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Nutritional habits of professional team sport athletes: An insight into the carbohydrate, fluid, and caffeine habits of English Premier League football players during match play

Andreas M. Kasper[a,b], James Allan[a], Daniel Hodges[a], Paul Catterson[a,c], Liam Mason[a], John Fitzpatrick[a], Nick Grantham[a], James P. Morton[b], Mark A. Hearris[d] and Graeme L. Close[b]

[a]Newcastle United Football Club, St James' Park, Newcastle, UK; [b]Research Institute for Sport and Exercise Sciences, Liverpool John Moores University, Liverpool, UK; [c]Human Nutrition Research Centre, Population Health Sciences Institute, Newcastle University, Newcastle upon Tyne, UK; [d]Institute of Sport, Manchester Metropolitan University, Manchester, UK

ABSTRACT

To better understand the in-match fuelling practices of elite football players and compare against current guidelines, we quantified the carbohydrate, fluid, and caffeine intake of players from an English Premier League club ($n = 22$) during 90 min of competitive match-play. Mean carbohydrate intake across match-play was 17 ± 11 g.h^{-1} with players demonstrating a preference towards CHO-containing fluids (58%) when compared with semi-solids (38%) and solids (14%), respectively. CHO intake was significantly lower than reported by players (17 ± 11 vs 24.8 ± 11 g.h^{-1}, $p < 0.001$) during initial consultation. Fluid was ingested at a rate of 0.45 ± 0.14 L.h^{-1}, with 54, 40 and 6% of ingested fluid coming from water, carbohydrate, and electrolyte-only solutions, respectively. The majority of players (91%) met the UEFA guidelines for fluid consumption. Of the players who consumed caffeine across match-play (55%) the average dose was 233 ± 148 mg (2.8 ± 1.1 mg.kg^{-1} body mass [BM]), which meets the UEFA consensus guidelines for caffeine intake. Caffeine capsules (42%) and caffeine containing fluids (30%) were the preferred format prior to the warm-up whilst caffeine gum was exclusively used prior to kick-off and during the half-time period (100%). We conclude that 81% of the total playing squad failed to meet the current UEFA CHO intake recommendations of 30–60 g.h^{-1}, which may be attributed to the preference towards fluid-based CHOs as the chosen format of delivery.

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Soccer; carbohydrate; fluid; caffeine

Highlights

- Soccer players demonstrate sub-optimal in-match fuelling practices, with 81% of players failing to meet current UEFA CHO intake recommendations of 30-60 g.h^{-1}
- Players demonstrate a preference towards fluid as the primary mode of CHO delivery over the use of semi-solid and solid formats.
- These data highlight the need for future research to test the efficacy of lower doses of CHO on elements of both physical and technical soccer performance in a dose-response manner.
- Future research is also necessary to investigate the impact of traditional guidelines and recommendations within football-specific contexts to assess their effectiveness and relevance in practical applications.

Introduction

Football is an intermittent team sport where professional players typically cover distances of 10–13 km per match (Bloomfield et al., 2007). Whilst most of this distance is classified as low-moderate intensity running (0–19.8 km.h^{-1}), high-speed running (HSR; >19.8 km.h^{-1}) accounts for approximately 8% of the total distance covered (Rampinini et al., 2007). Furthermore, an increase in the physical and technical demands of match-play across the past decade has resulted in increased high-intensity distances, sprint distances, and the number of sprints performed per player (Barnes et al., 2014) and is expected to rise further by 2030 (Nassis et al., 2020). Such developments in physical demands are likely to exacerbate the requirement for maximising carbohydrate (CHO) availability for skeletal muscle and the central nervous system during match-play. Indeed, substantial glycogen depletion has been reported in both professional male (Krustrup et al., 2006) and female (Krustrup et al., 2022) football players and is further enhanced during the extra-time period (Mohr et al., 2023) that may occur during cup competitions. In addition to whole muscle glycogen depletion, analysis of individual fibre types has revealed 50% of type II fibres appear depleted or almost depleted of glycogen following 90 min of friendly match play (Krustrup et al., 2006, 2022; Mohr et al., 2023). Importantly, these fibre types are responsible for sprinting and high intensity actions and thus glycogen depletion is commonly cited as a contributing factor to the progressive decline in such high-intensity actions across the course of match-play (Mohr et al., 2005).

CONTACT Graeme L. Close G.L.Close@ljmu.ac.uk Research Institute for Sport and Exercise Sciences, Liverpool John Moores University, Tom Reilly Building, Byrom St Campus, Liverpool L3 3AF
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Given the high-rates of glycogen utilisation during match-play, in-match carbohydrate ingestion can provide an additional substrate for energy production and may spare the limited storage pool of endogenous carbohydrate. This may be particularly important during congested fixture periods, where preserving glycogen may have a significant impact on the players ability to recover efficiently post-match. Indeed, the ingestion of a 6.9% CHO solution at a rate of ~50 g/h has been previously shown to reduce muscle glycogen utilisation by 22% during intermittent shuttle running (Loughborough Intermittent Shuttle Test; LIST) that mimics the physiological demands of football match-play (Nicholas et al., 1999). Carbohydrate ingestion has also been reported to improve physical aspects of performance in sub-elite groups such as total distance covered (Rodriguez-Giustiniani et al., 2019), high-intensity running capacity (Foskett et al., 2008) and sprint distances (Harper et al., 2017) as well as technical skills such as passing (Rodriguez-Giustiniani et al., 2019), dribbling (Currell et al., 2009) and shooting (Russell et al., 2012) when ingested at a rate of 30–60 g.h^{-1}.

While in-game carbohydrate provision has the potential to significantly impact match-day performance, it is not the sole nutritional consideration for elite footballers. Indeed, dehydration > 2% in response to simulated soccer protocols has been reported to impair both physical (e.g., intermittent running capacity (Edwards et al., 2007) and sprint speed (McGregor et al., 1999)) and technical (e.g., dribbling speed) (McGregor et al., 1999) elements of performance in sub-elite cohorts. Similarly, numerous data suggest that caffeine also improves both physical and technical elements of performance that are inherent to soccer match-play. For instance, caffeine has been reported to enhance repeated sprint and jump performance (Gant et al., 2010), reactive agility (Duvnjak-Zaknich et al., 2011) and passing accuracy (Foskett et al., 2009) during intermittent-type exercise protocols.

Current UEFA consensus guidelines recommend athletes should consume CHO at rates of 30–60 g.h^{-1} (Collins et al., 2021) although current practices of English Premier League (EPL) players appear to be at the lower end of such guidelines with reported intakes of 32 ± 22 g.hr^{-1} during match-play (Anderson et al., 2017). In reference to fluid and caffeine intake, UEFA guidelines recommend an individualised approach given the wide-ranging sweat loss responses reported across soccer players (K. A. Barnes et al., 2019) as well as the individual responses (both positive and negative) to caffeine ingestion. Despite such recommendations, current data on the actual practices of elite athletes is limited to a single study within a small cohort of female players (Tarnowski et al., 2022) whilst no data exist quantifying in-match caffeine intake. Of the small amount of observational data available, these studies are limited to a small number of athletes (*n* = 6-8) and/or fail to use ecologically valid and accurate methods which have inherent limitations and are known to result in misreporting of nutritional intake (Capling et al., 2017; Magkos & Yannakoulia, 2003), making it difficult to draw inferences on the behaviour of elite athletes in practice. Indeed, there is currently no research that simultaneously measures (using gold-standard methods) the in-match CHO, caffeine and fluid intake in elite football athletes. To address such issues, authors had the rare opportunity to directly quantify carbohydrate, fluid and caffeine habits of an elite team competing in the UEFA Champions League.

Thus, our primary aim was to directly assess carbohydrate intake during match-play using the weighed food inventory method (Rollo et al., 2016) across a cohort of 22 elite athletes competing within the English Premier League during a competitive fixture. To do this, we utilised a highly ecologically valid model of direct observation of elite athletes during competition, which scores highly on the Paper2Podium Matrix (Close et al., 2019). To realise our secondary aims, we also assessed fluid and caffeine intake using the same method and compared the recorded values against self-reported intake by each player following consultation with the lead author, an accredited Performance Nutritionist (Full Registrant of the Sport & Exercise Nutrition Register; Registered Nutritionist of the Association for Nutrition).

Methodology

Participants

Data was collected from 22 elite level male football players competing in the EPL (age: 27 ± 4 years; height: 182.9 ± 9.2 cm; body mass: 81.1 ± 8.5 kg). Players originated from either Europe (*n* = 19) or South America (*n* = 3) but had played in European leagues for a minimum of three seasons. Ethical approval for the analysis of data was granted by Manchester Metropolitan University (Application number: 54434) after gaining written consent.

Experimental design

Data were collected across two pre-season fixtures that occurred simultaneously against EPL opposition where the focus was 90 min match exposure. Both matches commenced at 11:00 and consisted of two 45-minute halves separated by a 15-minute half-time period. Weather conditions varied across the duration of the study (temperature: 27–31°C; wind speed: 4 mph; humidity: 45–58%; sun exposure with minimal cloud cover) and a fluid break was scheduled at the mid-point of each half to reduce thermal stress in accordance with current best-practice guidelines for exercise in the heat (Racinais et al., 2015) and practices that occur regularly within the EPL during hot conditions. Throughout the study period, carbohydrate, fluid, and caffeine intake of each individual player was monitored and, to assess the distribution of intake, time-points were categorised as a) prior to the warm-up (ARR-WU), b) during the warm-up (WU), c) prior to kick-off (POST-WU - KO), d) during the first half (1ST HALF), e) during half-time (HT) or f) during the second half (2ND HALF). A schematic of the experimental design can be seen in Figure 1.

Quantification of internal and external match load

Match load was monitored using portable heart rate monitors (Suunto Smart Sensor, Suunto Oy, Finland) and global positioning system (GPS) units (Catapult Vector, Catapult, Australia). Internal match load was analysed via the Firstbeat Sports dashboard (Firstbeat Sports, Firstbeat Technologies Oy, Finland) with mean heart rate (both absolute and relative to maximum HR) and the relative time spent in different HR zones (<50%,

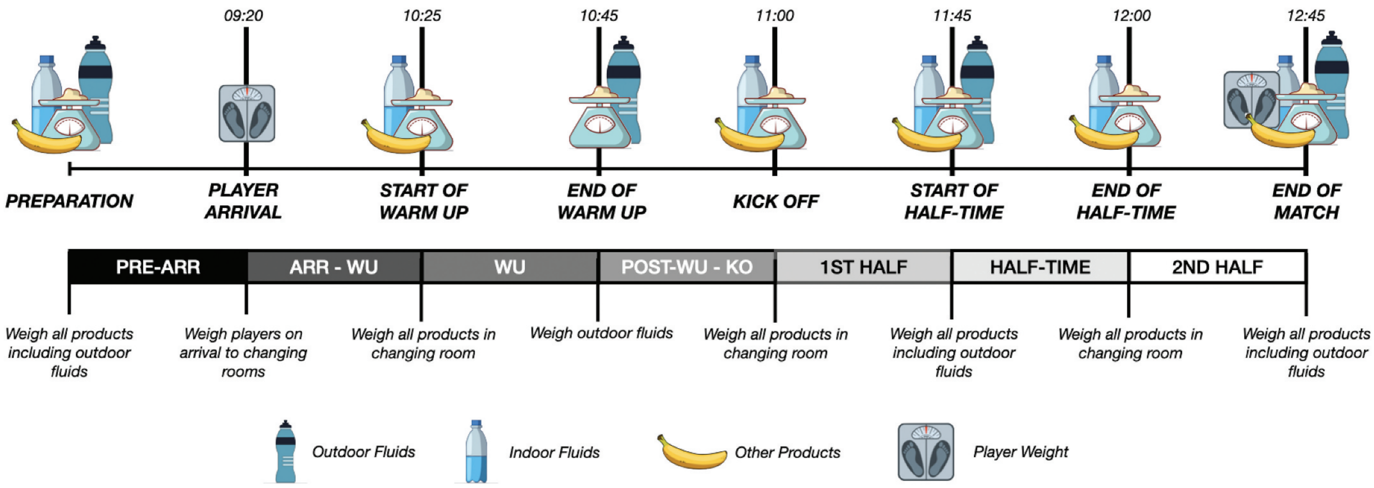

Figure 1. Overview of the observational design.

50–60%, 60–75%, 75–85%, 85–95% and > 95% HRmax) selected for analysis. External load variables selected for analysis included maximum running speed (MS), total distance covered (TD), high speed distance (HSD) (the total distance at speeds of 20–25 km.h^{-1}) and sprint distance (SD) (the total distance at speeds >25 km.h^{-1}). These speed thresholds are similar to those reported previously (Bradley et al., 2009; Mohr et al., 2003; Rampinini et al., 2007) and are commonly used day-to-day in professional football clubs.

Quantification of CHO, fluid, and caffeine intake

Throughout the study period, athletes had *ad libitum* access to water, electrolyte-only fluids, 6% carbohydrate fluids, semi-solid CHO gels and CHO containing food sources that are all typically available during match-play (see supplementary material for further details). Throughout data collection, the two primary researchers were present and had visible access to each athlete to record dietary intake data, with bottles containing CHO weighed before and after consumption to assess both fluid and CHO intake. Semi-solid and solid CHO sources were also weighed before and after consumption, accounting for any residual CHO that remained within the packaging. This method of measurement was chosen to avoid the issues that surround the use of self-reported dietary recall (Capling et al., 2017; Magkos & Yannakoulia, 2003) and to ensure athletes were unaware of the objectives of the experiment. Caffeine containing products (see supplementary material for further details) were handed out upon request from players and included caffeine containing fluids, semi-solid gels, gum and caffeine capsules.

Assessment of self-reported carbohydrate, fluid, and caffeine intake

To realise the secondary aim of the study, habitual self-reported carbohydrate, fluid, and caffeine intake for each athlete was recorded during individual consultations with the lead author, a registered sport & exercise nutritionist (SENr), prior to the completion of the observational assessment. Reported intake was subsequently compared against the recorded intake during match-play.

Statistical analysis

All statistical analyses were performed using SPSS Statistics Version 28 (IBM, US). Differences in actual and reported intake were analysed using a paired samples t-test. All data were normally distributed and are presented as means ± SD with p values ≤ 0.05 indicating statistical significance.

Results

Internal and external match load

As a global index of external match load, maximum speed, total distance, high-speed running distances and sprint distances are all displayed in Table 1. Players covered a mean total distance of 10.0 ± 0.8 km consisting of 646 ± 277 m at high speeds (HSD) and 174 ± 109 m sprinting (SD). In reference to internal match load, mean heart rate was 159 ± 7 b.min^{-1}, which equated to 84 ± 3% HR_{max}. The relative amount of time spent in each HR zone is presented in Table 1.

Carbohydrate, fluid, and caffeine intake

Carbohydrate, fluid, and caffeine intake for all players is presented in Figure 2. Intake values relative to different periods of the observational period are also presented in Table 2. Mean carbohydrate intake from warm-up to full-time was 40 ± 27 g (Figure 2(a)), equating to an ingestion rate of 17 ± 11 g.h^{-1} across the 140 min period. Carbohydrate in the form of fluids supplied 59% of total CHO intake whilst semi-solids (e.g., CHO gels) and solids (e.g., whole foods and CHO bars) accounted for 28 and 13%, respectively (Figure 2(c)). The majority of CHO intake came during the half-time period (42%), with similar amounts consumed immediately prior to kick-off (22%) and during the second half (25%). The remaining carbohydrate was consumed during the warm-up (2%) and during the first half (9%).

Table 1. Internal and external load data across the two fixtures as well as 18 EPL games of the 22/23 season for different positions and squad average.

	HR (b.min^{-1})	%HR$_{max}$	% of time spent in the HR zone (% HR$_{max}$)					
			>95	95-85	85-70	70-60	60-50	<50
Internal Load								
Current Match Data								
Mean	159 ± 7	84 ± 3	10 ± 11	53 ± 11	26 ± 11	9 ± 4	2 ± 2	0 ± 1
Minimum	149	77	0	31	14	4	0	0
Maximum	172	89	42	69	51	18	6	2

	Maximum Speed (km.h^{-1})	Total Distance (m)	High Speed Distance (m)	Sprint Distance (m)
External Load				
Current Match Data				
Mean	30.1 ± 2.1	10035 ± 796	646 ± 277	174 ± 109
Minimum	24.9	8693	260	2
Maximum	34.7	11400	1081	451
Fullback (*n* = 4)	29.1 ± 1.4	9362 ± 404	562 ± 91	132 ± 98
Central Defender (*n* = 4)	30.2 ± 1.2	9669 ± 257	330 ± 64	117 ± 49
Central Midfielder (*n* = 6)	28.7 ± 2.1	10875 ± 479	715 ± 209	137 ± 91
Wide Forward (*n* = 4)	31.6 ± 1.6	10311 ± 320	935 ± 90	304 ± 123
Centre Forward (*n* = 2)	33.0 ± 2.4	9046 ± 499	659 ± 247	224 ± 47
Squad averages for 22/23 season (n = 18 matches)				
Mean	32.4 ± 1.7	10091 ± 793	876 ± 211	229 ± 91
Minimum	29.0	8813	560	92
Maximum	35.7	11738	1178	421

Mean fluid intake across match-play was 1.06 ± 0.33 L (Figure 2(d)), equating to an ingestion rate of 0.45 ± 0.14 L.h^{-1}. Fluid was ingested at regular intervals throughout match-play, with the most fluid consumed during the half-time period (30%). Fluid intake during the first and second half equated to 22 and 21%, respectively, with the remaining fluid being consumed immediately prior to kick-off (19%) and during the warm-up (8%). Of the total fluid ingested, 54% was from water, with the remaining 40 and 6% attributed to carbohydrate and electrolyte only solutions, respectively (Figure 2(f)). In reference to fluid intake, average body mass decreased by 2.0 ± 1.1% from measures taken immediately prior to commencement of kick-off.

In total, 55% of players reported caffeine use across the duration of match-play, with an average caffeine intake of 233 ± 148 mg (2.8 ± 1.1 mg.kg^{-1} body mass [BM]). Caffeine intake was distributed either prior to the warm-up (136 ± 56 mg), immediately prior to kick-off (117 ± 41 mg) or during half time (120 ± 45 mg) (Figure 2(h)). Prior to the warm-up, caffeine was administered in the form of capsules (42%), caffeine containing fluids (e.g., shots; 30%) or caffeine containing gum (28%). Immediately prior to kick-off and during half-time, caffeine was administered solely in the form of gum (100%; Figure 2(h)).

Reported vs. actual intake

Reported carbohydrate intake during consultation with the lead author (Figure 2(a)) was significantly higher than actual intake (59 ± 25 vs. 40 ± 27 g, respectively; $p < 0.001$). However, no significant differences between the reported and actual fluid (1.25 ± 0.43 vs. 1.06 ± 0.33; $p = 0.084$) or caffeine (240 ± 103 vs. 233 ± 94 mg; $p = 0.86$) intakes during match-play were present.

Discussion

The aim of the present study was to directly assess the in-match nutritional intake of elite footballers using the gold-standard weighed food inventory method. To this end, we present the first direct measurement of in-match carbohydrate, fluid, and caffeine intake of a squad of professional football players from the EPL and observed that elite football players often do not adhere to "best-practice" guidelines. To realise our aims, we observed a cohort of 22 players across two separate fixtures at the beginning of the 2022/23 season. Importantly, the observed external match loads across both fixtures were representative of those observed during competitive fixtures within the EPL (Allen et al., 2023; C. Barnes et al., 2014; Bradley et al., 2009) as well as those observed within the same playing squad during this first 18 matches of the 2022/23 EPL season (Table 1). For example, total distance (10.0 ± 0.8 vs. 10.1 ± 0.8 km, respectively), high speed distances (646 ± 277 vs. 876 ± 211 m, respectively) and sprint distances (174 ± 109 vs. 229 ± 91 m, respectively) were all comparable between the present fixture and those observed during the competitive season. Internal match-load, represented by the relative heart rate responses during match-play, were also comparable to previous reports (84 ± 3 vs. 86 ± 5% HR$_{max}$, respectively) amongst elite footballers (Torreno et al., 2016). In relation to the players studied here, our data demonstrate that 82% of the total playing squad failed to meet current CHO intake recommendations of 30–60 g.h^{-1} (Collins et al., 2021) which may be explained by an overreliance on fluids as their primary format of CHO (58%) when compared with both semi-solid and solid formats (28 and 14%, respectively) and/or a preference towards CHO-free fluids (60% of ingested fluids were void of CHO).

Across the course of match-play, players consumed an average of 40 ± 27 g carbohydrate, equating to an ingestion rate of 17 ± 11 g.h^{-1} across the 140 min period (from the onset of the

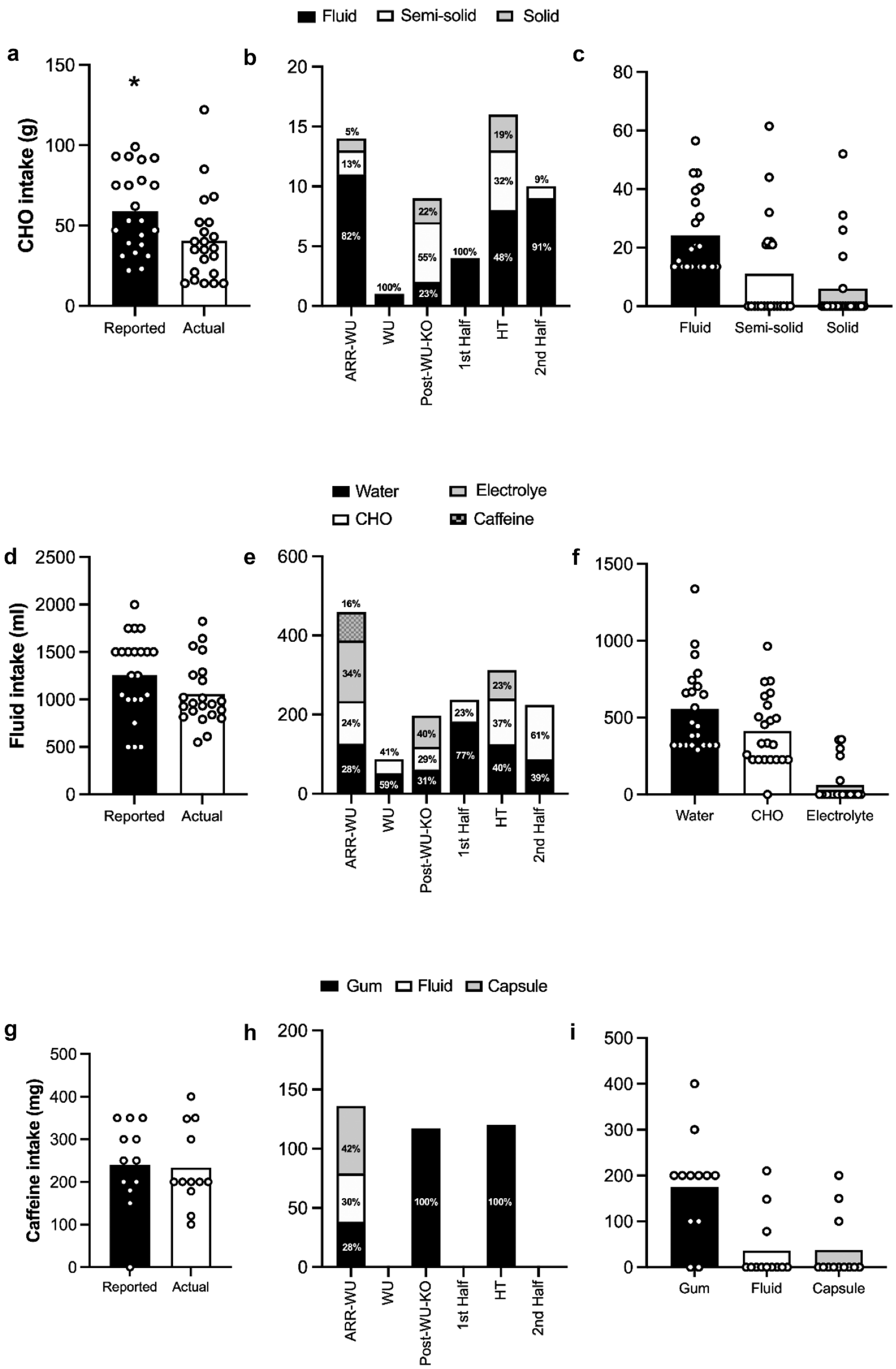

Figure 2. Mean reported and actual carbohydrate (a), fluid (d) and caffeine (g) intake across the observational period. The distribution and the format of delivery across the course of match-play for carbohydrate (b-c), fluid (e-f) and caffeine (h-i). Caffeine intake data (g-i) is representative of only those athletes who consumed caffeine ($n = 12$). No caffeine was consumed during the warm-up, first half or second half. *significantly different compared to actual intake ($p < 0.05$). Abbreviations: ARR-WU, arrival until warm-up; WU, warm-up; POST-WU-KO, post-warm-up until kick-off; 1ST HALF, first half; HT, half-time; 2ND HALF, second half.

warm-up). These values are considerably less than those previously reported in both EPL footballers (32 ± 22 g.h^{-1}) and Australian Football (AF) players (34 ± 11 g.h^{-1}), respectively (Anderson et al., 2017; Routledge et al., 2020) as well as current UEFA consensus guidelines of 30–60 g.h^{-1} (Collins et al., 2021). In fact, only 18% of players studied here achieved CHO intakes in the recommended range of 30–60 g.h^{-1}, markedly less than has been previously reported in both EPL (53%) and AFL (33%) athletes, respectively (Anderson et al., 2017; Routledge et al., 2020). Such differences may be explained by the use of different methodological approaches, given the use of self-report in previous studies compared with the gold-standard weighed

Table 2. Mean carbohydrate, fluid, and caffeine intake across different time periods. ARR-2ND HALF, upon arriving at the stadium until the end of match-play; WU-2ND HALF, from the commencement of the warm-up until the end of match-play; 1ST HALF-2ND HALF, from the commencement of the first-half until the end of match-play.

	ARR-2ND HALF	*WU-2ND HALF*	*1ST HALF-2ND HALF*
Estimated time (min)	205	142	105
Carbohydrate intake ($g.h^{-1}$)	16 ± 10	17 ± 11	17 ± 10
Fluid intake ($L.h^{-1}$)	0.44 ± 0.15	0.45 ± 0.14	0.44 ± 0.13
Caffeine intake ($mg.kg^{-1}$ BM)	2.8 ± 1.1	1.9 ± 1.2	1.4 ± 0.5

food inventory method used here. Indeed, athletes self-reported higher CHO intakes during match-play when compared with the recorded values in the present study (59 ± 25 vs. 40 ± 27 g) highlighting the discrepancies between the two approaches. In considering the absolute dose of CHO ingested at each feeding opportunity during match-play, we report average intakes of 4 g during the first-half, 17 g at half-time and 10 g during the second half, highlighting the opportunity to increase CHO intake during each of these periods. In support of this, CHO intake at the beginning (20–30 g) and end (20–30 g) of the warm-up period, during half-time (20–40 g) and possibly during the second half (20–30 g) has recently been suggested as a practical strategy to meet current CHO intake recommendations (Anderson et al., 2022). Whilst the present data suggest that increasing CHO intake at these time points appears a viable option, the ingestion of considerably higher doses may require practice given the habitually low intake reported during daily training (Anderson et al., 2017; I. Rollo et al., 2021).

In relation to the format of delivery, 58% of the CHO consumed was provided from fluids, with the remainder provided by semi-solids (e.g., gels; 38%) and solids (e.g., bars or whole foods; 14%), respectively. These values are markedly higher than those previously reported in EPL players (37%) (Anderson et al., 2017) and are closer aligned to those reported in Australian Football players (63%) (Routledge et al., 2020). Such differences may be related to the higher ambient temperatures observed in the present study (as well as that previously reported in AFL players) when compared with the typical ambient temperatures observed during the annual EPL. These differences may also help to explain the lower rates of ingestion observed in the present study when compared with previous reports in EPL players (17 ± 11 vs. 32 ± 22 $g.h^{-1}$) and suggest that CHO gels (or other concentrated forms of CHO) may offer a superior strategy to meet CHO requirements. Indeed, given the relatively low concentration of CHO-based fluids (typically 6%) coupled with the fact that only 38% of total fluid intake came from CHO-based solutions in the present study, the preferential intake of CHO from fluid would require considerably higher fluid intakes than reported here. In accordance with this, recent data from professional female Primera División players report only ~ 5-10% of total fluid intake came from CHO-based solutions (2–6% solutions) resulting in CHO intake rates of 0.5 $g.h^{-1}$ (Tarnowski et al., 2022). When taken together, these alternative formats (e.g., CHO gels) or more concentrated fluids may be required to meet current intake recommendations, although this now needs investigation using relevant research designs. In reference to the former, we recently demonstrated comparable rates of oxidation from CHO drinks, gels, chews, and a mixture of all three formats (Hearris et al., 2022). In relation to the latter, recent studies adopting the use of 12% solutions demonstrate CHO intakes of 60 g across the course of soccer match-play with minimal gastrointestinal discomfort (Funnell et al., 2017; Rodriguez-Giustiniani et al., 2019) demonstrating the feasibility of both strategies.

Within the present cohort of athletes, 55% reported caffeine intake across match-play at an average dose of 233 ± 94 mg (2.8 ± 1.1 $mg.kg^{-1}$ body mass [BM]), consumed either prior to the warm-up (136 ± 56 mg), prior to kick-off (117 ± 41 mg) or during the half-time period (120 ± 45 mg). These values align with previous reports from professional English football players who report caffeine intakes of 2–6 $mg.kg^{-1}$ BM (Tallis et al., 2021) yet are considerably lower than laboratory-based studies that demonstrate improvements in repeated sprint and jump performance (3.7 $mg.kg^{-1}$ BM) (Gant et al., 2010), reactive agility (6.0 $mg.kg^{-1}$ BM) (Duvnjak-Zaknich et al., 2011) and passing accuracy (6.0 $mg.kg^{-1}$ BM) (Foskett et al., 2009) during intermittent exercise. Interestingly, caffeine intake prior to the warm-up (45–60 min prior to kick-off) came from a combination of capsules (42%), caffeinated fluids (30%) and caffeinated gum (28%) whereas caffeine intake prior to kick-off and during the half-time period came solely from caffeinated gum (100%). These practices align with available pharmacokinetic data that demonstrate plasma caffeine concentrations peak approximately ~45 min after ingestion when delivered in capsule form (Graham & Spriet, 1995) and is considerably reduced when delivered in the form of a gum (~10 min) (Kamimori et al., 2002). Of the athletes who reported caffeine intake, 66% consumed multiple doses across the course of match-play (e.g., before the warm-up and at half-time) which may offer an effective strategy to maintain plasma caffeine concentrations throughout match-play (Syed et al., 2005).

Although the present data provide a unique insight into the nutritional habits of professional footballers within the EPL they are not without limitations, that are largely a reflection of the difficulties in collecting such data amongst elite athletes. Firstly, the data are reflective of the practices of one team (albeit a top EPL team) across two fixtures and may not be representative of the nutritional practices of other teams. Furthermore, the break in match-play during both the first and second half provided additional opportunities to consume fluid and/or CHO which may not be possible during different phases of the season. Nevertheless, despite the additional break periods, we still consider that the present data are indicative of failure to achieve recommended carbohydrate guidelines during football

(Collins et al., 2021) and provide practitioners with the relevant information to explore such practices.

In summary, we report the first direct assessment of carbohydrate, fluid, and caffeine intake of elite footballers from an EPL team. In accordance with the present data, we observed an apparent under-consumption of CHO across the course of match-play, the result of which could impair both physical and technical performance. These data also raise the question as to whether current UEFA guidelines are appropriate for soccer players during a single match week, considering that no data on the dose response relationship between CHO and both physical and technical elements of soccer performance are available. Future studies should test the efficacy of lower doses of CHO, such as those reported here, against current guidelines in a dose response manner and aim to find out whether athletes actually meet nutritional recommendations in various situations, and if not, why not? Indeed, there is a plethora of research within the area of nutrition, but practitioners and academics must design research and interventions to better drive behaviour change in practice, as it is apparent that players do not always meet recommendations.

Disclosure statement

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