec)	RSA total sprint time (s)	RSA average sprint time(s)	FI (%)
1	76	10.7	248	4.03	1700	50.68	2.07	49.75	7.11	4.61
2	84	11.7	291	3.44	1420	48.33	2.06	46.71	6.67	4.60
3	91	11.4	272	3.68	1180	46.31	2.23	45.64	6.52	12.52
4	78	10.1	248	4.03	1700	50.68	2.27	43.09	6.16	2.81
5	78	8.8	243	4.12	1840	51.86	2.30	47.24	6.75	5.62
6	77	11.6	232	4.31	2120	54.21	2.24	51.53	7.36	4.97
7	85	12.2	249	4.02	1700	50.68	2.09	51.58	7.37	5.00
8	100	14.3	305	3.28	580	41.27	2.09	46.3	6.61	2.92
9	71	11.1	266	3.76	1300	47.32	2.05	44.88	6.41	4.29
10	83	9.0	236	4.24	2020	53.37	2.35	39.99	6.67	3.04
11	81	10.4	240	4.17	1920	52.53	2.31	44.09	6.30	3.55
12	81	11.9	248	4.03	1700	50.68	1.90	42.48	6.07	2.00
13	89	11.7	252	3.97	1620	50.01	2.10	47.67	6.81	3.13
14	79	10.2	258	3.88	1480	48.83	2.39	47.21	6.74	2.70
15	79	12.7	304	3.29	600	41.44	2.25	49.67	7.10	4.76
16	72	11.0	261	3.83	1420	48.33	2.15	37.65	6.28	1.92
mean=	81.5	11.2	259.6	3.9	1518.8	49.2	2.18	45.97	6.68	4.28
sd=	7.3	1.4	22.8	0.3	441.8	3.7	0.13	3.89	0.40	2.47

High-Intensity Intermittent Running (HIIR)

n	Wgt (Kg)	BF%	1km TT (sec)	MAS (m/s)	YO-YO IR1 (m)	Vo2 max (ml·kg ⁻¹ ·min ⁻¹)	Best: Acc 10m (sec)	RSA total sprint time (s)	RSA average sprint time(s)	FI (%)
1	85	12.9	292	3.42	800	43.12	2.25	44.3	6.33	4.53
2	76	10.5	253	3.95	1580	49.67	2.18	45.89	6.56	6.25
3	76	8.7	222	4.50	560	41.10	2.35	49.95	7.14	7.49
4	66	9.7	266	3.76	1310	47.40	2.21	49.04	7.01	11.70
5	79	7.9	261	3.83	1420	48.33	2.16	43.81	6.26	1.28
6	86	10.5	260	3.85	1440	48.50	2.18	43.42	6.20	4.91
7	90	13.2	305	3.28	580	41.27	2.21	46.5	6.64	3.69
8	75	11.7	260	3.85	1440	48.50	2.15	43.32	6.19	4.63
9	85	10.6	269	3.72	1240	46.82	2.28	46.35	6.62	3.98
10	84	9.4	262	3.82	1400	48.16	2.23	50.48	7.21	1.96
11	81	10.3	278	3.60	1060	45.30	1.95	43.99	6.28	4.85
12	81	11.6	228	4.39	2240	55.22	2.29	45.99	6.57	5.42
13	77	10.1	258	3.88	1488	48.90	2.15	43.33	6.19	2.45
14	86	11.4	236	4.24	2020	53.37	2.08	42.78	6.11	0.98
15	66	7.9	262	3.82	1400	48.16	2.11	43.78	6.25	2.60
16	80	9.9	265	3.77	1320	47.49	2.11	43.42	6.20	6.05
mean=	79.6	10.4	261.1	3.9	1331.1	47.6	2.18	45.40	6.49	4.55
sd=	6.8	1.5	21.0	0.3	443.6	3.7	0.09	2.51	0.36	2.65

3.3 Weekly Herat Rate and s-RPE data sheets

3.3.1 Week 1

RER	Session info (V%)	RPE						s-RPE avg	HR						s-HR avg
		1	2	3	4	5	6		1	2	3	4	5	6	
1	V	4	4	5	5	7	7	5	111	122	145	149	167	175	145.0
2	V	4	4	5	6	8	8	6	128	128	132	154	172	177	142.5
3	V	2	2	4	5	8	8	5	109	108	129	146	175	189	145.7
4	V	6	5	6	6	7	9	7	142	149	131	154	179	187	150.0
5	V	5	5	6	7	8	8	7	148	131	154	174	181	189	160.7
6	V	4	5	6	6	6	7	6	114	109	153	158	186	167	147.7
7	V	5	5	4	6	7	7	6	137	126	154	163	167	179	159.7
8	V	5	5	6	7	8	8	7	105	102	159	171	178	189	155.7
9	V	4	5	5	5	6	8	6	125	138	146	149	167	172	149.5
10	V	5	6	7	8	8	8	7	151	156	167	178	179	189	170.0
11	V	5	6	6	7	8	7	7	145	157	151	167	178	167	160.3
12	V	3	3	4	5	6	6	4	115	122	115	147	151	143	135.7
13	V	1	2	3	5	6	6	4	121	145	156	154	168	161	152.5
14	V	7	7	8	9	8	8	8	167	160	178	189	181	189	177.8
15	V	3	4	5	7	8	8	6	143	156	151	167	179	169	160.3
16	V	3	4	6	6	6	8	6	142	156	157	165	156	167	153.5
mean		6							125.3						
sd		1.00							10.36						

Thursday

RER	Session info (V%)	RPE						s-RPE avg	HR						s-HR avg		
		1	2	3	4	5	6		1	2	3	4	5	6			
1	V	5	5	5	5	6	6	7	6	154	156	175	185	178	171	169.8	
2	V	7	6	5	5	7	7	6	6	165	155	170	177	181	156	163.3	
3	V	6	6	6	4	6	6	5	6	177	167	155	145	154	141	153.5	
4	V	7	6	5	5	7	8	7	7	145	166	165	177	171	169	165.5	
5	V	6	5	5	5	6	7	6	6	150	141	155	161	169	151	151.3	
6	V	5	6	5	5	7	8	7	7	165	179	165	178	182	167	172.7	
7	V	5	5	5	5	5	6	7	6	156	166	176	182	185	179	173.7	
8	V	5	5	5	5	7	6	7	8	6	159	170	177	185	177	181	174.8
9	V	6	5	5	5	7	6	7	6	131	157	123	120	156	187	145.3	
10	V	7	6	6	6	7	6	7	7	145	143	161	165	167	173	159.0	
11	V	7	7	6	6	5	6	7	6	145	163	143	166	167	178	158.7	
12	V	6	6	6	6	7	7	7	7	148	156	125	165	154	129	151.2	
13	V	4	4	3	3	4	5	4	4	140	154	143	132	163	156	147.2	
14	V	6	7	8	8	6	6	7	7	145	154	172	167	169	167	163.3	
15	V	5	5	6	5	6	7	6	6	155	159	144	160	161	167	157.7	
16	V	5	5	6	6	6	7	7	6	141	159	156	177	167	171	165.2	
mean		6							161.2								
sd		0.75							9.34								

Thursday

RER	Session info (V%)	RPE						s-RPE avg	HR						s-HR avg	
		1	2	3	4	5	6		1	2	3	4	5	6		
1	V	4	6	6	7	8	7	7	152	156	169	176	167	171	166.3	
2	V	5	5	5	6	7	6	7	6	118	140	151	149	155	147	150.0
3	V	5	4	4	5	6	5	6	5	120	138	165	156	170	172	152.8
4	V	5	6	6	7	7	7	7	6	182	179	168	157	159	167	168.7
5	V	6	5	5	5	7	6	8	6	119	100	132	149	156	167	135.5
6	V	5	5	5	4	6	7	7	6	149	145	163	161	179	182	160.2
7	V	5	6	6	5	7	8	7	6	139	135	154	162	177	167	156.3
8	V	7	7	7	8	7	7	6	7	160	172	167	163	178	181	175.5
9	V	5	6	7	7	8	8	6	7	154	145	167	172	166	162	161.5
10	V	5	5	5	6	5	6	7	6	154	162	154	168	173	176	162.7
11	V	4	4	4	5	6	5	5	5	145	139	156	159	167	169	153.3
12	V	5	5	4	6	5	6	5	5	149	144	151	165	147	135	148.1
13	V	6	7	5	8	7	7	7	7	152	147	148	152	166	173	155.3
14	V	5	6	6	7	8	7	8	7	137	143	150	162	173	168	151.7
15	V	5	4	5	5	7	7	6	6	144	153	169	157	162	169	156.1
16	V	6	6	5	5	6	7	6	6	160	169	181	178	189	170	171.2
mean								6	159.1							
sd								0.66	9.87							

Thursday

RPE	Session info	RPE						s-RPE avg	HR						s-HR avg		
		1	2	3	4	5	6		1	2	3	4	5	6			
1	V	5	6	6	6	6	7	7	6	171	155	169	168	176	156	163.8	
2	V	5	5	6	5	6	6	6	6	139	167	168	149	156	155	155.7	
3	V	5	7	6	6	5	5	6	6	146	179	181	185	176	172	176.5	
4	V	5	4	6	6	7	5	5	5	132	121	150	180	179	169	156.7	
5	V	5	6	5	5	6	6	6	6	162	149	157	165	167	159	159.8	
6	V	6	5	6	7	7	7	6	6	154	145	156	168	168	155	157.3	
7	V	5	5	5	5	6	6	7	6	6	149	134	145	179	167	159	152.3
8	V	6	4	5	5	7	6	6	5	158	139	149	169	152	157	146.5	
9	V	6	5	5	5	5	5	6	5	156	137	149	145	156	159	150.3	
10	V	6	5	6	6	6	7	5	6	163	150	173	159	166	173	167.5	
11	V	7	4	7	5	7	6	6	6	155	171	149	168	154	161	160.0	
12	V	6	5	6	6	7	6	6	6	153	172	169	179	178	159	167.0	
13	V	6	5	6	6	7	7	6	6	143	144	152	169	175	182	159.5	
14	V	8	6	6	6	6	6	7	7	181	155	159	161	161	177	162.3	
15	V	7	7	7	7	7	7	7	7	172	169	171	166	173	167	166.5	
16	V	5	6	6	6	7	7	7	6	143	165	165	172	177	161	163.3	
mean		6							160.4								
sd		0.55							7.46								

Thursday

Weekly RPE average	SSG	RER
mean	6	6
sd	0.65	0.81
Weekly HR average (bpm)	SSG	RER
mean	160.8	156.7
sd	8.40	10.12
Mean HR intensity (%)	SSG	RER
mean	81.4	81.4
sd	3.31	3.36

3.3.2 Week 2

HR	Session info	RPE						HR					
		1	2	3	4	5	6	1	2	3	4	5	6
1	V	4	5	5	5	7	7	4	151	165	172	185	167
2	V	4	4	5	6	8	8	6	161	165	169	167	179
3	V	3	4	4	5	8	8	5	162	170	186	167	178
4	V	4	5	6	6	7	8	6	155	161	151	167	170
5	V	5	5	6	7	8	8	7	141	154	167	170	167
6	V	4	6	6	6	6	7	8	156	165	169	167	181
7	V	5	5	5	6	7	8	6	139	160	165	165	151
8	V	5	5	6	7	8	7	6	125	165	160	156	177
9	V	4	5	5	5	6	8	6	139	141	159	154	155
10	V	5	6	7	8	7	8	7	134	145	169	167	169
11	V	5	6	6	7	8	7	7	110	156	179	178	183
12	V	5	5	6	6	6	6	5	145	159	167	178	167
13	V	5	5	5	5	6	6	4	159	167	179	182	184
14	V	7	7	8	9	8	8	8	156	156	168	178	156
15	V	5	5	5	5	7	8	6	167	159	168	167	164
16	V	4	4	7	7	8	8	6	145	156	168	167	171

mean= 6 160.6
sd= 0.91 8.87

HR	Session info	RPE						HR					
		1	2	3	4	5	6	1	2	3	4	5	6
1	V	5	6	6	7	7	7	7	152	154	160	170	167
2	V	5	5	6	7	6	7	6	138	160	157	160	155
3	V	5	4	5	6	5	6	5	156	165	165	156	172
4	V	5	6	7	7	7	6	6	182	179	168	157	159
5	V	6	5	5	7	6	8	6	134	166	157	156	167
6	V	5	5	4	6	7	7	6	169	168	165	163	179
7	V	5	6	5	7	8	7	6	139	136	154	162	177
8	V	7	7	8	7	7	6	7	160	172	167	163	178
9	V	5	6	7	8	8	8	7	154	162	167	172	166
10	V	5	5	6	5	6	7	6	154	160	154	168	170
11	V	4	4	5	6	5	5	5	145	159	156	159	167
12	V	7	7	5	7	6	7	7	169	164	150	165	165
13	V	6	6	5	8	7	7	7	157	167	161	152	166
14	V	8	8	8	6	8	8	7	165	163	150	162	170
15	V	8	9	9	9	7	6	8	144	155	169	157	163
16	V	8	8	7	5	6	6	7	160	169	161	178	170

mean= 6 160.1
sd= 0.79 8.11

Weekly RPE average	590	HR
mean	6	6
sd	0.75	8.06
Weekly HR average (bpm)	590	HR
mean	162.3	160.6
sd	7.55	8.09
Mean HR intensity (%)	590	HR
mean	84.3	82.3
sd	5.98	7.8

HR	Session info	RPE						HR					
		1	2	3	4	5	6	1	2	3	4	5	6
1	V	7	6	6	8	8	7	7	154	164	166	182	179
2	V	7	6	5	7	6	7	6	165	159	166	167	167
3	V	8	6	5	8	8	7	7	154	169	162	179	181
4	V	8	6	6	7	6	7	7	162	180	151	156	189
5	V	7	4	5	7	5	6	6	160	151	166	176	181
6	V	7	8	6	7	6	5	7	147	155	163	169	154
7	V	7	5	5	6	7	6	6	157	167	172	182	178
8	V	7	7	5	8	7	6	7	180	159	171	151	161
9	V	6	6	6	7	6	6	6	189	169	159	155	160
10	V	5	4	5	4	6	5	5	153	152	158	145	157
11	V	8	6	5	7	6	7	7	151	167	179	158	169
12	V	4	5	4	4	5	4	4	145	158	165	159	177
13	V	7	6	7	6	5	6	6	147	162	160	151	169
14	V	6	6	5	6	7	5	6	150	169	167	159	156
15	V	7	6	7	7	6	7	7	141	162	167	151	159
16	V	5	7	5	6	5	5	6	161	159	171	167	180

mean= 6 163.3
sd= 0.78 6.81

HR	Session info	RPE						HR					
		1	2	3	4	5	6	1	2	3	4	5	6
1	V	6	5	6	6	6	7	7	167	166	171	176	177
2	V	5	6	6	5	7	6	6	169	170	159	167	167
3	V	6	7	6	7	7	8	7	169	168	157	165	181
4	V	5	6	6	7	5	7	6	151	158	169	169	177
5	V	5	6	5	6	6	6	6	153	166	171	177	172
6	V	4	5	6	5	6	6	5	159	161	160	154	168
7	V	5	5	5	6	7	6	6	160	162	159	156	161
8	V	6	6	5	7	6	6	6	167	159	150	149	156
9	V	6	5	5	5	5	6	5	169	165	156	168	173
10	V	4	5	6	6	7	5	6	148	159	161	166	165
11	V	7	7	7	8	7	7	7	159	159	162	168	165
12	V	4	5	6	8	7	8	6	145	159	156	154	167
13	V	5	5	6	7	7	8	6	157	164	169	158	179
14	V	8	6	8	5	6	7	7	168	171	161	171	166
15	V	6	7	7	7	7	8	8	155	161	158	167	167
16	V	5	6	6	7	7	7	5	152	161	172	167	169

mean= 6 161.4
sd= 0.72 8.28

3.3.3 Week 3

HR	Session info	RPE						HR						s HR avg
		1	2	3	4	5	6	1	2	3	4	5	6	
1	V	4	5	5	5	5	6	7	5	150	150	150	150	162.7
2	V	4	4	5	5	6	7	7	6	142	161	168	156	159.2
3	V	2	4	4	5	5	7	7	5	160	151	149	165	165.0
4	V	4	5	6	6	6	7	7	6	155	155	152	160	161.8
5	V	5	5	6	6	7	8	8	7	162	154	167	176	167.7
6	V	4	6	6	6	6	6	7	6	156	169	169	167	166.0
7	V	5	5	5	4	6	7	7	6	145	154	164	174	160.5
8	V	5	5	6	7	7	7	7	6	159	158	154	156	161.3
9	V	4	5	5	5	5	6	8	6	152	164	165	154	160.2
10	V	5	6	7	8	7	8	8	7	164	154	169	167	159.0
11	V	5	6	6	6	7	8	7	7	145	166	178	177	169.4
12	V	5	5	6	6	5	6	6	5	151	164	167	177	165.8
13	V	1	3	3	5	6	6	6	4	161	173	179	180	171.7
14	V	7	7	8	9	5	8	8	8	160	175	179	182	175.2
15	V	3	5	5	7	6	7	5	5	154	170	178	167	167.2
16	V	4	4	7	7	6	6	6	6	145	156	162	150	155.1
mean														162.7
sd														7.40

Thursday

HR	Session info	RPE						HR						s HR avg
		1	2	3	4	5	6	1	2	3	4	5	6	
1	V	6	6	5	7	7	6	6	6	171	155	160	166	172.4
2	V	6	6	6	6	6	6	7	6	161	172	174	181	174.0
3	V	7	6	6	7	7	7	7	7	162	167	165	180	165.5
4	V	7	6	6	6	6	6	7	6	165	183	180	160	169.7
5	V	7	5	6	6	5	6	6	6	161	159	161	166	166.0
6	V	6	7	6	7	6	6	6	6	167	158	176	187	167.5
7	V	7	5	6	6	6	6	5	6	166	165	177	177	171.4
8	V	7	6	6	7	8	6	6	6	150	165	176	166	170.0
9	V	5	6	6	6	7	7	6	6	151	166	170	175	172.0
10	V	5	4	6	5	6	5	6	5	126	161	164	165	161.0
11	V	7	5	7	6	6	7	6	6	167	169	181	151	165.2
12	V	5	6	5	6	5	6	6	6	159	171	175	180	174.0
13	V	7	6	6	5	5	5	6	6	162	154	161	157	156.2
14	V	6	6	5	6	7	5	6	6	155	170	166	158	161.5
15	V	5	6	7	7	7	7	7	7	167	154	170	158	161.8
16	V	5	6	5	6	6	6	6	6	140	151	150	170	158.8
mean														163.4
sd														10.34

Thursday

HR	Session info	RPE						HR						s HR avg
		1	2	3	4	5	6	1	2	3	4	5	6	
1	V	5	5	5	7	7	6	7	145	154	163	169	171	162.7
2	V	5	5	5	7	6	5	7	6	139	164	152	168	160.7
3	V	5	5	6	6	7	6	6	6	128	156	166	165	155.3
4	V	5	6	7	7	7	6	6	6	169	154	166	160	159.3
5	V	6	5	5	7	6	8	6	6	160	160	160	160	161.8
6	V	5	5	6	6	7	7	6	6	151	166	166	160	166.0
7	V	5	6	5	7	8	7	6	6	164	154	166	160	162.0
8	V	7	7	8	7	7	6	7	7	159	162	164	162	172.3
9	V	5	6	7	8	7	6	7	7	155	164	160	172	160.3
10	V	5	5	6	5	6	7	6	6	155	159	155	169	161.0
11	V	4	4	5	6	5	7	6	6	167	151	155	150	155.7
12	V	7	7	6	7	6	8	7	7	166	161	155	167	154.0
13	V	6	6	6	8	7	7	7	7	171	168	160	153	154.5
14	V	7	7	8	6	6	8	7	7	170	163	150	166	151.3
15	V	6	6	6	8	7	6	8	7	165	156	167	158	157.3
16	V	6	6	7	5	6	6	7	7	166	170	162	167	171.5
mean														158.1
sd														7.96

Thursday

HR	Session info	RPE						HR						s HR avg
		1	2	3	4	5	6	1	2	3	4	5	6	
1	V	6	7	6	5	6	6	6	6	171	170	179	169	174.0
2	V	5	6	6	6	6	6	6	6	168	171	161	169	164.2
3	V	5	6	6	6	5	6	7	6	157	170	169	164	169.0
4	V	5	6	5	6	5	6	5	6	155	159	160	160	164.2
5	V	5	6	6	6	6	7	6	6	164	171	165	170	170.3
6	V	5	6	6	5	6	7	6	6	157	162	161	169	153.5
7	V	5	6	5	6	6	7	6	6	166	168	161	158	159.8
8	V	6	6	5	7	6	7	6	7	167	158	169	151	159.1
9	V	6	6	5	6	6	7	6	6	165	163	158	151	151.0
10	V	5	6	6	6	6	6	6	6	169	171	160	167	162.1
11	V	5	6	6	7	7	7	6	6	136	171	165	167	169.7
12	V	6	5	6	7	7	7	6	6	161	171	171	178	172.3
13	V	5	5	5	6	6	6	7	6	150	168	150	151	151.1
14	V	5	6	6	6	5	6	7	7	166	154	156	165	163.5
15	V	6	6	7	6	7	7	6	6	155	165	166	167	166.0
16	V	5	5	6	6	6	7	6	6	151	167	158	169	163.8
mean														161.1
sd														8.67

Weekly RPE average	SRG	HR
mean	6	6
sd	0.50	0.33
Weekly HR average (bpm)		
mean	SRG	HR
sd	162.2	166.5
	9.46	7.69
Mean HR intensity (%)		
mean	SRG	HR
sd	84.1	12.3
	3.48	1.4

3.3.4 Week 4

RER	Reserve ratio (%)	RPE						sRPE avg	HR						sHR avg
		1	2	3	4	5	6		1	2	3	4	5	6	
1	V	5	5	5	5	6	6	6	154	155	161	166	170	171	160.3
2	V	5	5	6	6	6	7	6	162	154	162	161	171	169	162.1
3	V	5	6	5	5	6	7	6	156	167	161	175	174	179	168.0
4	V	6	6	5	5	5	7	6	161	161	156	166	174	169	165.1
5	V	5	6	5	6	5	6	6	152	161	159	164	170	169	163.9
6	V	5	6	6	6	7	7	6	155	163	162	171	176	171	166.7
7	V	5	5	6	6	6	7	6	152	162	166	172	169	175	162.3
8	V	5	6	6	6	6	7	6	165	160	156	163	181	178	165.1
9	V	5	6	7	6	6	7	6	167	161	166	154	161	169	160.0
10	V	6	6	6	6	6	7	6	162	151	150	177	169	171	165.0
11	V	5	5	6	7	7	7	6	167	155	161	173	170	168	166.1
12	V	6	6	6	6	6	6	6	161	159	151	153	161	159	156.1
13	V	6	6	6	6	6	7	6	166	155	161	177	170	169	166.1
14	V	6	6	7	6	7	7	5	169	166	156	171	181	178	170.1
15	V	6	5	5	5	5	6	5	168	161	167	171	177	176	170.0
16	V	5	6	6	6	6	7	6	152	165	161	173	175	180	169.1
mean								6							165.0
sd								0.35							1.74

Tuesday

RER	Reserve ratio (%)	RPE						sRPE avg	HR						sHR avg
		1	2	3	4	5	6		1	2	3	4	5	6	
1	V	5	6	6	6	6	6	6	167	171	169	173	181	176	173.8
2	V	5	5	5	5	5	6	7	155	165	161	168	171	175	162.1
3	V	6	6	6	6	7	6	7	156	169	160	154	169	181	162.1
4	V	5	6	6	6	7	7	7	154	169	171	175	188	181	171.1
5	V	6	5	6	6	7	7	6	164	168	169	179	181	175	173.0
6	V	6	6	6	6	6	7	6	169	171	181	170	179	177	174.1
7	V	5	6	7	7	7	6	6	154	163	161	167	176	174	165.0
8	V	7	6	6	6	6	7	7	169	167	166	171	184	179	171.7
9	V	5	5	6	6	6	7	7	161	164	179	175	181	181	171.8
10	V	6	5	5	5	5	6	7	162	161	160	166	174	180	167.1
11	V	5	6	5	6	6	6	7	158	167	171	174	171	181	170.7
12	V	5	6	6	6	6	6	6	155	161	160	161	170	171	166.1
13	V	5	6	6	6	6	7	7	161	154	160	167	171	177	162.1
14	V	6	6	6	6	7	6	7	165	169	171	175	179	180	172.0
15	V	5	6	6	5	6	6	6	170	161	166	167	181	181	167.8
16	V	6	6	6	6	6	6	6	160	171	169	171	175	177	170.8
mean								6							169.9
sd								0.29							3.51

Thursday

RER	Reserve ratio (%)	RPE						sRPE avg	HR						sHR avg
		1	2	3	4	5	6		1	2	3	4	5	6	
1	V	6	6	7	6	5	5	6	167	169	154	160	161	169	156.7
2	V	4	5	7	6	5	6	6	167	155	169	162	171	174	160.1
3	V	5	5	6	5	6	6	6	154	166	154	171	169	175	164.3
4	V	5	6	7	7	7	6	6	156	157	164	166	170	171	166.0
5	V	4	5	5	6	5	7	5	154	152	167	165	166	171	160.1
6	V	5	5	6	6	6	7	6	154	162	160	161	166	166	161.5
7	V	5	5	5	6	6	7	6	155	153	160	170	160	169	161.1
8	V	7	7	8	7	7	6	7	164	167	161	158	161	151	161.0
9	V	5	6	7	8	7	6	7	169	156	165	150	161	166	177.8
10	V	5	5	6	5	6	7	6	161	162	157	171	171	174	160.1
11	V	4	4	5	6	5	7	6	164	151	154	175	169	167	160.0
12	V	7	7	5	6	5	7	6	150	155	151	158	161	165	157.0
13	V	6	6	5	6	7	7	7	165	154	160	175	171	160	165.5
14	V	7	7	6	6	6	7	7	167	160	151	165	170	165	160.0
15	V	7	7	8	7	5	5	7	169	166	161	171	180	166	165.7
16	V	6	7	7	5	5	6	6	155	163	160	171	181	179	169.8
mean								6							162.1
sd								0.51							1.50

Thursday

RER	Reserve ratio (%)	RPE						sRPE avg	HR						sHR avg
		1	2	3	4	5	6		1	2	3	4	5	6	
1	V	5	5	6	6	6	7	6	151	155	162	171	177	166	164.5
2	V	5	4	4	5	6	7	5	131	145	156	179	167	171	151.1
3	V	6	6	7	7	7	8	6	153	167	172	156	167	178	161.1
4	V	5	5	7	7	7	8	7	144	156	167	176	178	181	167.0
5	V	6	5	7	7	6	8	6	166	167	165	177	178	174	171.7
6	V	7	7	6	6	5	6	6	166	165	177	163	171	169	168.1
7	V	5	6	6	7	7	6	6	167	162	159	165	166	171	161.7
8	V	7	7	6	7	7	7	8	171	169	161	171	169	177	169.6
9	V	7	7	7	7	8	8	7	166	165	175	171	186	178	173.5
10	V	6	5	6	5	7	7	6	161	159	166	155	171	177	164.1
11	V	6	7	7	7	7	7	6	158	166	171	171	169	178	169.0
12	V	4	5	5	5	7	7	6	154	161	159	178	169	171	165.1
13	V	5	5	5	5	6	6	5	161	151	154	165	166	161	156.1
14	V	6	6	7	7	6	7	7	161	166	171	177	180	177	169.1
15	V	4	6	6	5	6	5	8	166	171	159	166	161	181	164.0
16	V	5	6	6	7	7	6	6	155	166	162	175	179	170	161.7
mean								6							161.1
sd								0.71							6.91

Weekly RPE average	600	RER
mean	6	6
sd	0.51	0.41
Weekly HR average (bpm)	600	RER
mean	160.9	161.6
sd	0.10	1.62
Mean HR intensity (%)	600	RER
mean	87.1	83.9
sd	1.06	1.31

3.3.5 Week 5

HR	Session no.	RPE							s RPE avg	HR							s HR avg
		1	2	3	4	5	6	7		1	2	3	4	5	6	7	
1	V	4	4	5	5	7	7	7	5	155	156	162	168	171	172	166.0	
2	V	4	4	5	6	8	8	8	6	156	157	162	159	165	172	161.3	
3	V	2	3	4	5	8	8	8	5	163	171	158	151	167	171	160.5	
4	V	6	5	5	5	6	7	7	6	159	156	164	176	174	168	166.8	
5	V	5	5	5	5	6	7	7	6	164	154	164	156	173	176	163.2	
6	V	4	5	6	6	6	6	7	6	162	169	153	167	178	180	159.8	
7	V	5	5	4	6	7	7	7	6	154	159	162	171	172	178	165.8	
8	V	5	5	6	6	7	8	8	7	123	133	132	165	161	167	140.5	
9	V	4	5	5	5	6	6	8	6	154	160	155	168	171	167	162.5	
10	V	5	6	7	8	7	7	7	7	136	129	140	169	153	161	145.0	
11	V	5	6	6	7	8	7	7	7	154	159	166	173	177	178	167.8	
12	V	3	3	3	4	5	6	6	4	155	147	157	164	170	179	160.2	
13	V	3	3	3	4	5	6	6	4	131	145	154	162	166	171	156.8	
14	V	3	6	7	6	7	7	7	6	133	139	143	161	159	169	150.7	
15	V	3	4	5	5	7	8	8	6	132	146	153	156	169	174	156.7	
16	V	3	4	5	5	6	6	6	5	159	165	154	169	177	176	166.7	
mean									6								159.2
sd									0.74								3.65

HR	Session no.	RPE							s RPE avg	HR							s HR avg
		1	2	3	4	5	6	7		1	2	3	4	5	6	7	
1	V	6	6	7	8	7	7	7	7	154	159	156	167	171	169	161.2	
2	V	5	5	6	7	6	7	6	6	145	154	166	171	173	173	163.7	
3	V	5	4	5	6	5	6	5	5	165	175	165	170	180	178	172.3	
4	V	5	6	7	7	7	6	6	6	173	156	169	167	177	174	169.3	
5	V	6	5	5	5	7	6	8	6	156	169	167	175	186	176	171.5	
6	V	5	5	6	6	7	7	7	6	145	159	161	172	178	170	164.2	
7	V	5	6	5	7	8	7	6	6	156	154	165	177	173	182	166.8	
8	V	7	7	8	8	7	7	6	7	140	139	151	166	157	174	155.5	
9	V	5	6	7	8	8	6	7	6	144	145	154	179	161	154	153.0	
10	V	5	5	6	5	6	5	6	7	154	164	156	170	183	179	167.3	
11	V	4	4	5	6	5	5	5	5	149	147	155	163	174	173	160.5	
12	V	5	4	4	4	5	6	7	5	151	147	159	157	160	163	153.0	
13	V	6	7	5	6	8	7	5	7	153	154	165	170	180	173	165.8	
14	V	5	6	7	8	7	8	7	6	153	155	154	169	174	173	162.8	
15	V	5	4	5	5	7	7	6	6	153	161	154	154	169	172	160.7	
16	V	6	5	5	6	6	7	6	6	162	178	165	174	180	164	169.2	
mean									6								163.4
sd									0.66								6.28

HR	Session no.	RPE							s RPE avg	HR							s HR avg
		1	2	3	4	5	6	7		1	2	3	4	5	6	7	
1	V	5	6	5	6	7	7	6	6	154	165	159	166	171	169	165.0	
2	V	5	5	5	5	6	5	5	5	154	167	165	170	177	170	167.2	
3	V	5	4	5	6	5	5	6	5	153	155	167	175	177	167	165.7	
4	V	5	6	7	7	7	7	6	6	155	167	171	174	177	176	170.0	
5	V	6	5	5	5	7	6	8	6	141	155	151	160	161	163	155.2	
6	V	5	5	4	6	7	7	7	6	147	141	155	160	163	170	156.0	
7	V	5	6	5	5	7	8	7	6	167	177	176	174	161	177	172.5	
8	V	4	7	8	7	7	7	6	7	139	142	153	169	152	165	146.5	
9	V	4	6	7	8	8	6	6	7	142	147	151	159	165	164	156.7	
10	V	3	5	6	5	6	7	7	5	132	141	145	152	159	163	148.7	
11	V	3	4	5	6	5	5	5	5	145	150	159	167	159	173	155.5	
12	V	5	4	4	4	5	6	7	5	139	142	154	154	159	160	151.3	
13	V	6	7	5	6	7	7	7	7	135	147	148	169	160	163	153.0	
14	V	5	6	7	7	8	7	8	7	154	160	160	165	174	177	166.5	
15	V	4	4	5	7	7	7	6	6	165	159	169	172	170	162	166.2	
16	V	4	5	5	6	7	6	6	6	154	160	169	172	178	179	167.8	
mean									6								160.1
sd									0.65								8.38

HR	Session no.	RPE							s RPE avg	HR							s HR avg
		1	2	3	4	5	6	7		1	2	3	4	5	6	7	
1	V	6	6	7	8	7	8	7	7	156	161	171	165	167	169	158.2	
2	V	5	5	6	7	6	7	6	6	123	139	154	167	161	156	150.0	
3	V	5	6	5	6	5	6	5	5	133	139	145	154	150	161	147.0	
4	V	5	6	7	7	7	7	6	6	143	149	156	165	171	169	158.5	
5	V	6	5	5	5	7	6	8	6	154	145	153	159	166	169	157.1	
6	V	5	5	4	6	7	7	6	6	151	154	159	169	172	178	165.7	
7	V	5	6	5	5	7	8	7	6	153	167	175	165	176	174	167.3	
8	V	7	7	8	7	7	7	6	7	133	140	156	163	181	179	165.7	
9	V	5	6	7	8	8	6	7	7	159	155	163	173	163	170	164.2	
10	V	5	5	6	5	6	5	6	7	154	165	170	182	180	175	171.0	
11	V	4	4	5	6	5	5	5	5	143	154	146	169	172	175	163.2	
12	V	5	4	4	4	5	6	7	5	153	165	171	181	177	169	169.3	
13	V	6	7	5	6	7	7	7	7	143	156	161	178	179	177	169.0	
14	V	5	6	7	7	8	7	8	7	155	155	169	173	185	172	168.2	
15	V	5	4	5	5	7	7	6	6	146	155	171	181	175	173	173.5	
16	V	6	5	5	6	6	7	6	6	154	150	171	175	173	165	171.0	
mean									6								163.7
sd									0.66								7.40

Weekly RPE average	SDD	HR
mean	6	6
sd	0.66	0.70

Weekly HR average (bpm)	SDD	HR
mean	160.6	159.7
sd	6.91	7.86

Mean HR intensity (%)	SDD	HR
mean	84.3	91.9
sd	1.82	3.4

3.3.6 Week 6

HR	Session info	RPE						s RPE avg	HR						s HR avg
n	(V/N)	1	2	3	4	5	6		1	2	3	4	5	6	
1	V	4	5	6	5	5	6	5	144	139	149	153	160	154	149.3
2	V	5	4	5	5	5	6	7	5	139	147	149	160	155	150.3
3	V	4	5	6	5	6	7	4	139	144	156	160	159	164	153.7
4	V	4	5	5	5	5	6	7	5	149	171	172	159	166	177
5	V	5	6	5	6	5	7	4	156	152	169	157	169	165	163.3
6	V	5	6	5	5	5	6	5	139	149	151	149	159	161	151.3
7	V	5	6	5	6	6	7	6	149	145	151	159	166	172	157.0
8	V	5	6	5	6	7	6	4	138	149	152	148	155	160	150.3
9	V	4	6	5	5	5	6	5	138	139	147	156	161	154	150.3
10	V	4	5	7	6	7	6	6	119	138	149	154	164	171	149.2
11	V	5	6	6	6	7	6	4	147	151	160	177	169	173	162.3
12	V	4	5	6	5	6	7	5	148	161	157	167	169	175	162.3
13	V	5	4	6	5	5	6	5	140	139	151	162	169	161	150.3
14	V	7	6	7	8	7	8	7	141	164	154	166	156	176	159.5
15	V	5	4	5	7	6	6	6	161	153	154	173	161	173	162.5
16	V	5	4	7	6	6	7	6	148	159	167	173	176	167	168.3
mean								6							157.1
sd								0.51							6.75

HR	Session info	RPE						s RPE avg	HR						s HR avg
n	(V/N)	1	2	3	4	5	6		1	2	3	4	5	6	
1	V	4	5	6	6	6	6	6	155	153	162	161	177	171	160.3
2	V	4	5	6	6	5	7	6	155	161	159	157	168	171	161.3
3	V	4	5	6	5	5	6	5	132	149	155	171	169	170	157.7
4	V	4	5	6	6	5	6	5	156	170	171	179	168	177	170.3
5	V	5	4	5	5	6	5	7	5	143	147	151	165	171	160
6	V	5	6	4	5	6	6	5	144	155	171	162	175	171	160.0
7	V	5	5	5	5	6	7	6	157	169	162	178	170	170	166.5
8	V	4	6	7	6	6	5	6	154	163	156	162	175	171	166.3
9	V	4	5	6	7	6	6	6	159	163	155	166	171	160	160.3
10	V	4	6	5	6	5	6	5	131	144	156	162	170	171	156.0
11	V	4	5	5	6	6	5	5	145	155	169	173	170	174	164.3
12	V	4	5	5	6	5	6	5	151	156	151	166	168	166	161.3
13	V	5	6	5	6	6	7	6	163	155	156	174	171	169	166.3
14	V	4	5	5	6	6	7	6	149	166	151	166	171	166	163.7
15	V	5	5	6	6	6	7	6	170	167	166	171	163	168	167.8
16	V	5	5	5	5	6	6	5	142	153	166	171	169	165	161.0
mean								6							162.9
sd								0.27							3.49

Weekly RPE average	590	HR
mean	5	6
sd	0.18	0.40
Weekly HR average (bpm)	590	HR
mean	164.2	160.0
sd	4.91	5.22
Mean HR intensity (%)	590	HR
mean	81.2	81.1
sd	1.26	1.41

HR	Session info	RPE						s RPE avg	HR						s HR avg
n	(V/N)	1	2	3	4	5	6		1	2	3	4	5	6	
1	V	6	5	5	6	5	6	6	159	151	155	163	172	171	161.5
2	V	5	5	5	6	5	6	5	149	161	155	163	171	171	163.3
3	V	5	4	6	6	5	5	5	126	161	159	168	165	171	155.5
4	V	5	5	6	6	6	5	6	144	161	152	176	171	169	158.8
5	V	5	5	6	6	7	6	6	142	164	166	169	171	180	165.3
6	V	5	5	4	6	5	5	5	147	175	178	171	168	173	172.0
7	V	4	5	5	6	5	6	5	136	159	160	169	159	166	156.2
8	V	6	6	5	7	5	6	6	154	154	165	176	177	181	171.3
9	V	5	5	6	7	7	6	6	149	180	159	168	172	177	167.5
10	V	6	5	5	5	6	6	6	165	156	177	167	171	183	169.3
11	V	5	4	5	5	5	5	5	159	155	166	171	169	175	165.5
12	V	5	4	4	5	5	6	5	155	161	177	171	169	179	168.7
13	V	5	6	6	5	6	6	6	166	167	177	179	162	175	169.2
14	V	5	5	5	6	6	6	6	139	155	151	171	169	175	160.0
15	V	5	5	5	6	6	6	6	146	151	153	166	174	171	160.2
16	V	6	6	5	5	6	6	6	155	166	169	177	178	182	171.2
mean								5							164.8
sd								0.15							5.51

HR	Session info	RPE						s RPE avg	HR						s HR avg
n	(V/N)	1	2	3	4	5	6		1	2	3	4	5	6	
1	V	5	4	4	5	6	6	5	141	154	160	171	165	173	160.2
2	V	4	4	5	6	5	6	5	144	151	166	171	170	169	161.3
3	V	5	5	4	6	5	6	5	131	164	151	155	171	177	162.3
4	V	6	5	6	5	6	6	6	150	166	140	181	177	181	166.2
5	V	5	6	7	6	6	7	6	140	155	167	174	180	181	166.5
6	V	5	4	4	6	6	6	5	140	159	177	179	165	179	168.3
7	V	5	5	5	5	6	7	6	140	144	170	171	180	177	160.3
8	V	6	5	6	7	6	5	6	157	162	156	178	168	169	163.7
9	V	5	4	5	6	6	7	6	151	172	166	177	169	175	169.0
10	V	5	4	5	6	5	6	6	149	164	163	163	172	176	165.5
11	V	4	5	5	5	5	5	5	144	165	179	168	177	179	167.3
12	V	4	5	4	5	5	6	5	159	177	159	173	169	181	169.8
13	V	5	6	5	6	7	6	6	149	147	166	167	168	170	157.8
14	V	5	5	5	6	7	6	6	147	144	148	151	166	171	156.5
15	V	4	5	4	6	6	6	5	151	155	156	158	163	174	160.5
16	V	6	5	6	6	5	6	7	151	159	169	167	174	170	165.0
mean								5							163.7
sd								0.41							4.36

3.3.7 Week 7

HR	Session g/s (V%)	RPE						s RPE avg	HR						s HR avg	
		1	2	3	4	5	6		1	2	3	4	5	6		
1	V	4	5	6	6	5	5	5	159	161	154	162	174	166	162.8	
2	V	4	5	5	5	5	6	5	158	154	165	170	179	174	166.1	
3	V	4	5	6	5	6	7	6	163	169	159	170	174	175	168.3	
4	V	4	5	4	5	5	6	5	163	154	165	165	156	167	155.5	
5	V	3	4	5	6	5	6	5	154	156	162	176	173	175	166.5	
6	V	5	6	5	6	5	6	6	163	169	172	174	175	177	171.1	
7	V	4	5	5	5	5	6	5	144	147	155	160	169	166	156.0	
8	V	4	5	5	5	6	6	6	5	157	168	170	172	173	169	168.1
9	V	3	4	5	5	5	5	5	148	156	162	175	170	181	165.5	
10	V	6	5	5	6	5	6	5	123	141	143	157	171	166	150.1	
11	V	4	5	5	4	6	5	5	132	144	146	162	164	169	155.1	
12	V	3	4	4	4	5	4	4	5	142	159	147	156	168	16	157.1
13	V	4	4	5	5	5	4	4	5	150	168	175	175	165	170	168.1
14	V	4	6	5	6	6	6	6	151	166	174	165	176	157	166.6	
15	V	5	4	5	6	7	6	6	151	163	164	174	179	168	166.1	
16	V	3	4	4	6	5	5	5	143	149	154	156	167	165	155.1	
mean								5								161.3
sd								0.10								4.97

HRG	Session g/s (V%)	RPE						s RPE avg	HR						s HR avg	
		1	2	3	4	5	6		1	2	3	4	5	6		
1	V	4	5	3	4	5	5	5	135	132	137	163	168	173	157.1	
2	V	4	5	4	6	7	6	6	132	156	165	179	182	176	161.1	
3	V	4	5	3	6	5	5	5	159	151	168	165	175	174	164.7	
4	V	4	4	4	6	5	5	6	151	146	156	173	180	179	164.1	
5	V	4	5	4	6	6	7	6	161	155	166	174	180	178	166.0	
6	V	4	5	4	6	6	6	5	158	161	169	173	181	175	169.1	
7	V	4	5	5	5	6	5	5	143	145	170	173	169	170	161.1	
8	V	5	6	6	6	7	5	6	159	169	181	177	176	179	171.1	
9	V	5	5	5	5	6	7	6	140	172	166	170	175	165	164.1	
10	V	6	5	5	5	6	6	6	163	165	172	184	175	178	171.1	
11	V	3	4	4	4	5	5	6	139	157	167	173	174	184	161.1	
12	V	5	4	4	4	4	5	5	139	143	151	163	160	170	156.0	
13	V	3	4	4	4	4	5	5	162	173	179	184	175	165	169.1	
14	V	4	5	4	4	6	5	6	173	175	171	164	173	177	171.1	
15	V	4	4	5	5	6	6	7	153	153	165	178	166	171	161.1	
16	V	4	5	5	5	6	7	6	156	169	170	167	184	179	171.1	
mean								5								161.5
sd								0.10								5.11

HR	Session g/s (V%)	RPE						s RPE avg	HR						s HR avg	
		1	2	3	4	5	6		1	2	3	4	5	6		
1	V	5	4	5	6	6	5	5	151	147	152	160	176	165	159.1	
2	V	4	4	5	6	5	6	5	145	151	159	165	170	165	159.1	
3	V	4	5	6	5	5	6	5	135	149	155	165	159	169	156.1	
4	V	4	5	6	6	6	5	6	156	170	175	179	168	177	170.1	
5	V	5	6	5	6	5	7	5	153	147	152	165	172	176	161.1	
6	V	5	6	4	5	6	6	5	154	155	170	160	175	171	166.1	
7	V	5	6	5	6	7	6	6	164	154	159	160	166	171	162.1	
8	V	4	6	7	6	6	5	6	145	154	149	165	159	161	155.1	
9	V	4	5	6	7	6	6	6	158	165	159	167	172	170	165.0	
10	V	4	5	5	6	5	6	5	151	160	160	156	171	175	162.1	
11	V	3	4	5	6	6	5	5	155	146	164	167	170	169	162.1	
12	V	3	5	5	6	5	6	5	164	149	151	166	167	166	160.1	
13	V	4	6	6	5	5	6	5	144	144	155	164	171	171	158.1	
14	V	4	4	5	5	6	5	5	148	156	155	166	166	166	159.1	
15	V	4	5	4	5	5	6	5	150	144	156	161	159	160	157.0	
16	V	5	6	5	5	6	6	6	154	153	156	169	171	161	161.0	
mean								5								160.9
sd								0.10								3.85

Weekly RPE average	SOG	HR
mean	5	5
sd	0.10	0.11
Weekly HR average (bpm)	SOG	HR
mean	166.4	161.0
sd	4.57	6.41
Mean HR intensity (%)	SOG	HR
mean	86.3	82.6
sd	1.15	1.80

Thursday																
HR	Session g/s (V%)	RPE						s RPE avg	HR						s HR avg	
		1	2	3	4	5	6		1	2	3	4	5	6		
1	V	4	5	5	5	5	6	5	143	156	171	174	168	174	164.7	
2	V	3	4	5	5	5	6	7	5	159	166	154	165	173	170	164.1
3	V	4	5	4	5	5	5	6	5	154	165	172	163	175	172	164.1
4	V	4	5	5	5	5	6	7	5	147	150	154	173	176	177	161.1
5	V	5	5	6	5	5	6	6	167	171	169	174	176	169	171.1	
6	V	5	4	4	5	5	6	7	5	155	176	177	165	174	179	171.0
7	V	4	5	5	5	6	7	6	166	174	172	171	175	177	171.1	
8	V	5	5	6	5	6	5	5	161	145	156	169	175	171	161.1	
9	V	4	4	5	5	6	5	6	5	150	176	165	174	154	151	161.0
10	V	5	6	4	6	4	6	5	163	169	174	166	175	176	171.1	
11	V	5	4	6	6	5	6	5	164	165	172	169	175	180	171.1	
12	V	5	4	4	4	5	6	6	5	160	175	179	169	174	183	171.1
13	V	5	5	5	6	5	6	6	162	164	171	165	164	159	161.1	
14	V	4	5	4	4	5	6	5	5	143	154	165	171	177	171	164.1
15	V	5	5	5	5	5	6	5	5	156	166	160	179	175	169	166.0
16	V	5	5	5	5	5	5	5	5	164	173	174	164	170	169	169.1
mean									5							167.1
sd									0.11							1.61

3.3.8 Week 8

HR	Session info (V/N)	RPE						s-RPE avg	HR						s-HR avg
		1	2	3	4	5	6		1	2	3	4	5	6	
1	V	5	4	5	5	5	5	5	169	152	155	155	163	176	157.3
2	V	4	5	5	5	5	5	5	168	163	159	165	164	154	160.2
3	V	4	6	5	5	5	5	5	168	156	161	176	180	171	160.3
4	V	3	4	5	5	5	6	5	162	150	159	154	163	165	155.5
5	V	4	4	5	5	5	5	5	150	155	160	172	171	181	160.8
6	V	5	6	5	5	5	6	6	145	154	148	169	150	159	150.7
7	V	4	4	5	5	6	6	5	127	139	147	158	159	161	150.2
8	V	4	4	6	6	6	5	5	141	151	152	167	154	155	160.6
9	V	4	4	5	5	6	5	5	132	129	147	152	161	159	146.7
10	V	4	5	5	5	5	4	5	154	164	158	162	173	173	163.7
11	V	4	5	6	6	5	6	5	149	174	164	172	175	169	167.2
12	V	4	3	4	5	6	5	5	151	145	155	156	171	164	156.3
13	V	4	4	4	5	5	6	5	149	159	165	171	171	182	166.5
14	V	4	5	5	5	5	6	5	123	132	144	145	160	154	143.0
15	V	5	4	5	5	5	6	6	149	159	167	175	178	174	166.0
16	V	4	5	6	5	6	6	5	153	159	164	156	185	171	161.2

mean= 5
sd= 0.25

HR	Session info (V/N)	RPE						s-RPE avg	HR						s-HR avg
		1	2	3	4	5	6		1	2	3	4	5	6	
1	V	3	4	5	5	5	6	5	145	144	156	159	161	166	155.2
2	V	4	4	5	5	5	6	5	164	171	167	175	159	175	168.5
3	V	3	5	6	5	6	5	5	135	149	152	160	171	169	156.3
4	V	3	5	6	6	5	6	5	166	156	165	169	167	171	165.7
5	V	4	4	5	6	5	6	5	143	147	152	169	160	169	158.8
6	V	4	6	4	5	5	6	5	144	145	162	162	154	155	160.2
7	V	5	5	5	5	6	6	5	144	154	161	175	167	155	162.3
8	V	3	5	6	6	6	5	5	145	154	169	165	159	171	157.2
9	V	4	5	5	6	6	6	5	158	149	155	167	163	170	160.3
10	V	5	5	5	6	5	6	5	151	153	155	156	167	169	158.5
11	V	4	4	5	6	6	5	5	145	146	159	160	173	174	159.7
12	V	4	5	5	5	5	6	5	144	143	155	155	173	174	156.5
13	V	4	5	6	5	6	5	5	154	160	162	155	151	162	158.2
14	V	3	4	5	5	6	5	5	143	156	155	173	165	171	161.3
15	V	3	4	4	5	6	5	5	150	144	146	155	159	168	153.7
16	V	4	5	6	5	6	5	5	154	153	160	168	169	173	162.7

mean= 5
sd= 0.25

Weekly RPE average	SIG	HR
mean=	5	5
sd=	0.26	0.25
Weekly HR average (bpm)	SIG	HR
mean=	160.0	158.3
sd=	0.38	6.32
Mean HR intensity (%)	SIG	HR
mean=	87.1	81.1
sd=	0.88	1.61

HR	Session info (V/N)	RPE						s-RPE avg	HR						s-HR avg
		1	2	3	4	5	6		1	2	3	4	5	6	
1	V	4	6	5	5	5	5	5	142	153	157	163	175	175	160.2
2	V	4	5	5	5	6	5	6	155	171	159	172	168	172	166.3
3	V	3	4	5	5	5	5	5	154	166	168	177	172	176	168.8
4	V	4	5	5	5	5	5	5	166	154	167	177	181	179	170.7
5	V	3	5	4	5	6	6	5	161	171	169	173	176	169	169.8
6	V	4	6	5	5	5	5	5	159	161	169	173	182	175	169.3
7	V	4	5	5	5	6	5	6	159	167	170	177	169	176	170.2
8	V	4	5	5	5	6	6	5	170	158	147	163	175	171	163.7
9	V	4	5	5	5	6	6	6	161	172	164	175	177	169	169.7
10	V	5	4	5	5	5	6	5	165	157	166	183	176	169	169.0
11	V	4	4	4	4	5	6	5	157	157	167	171	174	184	164.3
12	V	4	5	5	5	5	5	5	154	163	151	165	160	170	156.5
13	V	3	4	4	5	5	5	5	144	154	164	172	177	181	165.5
14	V	4	5	4	4	5	6	5	143	169	171	164	175	183	167.5
15	V	3	4	4	5	5	6	5	143	165	169	182	174	171	164.0
16	V	4	4	5	5	5	5	5	143	169	170	167	180	179	163.7

mean= 5
sd= 0.25

HR	Session info (V/N)	RPE						s-RPE avg	HR						s-HR avg
		1	2	3	4	5	6		1	2	3	4	5	6	
1	V	4	5	6	6	7	7	6	151	161	171	177	175	171	167.7
2	V	3	4	5	5	6	7	5	147	166	161	169	173	175	165.2
3	V	5	5	5	5	5	6	5	154	165	175	168	174	178	167.7
4	V	6	5	6	6	5	6	7	158	169	164	174	175	174	170.0
5	V	5	5	6	6	6	6	6	167	172	167	178	178	174	172.8
6	V	5	4	4	4	5	6	7	165	176	181	185	176	179	172.7
7	V	4	5	5	5	6	7	6	168	171	172	175	180	169	172.7
8	V	5	5	6	6	5	6	5	155	159	160	163	176	175	163.7
9	V	4	5	6	6	6	6	6	149	176	165	175	166	171	167.0
10	V	5	5	6	6	6	6	6	163	169	176	164	175	176	170.5
11	V	4	5	5	6	6	7	7	164	156	171	177	182	175	170.8
12	V	5	4	4	4	5	6	6	160	175	169	172	178	172	171.6
13	V	5	5	6	6	6	5	6	166	155	164	177	177	169	167.3
14	V	4	5	5	6	6	7	6	166	167	177	173	176	172	171.5
15	V	5	5	6	6	5	6	5	166	160	165	169	174	169	167.2
16	V	5	5	5	6	6	6	6	172	177	174	172	164	164	170.3

mean= 5
sd= 0.36

3.3.9 Week 9

HR	Intensity ratio (VNS)	RPE						s-RPE avg	HR						s-HR avg	
		1	2	3	4	5	6		1	2	3	4	5	6		
1	V	4	5	4	4	4	5	4	109	101	157	159	175	169	105.0	
2	V	4	5	4	5	5	4	5	151	155	161	154	169	169	159.2	
3	V	4	5	4	5	5	5	5	154	161	159	160	169	170	156.3	
4	V	4	5	5	5	6	5	5	142	151	149	161	158	169	155.0	
5	V	4	4	5	5	6	5	5	140	150	164	156	161	170	157.5	
6	V	4	4	6	6	6	5	6	5	132	140	155	149	155	171	150.7
7	V	4	5	5	5	5	6	5	140	161	151	166	159	174	158.5	
8	V	5	5	6	6	6	5	6	157	149	160	174	167	175	160.7	
9	V	4	4	5	6	6	6	5	139	144	149	167	154	166	153.2	
10	V	3	4	4	5	4	6	4	156	161	173	175	168	170	166.3	
11	V	5	5	6	6	6	7	6	143	162	176	169	175	169	165.5	
12	V	4	4	4	4	5	6	6	5	135	156	147	166	175	179	159.0
13	V	3	4	4	4	5	4	5	4	151	156	160	153	166	169	159.3
14	V	3	4	4	4	5	6	5	5	152	166	171	180	179	174	170.7
15	V	4	5	5	5	5	6	5	152	169	162	175	169	173	160.0	
16	V	3	3	3	4	4	5	4	4	151	149	166	156	161	159	157.0

mean= 5 159.7
sd= 0.52 5.96

HR	Intensity ratio (VNS)	RPE						s-RPE avg	HR						s-HR avg
		1	2	3	4	5	6		1	2	3	4	5	6	
1	V	5	5	4	4	5	6	5	156	161	168	175	169	172	166.3
2	V	5	5	6	5	5	5	5	158	149	164	155	165	169	160.0
3	V	4	5	5	5	5	6	5	155	167	151	163	155	166	159.3
4	V	4	6	5	5	6	6	5	132	149	155	163	157	167	153.2
5	V	3	4	5	5	5	6	5	151	161	164	172	169	174	165.3
6	V	3	4	5	5	6	6	5	153	149	149	167	156	166	155.0
7	V	4	4	5	6	6	7	5	146	151	175	178	162	175	165.0
8	V	5	6	5	5	6	7	6	147	144	159	173	166	172	160.3
9	V	3	4	5	6	6	7	5	142	145	150	162	174	170	158.5
10	V	4	4	5	5	5	6	5	164	176	169	176	156	167	167.7
11	V	3	3	5	5	5	6	5	209	255	163	165	175	177	182.0
12	V	3	4	5	6	5	6	5	154	149	167	166	154	165	155.8
13	V	3	4	5	5	5	6	5	138	142	160	164	159	174	156.3
14	V	3	4	5	6	5	6	5	137	165	155	165	166	169	159.3
15	V	3	4	5	5	6	6	5	148	155	171	165	171	165	162.5
16	V	4	4	4	5	5	6	5	143	165	155	165	177	166	161.8

mean= 5 160.5
sd= 0.31 9.40

Weekly RPE average	590	HR
mean	6	5
sd	1.94	0.45
Weekly HR average (bpm)	590	HR
mean	160.5	160.1
sd	4.38	3.23
Mean HR intensity (%)	590	HR
mean	81.6	82.1
sd	1.15	2.57

HR	Intensity ratio (VNS)	RPE						s-RPE avg	HR						s-HR avg
		1	2	3	4	5	6		1	2	3	4	5	6	
1	V	4	5	4	4	5	4	4	128	149	156	160	171	170	156.0
2	V	5	6	6	5	4	4	4	161	171	181	179	165	172	170.0
3	V	7	6	6	7	6	6	6	167	171	177	180	175	169	172.3
4	V	5	6	5	5	5	5	6	155	168	155	166	167	180	161.5
5	V	6	6	5	6	5	5	6	152	155	167	171	169	177	165.2
6	V	5	5	6	6	5	6	6	176	173	180	168	159	177	172.2
7	V	5	5	5	5	5	5	5	140	149	161	166	174	171	165.5
8	V	6	6	7	5	6	7	6	167	169	171	172	184	179	173.7
9	V	4	4	5	5	5	4	5	172	164	171	182	188	169	174.3
10	V	4	6	5	6	6	6	5	148	177	148	154	175	181	166.5
11	V	6	7	7	8	7	6	7	167	171	159	163	177	182	170.5
12	V	5	4	4	4	5	5	5	151	156	160	171	168	170	162.8
13	V	5	6	7	7	7	6	6	167	171	182	186	174	169	174.3
14	V	5	6	6	5	5	5	5	165	172	169	177	175	171	170.8
15	V	6	4	4	4	6	6	5	144	156	166	171	177	170	163.7
16	V	5	5	5	5	6	6	5	154	163	166	171	177	174	167.5

mean= 5 167.7
sd= 0.71 5.40

HR	Intensity ratio (VNS)	RPE						s-RPE avg	HR						s-HR avg
		1	2	3	4	5	6		1	2	3	4	5	6	
1	V	5	5	5	5	6	6	5	165	172	177	169	179	170	172.0
2	V	5	6	5	6	7	7	6	164	176	169	172	163	175	169.8
3	V	6	7	6	6	7	7	7	156	172	177	169	174	177	170.3
4	V	5	5	5	5	6	7	6	162	156	165	177	174	181	168.8
5	V	5	6	6	6	7	6	6	144	165	171	173	182	165	170.0
6	V	4	5	5	5	5	6	5	162	164	170	168	177	176	169.5
7	V	4	5	5	6	7	7	6	162	149	161	166	174	171	165.5
8	V	6	5	6	5	6	6	6	167	169	171	172	184	179	173.7
9	V	4	5	6	6	6	5	6	172	184	171	182	188	169	174.3
10	V	4	5	5	6	6	7	6	156	167	156	169	175	181	170.5
11	V	5	6	6	7	7	7	6	166	169	175	173	180	177	173.3
12	V	5	4	4	4	5	5	5	160	162	176	169	174	170	168.5
13	V	5	6	7	6	7	7	6	171	174	179	167	156	173	170.0
14	V	4	5	6	5	6	6	5	156	169	175	169	174	176	169.3
15	V	4	5	6	5	6	6	5	154	166	171	172	180	170	168.8
16	V	6	5	6	6	6	6	6	167	166	173	171	180	177	172.3

mean= 6 170.2
sd= 2.96 3.15

3.3.10 Week 10

HR	Session info	RPE						s RPE avg	HR						s HR avg
		1	2	3	4	5	6		1	2	3	4	5	6	
1	V	1	1	1	1	1	1	1	109	101	157	159	175	169	105.0
2	V	1	1	1	1	1	1	1	171	155	162	154	169	169	159.2
3	V	1	1	1	1	1	1	1	158	161	159	166	169	170	156.5
4	V	1	1	1	1	1	1	1	167	156	151	162	164	171	158.5
5	V	1	1	1	1	1	1	1	168	167	169	163	154	169	169.3
6	V	1	1	1	1	1	1	1	153	156	166	171	169	154	161.2
7	V	1	1	1	1	1	1	1	139	148	161	154	166	175	156.7
8	V	1	1	1	1	1	1	1	159	170	174	161	156	166	166.3
9	V	1	1	1	1	1	1	1	163	156	167	171	171	165	162.5
10	V	1	1	1	1	1	1	1	156	161	171	175	168	158	166.8
11	V	1	1	1	1	1	1	1	170	156	161	161	156	171	156.7
12	V	1	1	1	1	1	1	1	163	166	156	160	159	167	159.0
13	V	1	1	1	1	1	1	1	151	156	160	151	166	169	159.3
14	V	1	1	1	1	1	1	1	163	158	168	166	165	165	156.8
15	V	1	1	1	1	1	1	1	171	166	175	168	171	177	166.4
16	V	1	1	1	1	1	1	1	161	165	170	156	161	159	162.0

mean= 5 159.4
sd= 0.66 4.39

HR	Session info	RPE						s RPE avg	HR						s HR avg
		1	2	3	4	5	6		1	2	3	4	5	6	
1	V	1	1	1	1	1	1	1	132	138	145	156	140	163	146.0
2	V	1	1	1	1	1	1	1	163	150	151	161	161	167	145.8
3	V	1	1	1	1	1	1	1	123	137	161	154	155	160	145.3
4	V	1	1	1	1	1	1	1	138	140	151	159	167	162	147.3
5	V	1	1	1	1	1	1	1	161	155	151	166	161	163	155.2
6	V	1	1	1	1	1	1	1	155	159	162	162	170	171	166.1
7	V	1	1	1	1	1	1	1	139	162	151	155	163	166	151.7
8	V	1	1	1	1	1	1	1	160	163	159	165	166	154	168.2
9	V	1	1	1	1	1	1	1	167	166	161	154	158	171	153.3
10	V	1	1	1	1	1	1	1	162	150	159	154	161	165	155.5
11	V	1	1	1	1	1	1	1	162	165	168	163	171	161	151.7
12	V	1	1	1	1	1	1	1	165	156	168	169	150	158	150.7
13	V	1	1	1	1	1	1	1	158	159	164	155	168	150	161.7
14	V	1	1	1	1	1	1	1	161	159	171	169	165	175	168.3
15	V	1	1	1	1	1	1	1	169	159	164	170	166	171	166.8
16	V	1	1	1	1	1	1	1	150	167	172	163	159	169	167.3

mean= 5 155.1
sd= 0.10 4.19

Weekly RPE average	580	HR
mean	5	5
sd	0.53	0.49
Weekly HR coverage (bpm)	580	HR
mean	169.0	151.2
sd	5.28	6.29
Mean HR intensity (%)	580	HR
mean	81.3	80.6
sd	1.05	1.44

HR	Session info	RPE						s RPE avg	HR						s HR avg
		1	2	3	4	5	6		1	2	3	4	5	6	
1	V	1	1	1	1	1	1	1	128	149	156	160	171	170	156.0
2	V	1	1	1	1	1	1	1	161	171	181	176	165	171	150.0
3	V	1	1	1	1	1	1	1	167	171	177	180	175	169	152.5
4	V	1	1	1	1	1	1	1	155	168	159	166	167	180	161.5
5	V	1	1	1	1	1	1	1	151	155	167	171	168	177	165.2
6	V	1	1	1	1	1	1	1	156	173	180	168	159	177	172.2
7	V	1	1	1	1	1	1	1	163	169	164	166	174	171	160.5
8	V	1	1	1	1	1	1	1	167	169	171	172	184	179	171.7
9	V	1	1	1	1	1	1	1	171	164	171	182	188	169	154.3
10	V	1	1	1	1	1	1	1	168	177	168	154	175	181	166.5
11	V	1	1	1	1	1	1	1	167	171	159	167	177	182	150.5
12	V	1	1	1	1	1	1	1	151	158	160	171	168	170	162.3
13	V	1	1	1	1	1	1	1	167	171	182	188	174	169	154.3
14	V	1	1	1	1	1	1	1	165	172	169	177	175	171	159.8
15	V	1	1	1	1	1	1	1	164	154	166	171	177	170	163.7
16	V	1	1	1	1	1	1	1	154	163	166	171	177	174	167.5

mean= 5 167.7
sd= 0.71 5.60

HR	Session info	RPE						s RPE avg	HR						s HR avg
		1	2	3	4	5	6		1	2	3	4	5	6	
1	V	1	1	1	1	1	1	1	162	155	157	165	174	175	161.3
2	V	1	1	1	1	1	1	1	156	171	160	172	169	171	167.3
3	V	1	1	1	1	1	1	1	157	166	171	175	179	169	169.5
4	V	1	1	1	1	1	1	1	168	156	171	177	181	159	172.0
5	V	1	1	1	1	1	1	1	167	172	177	181	175	178	158.0
6	V	1	1	1	1	1	1	1	170	159	172	182	177	180	168.3
7	V	1	1	1	1	1	1	1	171	155	182	180	174	171	155.1
8	V	1	1	1	1	1	1	1	169	154	171	174	177	181	156.2
9	V	1	1	1	1	1	1	1	169	158	176	169	166	177	151.8
10	V	1	1	1	1	1	1	1	156	171	177	181	168	171	151.6
11	V	1	1	1	1	1	1	1	171	169	176	172	182	179	154.8
12	V	1	1	1	1	1	1	1	175	172	182	178	172	181	156.9
13	V	1	1	1	1	1	1	1	171	173	169	181	172	176	159.3
14	V	1	1	1	1	1	1	1	172	178	172	169	175	180	157.7
15	V	1	1	1	1	1	1	1	163	167	170	177	175	179	151.7
16	V	1	1	1	1	1	1	1	161	170	165	171	177	179	150.5

mean= 5 158.4
sd= 0.15 4.95

Appendix 4

SPSS statistical analysis data

4.1 Descriptive Analysis

	Active Dataset	DataSet1
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	32
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics are based on all cases with valid data.
Syntax		FREQUENCIES VARIABLES=Groups Age Hgt Wgt Body_Fat YO_YO_IR1 /HISTOGRAM NORMAL /ORDER=ANALYSIS.
Resources	Processor Time	00:00:06.59
	Elapsed Time	00:00:03.95

[DataSet1] E:\MOC_SPSS.sav

Statistics						
		Groups	Pre-Age (yrs)	Pre-Hgt (cm)	Pre-Wgt (kg)	Pre-BF %
N	Valid	32	32	32	32	32
	Missing	0	0	0	0	0

Statistics			Pre-YO_YO IR1 (m)
N	Valid		32
	Missing		0

Frequency Table

		Groups			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	SSG	16	50.0	50.0	50.0
	HIIR	16	50.0	50.0	100.0
	Total	32	100.0	100.0	

		Pre-Agr (yrs)			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	19.00	1	3.1	3.1	3.1
	20.00	1	3.1	3.1	6.3
	21.00	2	6.3	6.3	12.5
	23.00	3	9.4	9.4	21.9
	24.00	3	9.4	9.4	31.3
	25.00	4	12.5	12.5	43.8
	26.00	6	18.8	18.8	62.5
	27.00	2	6.3	6.3	68.8
	28.00	2	6.3	6.3	75.0
	29.00	3	9.4	9.4	84.4
	31.00	2	6.3	6.3	90.6
	32.00	1	3.1	3.1	93.8
	33.00	1	3.1	3.1	96.9
	34.00	1	3.1	3.1	100.0
	Total	32	100.0	100.0	

Pre-Hgt (cm)					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	170.00	3	9.4	9.4	9.4
	172.00	1	3.1	3.1	12.5
	175.00	4	12.5	12.5	25.0
	175.50	2	6.3	6.3	31.3
	177.00	4	12.5	12.5	43.8
	178.00	1	3.1	3.1	46.9
	179.00	1	3.1	3.1	50.0
	180.00	6	18.8	18.8	68.8
	182.00	3	9.4	9.4	78.1
	183.00	2	6.3	6.3	84.4
	185.00	1	3.1	3.1	87.5
	186.00	1	3.1	3.1	90.6
	187.50	1	3.1	3.1	93.8
	188.00	1	3.1	3.1	96.9
	192.00	1	3.1	3.1	100.0
	Total	32	100.0	100.0	

Pre-Wgt (kg)					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	64.50	1	3.1	3.1	3.1
	69.00	1	3.1	3.1	6.3
	70.40	1	3.1	3.1	9.4
	75.00	2	6.3	6.3	15.6
	78.00	4	12.5	12.5	28.1
	78.90	1	3.1	3.1	31.3
	79.00	2	6.3	6.3	37.5
	80.00	3	9.4	9.4	46.9
	81.40	1	3.1	3.1	50.0
	82.00	1	3.1	3.1	53.1
	83.00	2	6.3	6.3	59.4
	84.00	3	9.4	9.4	68.8

86.00	3	9.4	9.4	78.1
87.00	2	6.3	6.3	84.4
87.10	1	3.1	3.1	87.5
89.00	1	3.1	3.1	90.6
90.00	1	3.1	3.1	93.8
91.00	1	3.1	3.1	96.9
110.00	1	3.1	3.1	100.0
Total	32	100.0	100.0	

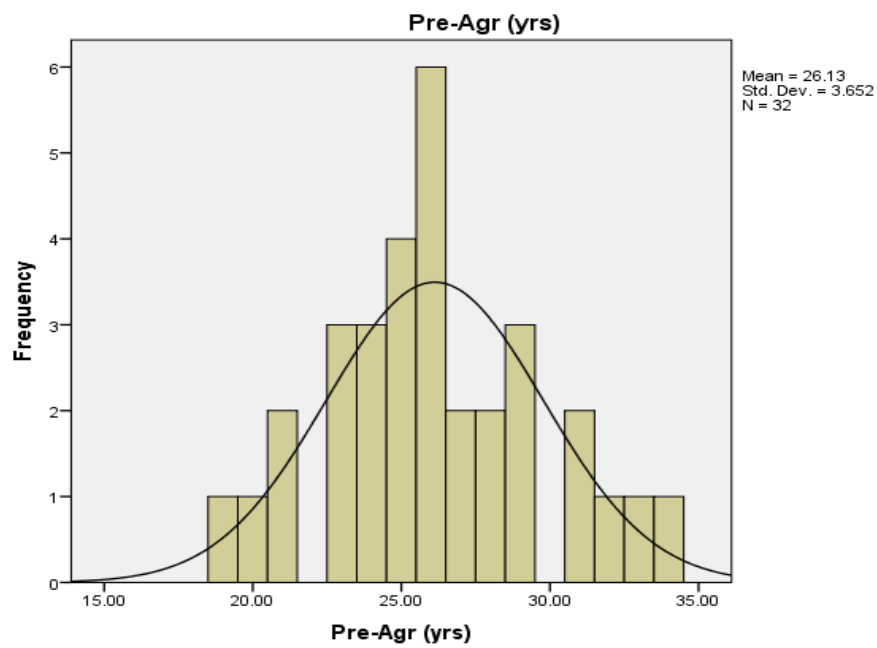
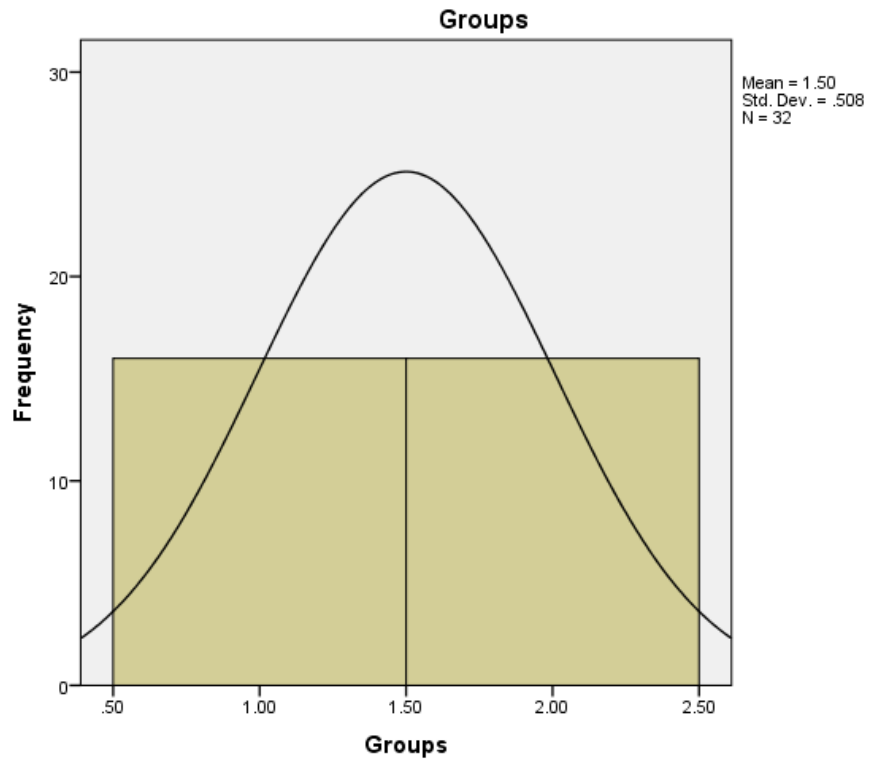
		Pre-BF %			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	7.80	1	3.1	3.1	3.1
	8.50	1	3.1	3.1	6.3
	9.10	1	3.1	3.1	9.4
	9.40	1	3.1	3.1	12.5
	9.90	1	3.1	3.1	15.6
	10.50	1	3.1	3.1	18.8
	10.70	2	6.3	6.3	25.0
	10.90	1	3.1	3.1	28.1
	11.00	1	3.1	3.1	31.3
	11.30	1	3.1	3.1	34.4
	11.70	2	6.3	6.3	40.6
	11.80	1	3.1	3.1	43.8
	12.00	1	3.1	3.1	46.9
	12.20	1	3.1	3.1	50.0
	12.50	1	3.1	3.1	53.1
	12.90	2	6.3	6.3	59.4
	13.20	2	6.3	6.3	65.6
	13.40	1	3.1	3.1	68.8
	13.70	1	3.1	3.1	71.9
	13.80	1	3.1	3.1	75.0
	14.50	1	3.1	3.1	78.1
	14.60	2	6.3	6.3	84.4
	15.00	1	3.1	3.1	87.5
	15.20	1	3.1	3.1	90.6
	15.60	1	3.1	3.1	93.8

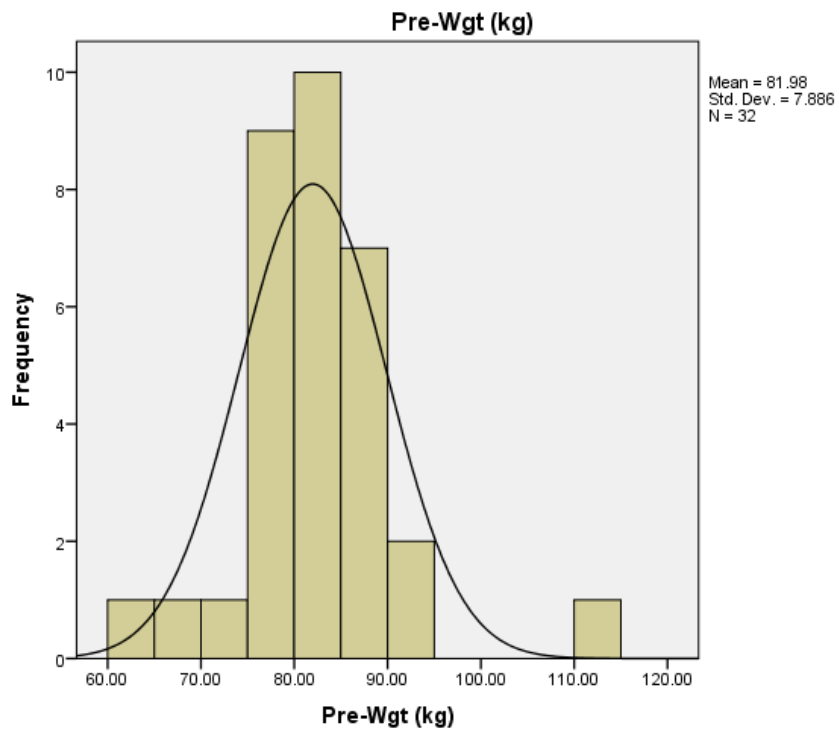
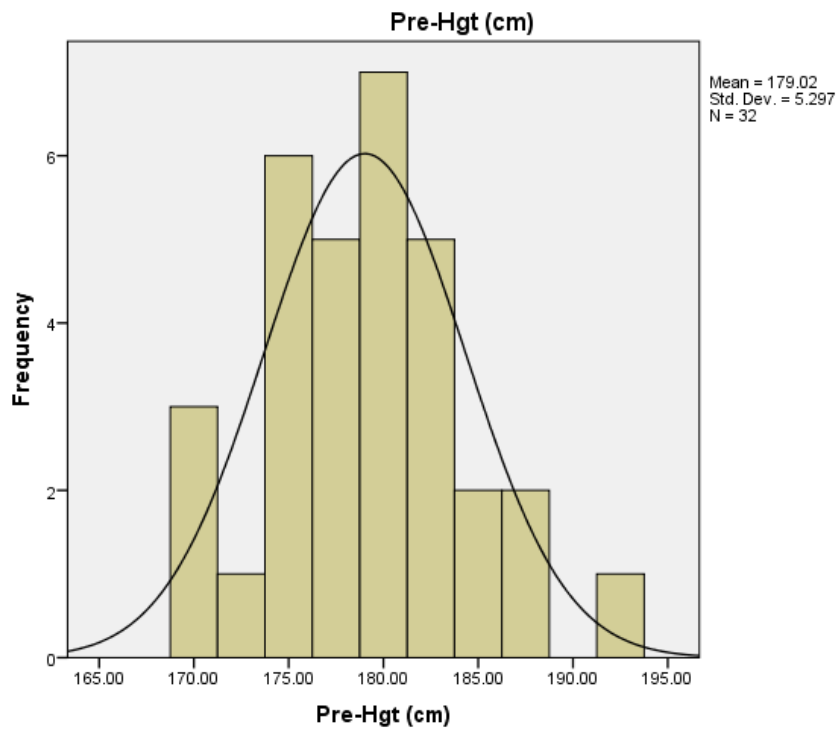
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Total	32	100.0	100.0	

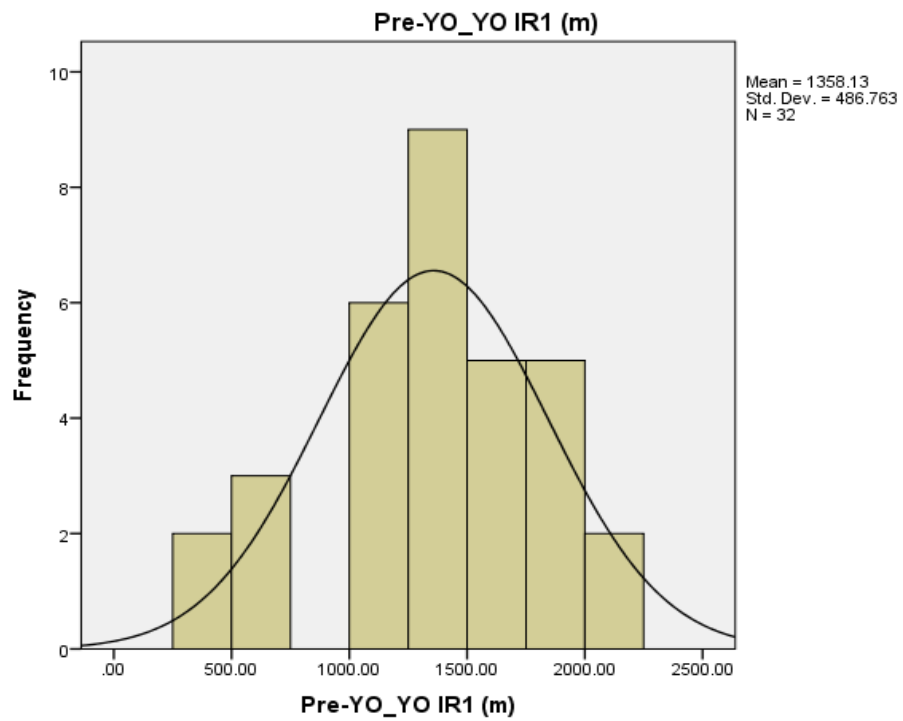
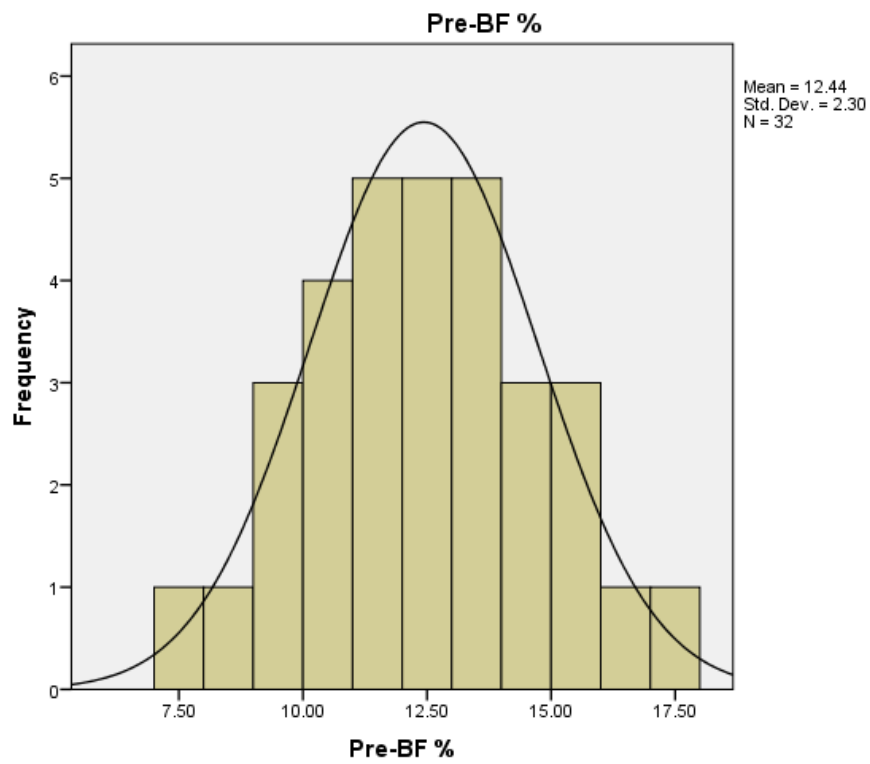
Pre-YO_YO IR1 (m)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	320.00	1	3.1	3.1	3.1
	400.00	1	3.1	3.1	6.3
	520.00	1	3.1	3.1	9.4
	600.00	1	3.1	3.1	12.5
	640.00	1	3.1	3.1	15.6
	1000.00	2	6.3	6.3	21.9
	1120.00	1	3.1	3.1	25.0
	1160.00	1	3.1	3.1	28.1
	1220.00	1	3.1	3.1	31.3
	1240.00	1	3.1	3.1	34.4
	1280.00	2	6.3	6.3	40.6
	1320.00	1	3.1	3.1	43.8
	1360.00	2	6.3	6.3	50.0
	1380.00	1	3.1	3.1	53.1
	1400.00	2	6.3	6.3	59.4
	1440.00	1	3.1	3.1	62.5
	1560.00	2	6.3	6.3	68.8
	1720.00	2	6.3	6.3	75.0
	1740.00	1	3.1	3.1	78.1
	1800.00	1	3.1	3.1	81.3
	1880.00	1	3.1	3.1	84.4
	1920.00	3	9.4	9.4	93.8
	2040.00	1	3.1	3.1	96.9
	2240.00	1	3.1	3.1	100.0
	Total	32	100.0	100.0	

Histogram







4.2 Test of Normality

Tests of Normality							
	Kolmogorov-Smirnov ^a			Shapiro-Wilk			
	Statistic	df	Sig.	Statistic	df	Sig.	
Pre-wgt (kg)	0.151	32	0.062	0.904	32	0.008	
Post-wgt (kg)	0.103	32	.200*	0.970	32	0.512	
Pre-BF %	0.065	32	.200*	0.932	32	0.996	
Post-BF%	0.081	32	.200*	0.985	32	0.932	
Pre-1 km TT (sec)	0.184	32	0.007	0.931	32	0.042	
Post-1 km TT (sec)	0.146	32	0.081	0.945	32	0.102	
Pre-MAS (m/s)	0.130	32	0.186	0.957	32	0.227	
Post-MAS (m/s)	0.115	32	.200*	0.967	32	0.416	
Pre-YO_YO IR1(m)	0.107	32	.200*	0.958	32	0.244	
Post-YO_YO IR1(m)	0.140	32	0.115	0.941	32	0.080	
Pre-Vo2 max (ml/kg/min)	0.107	32	.200*	0.958	32	0.245	
Post- Vo2 max (ml/kg/min)	0.140	32	0.115	0.941	32	0.080	
Pre-Acc 10m (s)	0.110	32	.200*	0.966	32	0.407	
Post_Acc_10m (s)	0.078	32	.200*	0.979	32	0.777	
Pre-RSA Total (s)	0.190	32	0.005	0.904	32	0.008	
Post-RSA Total (s)	0.103	32	.200*	0.965	32	0.376	
Pre-RSA_Avg (s)	0.187	32	0.006	0.904	32	0.008	
Post-RSA_Avg (s)	0.151	32	0.062	0.917	32	0.017	
Pre-FI %	0.095	32	.200*	0.956	32	0.216	
Post_Fatigue_Index (%)	0.189	32	0.005	0.840	32	0.000	

. *. This is a lower bound of the true significance.

4.3 Two-Way ANOVA test

Measure:

Within-Subjects Factors

Time
1
2

Between-Subjects Factors

Groups

Descriptive Statistics

Groups
Pre-F I %
Post_Fatigue_Index (%)

Multivariate Tests^a

Effect

Time

Time * Groups

a. Design: Intercept + Groups
Within Subjects Design: Time

b. Exact statistic

Mauchly's Test of Sphericity^a

Measure:

Within Subjects Effect

Time

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

a. Design: Intercept + Groups
Within Subjects Design: Time

b. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

Tests of Within-Subjects Effects

Measure:

Source
Time
Time * Groups
Error(Time)

Tests of Within-Subjects Contrasts

Measure:

Source
Time
Time * Groups
Error(Time)

Tests of Between-Subjects Effects

Measure:
Transformed Variable:

Source
Intercept
Groups
Error

Estimated Marginal Means

1. Grand Mean

Measure:
Mean
4.136

2. Groups * Time

Measure:
Groups
SSG
HIIR

3. Groups

Estimates

Measure:

Groups
SSG
HIIR

Pairwise Comparisons

Measure:

(I) Groups
SSG
HIIR

Based on estimated marginal means
a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Univariate Tests

Measure:

Contrast

Error

The F tests the effect of Groups. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.

4. Time

Estimates

Measure:

Time

1

2

Pairwise Comparisons

Measure:

(I) Time

1

2

Based on estimated marginal means

a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

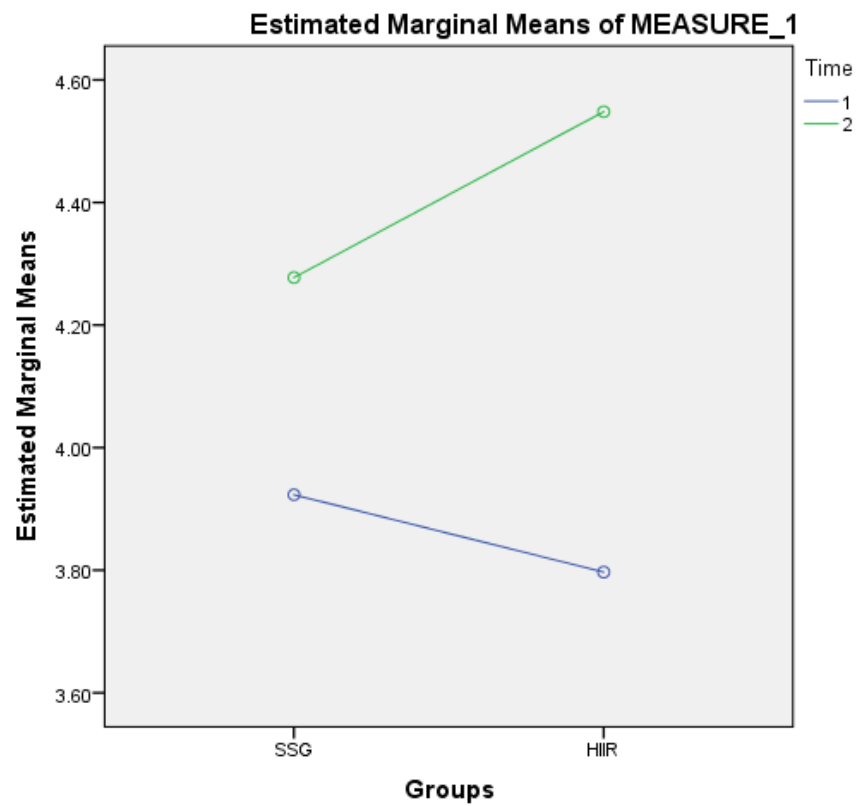
Multivariate Tests

Pillai's trace
Wilks' lambda
Hotelling's trace
Roy's largest root

Each F tests the multivariate effect of Time. These tests are based on the linearly independent pairwise comparisons among the estimated marginal means.

a. Exact statistic

Profile Plots



Measure: MEASURE_1

Time	Dependent Variable
1	Acc_10m
2	Post_Acc_10m

Between-Subjects Factors

Groups	Value Label	N
1.00	SSG	16
2.00	HIIR	16

Descriptive Statistics

Groups		Mean	Std. Deviation	N
Pre-Acc 10m (s)	SSG	2.2100	0.16358	16
	HIIR	2.2213	0.14156	16
	Total	2.2156	0.15059	32
Post_Acc_10m (s)	SSG	2.1781	0.13383	16
	HIIR	2.1806	0.09490	16
	Total	2.1794	0.11413	32

Multivariate Tests^a

Effect		Value	F	Hypothesis df	Error df	Sig.
Time	Pillai's Trace	0.137	4.758 ^b	1.000	30.000	0.037
	Wilks' Lambda	0.863	4.758 ^b	1.000	30.000	0.037

Time * Groups	Hotelling's Trace	0.159	4.758 ^b	1.000	30.000	0.037
	Roy's Largest Root	0.159	4.758 ^b	1.000	30.000	0.037
	Pillai's Trace	0.002	.069 ^b	1.000	30.000	0.794
	Wilks' Lambda	0.998	.069 ^b	1.000	30.000	0.794
	Hotelling's Trace	0.002	.069 ^b	1.000	30.000	0.794
	Roy's Largest Root	0.002	.069 ^b	1.000	30.000	0.794

a. Design: Intercept + Groups
Within Subjects Design: Time

b. Exact statistic

Mauchly's Test of Sphericity^a

Measure: MEASURE_1

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon ^b		
					Greenhouse-Geisser	Huynh-Feldt	Lower-bound
Time	1.000	0.000	0		1.000	1.000	1.000

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

a. Design: Intercept + Groups
Within Subjects Design: Time

b. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
Time	Sphericity Assumed	0.021	1	0.021	4.758	0.037
	Greenhouse-Geisser	0.021	1.000	0.021	4.758	0.037
	Huynh-Feldt	0.021	1.000	0.021	4.758	0.037
	Lower-bound	0.021	1.000	0.021	4.758	0.037
Time * Groups	Sphericity Assumed	0.000	1	0.000	0.069	0.794
	Greenhouse-Geisser	0.000	1.000	0.000	0.069	0.794
	Huynh-Feldt	0.000	1.000	0.000	0.069	0.794
	Lower-bound	0.000	1.000	0.000	0.069	0.794
Error(Time)	Sphericity Assumed	0.133	30	0.004		
	Greenhouse-Geisser	0.133	30.000	0.004		
	Huynh-Feldt	0.133	30.000	0.004		
	Lower-bound	0.133	30.000	0.004		

Tests of Within-Subjects Contrasts

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
Time	Linear	0.021	1	0.021	4.758	0.037
Time * Groups	Linear	0.000	1	0.000	0.069	0.794
Error(Time)	Linear	0.133	30	0.004		

Tests of Between-Subjects Effects

Measure: MEASURE_1
Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	309.056	1	309.056	9527.567	0.000
Groups	0.001	1	0.001	0.023	0.880
Error	0.973	30	0.032		

Estimated Marginal Means

1. Grand Mean

Measure: MEASURE_1

Mean	Std. Error	95% Confidence Interval	
		Lower Bound	Upper Bound
2.198	0.023	2.152	2.243

2. Groups * Time

Measure: MEASURE_1

Groups		Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
SSG	1	2.210	0.038	2.132	2.288
	2	2.178	0.029	2.119	2.237
HIIR	1	2.221	0.038	2.143	2.299
	2	2.181	0.029	2.121	2.240

3. Groups

Estimates

Measure: MEASURE_1

Groups	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
SSG	2.194	0.032	2.129	2.259
HIIR	2.201	0.032	2.136	2.266

Pairwise Comparisons

Measure: MEASURE_1

(I) Groups		Mean Difference (I-J)	Std. Error	Sig. ^a	95% Confidence Interval for Difference ^a	
					Lower Bound	Upper Bound
SSG	HIIR	-0.007	0.045	0.880	-0.099	0.085
HIIR	SSG	0.007	0.045	0.880	-0.085	0.099

Based on estimated marginal means

a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Univariate Tests

Measure: MEASURE_1

	Sum of Squares	df	Mean Square	F	Sig.
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Contrast	0.000	1	0.000	0.023	0.880
Error	0.487	30	0.016		

The F tests the effect of Groups. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.

4. Time

Estimates

Measure:

MEASURE_1

Time	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
1	2.216	0.027	2.160	2.271
2	2.179	0.021	2.137	2.221

Pairwise Comparisons

Measure:

MEASURE_1

(I) Time		Mean Difference (I-J)	Std. Error	Sig. ^b	95% Confidence Interval for Difference ^b	
					Lower Bound	Upper Bound
1	2	.036*	0.017	0.037	0.002	0.070
2	1	-.036*	0.017	0.037	-0.070	-0.002

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Multivariate Tests

	Value	F	Hypothesis df	Error df	Sig.
Pillai's trace	0.137	4.758 ^a	1.000	30.000	0.037
Wilks' lambda	0.863	4.758 ^a	1.000	30.000	0.037
Hotelling's trace	0.159	4.758 ^a	1.000	30.000	0.037
Roy's largest root	0.159	4.758 ^a	1.000	30.000	0.037

Each F tests the multivariate effect of Time. These tests are based on the linearly independent pairwise comparisons among the estimated marginal means.

a. Exact statistic

Profile Plots

