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Disadvantage starts early: academy football has high levels of oral disease

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ABSTRACT

Objectives We have previously reported high levels of oral disease in professional senior team footballers in England and Wales. In this study, we aimed to determine the prevalence of oral disease in professional academy footballers, to identify if problems start earlier and to inform health promotion strategies.

Method Professional academy football clubs in England (footballers aged 16–18 years) were invited to participate. Questionnaires were used to collect oral health behaviours and self-reported impacts and validated clinical outcomes to assess oral health.

Results 160 academy footballers were recruited from 10 English academy football clubs, of whom 86.8% (n=139) were men and 13.2% (n=21) were women, with a median age of 16.9 years. We identified high levels of oral disease: 31.2% (n=50) had dental caries requiring treatment; 76.8% (n=123) had gingivitis; and 22.5% (n=36) had periodontitis. Tooth wear affecting up to at least 50% of tooth structure was present in 15.5% (n=25) of participants. While 76.2% (n=122) self-reported brushing their teeth twice a day, 15.5% (n=25) brushed once or less a day and 21% (n=34) had not attended the dentist for >2 years. There was a general perception that oral health issues impacted the sporting performance of participants.

Conclusion In this study, the prevalence of oral diseases among professional academy footballers in England was high and greater than found in national surveys of a similar age demographic. Urgent action is needed to embed oral health promotion in development and youth football, to reverse and prevent the disadvantages that will have lifelong consequences for treatment burden, quality of life and sporting performance.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ There is a high level of oral disease in elite athletes, including professional first team footballers, but no previous research exists looking at the oral health status of academy footballers.

WHAT THIS STUDY ADDS

⇒ High levels of oral disease were identified in academy footballers in England.

⇒ There was a lack of dental attendance, poor oral hygiene routines and poor diet, contributing to poor oral health and ultimately general health and sporting performance.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ More oral health promotion is needed at the academy football level, with a greater level of understanding of the impact of oral health on sporting performance required by sports medicine teams, football clubs and footballing authorities.

INTRODUCTION

Good oral health is a basic human right and an essential determinant of general health, well-being and quality of life.[1–3] Poor oral health is related to systemic disease,[4–7] and diseases can negatively impact athlete performance.[8 9] Epidemiological studies have previously reported that the oral health of elite and professional athletes is worse than comparable national population survey data, with 37% of footballers presenting with dental caries requiring treatment.[9–11] Furthermore, self-reported impact on performance from oral diseases was present in 7–30% of all athletes,[9 11–13] and a call to action has previously been made for oral health screening to be made routine in professional football.[13]

Academy teams are crucial to the ongoing development of young footballing talent worldwide. Given the links between oral health, general health and athletic performance,[8 10 12 14] it is important to identify whether oral health issues exist within this young cohort, since these conditions are preventable with simple, low cost, evidence based interventions. It is therefore crucial to identify earlier opportunities to embed oral health promotion as a prevention strategy.[11] The aim of this study was therefore to investigate the oral health of a representative sample of academy footballers in England and to explore possible influences on their oral health.

MATERIALS AND METHODS

Study design

After informed consent, quantitative data were collected in the form of clinical dental screening and a hard copy questionnaire modified from a validated health related quality of life measure, previously used at the

London 2012 Olympic Games.[12] To ensure completeness and reduce subjectivity, each participant was screened by the same two clinicians (SNK, PF), who corroborated each screening, both of whom have been trained in the field of sports dentistry and dental screening techniques. The screening method was based on an established oral health screening protocol.[15] This included experience of dental caries in the form of the decayed, missing and filled teeth (DMFT) indices[16] using the International Caries Detection and Assessment System (ICDAS),[17] with an ICDAS score of ≥3 used to identify teeth with a carious lesion requiring treatment. Periodontal health was assessed with basic periodontal examination (BPE) indices[18] and basic erosive wear examination (BEWE) indices[19] for assessing tooth wear.

Other infections and mucosal conditions were assessed with the PUFA (open pulp, ulceration, fistula and abscess) indices,[20] as well as infection associated with wisdom teeth. Screening for the presence of dental trauma was also included. These screening indices were chosen as they are well established tools used to identify early oral disease and help implement preventative interventions and management strategies to reduce further oral health morbidity. ICDAS, BPE, BEWE and PUFA scoring classifications are presented in online supplemental appendix 1 and the screening document in online supplemental appendix 2.

The bespoke questionnaire looked at: (i) demographics, (ii) oral health behaviours, including dental attendance, current dental issues (ie, dental pain or bleeding gums) as well as oral health routines, such as tooth brushing or the use of dental floss; (iii) frequency of sports/energy and fizzy drink consumption; and (iv) self-reported impact of oral health and trauma on training or performance (online supplemental appendix 2).

Screening sessions were undertaken in the physiotherapy room at the respective football academy teams' training ground to gain maximum participation. A standard single use field dental screening equipment kit, comprising a mirror, BPE periodontal probe and tweezers, was used. Each clinician provided their own dental loupes for magnification, a head torch and all appropriate personal protective equipment.

Recruitment

Medical teams at academy football clubs in England were contacted by email and invited to participate in the study. Each club was provided with the approved study proposal, information sheet and consent form for players and/or guardians to read and sign ahead of the screening. All players who participated in the study signed the consent form that was based on established screening protocols.[21 22] Female and male players were included in the study and players had to be aged 16–18 years to be eligible to participate. We aimed for as complete recruitment of eligible academy players[23] as could be achieved. Fourteen English professional clubs with academies were invited to participate after previous professional introductions to the medical teams. To enable participation, all screening was conducted at the training ground of the club, facilitating access for the athletes and minimising the burden on the players and academies. Ten clubs responded positively to the invitations.

Sample size

A sample size of 138 academy players was calculated to achieve 90% power to detect effects of medium size (OR=2.00) in three separate ordinal logistic regression models, measuring the effect of eight predictors (self-reported behaviours, beliefs and experiences) on clinical outcomes (periodontal health, tooth wear and caries, respectively). Alpha was adjusted to 0.017 (0.05/3) to accommodate multiple comparisons, based on Bonferroni's correction method.[23] This sample size calculation was conducted with G*Power 3.1.

Equity, diversity and inclusion statement

The author group was gender balanced, made up of mid-career and senior researchers from different disciplines, with one author from a marginalised group and two different countries represented across the group. Female and male participants were included in the study but no socioeconomic levels, race/ethnicity or cultural identities were predetermined when deciding on the selection criteria for this study. The influence of gendered environments on oral health and perceptions of oral health was not considered in the discussion.

Primary statistical analysis

Descriptive statistics were used to summarise the prevalence of the different oral diseases. To identify potential determinants of dental caries (ICDAS), periodontal health (BPE) and tooth wear (BEWE) (online supplemental appendix 1), three separate ordinal logistic regression models were built. Each model regressed one outcome (dental caries, periodontal health or tooth wear) on the following variables: brushing (coded 0=never to 4=three times a day), flossing (coded 0=never to 5=daily),

Table 1 Academy football club participation

Academy football club	No of players screened (eligible players aged 16–18 years)	% of total participants (total No of footballers=160)
1	21 (24)	13.1
2	18 (18)	11.2
3	12 (22)	7.5
4	13 (13)	8.1
5	9 (9)	5.6
6	21 (21)	13.1
7	27 (27)	16.8
8	10 (12)	6.2
9	4 (4)	2.5
10	26 (29)	16.2

Table 2 Participant dental experience

Dental attendance and experience	No of participants	% of participants	Median	IQR
Last dental visit <12 months	121	75.6		
Last dental visit >2 years	15	9.3		
Cannot remember last dental visit	17	10.6		
Required fillings at last dental visit	18	11.3		
No current dental issues reported	122	76.2		
Currently has toothache	15	9.3		
Currently has bleeding gums	8	5.0		
Missed training/competition due to oral health issues	17	10.6		
Missed training/competition due to dental trauma	5	3.1		
Perceived impact of oral health on sporting performance			58/100	40

mouthwash (coded 0=never to 5=daily), sports drink consumption (coded 0=never to 5=three times a day), fizzy drink consumption (coded 0=never to 5=three times a per day), perceived importance of oral health to sporting performance (coded 0=not important at all to 100=extremely important), time since last check-up (months) and time at club (months). Full details of the coding of these variables can be found in online supplemental appendix 3. P values ≤0.017 (0.05/3) were considered significant (see section on Sample size).

Exploratory statistical analysis

Dental caries, periodontal health and tooth wear were compared across clubs using Kruskal–Wallis tests, given that previous research identified club level differences in clinical outcomes.[11] Spearman rho correlation matrix was used to explore the relationships between the following self-reported behaviours, beliefs, experiences and clinical findings: dental attendance (number of months since last dental check-up), brushing (0–4), flossing (0–5), mouthwash (0–5), sports drink consumption (0–5), fizzy drink consumption (0–5), personal experience of oral health issues interfering with training (0=no, 1=missed training due to dental issues), personal experience of oral health issues interfering with matches (0=no, 1=missed matches due to dental issues), perceived importance of oral health to sporting performance (0–100), restorative index and unmet dental need/DMFT/ICDAS, periodontal health/BPE and tooth wear/BEWE (online supplemental appendix 1).

Spearman rho was used here to explore potential correlations between (i) perceived importance of oral health to sporting performance (0–100) and (ii) a number of self-reported oral health issues, including pain, fractured teeth, discoloured teeth, bleeding gums, ulcers, broken fillings, abscess, wisdom tooth problems and other dental issues (all coded 0=no, 1=yes). For exploratory analyses, p values ≤0.05 were considered significant.

The data were analysed in March 2024 using SPSS (Statistical Package for the Social Sciences) V.29 and Stata/MP 17.0. Statistical analyses were conducted and presented in accord with the CHAMP statement.[24]

Table 3 Participant oral hygiene and diet behaviours

Oral hygiene and diet behaviours	No of participants	% of participants
Brush teeth twice a day	122	76.2
Brush teeth once a day	18	11.2
Brush teeth when remember	7	4.3
Use dental floss at all	91	56.9
Use dental floss daily	8	5
Sports/energy drink consumption	122	90.6
Daily sports/energy drink consumption	37	23.1
Fizzy drink consumption	85	53.1
Daily fizzy drink consumption	14	8.7

Data storage and distribution

All questionnaires and screening documents were anonymised by assigning each participant a unique number. Each club medical team was given a separate oral health screening outcome form for each participant, highlighting any clinical findings and dental treatment needs (online supplemental appendix 2).

RESULTS

Of the 179 potentially eligible footballers, 160 completed the screening (table 1), thus fulfilling the sample size calculation. This represents 83–100% completeness of screening at each club with the exception of club 3 (55%). Nineteen footballers were not available for screening on the day. Most participants were men (87%; n=139/160) and 13% were women (n=21/160), with a median age of 16.9 years (range 16–18). Median time spent by players at each academy club was 55 months (range 1–144).

Decayed, missing and filled teeth (DMFT) findings

A total of 56% (n=89) of participants presented with at least one decayed tooth that required treatment, was

missing due to decay or had been filled. We found that 31.2% of participants (n=50) presented with at least one tooth with obvious caries (ICDAS score 3), 7.5% (n=12) with three or more carious teeth and 3.75% (n=6) with five or more carious teeth, all of which required treatment (online supplemental appendix 1 has ICDAS classification).

Periodontal health (BPE) findings

Most participants (76.8%; n=123) had a grade 1 or 2 BPE score in at least one sextant, with gingival inflammation and bleeding; 22.5% (n=36) of participants had grade 3 or 4 BPE, indicating irreversible periodontitis. Only one participant (0.5%) presented with a grade 0 BPE score at all sites in the mouth, indicating no gingival inflammation or bleeding (online supplemental appendix 1 has BPE classification).

Tooth wear (BEWE) findings

The mean BEWE score, indicating the presence of erosive tooth wear, was 5.3 (range 0–15), with 63.1% (n=101) presenting with some initial tooth wear confined to the enamel with initial loss of surface texture (complexity level 1). It was reported that 13.7% (n=22) of participants had moderate wear affecting ≤50% of the tooth structure, including dentine exposure (complexity level 2) and 1.8% (n=3) had tooth wear affecting >50% of the tooth surface, including exposure of dentine (complexity level 3), requiring professional management and intervention (online supplemental appendix 1 has BEWE classification).

Dental trauma findings

More than a third of participants (35.6%; n=57) had dental trauma to their incisors, with 10% (n=16) actively recalling that they received either a soft tissue injury (lips or tongue) or dental trauma during training or competition whilst at the academy club football. No players reported wearing a mouthguard during sport.

Pericoronitis and other oral infections

We found that 5.6% (n=9) of players presented with signs of pericoronitis affecting their wisdom teeth and a further 11 participants presented with PUFA signs. Of those with PUFA signs, one had a clear dental abscess requiring immediate treatment and 10 had oral ulceration.

Self-reported oral health issues

Self-reported issues included 10.6% (n=17) currently experiencing dental pain at the time of assessment, with 5% (n=8) reporting bleeding gums and 5.6% (n=9) reporting broken or fractured teeth and fillings (table 2).

Oral health and impact on training, competing and sporting performance

Table 2 shows that 10.6% (n=17) and 3.1% (n=5) of participants reported a negative impact on their sporting performance from oral health issues or dental trauma, respectively. Participants ranked (from 0 to 100) their general perception of the impact of oral health issues on overall sporting performance, with 56.2% (n=90) ranking 60 or above (median score 58/100).

Statistical analysis

The results of the primary analysis (ordinal logistic regression models) are available in online supplemental appendix 3. Only one finding was significant at the adjusted alpha threshold of 0.017: greater time since last dental check-up was associated with higher (worse) periodontal health scores (p=0.015). Findings that were significant at the traditional alpha threshold of 0.05 are available in online supplemental appendix 3.

Only periodontal health differed significantly by club (Kruskal–Wallis H (9) =28.77, p<0.001). An exploratory correlation matrix revealed significant associations between brushing and flossing (those who brushed more frequently also flossed more frequently: rho=0.17, p=0.033), and between sports/energy drink consumption and fizzy drink consumption (greater use of one was associated with greater use of the other: rho=0.27, p<0.001) (online supplemental appendix 3). Flossing was associated with dental attendance: the longer the time since their last check-up, the less frequently they flossed (rho=–0.20, p=0.015), and dental attendance was in turn associated with periodontal health/BPE: the longer the time since their last check-up, the higher their BPE (rho=0.21, p=0.014). Periodontal health/BPE was positively associated with tooth wear/BEWE: the higher the BPE, the higher the BEWE (rho=0.26, p=0.001).

Use of mouthwash was significantly associated with perceived importance of oral health to sporting performance: those who perceived a stronger link between oral health and sporting performance were more likely to use mouthwash (rho=0.19, p=0.016). Paradoxically, perceived importance of oral health to sporting performance was positively associated with DMFT: those with higher DMFT perceived a stronger link between oral health and sporting performance (rho=0.16, p=0.040). Indeed, those with higher DMFT were more likely to report that dental issues had affected their training (rho=0.20, p=0.013), as were those with high levels of decay (rho=0.17, p=0.032), which was positively associated with DMFT (rho=0.66, p<0.001).

DISCUSSION

Key findings

The findings of the study showed that there were high levels of oral disease in professional academy footballers in England. There was evidence to suggest that the level of dental attendance, dental treatment needs as well as some oral hygiene habits were worse than previous national epidemiological surveys, which were related to those aged ≤15 years and 18–23 years.[21 25 26] Some participants also reported that they were negatively impacted by their own experience of oral health issues, affecting their training or sporting performance.

Determinants of oral health

It is well documented that poor oral health is disproportionately associated with levels of deprivation,[27–30]

and that dental attendance is linked to socioeconomic status.[31] Therefore, the socioeconomic status of the academy players might be an important determinant of their oral health, as low dental attendance was associated with higher BPE scores (worse periodontal health) in this study, compounded by the low prevalence of interdental cleaning, such as daily dental floss. Although no data were collected on player socioeconomic status as part of this study, it is clearly an important area for future research.

It was surprising to see such high levels of tooth wear in such a young population. Tooth wear is a multifactorial issue, affected by dietary acids, stress induced tooth clenching and grinding (parafunction), and eating disorders (bulimia) or acid reflux. There were clear patterns of tooth wear identified during the study on the palatal surfaces of the upper front teeth, characteristic of acid reflux and possible eating disorders. This should be of concern given that in many instances these issues will go undetected until it becomes problematic to the player, affecting not just their dental health but their general health and well-being.[32] In view of the increasing awareness of eating disorders in youth and elite sport,[32] this aspect should be explored further as it might help to screen for affected individuals leading to earlier support.

The impact of sports drinks on dental health has been well researched. Demineralisation of teeth in low pH environments increases their risk of decay and tooth wear. The consumption of sports, energy and fizzy drinks contribute to this, due to their high sugar and acidity levels.[33–36] It has also been suggested that cumulative training time is positively associated with higher rates of tooth wear through dental erosion, possibly due to a reduced buffering capacity of saliva due to oral dehydration during physical exercise.[37 38] This could further explain the higher rates of tooth wear identified during this study. We therefore strongly recommend better communication between sports nutritionists and dental teams on the management of hydration, nutritional supplements and their potential impact on dental health.[39] These findings call strongly for early preventative dental screening programmes and more regular dental examinations to help identify these additional risk factors[40] in academy footballers.

Although levels of reported dental and soft tissue trauma during sport were relatively low, it would be beneficial to players and clubs to have some basic training on the long term implications and management of dental trauma, including following recognised dental trauma recall protocols[41] which did not appear to be particularly well adhered to by participants.

Oral health and performance impacts

It would be surprising if the levels of oral disease reported in this study did not have a negative effect on training and/or performance, with pain and acute infection being the most obvious mechanisms. We have previously shown a plethora of psychosocial impacts that may also be involved.[42] Evidence is also emerging of a negative association between oral inflammation and markers of cardiorespiratory performance.[43] An interesting finding in the statistical analysis was the relationship between high DMFT and perceptions of the link between oral health and sporting performance. A possible explanation is that these individuals had experienced the negative consequences of poor oral health and so were more aware of its impact on their sporting performance.

Strengths and limitations of research findings

This study is the first of its kind to assess professional academy footballers and a necessary follow-up to the previous study of professional first team footballers in England.[11] A key strength was the size of the study and the high proportion of academy players who participated, which suggest that the data are representative of English academy football. The use of two trained clinicians (SNK and PF) using validated clinical outcome measures also strengthens the validity of the data.

It is possible that the final screened sample was subject to selection bias in view of the non-participation of four out of fourteen potential teams and the players who could not attend for screening on the day. The most common reason for lack of eligibility was players falling outside of the age criteria, rather than convenience sampling. However, the high completeness of screening from nine out of ten teams and the widespread findings of oral ill health, especially in relation to dental caries, strongly suggest that these findings can be generalised to England football academy players more widely.

Self-reported oral health and oral health behaviour data may have been affected by social desirability bias, given that participants completed their questionnaires in close proximity to each other due to the practicalities of the screening environment. The low self-reporting of bleeding gums compared with the high rates of gingival bleeding and inflammation identified during the clinical screening may also reflect this. However, similarly low correlations have been reported previously in adolescents[44] and might instead represent a lack of awareness that could be harnessed for health promotion.

Comparative data are limited, and we did not recruit a comparison population for this study. Instead, we have made cautious comparisons with previous national surveys, including the Child Dental Health Survey in England of participants aged 15 years in 2013[21] and the 2009 Adult Dental Health Survey,[26] accepting that demographic differences between our study participants and those in the national representative surveys are likely to exist.[25]

The relatively small number of female participants is a limiting factor for the generalisability of this study. This was due in part to a limited response to the invitation to participate in the study, the number of female players available within the required age cohort as well as availability of players on the proposed screening days.

Research implications and impact on sporting performance

The high levels of oral diseases in academy football will have long and consequential implications for these participants. In the short term, these will include impacts on life quality, confidence and self-reported performance. Longer term, an additional lifelong burden of dental treatment and disadvantage can be expected, including negative effects on life quality, social mobility and risk of systemic diseases, including diabetes and cardiovascular disease.[1 45] In view of their age, these athletes are dependent on support and guidance from others and therefore oral health should be integrated into overall athlete health and well-being; the Duty of Care in Sport report in 2017[46] recommended that safety, well-being and welfare are at the heart of what sport does, and that government should consider how different government departments and agencies can work together on concussion and other medical issues.

Good oral health should be based on effective integrated health promotion. Knowledge alone is insufficient and behaviour change will be key. We have shown that this can be incorporated into high performance sport[45] underpinned by behaviour change theory, identifying valued motivators and developed by engaging with stakeholders. Such health promotion can (and should be) delivered within existing academy resources. A further lynchpin should be regular dental screening to personalise preventative oral health advice based on dental need.[13] Oral health screening at football clubs for these players should take place annually, preferably during pre-season health checks. We strongly recommend that academy players also have regular dental examinations in a dental surgery with appropriate dental radiographs and professional hygienist services. Dental health assessments should be on a risk based frequency, following the recommended guidance.[15 47] In many cases, the participants of this study would be classified as high risk with a recommended 3 monthly dental recall for both check-ups and professional hygiene appointments, highlighting the vast gap between current experience and national recommendations for dental care.[47] Collaboration between sport and oral health organisations is needed, with leadership from sport policy makers and federations.

Given the quite specific general and oral health demands of the professional sporting community, consideration should be given for a specific sports related oral health guidance section in the national guidance document, Delivering Better Oral Health: an evidence-based toolkit for prevention,[47] in addition to the existing guidance produced by individual institutions.[15]

CONCLUSIONS

In this study, we found that academy footballers in England had high levels of oral diseases as well as infrequent rates of dental attendance and suboptimal oral hygiene routines. The potential for lifelong disadvantage is substantial and will include the need for ongoing restorative dentistry, risk of tooth loss, effects on physical and psychosocial health, and social mobility. However, prevention of oral diseases is effective and low cost, and could be achieved with an integrated strategy to incorporate oral health within overall youth athlete health and well-being development.

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