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Understanding the presence of mental fatigue in elite female football.

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Abstract

Previous research investigating the impact of induced mental fatigue in football (soccer) has demonstrated associated performance decrements in physical, technical, tactical and decision making performance. A common limitation amongst this research is the protocols used to induce mental fatigue which provide low ecological validity, and the inclusion of recreational or sub-elite players (Smith et al., 2018). Therefore, understanding the presence of mental fatigue in elite football can provide insight into protocols with greater ecological validity. The current study used focus groups with 10 elite female football players, focusing on five topics (travel, fixture congestion, receiving tactical information, pre-match routine and pressure to win) related to the perceived causes of mental fatigue in elite football (directed by anecdotal quotes in elite football and research-based theories). Several themes emerged from the data; travel fatigue, inability to switch off from football, fatigue experienced following team meetings, use of pre-match music and internal pressure to succeed. These findings present practical recommendations to reduce mental fatigue in elite football settings, such as considering the timing, content and duration of team meetings, providing players with free time/rest where possible, and considering the modality of coaching instructions during matches.

Keywords

Women soccer, focus group, coach development

Introduction

1 In elite female football (soccer), the physical demands of match-play (i.e. total distance run,
2 volume of high-intensity running, number of sprints) are well understood (Datson et al.,
3 2017; Bradley et al., 2010), however the mental demands remain unknown, and are limited to
4 editorial articles, with no known empirical evidence. Bauman (2016) theorises the monetary
5 pressure, pressure to perform, plus the influence of the multiple media outlets that are quick
6 to glorify successful athletes and critical to those who fail. Coutts (2016) has also speculated
7 that mental fatigue is present in elite football, but this has yet to be assessed empirically.
8 Mental fatigue is a psychobiological state, characterised by feelings of tiredness and a lack of
9 energy, and is induced by prolonged periods of demanding cognitive activity (Boksem,
10 Meijman, and Lorist 2005; Lorist, Boksem, and Ridderinkhof, 2005). Mental fatigue is
11 suggested by Coutts (2016) to be experienced by elite football players from pressures
12 received from coaching staff, supporters, the media and club sponsors. Players are also likely
13 exposed to mental fatigue during matches, due to the requirement to remain vigilant and
14 adapt to opposition movements and to the match tactics of their own coach (Coutts, 2016).
15 Such decisions must be made quickly and accurately under high levels of pressure in a
16 dynamic environment (Williams, 2000). However, the present evidence detailing the
17 presence of mental fatigue in elite female football is limited by the lack of female
18 representation in the literature.

19 Only six original studies have examined the effect of mental fatigue on football-specific
20 performance (see Smith et al., 2018 for a review); all of which have been conducted using
21 recreational or sub-elite academy age male players. Three of these were laboratory
22 investigations which reported impaired football-specific skill performance (Loughborough
23 Soccer Shooting Test and Loughborough Soccer Passing Test) (Smith et al., 2017; Smith,
24 Coutts et al., 2016) and visual search behaviour in a football-specific decision making task
25 (Smith, Zeuwts et al., 2016). In small-sided-games, mental fatigue has had unclear effects on

1 physical (distance covered per minute and the number of accelerations and decelerations)
2 performance (Coutinho et al., 2017), negative effects for technical (match involvement,
3 match possession, tackle success) performance (Badin et al., 2016), along with reductions in
4 tactical performance due to decreased team dispersion and movement synchronisation
5 (Coutinho et al., 2018).

6 Moreover, it is of interest to understand the real-life causations of mental fatigue, as the
7 current tasks used to induce mental fatigue provide little ecological validity in football-
8 specific settings (Thompson et al., 2018; Carling et al., 2018). The aforementioned studies
9 have used either a 30-min modified Stroop task (Coutinho et al., 2018; Smith et al., 2017;
10 Badin et al., 2016; Smith, Coutts et al., 2016; Smith, Zeuwts et al., 2016b) or a 20-min
11 whole-body coordination task (juggling a tennis ball whilst completing agility ladders)
12 (Coutinho et al., 2017) to induce mental fatigue. These tasks do not resemble the real-life
13 cognitive activities experienced by football players, and as stated by Carling et al., (2018), it
14 is important for future mental fatigue research to develop ecologically valid protocols to
15 induce mental fatigue in football-specific environments. In order to understand the real-life
16 cognitive demands by elite athletes, more recent research has adopted the use of focus groups
17 and surveys. A focus group study of elite athletes (n=17) and coaches (n=15) from a range of
18 eight elite sports (predominantly netball, rugby and cricket) culminated in several themes on
19 perceptions of mental fatigue (Russell et al., 2019). Firstly, mental fatigue had a perceived
20 association with change in behaviour (i.e. disengagement, decreased motivation and
21 enthusiasm). Secondly, a decrease in concentration and reduced discipline and attention to
22 detail were common descriptors of mental fatigue. Moreover, media duties, repetitive tasks
23 and thinking about the sport in question were reported perceived causes of mental fatigue.
24 Conversely in another study on elite academy soccer players in England (n = 256; age groups
25 - U14 – U23) by Thompson et al., (2020), mental fatigue was not perceived as detrimental to

performance. Common pre-match activity (up to 2-hours prior to kick-off) included listening to music (82% of players), using social media (58%) and watching videos (34%), however retrospective 0-100mm visual analogue scales (low-high) with arbitrary units (AU) revealed that pre-match subjective mental fatigue was low (19 ± 19 AU), and most frequently reported at the end of a match (47 ± 26 AU), and remained elevated 24-hours post-match (36 ± 27 AU). In addition, travel to training (29 ± 24 AU), fixture congestion (44 ± 25 AU) and education commitments (30 ± 26 AU) demonstrated a low to moderate presence of subjective mental fatigue.

Indeed, the current literature may not resemble the demands experienced by elite female football players, who are under-represented in psychological research (Gledhill, Harwood and Forsdyke, 2017). Bensing et al., (1999) describe a psychological framework hypothesising a contrast in how males and females cope with physical symptoms, emotions and stress, and that there may even be a difference in personality structure. Future research is required to understand the psychological demands experienced in elite female football and its impact on performance. Therefore, with little understanding of the real-life causations of the psychological demands of elite football and no representation of female players in the literature, the aim of the current study is to use focus groups with elite female football players to explore the types of activity which result in mental fatigue in elite international female football players. Indeed, elite female football players must balance domestic (and potentially international) training/match-play demands with full time/educational commitments, leaving less time for a break in comparison to elite male counterparts (e.g. off-season, winter break, recovery days in-season). The information gained from this study may inform the development of more ecologically-valid tasks to induce mental fatigue in subsequent experimental research on the effects of mental fatigue on football performance, as well as

- 1 guide practitioners in understanding causations of mental fatigue and how to minimise its
- 2 presence.
- 3

1 **Methods**

2 ***Participants***

3 Ten elite female football players (age – 27.1 ± 4.8 y) were recruited for the study. All players
4 represented the same international team (collective number of senior international
5 appearances - 411), and were contracted to domestic clubs in several major European
6 countries. The players were exposed to a full domestic season in their respective leagues
7 (between 18 – 21 matches per season), as well as several call-ups to international fixtures per
8 season, both in and out of the domestic season period. Moreover, players all combined
9 football with full-time education, employment (part-time and full-time), or a combination of
10 the two.

11 ***Procedures***

12 Following university ethical approval, permission was obtained by the head coach of an
13 international female football team to recruit players from the squad to participate in the study.
14 All players were informed of the purpose and aims of the study and completed informed
15 consent. Given the elite nature of the sample, participants were informed that confidentiality
16 could be not always be guaranteed, but assured that names of players, teams, stadiums and
17 competitions would be removed from any published data to increase levels of anonymity. All
18 players were provided with a copy of the focus group transcripts and subsequent coded
19 documents, with permission granted to publish the data.

20 ***Focus group procedure***

21 Two focus groups (2 x 5 players) each lasting approximately sixty minutes were conducted to
22 enable players to engage in an open discussion and share their opinions in a comfortable
23 environment (Smith, Harré, and Van Langenhove 1995). As a guideline for the focus groups,

1 a pre-prepared list of questions and phrases pertinent to the aims of the study was created.
2 This approach was taken due to previous research which has demonstrated or theorised the
3 impact of football-related actions (i.e. travel, prolonged listening, pre-match activity) on the
4 presence of mental fatigue (Thompson et al., 2018; Smith et al., 2018; Coutts, 2016; Moore et
5 al., 2017). Moreover, a news article related to the question was initially presented to the
6 group before each question to facilitate discussion and help depersonalise the question and
7 potential responses. Each article contained a quotation from a player, manager, practitioner or
8 official related to their exposure to mental fatigue, and players in the focus group were then
9 asked to provide their opinion on the article and discuss whether it related to their own
10 experiences. The purpose of the questions provided were to elucidate the perceived
11 psychological load of the aforementioned topic areas (e.g. travel, prolonged listening, pre-
12 match activity) to inform the use of ecologically valid tasks in future mental fatigue research
13 (i.e. use of tasks before a match). The psychological demands of match-play were not
14 considered for the focus groups due to the complex and multifaceted nature of each match,
15 which may prove difficult for participants to accurately recall in focus groups.

16 The focus groups consisted of an introductory phase and a list of five question topics with
17 sub-questions. In the introductory phase, the lead researcher built a rapport with the group by
18 speaking about themes related to football, explaining the nature of the focus group and
19 explaining measures to aid data confidentiality. The first topic explored the group's
20 perception of travel demands ("How do you find having to travel frequently with your teams?
21 What, if any, mental demand does this have on you? Can you give me any examples?").
22 Second, the relationship between fixture congestion and mental fatigue was examined ("I
23 have here an article from an international football manager who speaks about the risk of
24 mental fatigue in the lead up to tournaments, particularly from players playing in England
25 without a winter break. What do you think about this?"). Third, the group's opinion about a

1 magazine article which spoke of the potential “analysis paralysis” of receiving high amounts
2 of tactical information from coaches was explored (“Do you have any experience of this? If
3 so, can you describe what happened and how you felt?”). The fourth topic focused on the
4 players’ pre-match routine, beginning with an anecdotal account from a high profile retired
5 football player’s pre match routine, followed by the probing of the group’s own routines
6 (“What, if any, typical routines do you have on the day of a match before kick-off? Why do
7 you do this? How, if at all, does it make you feel mentally?”). The final topic was examined
8 using a quotation from a news article by a high profile football manager related to the mental
9 pressure associated with match outcome success (“I have here an article from a manager who
10 speaks about the huge pressure to win and how it may be more mentally – than physically –
11 difficult to win matches. How would you describe the pressure to win matches?”). Throughout
12 the focus group, sub-questions from the pre-prepared script were used to collect further
13 information if required. Additional open-ended probes were also used if more detail was
14 required from a participant (e.g. “Why?”, “What makes you say that?”, “Could you expand
15 on that last point please?”) (Smith et al., 1995).

16 ***Data analysis***

17 The recorded interviews were transcribed verbatim. The transcripts were then read several
18 times by the lead and second author to enhance familiarity with the data, which was
19 subsequently analysed inductively and thematically by the lead author (Braun & Clarke,
20 2006). Following the thorough reading of the transcripts, initial codes were generated. This
21 phase involved the production of initial codes from the transcripts which linked to a common
22 theme or idea and refer to the most basic segment, or element, of the raw data (Boyatzis,
23 1998). Next, similar codes (i.e. quotations/themes) were identified throughout the transcripts,
24 which were then sorted and extracted into groups to develop higher order themes. These
25 higher order themes were categorised into singular topics which formed the results of the

1 study. To ensure trustworthiness of the data and enhanced credibility of the data's
2 interpretation (Smith, 2018), a relativist approach was adopted (Smith & McGannon, 2017).
3 The lead author frequently discussed the analysis and findings of the transcripts with
4 members of the research team, who acted as “devil’s advocate”, questioning the lead author
5 on the method of analysis and the themes generated from the transcripts. This resulted in
6 several minor changes to the coding of the data. In order to enable naturalistic generalisability
7 of the data, contextual detail using direct quotations and interactions between the participants
8 and the researcher were presented to allow the reader to make connections to their own
9 experiences (Smith, 2018).

10

1 **Results**

2 The following results have been broken down into five sections: travel fatigue, inability to
3 switch off from football, perception of team meetings, internal pressure to succeed and
4 reducing mental fatigue. Names and locations have been removed where appropriate in the
5 interest of anonymity.

6 ***Travel fatigue***

7 Fatigue from travel was cited by several members of the squad, with greater perceptions of
8 fatigue dependent on travelling distance.

9 ***Participant 7** – I think that's one of the main things, because over the season we'll do most likes of*
10 *eight or nine away trips to London, pretty much, Brighton, so it is mentally demanding, but I think it's*
11 *a lot worse if you're not used to it.*

12 ***Participant 8** – Yeah I think it's like that with us, we're in full time, so we're in everyday, so we get*
13 *like one day off a week, but then like on a weekend so we played XXXXXX at the weekend and erm, so*
14 *we have been in all week, and then it comes to Saturday morning and we're traipsing all the way up*
15 *to XXXXXX, and it's just like, you know, you don't get a break from it, so when it's an away trip it can*
16 *be quite, mentally take over, just kinda feel like it's consumed you almost and yeah you're not getting*
17 *time to switch off, so when you come home on a Friday, you know you'll sit down and have your*
18 *dinner but then you're up again the next day and travelling and you're away for the whole weekend.*
19 *Erm so sometimes you know just the luck of the draw if you have a long place to travel to it can be*
20 *quite mentally exhausting, yeah.*

21
22 Travel had an additional effect on perceived training readiness and performance

23 ***Participant 2** – So we've had times where its took us that long to travel and by the time we get there,*
24 *the next day we're training and stuff, so it is tough to recover from that.....you know, yeah...*

25 ***Participant 5** – I think we're obviously fortunate that probably XXXXXX is a lot smaller than what*
26 *XXXXXX would be, and that the travel wouldn't be sort of the extreme relation to this article. Like, I'd*
27 *say for the majority of us it would be about less than 30 miles each way, like, but, obviously yes for*
28 *international matches abroad we'd seem to go out of like, XXXXXX which is two hours on top of*
29 *before you even start to fly.*

30 ***Interviewer** – Yeah.*

31 ***Participant 5** – And then just through no fault sometimes of the XXXXXX, they go the less direct way,*
32 *so we go via somewhere else, erm, just probably to save a bit of cost, but yeah so, by the time you get*
33 *there you probably are mentally sort of drained 'cause you have been on your feet or you have been*
34 *travelling or you've maybe worked the day before and then had the travel with football teams. So, the*
35 *last thing you want to do is go out and train the next day. But erm, we would normally go out and*
36 *train obviously the next day after all the travelling for maybe 24 hours, it's just, it's tiring like.*

37 ***Participant 1** – Erm, some- sometimes like there's are situations you're not getting there til 2 o'clock*
38 *in the morning, and then you're being asked, obviously we get up at normal time, even if the time zone*
39 *has changed, you know, were trying to stick, getting in their time zone. We're getting up at 9 o'clock*

1 and training by maybe 11 or 12 that day, so, ah, it's just what the girls are saying there, about you
2 being mentally fatigued as well as physical.

3
4 **Inability to switch off from football**

5 Likely due to a more infrequent playing schedule in comparison to men's football, the impact
6 of match-play in isolation received little attention in the focus groups. However, the general
7 overall perceived heavy exposure to football related activity was frequently mentioned.

8 **Participant 9** – Yeah I just think about everything I do is football. When I go home, my dad's got
9 football on and it's like all of a sudden "how was your game?" and it's like "fu-".

10 *Laughter*

11 **Participant 9** – To talk about it again, then you go on social media, and all, all you'll see is FA
12 (Football Association), the WSL (Women's Super League) you know, so it's all football. It's...you
13 can't get away from it, don't get me wrong, I love social media, I go on it all the time, but it is
14 everywhere. You go watch it on TV, you've now got Alex Scott and sportswomen working on there.
15 You can't literally get away from it.

16 *Laughter*

17 **Participant 9** – Which is good, brilliant for the women's game, but we are in this bubble at the
18 minute, we can't get out of.

19 **Participant 6** – Yeah.

20 *Laughter*

21 **Participant 8** – We just need to stop her talking!

22 *Laughter*

23 **Interviewer** – No. Be as honest as you want!

24 **Participant 8** – But I get what you mean, about like, say like I've just had a heavy week, and the
25 game's on at the weekend like, it'll be on in the house, and I can't think of anything...

26 **Participant 9** – Yeah.

27 **Participant 8** – ...like, I don't even wanna watch it like. That, because I'm like "this is still football
28 like", and that's all I hear. Sometimes I just wanna switch off.

29 **Participant 9** – and Match of the Day is on, and the woman from the WSL (Women's Super League)
30 show hasn't even come on yet, oh top!

31

32 The need for a break from football was raised.

33 **Participant 2** – We don't really get a break, especially in the campaign. So we have a few weeks off in
34 Christmas time, but apart from that, we're just like constant.

35 **Participant 1** – Because we finished last season, we finished end of August and then we're straight
36 into these qualifiers, and then we obviously had erm, XXXXXX and, erm, oh, is that this year?

37 **Participant 2** – XXXXXX?

38 **Participant 1** – Oh yeah, XXXXXX last year and XXXXXX. This year's been kinda constant since,
39 since then. Because the way this season works, it usually coincides with our season finished, and a
40 new campaign is starting, and it'd be the - the same next year because the qualifiers start again in
41 September.

42 **Participant 2** – Yeah.

43 **Participant 3** – Even though your body needs it physically as well, mentally you do need a break like.

44 **Participant 2** – Yeah.

Participant 3 – You're with the same people all year like three or four times a week. Sometimes it's nice just to get two weeks off where you don't have to think about football. Just have some downtime where you can kinda do whatever you want with your evenings.

Participant 1 – Be normal for once. Be a normal person.

Participant 2 – Yeah. Because we're obviously cause we're not like professional setup, we train in the evenings and we train on weekends. So there are sometimes we'll be out on a Sunday all day because that's when our club trains. Sunday morning and then Sunday afternoon, and then Monday, like Tuesday was. Thursday, so we'll be out a lot training. And obviously you're working in the day and stuff. So there is points in the year where you're like, just need....

Participant 5 – Need a holiday.

Participant 2 – You do, you do like, you become tired, a wee bit tired.

Fatigue experienced in team meetings

A key point commonly raised in the focus groups was the perceived unnecessary length of the team meetings used to prepare for upcoming international matches. These team meetings, they suggested, could last up for two hours.

Participant 6 – But if it's constant, ergh, just flat and going over the same thing over and over and over, it just kills me, drains the life out of me.

Participant 8 – Yeah. I think in this environment as well, you come into camp and today like we've had like heavy day, we've been trained twice and like everyone's physically and mentally already drained, and then you have a meeting and it's like, oh my God, I mean the meetings have lasted a good two hours.

Participant 6 – Yeah.

Participant 8 – And when the meeting's done, you're going to bed. You're sitting in the meeting, trying not to fall asleep like, it gets that bad but it's the information like XXXXXX says, it's repetitive, and it's repetitive and it's going round in circles. Yeah and then obviously you're going to bed and then the next day you're waking up and you're shattered, like, it's just pointless really.

Participant 6 – Yeah.

Participant 8 – There's just no point. There's no need for it.

Participant 7 – I think in the last camp that happened, and we didn't have like one minute for the first like four days.

Participant 6 – Yeah.

Participant 7 – It was like a meeting in the morning, and at lunchtime there was a meeting about somebody else had come wanting something. And then in the afternoon there was another meeting, oh in the night time, there was another meeting. It came to a point where I was like, I don't mind a meeting, but I don't know what's going on here. I don't know why we're having this meeting like.

To improve team meetings, a shorter duration length with more concise information was proposed.

Participant 8 – There's just no need to have prolonged meetings like, like literally only need to be 20 – 30 minutes max, like.

Participant 9 – Yeah.

Participant 8 – There's just no need. Anything more than that, it's just repetition.

Participant 9 – The thing is, if you don't have that meeting there, you just say, look we'll have a quick five minutes before, ok, everyone could have had that nap in their room, then got psyched up a bit more in here, and we're on the bus listening to our music ready to go. Instead we're doing it in the

reverse order when we have to be down here an hour and a half early, and then we're there and then we're knackered.

Half time team talks were also critical in their delivery.

Participant 1 – Just for me personally, sometimes I know it's not before kick-off, but at half time like, if a coach comes in and talks for the whole fifteen minute period at half time, I just find that really draining.

Participant 2 – Yeah.

Participant 3 – Yeah.

Participant 1 – Because at half time I just want say three or four points of either what we're doing, you know a mixture of make sure what we're doing well and what we need to improve on, but I want it, like short concise instead of fifteen minutes of talking because it's yourself as a player, you want a few minutes to switch off and relax again at half time before you obviously go back out again. I just find it draining sometimes if someone just talks constantly, you know for the fifteen minutes.

Participant 5 – Yeah, I agree.

Interviewer – What are your opinions on the half time then, team talk?

Participant 3 – Yeah even getting yourself ready, if the manager's talking, you feel like you can't get up and go to the bathroom and get a drink and get something you know, to eat, cause you feel like you need to sit there and give him your attention, and then when he's finished you're rushing yourself to get back out and get on the pitch again so, so I think as XXXXXX said, making it short, concise, two or four points you can kinda remember.

Anecdotes of effective half time team talks at domestic clubs were shared.

Participant 2 – What I like, like at our, at our club, erm, when we come in at half time, our coach kinda stays in the background, kinda gives us a minute, that...

Participant 4 – Yeah.

Interviewer – Yeah.

Participant 4 – Amongst ourselves.

Participant 2 – Kinda a discussion amongst ourselves and get erm, your drinks or your snacks or whatever, and he gives us our time to kinda, just have a good chat amongst yourselves, and that's when he comes in. But as XXXXXX says like, I think it's key that you do get told about this is what we need to fix, and this is how we need to fix it. So when we go out for the second half, we can obviously, you can, yeah, fix what's not working.

Internal pressure to succeed

Players frequently cited a pressure from within their own team to succeed, which negatively impacted on perceived performance.

Participant 8 – It comes from those around you like, like in the environment it could be coaches or it could even be players in some, erm situations. Like it could be part of the team, or the players really get on at each other, and if you do, you're doing something bad straightaway, they're on your case. And then that could lead you to feel under pressure every time you get the ball, and do it right this time, we need to do it right, or they're getting on you again, or it could be coming from the coaches. So I feel it could be coming from around as well, erm, yeah.

1 **Participant 10** – I think like, I think worst thing is when you know you've done something wrong, and
2 you hear it coming from the sideline, and you're like, I know, I just did it myself, like, I don't need
3 someone screaming at me telling me I've done it.

4 **Interviewer** – Yeah.

5 **Participant 10** – And then like XXXXXX said, the next time you get the ball, the last thing you wanna
6 do is mess up.

7 **Participant 8** – Uh huh.

8 **Participant 10** – But then you just get into this mindset, and then like, just put pressure on yourself.

9 **Participant 9** – Yeah.

10 **Participant 8** – Yeah, yeah.

11 **Participant 10** – And you're more likely to actually make a mistake.

12 **Participant 9** – But then like as well, with XXXXXX I start thinking what does he want me to do? I've
13 got the ball at my feet and I should be able to make my own decisions, I can see the pitch. But I'm
14 thinking actually...

15 **Participant 6** – It becomes robotic.

16 **Participant 9** – ...he wants me to hit that, I know he does. And you hesitate, and by the time you
17 hesitate someone's straight on you and takes the ball off you.

18 **Participant 6** – Yeah.

19 **Participant 9** – But really you should just play the game with freedom, and that's why you're here, do
20 you know what I mean?

21 **Interviewer** – Yeah.

22 **Participant 9** – You should, you've got your strengths, use them, but unfortunately, I think that's a lot
23 of pressure, and some team mates are like that, some team mates would be like, erm not here, but like
24 that.

25
26 The pressure to succeed appeared to negatively impact on younger and inexperienced players.

27 **Participant 7** – But I think we're alright because we're older, but the kids.

28 **Participant 8** – Yeah the kids.

29 **Interviewer** – Really?

30 **Participant 7** – Yeah go into holes, they're really good players but they just don't want to play.

31 **Participant 6** – Like XXXXXX for example, she couldn't handle the pressure like. She was a good
32 player that was in before, and she just couldn't handle the pressure, the constant pressure that was
33 under, so it's just not....

34 **Interviewer** – Yeah.

35 **Participant 7** – ...and there's loads of girls in about a year, loads that have just had a fall out over it,
36 who maybe aren't strong enough to, you know.

37 **Interviewer** – Yeah.

38 **Participant 7** – Some of us are more, right I enjoy this experience, more than worrying about what
39 you're gonna say.

40 **Participant 8** – Yeah.

41 **Participant 7** – And the things that they've been told over the years. It's like if we weren't mentally
42 tough, there's girls who just haven't, never come back.

43 **Participant 8** – Crumble...

44 **Participant 7** – Actually just stuck through it for some reason.

45 **Participant 9** – Yeah.

46 **Participant 7** – But I don't know why!

47 *Laughter*

48 **Participant 8** – We've just managed to come back again.

49 **Interviewer** – Yeah.

50 **Participant 8** – And so many talented players have just walked away because they can't handle it.
51 Can't put themselves through it again, can't cope with the pressure and, you know, it's not fair is it?

52
53 Differences were apparent between international and domestic settings.

1 **Interviewer** – How do you compare that to domestic football?

2 **Participant 2** – You definitely feel more of a confident player in terms of club level, I would say.

3 **Participant 3** – Yeah.

4 **Participant 2** – You kinda get to express yourself more I suppose. And obviously, erm, probably be in
5 that kind of environment a lot more, you know with other, like you spend a lot of time with club, club,
6 erm, mates obviously so, I suppose you don't really have the pressure, like it doesn't compare.

7 **Participant 3** – Yeah

8 **Participant 2** – It just doesn't compare at international level. Like, at all.

9 **Interviewer** – Yeah.

10 **Participant 2** – Erm, yeah obviously you wanna go in and win. I suppose we go in the club games
11 wanting to win them. Especially this year like, we go in wanting to win because we know we're
12 capable of winning them, so yeah.

13 **Participant 4** – It's a lot different for me because I'm one of the younger ones here. So it's like, less
14 pressure but there's more pressure because I have to prove I'm good enough to be. I go out in the
15 club I'm still one of the younger ones but more experienced in their groups.

16 **Participant 2** – Yeah.

17 **Participant 4** – But with me being, so there's that different expectation or pressure. I feel that, yeah.

18 **Participant 2** – Yeah.

19 **Interviewer** – What about yourself, anything to add?

20 **Participant 3** – Yeah, I don't really know, I don't really know how to describe the difference between
21 international and club, it is just different emotion whenever you go out to play.

22 **Participant 2** – Yeah.

23 **Participant 3** – But if you do get in to play league, cups, finals like that, there still is that expectation
24 that you have to step up and like, the international players have to be big players on those occasions,
25 and you have to perform well, but I don't know, you probably don't get as overwhelmed, or in awe of
26 the occasion as you would at international level.

28 **Pre-match activity**

29 Music played a large role in player preparation before a match. The role of music acted as

30 both relaxation in the hours leading up to the match.

31 **Participant 1** – I think a lot of us on the way to games and stuff, lots of people prefer to listen to music
32 by themselves, or there are a couple of people with headphones in, but all of our team would try and
33 zone out, try and get themselves in the zone, try and listen to some music, you know if you're traveling
34 by bus or whatever to the game. Erm because obviously, everyone has a preference of what they're
35 gonna listen to before the game. Erm but that's on the way to the game, most people would kinda do
36 that.

37 **Participant 2** – I think it's very different in terms of club matches and international match days, it's
38 completely different for everyone. Well maybe not you, you don't do anything!

39 *Laughter*

40 **Participant 2** – Club matches you're going from work, and kinda picking people up whatever.

41 **Interviewer** – Yeah.

42 **Participant 2** – But in terms of international games like, it's nice to, you know when you get time
43 during the day, to just lie and chill and listen to your music, to just lie on top of your bed and just
44 yeah, get some peace for a while.

46 Music acted as more of a motivating factor closer to kick-off.

Participant 6 – It's changing room, music on, getting ready to warm-up, and then going out warming up.

Participant 9 – Yeah 45 minutes before innit, when we go out isn't it?

Participant 6 – I think it's the same after you come in from the warm-up, music on again, kinda buzzing, everybody's kinda geeing each other up.

Discussion

Whilst the physical demands of elite female football have been well investigated (Datson et al., 2017; Bradley et al., 2010), little is known about the impact of mental fatigue. Despite six original studies investigating the effects of mental fatigue on football-specific performance (Smith et al., 2018), they were limited by the ecological validity of the tasks used to induce mental fatigue, and lack of female representation. The aim of the present study was to therefore identify the real-life causes of mental fatigue in elite female football players, using several relevant topics from anecdotal quotes in elite football and themes theorised/demonstrated in recent publications to inform the choice of questions (Thompson et al., 2018; Smith et al., 2018; Coutts, 2016; Moore et al., 2017). The focus groups revealed a perceived negative impact of travel, combining work/education commitments with football, and the nature of team meetings as mentally fatiguing and detrimental to football-specific performance. The information gathered from these focus groups have provided a novel insight into “real-world” psychological issues which may aid future mental fatigue research and practice.

The impact of air travel on lower sleep duration and impaired football training performance amongst several players in the squad was cited in the focus groups. Knowledge on the impact of travel on sleep duration is not available in female football research, gender differences in sleep problems have been reported in the literature, with females from a general population experiencing more trouble falling asleep, waking during the night and feeling un-refreshed

1 upon waking than males (Groeger, Zijlstra, and Dijk, 2004). Previous literature in air travel
2 and sleep quantity is limited to elite male football, but has demonstrated that international
3 flights (10-18 hours) significantly reduces sleep quantity in the early phases of an
4 international training camp (Fullagar et al., 2016; Fowler et al., 2015). In both studies,
5 negligible effects were found for the effects of air travel on perceived recovery and
6 preparedness to train and play, which was contrasting to the current findings from the focus
7 groups. This may be explained by the validity of the psychometric tools used, or perhaps a
8 more prominent psychological issue associated with a series of transient negative effects,
9 collectively referred to as 'travel fatigue', which consists of anxiety concerning the journey
10 and the significant change to daily routine associated with international matches
11 (Waterhouse, Reilly, and Edwards, 2004). Indeed, many of the players in the current study
12 voiced such concerns as taking time away from work and the anxiety of travelling home to
13 return to work, domestic duties and club football commitments. To improve sleep, players
14 may benefit from education and support with sleep quality/quantity. In elite female netball, a
15 60 minute education program on sleep hygiene with practical advice (sleep routine, lighting,
16 avoidance of caffeine and light emitting technology, and relaxation strategies) significantly
17 resulted in increased sleep quantity during a pre-season training camp (O'Donnell and
18 Driller, 2017). Sleep hygiene education has also improved sleep quality/quantity for females
19 in full-time employment (Chen, Kuo, and Chueh, 2010). Further research is required in elite
20 female football to understand the impact of travel on sleep quality/quantity, preparedness to
21 train, and the impact of sleep hygiene education programs.

22 The education and work commitments of players led them to support proposals for a break
23 from football-related activity. In order to commit to international call ups, players were
24 required to take annual leave from their jobs or reduce the focus placed on education and
25 work commitments. With players studying and/or working full-time and domestic football

1 matches predominantly played on weekends and consisting of frequent travel demands, it is
2 challenging for elite female players to find free time to unwind physically and mentally.
3 Previous focus group research in elite female footballers (Gledhill and Harwood, 2015) cited
4 the difficulty of combining education and football commitments and a lack of female football
5 career opportunities. This study subsequently proposed that players, coaches, teachers and
6 parents should adaptively interact to produce an optimal talent development learning
7 environment for elite football players. Examples of this support included football-specific
8 advice and guidance (e.g. psychological skill development), realistic expectations and role
9 strain management. A further consideration is detachment from sport (i.e. rest days), which
10 has shown to be effective in promoting physical and cognitive recovery (Balk, de Jonge,
11 Oerlemans, and Geurts, 2019; Balk, de Jonge, Oerlemans, and Geurts, 2017). In one study
12 consisting of 18 female University field hockey players (Eccles and Kamzier, 2019),
13 participants became rested by sleep and not thinking about their sport (wakeful resting).
14 Activities to distract oneself from sport included watching television and socialising with
15 friends. Indeed, the study also noted that obtaining restful experiences was difficult due to a
16 busy schedule, which would only be more challenging in the current cohort of international
17 football players who lead a dual career. Therefore, future research and practice are required to
18 further investigate and implement a support network to decrease the strain of dual career in
19 elite female football players. This will allow more time to focus on football-specific activity
20 and reduce work/study related stress and feelings of mental fatigue.
21 town). Obtaining resting experiences during in-season rest days is challenging due to limited
22 time but more time is available to obtain these experiences during the off-season.

1 An additional theme captured from the focus groups was negative connotations towards
2 prolonged information intake from coaching staff, predominantly in team meetings and in the
3 half time period of matches. The information received in meetings was often perceived to be
4 irrelevant or repetitive, and led to feelings of decreased arousal and increased mental and
5 physical fatigue. Only recently has sustained listening and its impact on arousal and mental
6 fatigue levels been investigated in normal hearing populations. Using a 50-min auditory
7 choice task, Moore et al., (2017) reported decreased task performance and increased
8 subjective mental fatigue pre-post trial, whilst event-related potentials revealed changes in
9 neural activity consistent with decreased arousal. This decrease also revealed a significant,
10 positive correlation with subjective report of reduced motivation. Indeed, many of the
11 meetings detailed in the focus groups were significantly longer than the 50-min task used by
12 Moore et al., (2017). In addition, despite the topic of football likely to be more interesting
13 than a generic auditory task to an elite playing population (and therefore in theory less likely
14 to incur changes in arousal and fatigue), it is evident that the perceived irrelevant content and
15 repetition of information is what likely caused the negative emotions towards the meetings. In
16 a training week preparing for a match, the length of time spent together in elite female
17 football is brief but full of many commitments (i.e. training, playing, media), making it
18 challenging for a coach to deliver the information necessary to be prepared for the upcoming
19 opposition. However, the findings from the focus groups suggests that coaches must adopt a
20 concise approach free from repetition which engages the concentration of the players.

21 Of particular interest in the current study was to elucidate the activity profile of elite female
22 football players in the lead up to a match. Indeed, the majority of the current mental fatigue in
23 football literature has demonstrated that a 30-min cognitive task (modified Stroop task)
24 induces mental fatigue (Smith et al., 2018), yet further research was required to elucidate
25 real-life activities performed by elite football players. The focus groups revealed that music

1 played a large role in the dressing room pre-match, and no reported activity (e.g. warming up,
2 communicating with players and staff) appeared to have a negative impact on subjective
3 mental fatigue or match performance. These findings complement previous research which
4 has shown that up two hours before kick-off, listening to music was the most common (82%
5 of players) pre-match activity in English Category 1 & 2 Academy male football players
6 (Thompson et al., 2020). Mixed effects of music are evident in female football literature, with
7 warm-up music shown to have a positive impact on repeated sprint ability in female
8 footballers (Tounsi et al., 2019), and conversely no influence on football-specific running and
9 heart rate/rating of perceived exertion (Young et al., 2009). Indeed, as these are isolated
10 performance tasks, the impact of warm-up music on match-play is unknown in female
11 football. However, research in male academy football has shown that music in conjunction
12 with imagery is associated with increased perceived match performance (Pain, Harwood, and
13 Anderson, 2011). Music therefore appears to have the ability to inspire, motivate and
14 heighten perception of task performance. The focus groups showed that routines are typically
15 regimented (i.e. set routine of a warm-up, listening to music, receiving a team talk and
16 entering a team huddle) and do not elicit mental fatigue. These findings demonstrate that
17 players in the current study do not enter match-play mentally fatigued, which is interesting
18 considering that mental fatigue has been consistently induced immediately prior to the
19 football-specific performance task (Smith et al., 2018). Future research is required to
20 investigate the presence of mental fatigue at different time points (e.g. during/after match-
21 play, pre and post-training, post-media commitments) to understand its potential onset period
22 in real-life settings.

23 A further finding from the focus groups was the perceived greater internal pressure to win
24 matches at international level in comparison to the players' respective domestic leagues. This
25 was possibly due to low world ranking place of the nation and results in previous

1 international tournament qualification campaigns of those interviewed, which likely lessens
2 external (supporters, media) expectations. This internal pressure appeared to come from the
3 style of coaching during already high pressurised match-play scenarios. Indeed, it is
4 commonplace for athletes to receive tactical information, instructions and feedback to
5 enhance performance (Porter, Wu and Partridge, 2010), which can come in explicit
6 (consciously clear and obvious) or implicit (the need for an athlete to take more ownership of
7 a scenario) forms. Research has shown that explicit forms of feedback are inversely related
8 with playing experience and can be detrimental to sporting performance (Buszard, Farrow,
9 and Kemp, 2013). The reported overuse of explicit feedback during match-play from the
10 focus groups appears to stifle concentration levels and freedom of thought. Elite players are
11 likely to benefit from implicit instructions which allow them to solve movement patterns and
12 environmental cues in a match, something which has been previously shown to improve
13 perceptual cognitive skills (Farrow and Abernethy, 2002).

14 The current study has cited travel fatigue, pre-match activity and the impact of team talks on
15 mental fatigue, which leads to future research directions. Future research should consider the
16 use of mental fatigue monitoring (e.g. 0-100mm visual analogue scale) during bouts of
17 prolonged travel (e.g. international camps) in addition to the traditional measurements used
18 (e.g. jetlag, sleep quantity) in previous literature measuring player wellbeing after long-haul
19 international travel (Fullagar et al., 2016; Fowler et al., 2015). The information gained from
20 subjective wellbeing scales (mental fatigue, preparedness to train) may aid coaches during
21 international camps when preparing the cognitive load of subsequent team meetings and
22 training sessions. Moreover, caffeine has proven effective in reducing mental fatigue and
23 subsequent cognitive task performance (van Cutsem et al., 2018) and is recommended for
24 players before the exposure of cognitive tasks which require attention and memory recall
25 (e.g. team meetings). Future research must also elucidate the impact of real-life activities on

mental fatigue in football. One study concluded that 30-min & 45-min of continuous exposure to social networking apps (e.g. WhatsApp, Facebook & Instagram) impaired passing decision-making in a 90-min simulated match. The study also revealed that 15-min exposure to the same condition did not impair passing decision-making (Fortes et al., 2019). Whilst smartphone use has been shown to be prevalent up to two hours before match-play in elite academy football players (Thompson et al. 2020), it is unlikely that players would be able to continuously use their smartphones 30/45-min in the two hours leading up to kick-off. Based on the aforementioned impact of prolonged listening on mental fatigue (Moore et al. 2017), further research may consider the impact of information intake from a coach (e.g. 15-min vs 30-min of exposure to coaching information) on perceived mental fatigue, tactical memory recall and task performance. Such evidence may aid coaches and performance analysts in future practice (e.g. length and content of tactical meetings, the use of short breaks for players to regain focus).

Conclusion

The present study aimed to provide novel findings related to the real-life experiences of mental fatigue from elite female football players. Many players felt a discomfort in being taken away from their daily routine and felt over absorbed by the constant exposure to football related activity. In addition, team meetings were often perceived as being unnecessarily long and met with frustration and low arousal. These findings provide useful applications for both future research and practice. Subsequent research on prolonged listening (using a simulated team talk or an auditory task) could aid in the development of a more ecologically valid task to induce mental fatigue, as opposed to the commonly used modified Stroop task (Thompson et al., 2018). Practitioners and coaches may also wish to consider alterations to daily practice in training camps, such as the timing, content and duration of

- 1 team meetings, providing players with free time if possible, and the modality of coaching
- 2 instructions during matches.

3 **Conflicts of interest**

- 4 There are no conflicts of interest for this study. Furthermore, no external financial support
- 5 was required.

6

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Reviewer comments

Opening message

We wish to thank the reviewers for taking the time to thoroughly review this manuscript and provide such helpful feedback. It is often a thankless task reviewing papers, but we are truly grateful for your time and effort. We hope all is well with you and your loved ones during these challenging times.

REVIEWER 1

Specific

Abstract

Advice: to optimize the search of the manuscript on the search engines, insert different keywords from those present in the title. For example: “women soccer” or “female soccer” instead of “female football”. Add "focus group" that helps the scholar to research articles using a qualitative research technique. Remove “mental fatigue”.

We thank the reviewer for this suggestion. The keywords “women soccer” and “focus group” have now replaced “female football” and “mental fatigue”

Overall manuscript

The APA style was used for the references. So, you must enter the comma after the last surname and before the year. For example: Page 3, lines 3,4: (Datson et al., 2017; Bradley et al., 2010)

Page 3, lines 10, 11: (Boksem, Meijman, and Lorist, 2005; Lorist, Boksem, and

Ridderinkhof, 2005).

Page 3, line 15: (Coutts, 2016); line 17: (Williams, 2000).

Many times, the semicolon is missing between two references, for example, pages 3, line 11 and 24.

Correct the references in the text by following these tips.

We thank Reviewer 1 for noting these errors. These have now been amended based on your recommendation of APA guidelines.

Reviewer 2

Specific comments

Introduction

Especially in the Introduction, it seems that the authors suggest that their study directly addresses one of the shortcomings of previous experimental research on the effects of mental fatigue on football performance: the low ecological validity of the cognitive tasks used to induce mental fatigue. This is not the case. This study simply identifies, using a qualitative approach, some of the activities that may induce mental fatigue in female football players. Such information may inform the development of more ecologically-valid tasks to induce mental fatigue in subsequent experimental research on the effects of mental fatigue on football performance. This should be made more clear in the Introduction.

We thank the reviewer for this suggestion. We have since amended some of the wording in the final paragraph in the introduction, as well as added the following sentence at the very end of the introduction:

“The information gained from this study may inform the development of more ecologically-valid tasks to induce mental fatigue in subsequent experimental research on the effects of mental fatigue on football performance, as well as guide practitioners in understanding causations of mental fatigue and how to minimise its presence.”

I find the bit about gender differences in the way people process and perceived psychological demands (page 4, line 7-13) out place at the end of this paragraph. I think it should have its own paragraph or added to the paragraph in which the authors rightly propose that female specific research should be done on mental fatigue and football (and sport performance in general).

We thank the reviewer for this suggestion. We have now moved this section to the final paragraph of the introduction to strengthen the need for female-specific research.

Methods

I am not an expert in qualitative methods of research, but the Methodology used for this seems sound to me. My main comment is about the fact that most of the topics proposed for discussion during the focus groups did not specifically referred to mental fatigue. Personally, I think this is not a weakness because I believe that athletes cannot so easily differentiate between fatigue induced by mental tasks and fatigue induced by physical tasks or, in the case of football, a complex combination of the two. An investigation of the potential factors that may cause “psychological load” (ie. mentally demanding tasks) is much more feasible and may identify potential sources of mental fatigue and inform the development of new tasks for future mental fatigue research in the lab. However, I think the authors should address in the Discussion this methodological feature of their work which is different from other qualitative studies in which athletes were explicitly asked to discuss or rate mental fatigue. I would also like to see a methodological or theoretical explanation for the quite specific choice of topics for discussion. For example, I find quite surprising that the authors did not explore the fact that the mental demands of playing football itself (both during matches and during training) may cause mental fatigue, and not just additional activities like meetings, travelling, coach talks etc.

We thank the reviewer for these suggestions, and understand the points made. It may not have been fully clear in the original manuscript, but the angle of the study is to predominantly understand the activities away from football which may cause mental fatigue, in particular the pre-match activity (travel, intake of information from coaches, pre-match activity). The previous work has typically used the Stroop task before using a performance task, meaning this study wanted to find information leading to a more ecologically valid task than the Stroop. In pilot work, questioning match-play demands proved challenging due to the difficulty of recalling specific information and breaking down physical/mental fatigue (as you quite rightly pointed out as well!).

In the first section of the methodology, the following sentences have been added to answer some of the questions/comments you have raised:

“The purpose of the questions provided were to elucidate the perceived psychological load of the aforementioned topic areas (e.g. travel, prolonged listening, pre-match activity) to inform the use of ecologically valid tasks in future mental fatigue research (i.e. use of tasks before a match). The psychological demands of match-play were not considered for the focus groups due to the complex and multifaceted nature of each match, which may prove difficult for participants to accurately recall in focus groups.”

Results

The results section is clear to me although I am not sure that Reducing Mental Fatigue is the correct heading describing the results about playing music before matches. It is not so clear from the results that the main purpose of playing music was to reduce fatigue, and music could be used before the match for many other reasons (e.g. motivational, reduce or increase arousal).

We thank the reviewer for this suggestion, and agree with the point made. This sub-heading has been changed to “Pre-match activity”.

Discussion

I would like to see something about the Methodology used and its potential limitations (see comments on Methods section) and more extensive discussion of how the findings of this study could inform the development of experimental tasks to investigate the effects of mental fatigue in football.

We thank the reviewer for this highly valid suggestion. A further paragraph has now been added at the end of the discussion:

“The current study has cited travel fatigue, pre-match activity and the impact of team talks on mental fatigue, which leads to future research directions. Future research should consider the use of mental fatigue monitoring (e.g. 0-100mm visual analogue scale) during bouts of prolonged travel (e.g. international camps) in addition to the traditional measurements used (e.g. jetlag, sleep quantity) in previous literature measuring player wellbeing after long-haul international travel (Fullagar et al., 2016; Fowler et al., 2015). The information gained from subjective wellbeing scales (mental fatigue, preparedness to train) may aid coaches during international camps when preparing the cognitive load of subsequent team meetings and training sessions. Moreover, caffeine has proven effective in reducing mental fatigue and subsequent cognitive task performance (van Cutsem et al., 2018) and is recommended for players before the exposure of cognitive tasks which require attention and memory recall (e.g. team meetings). Future research must also elucidate the impact of real-life activities on mental fatigue in football. One study concluded that 30-min & 45-min of continuous exposure to social networking apps (e.g. WhatsApp, Facebook & Instagram) impaired passing decision-making in a 90-min simulated match. The study also revealed that 15-min exposure to the same condition did not impair passing decision-making (Fortes et al., 2019). Whilst smartphone use has been shown to be prevalent up to two hours before match-play in elite academy football players (Thompson et al. 2020), it is unlikely that players would be able to continuously use their smartphones 30/45-min in the two hours leading up to kick-off.

1 Based on the aforementioned impact of prolonged listening on mental fatigue (Moore et al.
2 2017), further research may consider the impact of information intake from a coach (e.g. 15-
3 min vs 30-min of exposure to coaching information) on perceived mental fatigue, tactical
4 memory recall and task performance. Such evidence may aid coaches and performance
5 analysts in future practice (e.g. length and content of tactical meetings, the use of short breaks
6 for players to regain focus).”