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Free-sugar, total-sugar, fibre and micronutrient intake within elite youth British soccer players: a nutritional transition from schoolboy to fulltime soccer player

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Shortened Title: Sugar intake in elite adolescent soccer

Abstract

It is recommended that soccer players consume a high carbohydrate (CHO) diet to augment performance. However, growing evidence suggests that there is a link between high free-sugar (FS) intake (>5% total energy intake; TEI) and metabolic diseases. Furthermore, foods that are often high in sugar, such as processed foods, are typically lacking in nutrient quality. We therefore analysed total- and FS, dietary fibre and micronutrient intake of players from an English Premier League academy under(U) 18 (n=13); U15/16 (n=25); U13/14 (n=21) using a 7-day food diary. Data was compared to current UK dietary reference value (DRV) for free-sugar via a t-test. The U13/14s (10±18 %) and U15/16s (11±30 %) both consumed higher amounts of free-sugar in comparison to the UK DRV of 5% TEI 5% (P<0.01), conversely, the U18s did not exceed the DRV (5±13 %). Furthermore, FS intake of the U18s was significantly lower than the U13/14s and U15/16s (P<0.01). Dietary fibre was below the DRV (25g/d for U13/14 & U15/16s; 30g/d for U18s) for all squads (19.0±4.7; 19.6±8.3; 17.1±4.2 g/d, respectively), but not different between squads. Additionally, micronutrient reference intakes were generally met. In conclusion, we provide novel data on dietary sugar, fibre and micronutrient intake within elite youth soccer players. We report an apparent 'nutritional transition' from schoolboy to fulltime soccer player, with U18s showing a significantly lower intake of sugar in comparison to younger squads, and a similar intake of FS to the UK DRVs. Practitioners should target improving player education around sugar and fibre consumption.

Keywords: Sugar, Micronutrient, Fibre, Soccer, Nutrition, Adolescent, UK

Introduction

Whilst the research into youth soccer has markedly rose over the last decade, relatively little is currently known about the nutritional intake and habits of elite British adolescent soccer players. To the author's knowledge, only three studies have been conducted within this area (Briggs et al., 2015; Naughton et al., 2016; Russell & Pennock, 2011), with these investigations mainly concentrating on energy and macronutrient intakes. Nutritional guidelines for soccer players, albeit in adults, encourage a diet high in carbohydrate (CHO) (6-10 g·kg·Body Mass $(BM)^{-1}\cdot day^{-1}$) (Burke et al., 2006); due to their ergogenic effect on both physical performance (Cermak & van Loon 2013; Hawley et al. 1994; Hespel et al. 2006) and the well documented improvements on soccer specific performance (Ali & Williams, 2009; Currell et al., 2009; Ostojic & Mazic, 2002; Russell et al., 2012). To support the apparent CHO demand before, during, and after training/match sessions, sugar based sports drinks are frequently consumed and recommended to soccer players in an attempt to help improve performance and recovery (Russell et al. 2014).

As a result of these CHO recommendations, particularly frequent intake of sugar based sports drinks, it is possible that youth soccer players are consuming high amounts of free-sugar (FS). High FS intake has been linked to adverse health effects particularly when consumed in excess. High FS intake (>5% Total Energy Intake [TEI]) has been associated with increased obesity (Siervo et al., 2014), hypertension (Siervo et al., 2014), metabolic diseases (Stanhope, 2016) and dental caries (Freeman, 2014). Therefore, the current UK guidelines have revised their recommendations for FS from 10% to 5% TEI (SACN, 2015). Within the general UK adolescent (11-18 years old) population, a FS intake of 15.4 ± 6.4% of TEI (Newens & Walton, 2016) has been reported, triple that of the new dietary reference value (DRV) (SACN

2015). Whilst it is clear that CHO intake has an ergogenic benefit on soccer performance, paradoxically youth players could be putting their health at risk if they over consume FS. Currently there is no data on the FS intake of elite youth British soccer players.

Another form of CHO which may be of interest is dietary fibre due to its associated health benefits and presence in foods of high nutrient value (Lairon et al. 2005; Montonen et al. 2003; Butcher et al. 2010). Current UK guidelines recommend a daily fibre intake of 25g/day for children (<16 years old), and 30g/day for adults (SACN 2015). However, within the general population fibre intake has been reported as much lower in both children (11-12 g/day) and adults (14 g/day) (SACN 2015). Only one study has assessed dietary fibre intake in British youth soccer players (Russell & Pennock, 2011), reporting an intake of 16 g/day in an U18s team. Currently, there is no data available in elite British soccer players ≤U16s.

Similar to FS and fibre, there is limited data concerning the micronutrient intake of youth British soccer players. Calcium and iron intakes, in particular, have been identified as important for adolescent athletes (Desbrow et al. 2014), due to their important role in skeletal development and oxygen transport. Only one previous study has assessed the micronutrient intake in British soccer players (Russell & Pennock, 2011), who reported that an U18 cohort of players met the Reference Nutrient Intakes (RNIs). Yet, as with fibre, there is no data for the micronutrient intake for British soccer players ≤U16s.

Therefore, the aims of the present study were twofold: 1) to quantify and compare daily FS, total sugar, dietary fibre and micronutrient intake amongst 3 different age groups (U13/14s, U15/16s and U18s) of elite youth soccer academy players, and 2) to compare against UK DRVs and reference nutrient intakes (RNIs). We hypothesise that due to the previously reported higher intake of CHOs in the U13/14 and U15/16s in comparison to the U18s (Naughton et al., 2016), the U18s will have a lower contribution of FS to TEI.

Methodology

Participants

Elite youth male soccer players were recruited from a local English Premier League (EPL) club's academy. Researchers provided a presentation and participant information sheets to players and their parents, from the U13-18s to invite them to participate in the study. Ninety-one players were initially recruited, however due to incomplete diary entry 32 were withdrawn, leaving a sample size of 59. Incomplete diary entry was classified as having more than 1 days intake missing or not having at least 3 main meals (breakfast, lunch and dinner) reported on a minimum of 6 days. This study was conducted according to the guidelines laid down in the Declaration of Helsinki. All participants gave written informed consent, for those participants under 18 years of age their parents gave written informed consent on their behalf. Ethical permission was obtained from the Liverpool John Moores University Ethics Committee.

Participants were categorised into the following squads; U18s (*n*=13), U15/16 (*n*=25) and U13/14 (*n*=21). The mean (±SD) body mass (determined by scale mass – Seca, Hamburg, Germany) and height (determined by stadiometry) were verified to the nearest 0.1 kg and cm respectively for all 3 squads and are displayed in Table 1 along with field and off field training frequency. Data collection occurred during the pre-season period of the 2014-15 season.

Dietary Intake

Participants were asked to record everything they consumed in a dietary diary for 7-consecutive days. Each participant was asked to provide as much detail as possible, including the type of day it was in respect to their soccer activity (rest, match, or training day), the commercial brand names of the food/drink, the cooking/preparation methods, and time of consumption. Additionally, each participant was requested to quantify the portion of the foods / fluids consumed using standardised household measures or, if possible, referring to the weight/volume provided on food packages, or by providing the number of items of a determined size. Upon the return of the dietary diary the primary researcher checked for any cases of missing data and, if necessary, asked participants to clarify. Total CHO and energy intakes are displayed in Table 2 as reported by Naughton *et al.* (Naughton et al., 2016). For a full overview of methodology please refer to Naughton *et al.* (Naughton et al., 2016).

Data Analysis

Food diary data was analysed using Nutritics software (version 3.74 professional edition, Nutritics Ltd., Co. Dublin, Ireland). All analyses where carried out by a single trained researcher so that potential variation of food diary data interpretation was minimised (Deakin, 2000). Any foodstuff that wasn't present within the software package, was manually added by the same researcher from the packaging information available. From this program's analysis comprehensive information on the intake of the different micronutrients was obtained. All data were initially assessed for normality of distribution according to the Shapiro-Wilk's test. Participant's FS and DF were compared to their age specific UK DRVs and UK RNIs for micronutrient intake. For micronutrient intake the RNI was chosen for comparison as it is considered that this level of intake is likely sufficient to meet the requirements of 97.5% of the population (Department of Health, 1991). To identify if players met their DRVs one-way sample *t-tests* were used. All analyses were completed using SPSS for Windows (version 21, SPSS Inc., Chicago, IL) where $P < 0.05$ is indicative of statistical significance. Statistical comparisons between squads were performed according to a one-way between-groups analysis of variance (ANOVA) or the Kruskal-Wallis test where data were not normally distributed. Where significant main effects of the ANOVA were present, Tukey post hoc analysis was conducted to locate specific differences. For non-normal data post hoc analysis was performed using multiple Mann-Whitney U tests with a Bonferroni adjustment. All data are presented as mean (± SD).

Results

Participant Characteristics

Participant characteristics are displayed in Table 1.

Sugar, dietary fibre and micronutrient differences between squads

A significant difference between squads was reported for absolute total-sugar intake (P = 0.01) and for percentage contribution of FS intake percentage contribution of TEI ($P < 0.01$). The U18s had a significantly lower intake in comparison to the U13/14s and U15/16s for both variables ($P < 0.01$) (Table 3). No significant difference was reported for dietary fibre intake ($P = 0.63$). For micronutrients, only phosphorus, zinc and vitamin B12 intakes were significantly different between squads ($P < 0.01$). Post-hoc analysis revealed that for zinc and vitamin B12 intake in the U18s was significantly higher than that of the U13/14s and U15/16s squads ($P < 0.05$). For phosphorus, the U18s intake was significantly higher than that of the U15/16s ($P < 0.01$) (Table 4).

Total- and free-sugar and fibre intake in comparison to the DRVs

U13 & U14s

A higher percentage contribution of FS TEI (10.0 ± 17.7%, $P < 0.01$) was observed in comparison to the DRVs, whilst total-sugar contribution total-sugar to TEI was 21 ± 5%. Dietary fibre intake was lower than that of the DRV ($P < 0.01$) (Table 3). The mean daily intakes of sodium, chloride, phosphorous, iron, B1, B2, B6, B12, Vitamin C and folic acid mean daily intakes were all higher than the current UK RNIs ($P < 0.01$). Additionally, magnesium, zinc and vitamin A intake were higher than the current RNIs ($P < 0.05$). Similarly, mean daily intakes of potassium and calcium were higher than the recommended RNIs but not statistically significant ($P > 0.05$) (Table 4).

U15 & U16s

A higher percentage contribution of FS TEI (11 ± 30 %, $P < 0.01$) in comparison to the DRV was observed, whilst total-sugar intake contribution to TEI was 21 ± 5%. Dietary fibre intake was lower than that of the DRV ($P < 0.01$) (Table 3). The mean daily intakes of iron, sodium, chloride, phosphorous, B2, B6, B12, folic acid and vitamin C intakes were all higher when compared to the RNIs ($P < 0.01$) as was B1 ($P = 0.01$). Although calcium and zinc intake were marginally above that of their respective RNIs, no significance was reported ($P > 0.05$). In contrast, potassium intake was lower ($P < 0.01$) than that of the RNIs. Both magnesium ($P = 0.90$) and vitamin A ($P = 0.96$) intakes were slightly below the RNI value (Table 4).

U18s

The percentage contribution of FS intake (5 ± 13%) was not different from the DRV, whilst total-sugar intake contribution to TEI was 14 ± 3%. Conversely, dietary fibre intake was found to be lower than that of the DRV ($P < 0.01$) (Table 3). The mean daily intakes of iron, sodium, chloride, phosphorus, zinc, B1, B2, B6, B12, folic acid, and vitamin C were all ($P < 0.01$) higher than RNIs. However, magnesium ($P = 0.28$), vitamin A ($P = 0.09$), potassium ($P = 0.64$) and calcium ($P = 0.19$) intakes were not significantly different from the RNIs (Table 4).

Discussion

We provide novel data on the dietary FS and total sugar intake within elite youth soccer players. Our data reports that U18s reported a similar intake of FS to the new UK DRVs whilst the U13/14s and U15/16s reported a significantly higher FS intake in comparison to the UK DRV (SACN, 2015). With respect to sugar, we see a ‘‘nutritional’’ transition from schoolboy to fulltime soccer player, with fulltime players consuming less total- and FS than the schoolboy squads. All squads’ dietary fibre intakes are significantly below that of the RNI; however, it would appear that all squads are generally meeting their micronutrient intakes.

One of the novel aspects of the present study was the observation that U18 players consumed less FS than their younger counterparts. Indeed, whereas the U13/14 and U15/16 squads consumed greater than the updated DRV for FS, the contribution of FS to TEI for the U18 players was equal to that of the RNI (i.e. 5%). Although the U18 players’ choices may be reflective of adopting a more professional attitude towards dietary choices, they may also be underpinned by the fact that these players are based full-time in the soccer academy, and hence much of their daily food intake is provided by the club’s catering staff. Indeed, such players receive breakfast, lunch and snacks whilst attending the academy for 5 days per week. These players are also subjected to nutritional educational material provided by the club sport science staff whilst the younger players are not yet subjected to such frequent educational exposures. It is noteworthy, however, that all squads (regardless of age) report lower FS daily mean values compared to the British adolescent population (15 ± 6%) (Newens & Walton, 2016). This is an interesting finding as although the cohort within the current study are elite soccer players there are no clear additional social or economic factors which separate them from the general population. It could be speculated therefore that the mere exposure to a professional sport environment steers such individuals towards better food choices than that consumed by the non-athlete adolescent UK population. Future studies employing larger sample sizes are now required to verify this relationship.

For all squads, fruit-juice and cereals were amongst the top sources of FS (Table 5). Fruit juice, such as pure orange or apple juice, are perceived as a 'healthy' options due to the high amount of vitamins and minerals they are believed to contain and that they can contribute to daily fruit and vegetable intake (Clemens et al., 2015). Whilst that may be true of 100% freshly squeezed fruit juices, evidence shows processed fruit juices are deficient in several nutrients in comparison (Clemens et al., 2015). Due to this perception, soccer players may be consuming fruit juice in place of sugar sweetened beverages in the belief that it is a healthier alternative without realising that they are consuming high amounts of FS. Within the UK, it has been reported that breakfast cereals significantly contribute to the micronutrient intake of the general population (Holmes et al., 2012) due to the cereals being fortified, with iron for example. Many of the breakfast cereals available in the UK are relatively high in FS (LoDolce et al., 2013), and within this study cereals were not only consumed at breakfast but as a snack choice at other times in the day. As such, the high use of cereal intake may help to achieve daily CHO and micronutrient requirements but paradoxically, may also contribute to the relatively high FS intakes.

The intake of dietary fibre is also of interest, as higher intakes of dietary fibre has been shown to have an inverse relationship with obesity (Lairon et al., 2005), diabetes (Montonen et al., 2003), cardiovascular disease (Butcher & Beckstrand, 2010), and bowel disease (Pituch-Zdanowska et al., 2015). Due to the increasing evidence of the benefits to health dietary fibre the UK dietary guidelines have recently been raised (SACN, 2015), increasing the DRV for 11-16 year olds from 18 g/day to 25 g/day, and for >16 years old to 30 g/day from 25 g/day. Within the present study, daily dietary fibre intakes were the following; U13/14s 19.0 ± 4.7g; U15/16s 19.6 ± 8.3g; and U18s 17.1 ± 4.2g. These data show that all squads are consuming less than their age specific DRV (SACN, 2015) and are similar to previously reported dietary fibre intakes (16 ± 1 g/day) in this population (Russell & Pennock, 2011). As can be seen, dietary fibre intake across the different ages was similar (Table 3) and it would appear that although U18s consume less cereals and bread products (Naughton et al., 2016), they are still consuming similar dietary fibre to the younger squads. This may be due to an increase consumption of other fibre rich foods, such as vegetables, to compensate for this loss of dietary fibre from cereal and bread products (Table 4). The observation of a low daily fibre intake in the U18 players may also be reflective of a habitually low daily CHO diet, as previously reported (Naughton et al., 2016).

As displayed in Table 4, all squads met and generally exceeded the current UK RNIs for micronutrients. The exception is calcium in the U18s squad, along with potassium intakes within both the U15/16s and U18s squads. The finding that the U18s did not meet the calcium RNI is in contrast to previously reported values in an U18s soccer team population (Russell & Pennock, 2011). One potential reason for the finding that U18s didn't achieve their calcium, is that they have a protein based breakfast (such as eggs) as opposed to a CHO based breakfast (such as cereal and toast) (Naughton et al., 2016). Consequently, this would lead to the U18s consuming less milk which is a key source of calcium; which may explain in part the lower intake of these micronutrients in comparison to both the younger squads and the RNIs. Although not statistically significant, the finding that the U18s are not meeting their calcium RNI is of potential concern, as they are exposed to a higher training load (Wrigley et al., 2012) and a more physically demanding version of the game (Anderson et al., 2015). The role of calcium in the development and maintenance of bone is well established (Desbrow et al., 2014). The reported suboptimal intake could potentially lead to an increased risk of bone fractures and breaks as skeletal development may be compromised (Rizzoli et al., 2010) and not be able to withstand the training / match load and potential impacts within training / matches. During adolescence and early adulthood, there is evidence to suggest that optimal bone mineral growth is vital to achieve a high peak bone mass to reduce the potential risk of later life osteoporosis (Rizzoli et al., 2010). Furthermore, it may be potentially beneficial for practitioners to educate players about the foods that provide relatively high amounts of calcium, such as milk and yoghurts, and help athletes incorporate them into their habitual diet.

Previous research from our group have shown that the population investigated in the present study have higher protein diets (>1.5 $g/kg/BM^{-1}$) (Naughton et al., 2016) in comparison with the current RNI (0.8 $g/kg/BM^{-1}$). A higher protein diet has been suggested to result in greater intake of micronutrients (Phillips et al., 2015). It is proposed that foods that are high in quality protein (such as eggs, poultry, beef, dairy products etc.) are also high in important micronutrients – such as iron in beef, and calcium in dairy. Thus, due to the previous findings of the current authors, it is perhaps unsurprising that the majority of micronutrients RNIs are surpassed in the current study. This apparent additional benefit of dietary protein has perhaps been overlooked and potentially could be a method to increase micronutrient intake within adolescents; however, more research is required within this population. As new guidelines have only recently been published, it could also be potentially viewed that the schoolboy squads simply need an updated education on sugar consumption, which may help players understand how to decrease their FS intake through simple dietary alterations, such as decreasing the consumption of fruit juice and sports drinks.

A limitation of the current study is the use of food diaries to analyze nutritional habits, and indeed, previous research has shown a potential under-reporting effect of up to 20% (Burke & Deakin, 2010). Therefore, it is possible that we may have under-estimated the FS, fibre and micronutrient intakes reported here. However, this method is often used within this population (Briggs et al., 2015; Naughton et al., 2016; Russell & Pennock, 2011), additionally, unpublished pilot research on the current study's population displayed a high completion rate (75%) over the 7-days (Naughton et al., 2016). Furthermore, reporting micronutrient intake is not necessarily indicative of micronutrient status, therefore future research should aim to analyze blood samples to gain a more objective reflection of micronutrient status. Additionally, the sample population for the present study was taken from a single EPL academy based in the North-West of England, and therefore may not be fully representative of elite players based at other clubs in other regions or countries. Nonetheless, given that our macronutrient intake data reported previously (Naughton et al., 2016) is similar to other UK based EPL soccer academies (Russell and Pennock 2011; Briggs et al. 2015), we suggest that our data is indeed reflective of the UK adolescent soccer player.

In summary, we provide novel data by reporting the dietary FS and total sugar intake within elite youth soccer players. We report for the first time an apparent nutritional transition from schoolboy to fulltime soccer player in that players approaching adulthood consume less FS and total sugar than their younger counterparts. Importantly, all players (regardless of age) consume less dietary fibre intake than current recommendations though all squads generally met and exceeded micronutrient intakes, potentially due to high daily protein intakes. When taken together, these data suggest that nutritional educational packages for youth soccer players should also focus on strategies to reduce sugar and increase fibre consumption so as to promote both health and performance.

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Conflict of Interest

None

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Conflict of interest

None

Authorship

All authors contributed to the design of the study; RN collected and analyzed all data; RN, JA, EM, JPM, & IGD drafted the manuscript; All authors critically revised the manuscript; All authors approved the final manuscript for publication. There are no conflicts of interest to disclose.

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Table 1. A comparison of age, body mass, height, BMI, soccer and non-soccer training between elite youth soccer players from an EPL academy from the U13/14s, U15/16s and U18s squads. Weekly training data adapted from Brownlee *et al.* (Unpublished data).

Squad	Age (years)	Body Mass (kg)	Height (cm)	BMI (kg/m^2)	Soccer Training (min/week)	Non-Soccer Training (min/week)
U13/14s	12.7 ± 0.6	44.7 ± 7.2	157.8 ± 11.0	17.9 ± 1.3	436 ± 29	33 ± 28
U15/16s	14.4 ± 0.5	60.4 ± 8.1	173.1 ± 7.8	20.1 ± 1.5	212 ± 57	81 ± 39
U18s	16.4 ± 0.5	70.6 ± 7.6	180.1 ± 7.3	21.7 ± 0.9	224 ± 38	89 ± 21

Values are mean ± SD.

Table 2. Total daily CHO and energy intake of all 3 squads. Adapted from Naughton *et al.* (2016) with permission.

Squad	Total carbohydrate intake (g/day)	Total energy intake (Kcal/day)
U13/14s	266.3 ± 58.4	1903 ± 432.4
U15/16s	275.1 ± 61.9	1926.7 ± 317.2
U18s	223.7 ± 79.9	1958.2 ± 389.5

Values are mean ± SD.

Table 3. A comparison of daily total- and free-sugar intake between elite youth soccer players from an EPL academy from the U13/14s, U15/16s and U18s squads and current UK DRVs or RNI were applicable.

	U13/14s (DRV/RNI)	**U15/16s** (DRV/RNI)	**U18s** (DRV/RNI)
Total-Sugar (% of TEI)	20.7 ± 4.7^	20.6 ± 5.1^	13.8 ± 3.3
Total-Sugar (g)	100.0 ± 36.1^	100.5 ± 34.8^	68.2 ± 23.2
Free-Sugar (% of TEI)	10.0 ± 17.7*^ (5)	11.2 ± 30.0*^ (5)	5.1 ± 12.7 (5)
Free-Sugar (g)	47.6 ± 19.2^	54.1 ± 23.8^	25.0 ± 12.4
Fibre (g)	19.0 ± 4.7* (25)	19.6 ± 8.3* (25)	17.1 ± 4.2* (30)

Values are mean ± SD. *Denotes significant difference from DRV / RNI. ^Denotes significant difference from U18s.

Footnote – TEI = Total energy intake; DRV = Dietary reference value; RNI = Reference nutrient intake

Table 4. Comparison of micronutrient intake for all 3 squads. RNI values are in brackets.

Micronutrient (units)	U13 - U14s (RNIs)	U15s – U16s (RNIs)	U18s (RNIs)
Sodium (mg)	2679.7 ± 779.6* (1600)	3048.2 ± 553.6* (1600)	2874.3 ± 800.3* (1600)
Potassium (mg)	3151.2 ± 720.3 (3100)	3044.1 ± 593.0 (3500)	3432.5 ± 508.7 (3500)
Chloride (mg)	3907.4 ± 1150.0* (2500)	4240.6 ± 794.0* (2500)	4074.3 ± 1366.1* (2500)
Calcium (mg)	1148.2 ± 382.1 (1000)	1035.4 ± 305.7 (1000)	883.1 ± 305.1 (1000)
Phosphorus (mg)	1625.7 ± 496.0* (775)	1485.2 ± 292.8*^ (775)	1874.2 ± 338.9* (775)
Magnesium (mg)	323.4 ± 73.9* (280)	298.0 ± 79.2 (300)	320.5 ± 64.8 (300)
Iron (mg)	13.2 ± 2.5* (11.3)	14.3 ± 3.9* (11.3)	15.0 ± 3.4* (11.3)
Zinc	10.3 ± 2.3*^	10.2 ± 2.5^	12.9 ± 2.1*

(mg)	(9)	(9.5)	(9.5)
Vitamin A (μg)	735.0 ± 271.9 (600)	695.6 ± 425.7 (700)	912.8 ± 414.8 (700)
B1 (mg)	1.8 ± 0.4* (0.9)	2.3 ± 2.0* (1.1)	1.9 ± 0.5* (1.1)
B2 (mg)	1.2 ± 0.7* (1.2)	2.1 ± 0.7* (1.3)	2.1 ± 0.5* (1.3)
B6 (mg)	2.6 ± 0.6* (1.2)	3.0 ± 0.7* (1.5)	3.1 ± 0.7* (1.5)
Folate (μg)	318.7 ± 84.7* (200)	343.6 ± 101.0* (200)	329.4 ± 60.0* (200)
B12 (μg)	5.4 ± 2.4*^ (1.2)	4.5 ± 1.2*^ (1.5)	7.0 ± 1.7* (1.5)
Vitamin C (mg)	105.7 ± 64.4* (35)	114.2 ± 56.8* (40)	127.5 ± 59.1* (40)

Values are mean ± SD. *Denotes significant difference from DRV / RNI. ^Denotes significant difference from U18s.

Table 5. A comparison of the three most frequent sources for free-sugar and fibre intake, expressed as percentage of players, between elite youth soccer players from an EPL academy from the U13/14s, U15/16s and U18s squads.

Squad	**Free-sugar (%)**	**Fibre (%)**
	Fruit Juices – 30	Bread – 35
U13/14s	Cereals – 15	Cereals – 25
	Cereal Bars – 13.3	Vegetables – 21.7
	Fruit Juice – 25.4	Bread – 38
U15/16s	Cereals – 18.3	Vegetables – 26.8
	Sports Drinks – 14.1	Fruit – 16.9
	Yoghurt Products – 20	Vegetables – 48.7
U18s	Cereals – 15	Fruit – 17.9
	Fruit Juice – 12.5	Bread – 17.9