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Title: Seasonal changes in soccer players' body composition and dietary intake practices

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ABSTRACT

The aims of this study were two-fold: to determine seasonal changes in dietary intake and body composition in elite soccer players and to evaluate the influence of self-determined individual body composition goals on dietary intake and body composition. This longitudinal, observational study assessed body composition (total mass, fat-free soft tissue mass and fat mass) using dual-energy x-ray absorptiometry and dietary intake (energy and macronutrients) via multiple pass 24-hour recalls, at four time points over a competitive season in elite soccer players from one professional club in the Australian A-League competition. Self-reported body composition goals were also recorded. Eighteen elite male soccer players took part (25 ± 5 years, 180.5 ± 7.4 cm, 75.6 ± 6.5 kg). Majority (≥67%) reported the goal to maintain weight. Fat-free soft tissue mass increased from the start of preseason (55278 ± 5475 g) to the start of competitive season (56784 ± 5168 g; $p<0.001$) and these gains were maintained until the end of the season. Fat mass decreased over the preseason period (10072 ± 2493 g to 8712 ± 1432 g; $p<0.001$), but increased during the latter part of the competitive season. Dietary intake practices on training days were consistent over time and low compared to sport nutrition recommendations. The self-reported body composition goals did not strongly influence dietary intake practices or changes in body composition. This study has demonstrated that body composition changes over the course of a soccer season are subtle in elite soccer players despite relatively low self-reported intakes of energy and carbohydrate.

Keywords: nutrition, sport, athlete, dual-energy x-ray absorptiometry, body composition, soccer

INTRODUCTION

Serial measurements of body composition and dietary intake are important to evaluate athletic status, contribute to training and nutrition program design, and monitor athlete progression [4,5,10,24]. Soccer (football) is a popular, high-intensity, intermittent field-based team sport where low body mass, as a result of low body fat, is beneficial to performance [8,11,24]. Whole body dual-energy x-ray absorptiometry (DXA) scans are becoming increasingly popular and accessible to assess small changes in body composition that may occur over time [4,9]. Seasonal changes in body composition as assessed via DXA have been reported in a cohort of English Premier League soccer players [12]. Specifically, fat mass reduced during preseason training period, but increased towards the end of the competitive season. Meanwhile, lean mass decreased towards the end of the competitive season. However, no studies have reported body composition of soccer players from Australia with the use of DXA technology over a competitive season.

Elite athletes can feel substantial pressure to conform to body composition ideals and decisions to alter body composition can be dictated by 'accepted' physique ranges [6]. Athletes, who are forced, encouraged or feel they need to meet unrealistic body weight and fat mass targets can resort to extreme and inappropriate diets [6]. Consequently, performance is possibly negatively influenced much more than the purported undesirable effect of the initial body weight or fat mass. As such, body composition goals need to be individualised and based on a comprehensive assessment including, but not limited to sport, playing position, past experience and competition timing [3]. Considering this, individualised body composition goals, in combination with body composition assessments, are essential to designing and monitoring nutrition interventions.

Sport nutrition recommendations guide dietary intake practices of soccer players [13,14,15]. Energy, macronutrient, and fluid requirements vary according to specific training and competition demands, stage of competitive season, body composition goals (i.e. gain or lose weight), playing position, genetic differences as well as environmental factors such as temperature and humidity [14,30]. Recently, dietary intake practices of elite and sub-elite soccer players in Australia were reported as being suboptimal when compared to recommendations and international reports [1]. However, these authors noted that only a small number of players completed food records appropriately, with 15 of the 29 (52%) elite soccer players returning adequate food records. Furthermore, the authors were only able to report dietary intake relative to body weight for 10 of the 72 (14%) soccer players recruited. Consequently, these findings might not be representative of soccer players in Australia due to reporting bias. Further systematic data are necessary to determine the dietary intake practices of elite soccer players in Australia compared to recommendations and in combination with individual body composition goals to elucidate if suboptimal dietary intake practices are purposeful.

Therefore, the aim of the current study was to assess and report on the dietary intake practices and body composition of Australian soccer players over a competitive season, whilst taking into consideration players self-reported body composition goals.

METHODS

Experimental Approach to the Problem

This longitudinal, observational study assessed body composition (DXA), dietary intake (multiple pass 24-hour dietary recall) and self-reported body composition goals of elite soccer players in Australia over a competitive season. Participants attended testing sessions on four occasions over the 2014/2015 competitive season (Table 1). All data were collected in a single session at each time point and all visits took place in the same laboratory, using the same equipment and performed by the same trained technician.

TABLE 1 PLACED HERE.

Subjects

Eighteen elite male soccer players (25 ± 5 years, 180.5 ± 7.4 cm, 75.6 ± 6.5 kg) were recruited from one A-League soccer club competing in the Australian competition, run by the Football Federation Australia. Each participant was provided with verbal and written communication of the scope and risks of the study prior to signing an approved consent form. The study was approved by La Trobe University Human Research Ethics Committee.

Methods and Procedures

At each time point, participants were asked to report their individual self-reported body composition goals from three options; 'aim to gain weight/muscle mass', 'aim to lose weight/fat mass', or 'aim to maintain current weight'. Body mass was measured to the nearest 0.1 kg using digital scales (WM203; Wedderburn, Willawong, QLD, Australia). Stretch stature measured according to ISAK protocol [20] by an ISAK accredited technician using a wall-mounted stadiometer (SE206; SECA, Seven Hills, NSW, Australia) was recorded to the nearest 0.1 cm.

Body composition was measured from a whole-body scan using a fan beam densitometer (Discovery W; Hologic, US). Analysis was performed using QDR for Windows to quantify fat mass (FM; total adipose tissue), bone mineral content (BMC; bone tissue) and lean mass (LM; fat-free soft tissue mass). Consistent with previous research in athletic cohorts, the term 'lean mass' will be exchanged with 'fat-free soft tissue mass' (FFSTM) as it provides a more appropriate description of the measurement obtained [4,23].

Procedures were standardised according to recommendations of the Australian and New Zealand Bone and Mineral Society and best practice protocol for DXA measurements in athletes [2,23]. Before testing, the DXA instrument was calibrated according to the manufacturer guidelines. All scans were analysed automatically by the software and confirmed by the same technician.

Participants presented to the laboratory after an overnight fast and rested (no exercise on morning of measurements) prior to 10:30 am. Participants were instructed to wear minimal clothing and all jewellery and metal objects were removed. A mid-stream urine sample soon after waking on the morning of each measurement was collected to assess and control for hydration. The urine specific gravity (USG) was measured using a digital refractometer (UG-1; ATAGO co. Ltd., Tokyo, Japan). No differences in USG was detected over time (Start of preseason 1.016 ± 0.008; Start of season 1.017 ± 0.007; Mid-season 1.018 ± 0.007; End of season 1.020 ± 0.006; $F_{(3,12)} = 0.788$, $p = 0.212$). Prior to each scan participants were asked to void their bladder.

Based on the immediate repositioning of 31 active adults prior to conducting this research, the technical errors of measurement are approximately TM (g) = 0.3%, BMC (g) = 0.7%, FFSTM (g) = 0.5% and FM (g) = 0.7%, expressed as coefficients of variation for the DXA machine used in this study.

Reported dietary intake was obtained via multiple-pass 24-hour dietary recalls at each time point (Table 1). This involved three passes through the 24-hour recall, providing participants with additional memory cues, thus increasing accuracy. Details have been described previously [16,17]. Multiple 24-hour recalls have been reported to be a valid measure of energy intake in young children [16]; however, men have been found to under-report dietary intake via this method [17]. Common household measures (e.g. cups, tablespoons) were used to quantify portion sizes. Recipes and information regarding any food or drink items provided by the club was obtained from the club caterer. The 24-hour period was a scheduled training/practice day for all participants at all time points.

Dietary intake data were subsequently entered into Foodworks© Software (Xyris, Brisbane, QLD) to estimate nutrient intake composition. This was performed by the same dietitian who conducted all 24-hour recalls to ensure consistency, reduce possible error and variability in interpretation, coding and entering of all data. All food and beverages were analysed, including protein powders, liquid meal supplements and sports drinks. For sports foods not listed in databases, nutrient composition was obtained from the product label. Vitamin and mineral supplements were excluded from analysis. Average energy and macronutrient intakes (carbohydrate, protein, fat) for all participants were obtained. Throughout the multiple pass 24-hour recall process, qualitative information was obtained and documented regarding participants food choice preferences, food availability and food preparation.

Statistical analysis

All statistical analysis was conducted on IBM SPSS Statistics for Windows, Version 22.0 (IBM Corp, Armonk, New York, USA, 2013) with significance set at $p \leq 0.05$. All variables were tested for normality using the Kolmogorov-Smirnov statistic and visual assessment of histogram and appropriate statistical tests were subsequently conducted. Data with a Kolmogorov-Smirnov statistic p value of less than 0.05 suggests violation of the assumption of normality and thus median and range are presented [25]. Otherwise, data are presented as percentages, means and standard deviations. Participants were categorised at each time point into subgroups based on self-reported body composition goals (gain weight, maintain weight and lose weight) for analysis.

Changes over time in body composition (TM, FFSTM, FM, %BF, BMC) and mean total energy and macronutrient (carbohydrate, protein, fat) intake were assessed via one way repeated measures ANOVA for all players (n = 18), with pairwise comparisons and Bonferroni adjustment when statistically significant differences were detected.

Differences in body composition (TM, FFSTM, FM, %BF, BMC) and mean total energy and macronutrient (carbohydrate, protein, fat) intake between self-reported body composition goal groups at each separate time point were determined via one-way between groups analysis of variance (ANOVA), with Tukey post-hoc comparisons conducted when statistical differences were detected.

The changes in body composition (percentage change in TM, FFSTM and FM) were calculated for each individual player between time points over the season. Comparisons were made between preseason to start of the season, preseason to end of season, start of season to mid-season, start of season to end of season and mid-season to end of season. Median and range of the percentage change in body composition variables are presented for all players and according to self-reported body composition goal group, which were based on the body composition goal reported at the start of preseason. A Kruskal Wallis Test was performed to detect differences in the percentage change in body composition between the self-reported body composition goal groups. Follow up Mann Whitney U tests were conducted when statistical significance was detected with Bonferroni adjustment applied to alpha values.

RESULTS

Eighteen elite male soccer players completed all of the study requirements. The median duration of experience at the elite level was 5 years (range: 2 to 19 years).

Participants self-reported body composition goals and the number of players (%) aiming to gain weight, maintain current weight, or lose weight are presented in Table 2. The majority of players reported the aim to maintain current weight at all time points (≥67%) and no players reported the aim to gain weight.

TABLE 2 PLACED HERE

Results obtained from whole body DXA analysis (TM, FFSTM, FM, %BF, BMC) are presented in Table 3 for all players and according to self-reported body composition goal groups. The FFSTM of all players increased during the preseason period and these gains were maintained until the end of the competitive season ($p < 0.001$). Conversely, FM of all players decreased over the preseason period ($p < 0.001$) and changes were maintained until mid-season time point. By the end of the competitive season, FM returned to start of preseason values with no significant difference in FM between preseason and end of season ($p = 0.761$).

TABLE 3 PLACED HERE

Table 4 outlines reported mean energy and macronutrient intakes over the competitive season for all players and according to self-reported body composition goal groups. Reported dietary intake was consistent over time ($p > 0.05$). The self-reported body composition goals did not influence reported dietary intake except players aiming to lose weight at the start of the season consumed significantly more fat (total, $g \cdot kg^{-1} \cdot day^{-1}$ and %TEI) than players reporting the aim to maintain weight.

TABLE 4 PLACED HERE

Throughout the dietary recall, qualitative comments regarding food choice preferences, food availability and other comments were recorded. Over half of the elite soccer (10 of 18 participants; 56%) players noted dissatisfaction with the foods provided; 'lack of choice', 'bland tasting' and 'minimal variation' were commonly reported comments throughout the season.

Table 5 presents percentage change in whole body TM, FM and FFSTM for all players and according to self-reported body composition goal groups. Players reporting the aim to lose weight ($n = 6$) lost significantly more FM than players reporting the aim to maintain weight from preseason to end of season. No other differences in the percentage change in body composition variables were detected between the self-reported weight goal groups.

TABLE 5 PLACED HERE

DISCUSSION

The main findings of this study were: 1) body composition of elite soccer players changed throughout the competitive season, 2) dietary intake practices were low compared to recommendations, 3) majority of elite soccer players reported the goal to maintain weight and these goals remained fairly consistent over time, and 4) dietary intake practices and body composition changes were not largely influenced by body composition goals in this cohort.

The body composition (FM and FFSTM) of elite soccer players changed throughout the competitive season. Specifically, FM decreased from the start of preseason to the start of the competitive season. By the end of the competitive season, FM returned to start of preseason values. FFSTM significantly increased from start of preseason until the start of the season and these changes were maintained over the entire competitive season.

Decreases in FM and increases in FFSTM are considered beneficial changes for soccer players. Lower FM reduces a player's energy demands during training and competition and higher FM is detrimental to speed [8,24]. Many aspects of a soccer game, including pursuit for the ball or creating opportunities to score are reliant on speed [8,24]. Furthermore, FFSTM has been shown to be moderately correlated with vertical jump height, another important skill in soccer and a strong predictor of overall power [28]. Thus, the body composition changes described in this cohort from start of preseason and maintained until mid-season are likely to impact performance. However, these changes in FM were not maintained until the end of the season. These findings probably reflect a substantial skills focus in training. Maintaining the focus on body composition, in combination with skills, may assist in improving performance through the latter half of a competitive season. Importantly, the end of season DXA scans were conducted on the day following the last game of the season and therefore the increase in FM back to preseason values is not due to timing of the scans.

No previous reports of Australian soccer players' body composition via DXA are available. Soccer players in the current study appeared to have similar fat mass during the season as English Premier League players, but lower levels of FFSTM [22]. Nevertheless, American collegiate soccer players have similar FFSTM and FM to the players in the current study [29]. Additional research assessing and monitoring the body composition of elite soccer players from Australia is required to develop normative values although the current study provides initial insight into the current body composition ranges of soccer players competing within the Australian competition.

Overall, dietary intake practices of the soccer players in this study appeared suboptimal compared to current recommendations [13,14,15]. Average energy intakes in the current study ranged between 9 and10 MJ, yet previous research in international cohorts report energy intakes between 11 and 16 MJ [14,21,27]. The low average energy intake in the current study at each time point over the season did not seem to result in any adverse effects to body composition such as loss of FFSTM. Of importance would be reported carbohydrate intake in relation to athletic performance although this was not measured in the current study.

During the 24-hour dietary recall interviews, the majority of participants commented that they disliked the food provided by the club for numerous reasons such as lack of variety (e.g., only one flavour of yoghurt available) and foods not in line with personal preferences (e.g., disliked the flavour of yoghurt provided or eggs provided for breakfast and player preferred cereal). This might explain the low reported total energy intakes of the players in the current study. By providing players with food, professional clubs attempt to assist players to meet nutritional requirements and highlight the importance of nutrition. However, without consulting players on personal preferences and usual dietary habits, as well as considering the range of taste preferences, cultural beliefs and dietary requirements that would exist amongst a group of elite soccer players, food service provision may not be advantageous. Furthermore, practical strategies to maintain appropriate intake such as provision of fluid-based recovery snacks might need to be incorporated into the food service provision and nutrition education to ensure dietary intake practices are close to optimal [14].

The reported carbohydrate intake of players in the current study (2-4 $g \cdot kg^{-1} \cdot day^{-1}$) were below the most recent IOC sport nutrition guidelines (approximately 6 - 10 $g \cdot kg^{-1} \cdot day^{-1}$ for the team-based sport athletes, or between 3 - 12 $g.kg.day^{-1}$ including low-intensity/skill based activities through to very high training loads) [7]. They were also lower than football (soccer) specific recommendations (5 - 7 $g \cdot kg^{-1} \cdot day^{-1}$ for low intensity sessions and 7 - 10 $g \cdot kg^{-1} \cdot day^{-1}$ for moderate to heavy training and pre-match loading) [13]. The reported intakes might be appropriate for light, skill-based activities, but suboptimal for heavy, endurance based sessions. Low carbohydrate intakes could be a result of catering choices and food palatability, or due to players intentionally restricting carbohydrate due to perceptions this may influence or help control and maintain appropriate body composition. More detailed assessment of the dietary intakes of elite soccer players in Australia, involving longer periods of data collection and specific details regarding timing of dietary intake in relation to training and competition is required in order to elucidate the reasoning for low reported carbohydrate intakes to address the issues and optimise dietary intakes.

While reported carbohydrate intakes were lower than recommendations, the reported protein intakes were at the upper limit or exceeded protein recommendations [18,26]. The protein intakes of players in the current study where consistent with previous reports in soccer players, ranging from approximately 1.2-2.3 $g \cdot kg^{-1} \cdot day^{-1}$ [1,14,21]. Protein consumed in excess is likely to be of limited benefit and at the cost of carbohydrate intake which has been shown to be important for running and the endurance nature of soccer [19].

The soccer players in the current study reported consistent dietary intake over time. This may be due to the 24-hour dietary recall method used. Variation in intake might not have been captured and longer period of dietary intake assessment may be required. Recent research assessing Australian Football players reported differences in dietary intake practices over a season when recording dietary intake practices over three days at each time point [3]. Additionally, consistent intake could be a result of stable environment and professional setting of the club as well as training day dietary intake information obtained at each time point. However, from the data available, it appears the increase in FM back to preseason values at the end of season is not likely due to dietary intake changes (based on training day dietary intake data obtained), but possibly a result of change in training focus in the latter half of the season.

The majority of the soccer players within this study reported the aim to maintain weight, with no players reporting to aim to gain weight. There was no difference in the body composition of the players according to their self-reported goals except at the start of preseason. Players reporting the aim to lose weight had significantly greater FM than those aiming to maintain weight indicating the broad body composition goals reported were likely realistic. Furthermore, the self-reported body composition goals did not largely influence reported dietary intake or changes in body composition detected. Of note, participants aiming to lose weight at the start of season did appear to lose more fat mass than those aiming to maintain weight over the competitive season. Minimal differences in dietary intake were detected between the self-reported body composition goal groups. To lose weight, players require a decrease in total energy intake, protein intakes as close as possible to recommendations to prevent loss of FFSTM. However, in the current study, at the start of the season, players reporting the aim to lose weight actually consumed more fat than players reporting the aim to maintain weight. This highlights players self-reportedly desire to change body composition yet may not have the nutrition support, knowledge or skills required to follow appropriate dietary practices to achieve such goals.

When interpreting the findings the following limitations need to be considered. The sample within this study may not be representative as is based on one elite soccer club in Australia. As this is the first published report in Australia for elite soccer players, this data set provides a reference for future work designing interventions to modify body composition or dietary intake to assist with performance. Obtaining more information regarding dietary intake would be of value. In particular, numerous multiple pass 24-hour recalls were the method a choice due to limited time and already high demands placed on the elite players. Although the multiple pass method provides many opportunities for participants to recall intake and assesses dietary intake at numerous time points, under-reporting is acknowledged as a limitation of this method. Consequently, this method of dietary assessment might have partially contributed to the low reported energy intake reported in this study. Additionally, even though all athletes were players from one elite club and the training patterns were consistent throughout the study, individual energy expenditures were not determined.

PRACTICAL APPLICATIONS

- Food service provision should take into consideration players' individual preferences to assist with improved dietary intake practices.
- Provide players with practical strategies to assist with managing appetites to ensure dietary intake is optimal for training and competition.
- Taking into consideration individual player's body composition goals is required in order to appropriately assess both body composition and dietary intake over time.

CONCLUSIONS

Body composition of soccer players changed over a competitive season, with a decrease in FM and increase in FFSTM during the preseason period, likely to be favourable for performance. However, by the end of the competitive season, FM values had returned to similar to preseason FM values. Although statistically significant, the changes in body composition detected were subtle. Reported dietary intake was low compared to recommendations yet consistent over time. Suboptimal dietary intake reported in this study may be a result of the food service provided to players on the day of each dietary recall and food service provision should ideally consider players personal preferences.

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Table 1. Data collection time points over a competitive season

Stage of season	**Month of visit**	**Days between visits**
Start of preseason (Pre)	June 2014	
Start of season (Start)	September 2014	96 ± 3 (Pre to Start)
Mid-season (Mid)	January 2015	135 ± 4 (Start to Mid)
End of season (End)	April 2015	104 ± 1 (Mid to End)

Days between visits recorded as (Mean ± SD)

Table 2. Self-reported body composition goals of elite male soccer athletes over a competitive season (number and percentage of athletes)

	Self-reported body composition goals		
	Gain weight	Maintain weight	Lose weight
Preseason (n = 18)	0 (0%)	12 (67%)	6 (33%)
Start of season (n = 18)	0 (0%)	12 (67%)	6 (33%)
Mid-season (n = 18)	0 (0%)	13 (72%)	5 (28%)
End of season (n = 18)	0 (0%)	15 (83%)	3 (17%)

Table 3. DXA whole body analysis for elite male soccer athletes over a competitive season (mean ± SD)

	TM (g)	FFSTM (g)	FM (g)	% BF	BMC (g)
Preseason					
All athletes (n = 18)	68536 ± 6615	55278 ± 5475 [a b c]	10072 ± 2493 [a b]	14.7 ± 3.0 [a b]	2707 ± 244
Maintain weight (n = 12)	66719 ± 6775	55225 ± 5704	8732 ± 1559	13.1 ± 1.8	2718 ± 247
Lose weight (n = 6)	72172 ± 4897	56474 ± 4334	12980 ± 1460^	18.0 ± 1.9^	2717 ± 205
Start of season					
All athletes (n = 18)	69233 ± 5698	56784 ± 5168	8712 ± 1432	12.8 ± 1.9	2717 ± 242
Maintain weight (n = 12)	67780 ± 4908	56849 ± 4457	8281 ± 9590	12.2 ± 1.4	2650 ± 227
Lose weight (n = 6)	72422 ± 5240	59114 ± 4710	10535 ± 1328	14.6 ± 1.8	2773 ± 266
Mid-season					
All athletes (n = 18)	69166 ± 6151	56761 ± 5480	8528 ± 1353	12.6 ± 1.9	2734 ± 239
Maintain weight (n = 13)	69506 ± 5541	58121 ± 5063	8683 ± 1326	12.6 ± 1.9	2756 ± 260
Lose weight (n = 5)	69590 ± 10827	57503 ± 9522	9221 ± 1838	13.3 ± 2.2	2867 ± 367
End of season					
All athletes (n = 18)	69609 ± 6617	56363 ± 5490	9504 ± 1647 [a b]	13.8 ± 2 [a b]	2749 ± 257
Maintain weight (n = 15)	69460 ± 5521	57130 ± 4984	9632 ± 1359	13.9 ± 1.9	2699 ± 253
Lose weight (n = 3)	73988 ± 6729	60047 ± 7090	10960 ± 1116	14.9 ± 2.5	2981 ± 413

Note: DXA = Dual-energy x-ray absorptiometry; TM = Total mass; FFSTM = Fat free soft tissue mass; FM = Fat mass; % BF = Percentage of body fat; BMC = Bone mineral content. Technical error of measurement: TM (g) = 0.3%, BMC (g) = 0.7%, FFSTM (g) = 0.5% and FM (g) = 0.7%. No soccer athletes reported the aim to gain weight. [a] significantly different to start of season [b] significant different from mid-season [c] significantly different from end of season ($p < 0.05$). ^ significantly different from athletes reporting aim to maintain weight ($p < 0.05$).

Table 4. Total energy and macronutrient intake (mean ± SD) of elite soccer athletes obtained via 24-hour recalls at different time points over a competitive football season for all athletes and according to self-reported body composition goals

	Energy	Protein			Carbohydrate			Fat		
	Total (MJ)	Total (g)	$g.kg^{-1}.day^{-1}$	%TEI	Total (g)	$g.kg^{-1}.day^{-1}$	%TEI	Total (g)	$g.kg^{-1}.day^{-1}$	%TEI
Preseason										
All athletes (n = 18)	9.2 ± 2.3	137 ± 40	1.9 ± 0.6	26 ± 4	210 ± 76	2.9 ± 1.3	38 ± 12	86 ± 35	1.1 ± 0.5	34 ± 12
Maintain weight (n = 12)	9.7 ± 2.7	139 ± 46	1.9 ± 0.7	25 ± 4	224 ± 88	3.2 ± 1.4	38 ± 15	91 ± 42	1.2 ± 0.6	34 ± 14
Lose weight (n = 6)	8.4 ± 0.8	133 ± 27	1.7 ± 0.3	27 ± 4	183 ± 33	2.4 ± 0.5	36 ± 5	78 ± 16	1.0 ± 0.2	35 ± 7
Start of season										
All athletes (n = 18)	9.4 ± 2.3	140 ± 35	1.9 ± 0.5	26 ± 6	220 ± 76	2.9 ± 1.1	38 ± 8	83 ± 31	1.1 ± 0.4	33 ± 9
Maintain weight (n = 12)	8.8 ± 1.1	144 ± 29	2.0 ± 0.5	28 ± 7	223 ± 56	3.0 ± 0.8	41 ± 6	65 ± 16	0.9 ± 0.2	28 ± 7
Lose weight (n = 6)	9.6 ± 3.0	131 ± 46	1.6 ± 0.6	23 ± 5	200 ± 92	2.5 ± 1.1	33 ± 7	101 ± 25*	1.3 ± 0.3*	40 ± 6*
Mid-season										
All athletes (n = 18)	9.6 ± 2.3	149 ± 40	2.0 ± 0.5	27 ± 8	222 ± 87	2.9 ± 1.1	40 ± 16	84 ± 34	1.1 ± 0.5	32 ± 11
Maintain weight (n = 13)	9.3 ± 2.2	151 ± 33	2.0 ± 0.5	29 ± 9	221 ± 101	2.9 ± 1.4	43 ± 21	75 ± 30	1.0 ± 0.4	30 ± 11
Lose weight (n = 5)	10.6 ± 2.5	147 ± 53	1.9 ± 0.6	24 ± 8	239 ± 84	3.1 ± 0.7	37 ± 5	105 ± 24	1.4 ± 0.4	37 ± 8
End of season										
All athletes (n = 18)	9.7 ± 2.1	157 ± 51	2.1 ± 0.7	29 ± 14	213 ± 107	2.8 ± 1.4	35 ± 13	86 ± 31	1.2 ± 0.5	33 ± 11
Maintain weight (n = 15)	10.2 ± 2.2	159 ± 54	2.1 ± 0.7	28 ± 16	232 ± 122	3.1 ± 1.5	36 ± 14	88 ± 34	1.2 ± 0.5	32 ± 12
Lose weight (n = 3)	8.5 ± 1.6	148 ± 55	1.9 ± 0.7	29 ± 8	150 ± 46	1.9 ± 0.5	30 ± 9	88 ± 20	1.1 ± 0.3	39 ± 7

Note: %TEI = Percentage of total energy intake.
No statistically significant differences in dietary intake variables over time based on all athletes ($p > 0.05$).
*Statistically significant to athletes reporting the aim to maintain weight ($p < 0.05$)

Table 5. Percentage change in body composition over time according to self-reporting body composition goals (median and range)

	% change in TM Median (range)	**% change in FM** Median (range)	**% change in FFSTM** Median (range)
Preseason to Start of season			
All (n = 18)	0.5 (-3.9, 3.6)	-10.2 (-24.7, 4.1)	2.3 (0.9, 5.3)
Maintain weight (n = 12)	1.1 (-2.0, 3.6)	-7.6 (-19.7, 4.1)	2.0 (0.9, 5.3)
Lose weight (n = 6)	-0.9 (-3.9, 1.7)	-21.2 (-24.7, -3.4)	2.8 (1.0, 4.2)
Preseason to End of season			
All (n = 18)	0.3 (-2.3, 6.0)	-6.4 (-22.2, 21.4)	2.1 (-1.1, 5.2)
Maintain weight (n = 12)	1.6 (-0.6, 6.0)	-2.2 (-15.4, 21.4)	2.8 (0.5, 4.2)
Lose weight (n = 6)	0.8 (-2.3, 1.1)	-13.7 (-22.2, -10.0)*	1.8 (-1.1, 5.2)
Start of season to End of season			
All (n = 18)	0.8 (-3.4, 4.6)	-0.4 (-29.4, 39.9)	1.4 (-4.8, 6.5)
Maintain weight (n = 12)	1.8 (-3.4, 4.6)	0.3 (-29.4, 39.9)	1.4 (-3.8, 5.5)
Lose weight (n = 6)	0.5 (-3.0, 4.2)	-2.2 (-17.6, 14.5)	1.3 (-4.8, 6.5)
Mid-season to End of season			
All (n = 18)	0.3 (-10.2, 24.4)	0.1 (-10.3, 24.4)	0.1 (-3.1, 4.1)
Maintain weight (n = 12)	0.3 (-10.2, 24.4)	0.2 (-10.2, 18.44)	0.1 (-3.1, 3.8)
Lose weight (n = 6)	-0.1 (-2.0, 4.1)	-0.1 (-10.3, 24.4)	0.0 (-3.0, 4.1)

*significantly different to maintain weight group (p < 0.05). Assessed via Kruskal-Wallis Test.