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Participation in football and health-related quality of life among middle-aged and older men

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ABSTRACT

Background This study aimed to investigate the relationship between participation in football and health-related quality of life (HRQOL) in middle-aged and older men in Japan.

Methods This was a survey with cross-sectional design. Middle-aged and older men who were registered members of the Japan Football Association as players were recruited (Football group). We also performed an online survey of middle-aged and older men and categorised them into two groups based on questions for this survey about their current engagement in sports/exercise activities (none group and individual sports group). HRQOL was assessed using the 36-Item Short Form Health Survey (SF-36). The physical component summary (PCS) score and mental component summary (MCS) score were calculated based on eight SF-36 subscales.

Results The total number of participants in this survey was 5761 (none: 1988; individual sports: 1,776; football: 1997). After adjustment for covariates, PCS scores revealed no differences among groups (none: 51.2±11.1; individual sports: 51.9±8.9; football: 52.1±5.6), although the corresponding subscale scores differed significantly among groups. The football group exhibited significantly higher MCS scores compared with the other groups (none: 48.9±10.1; individual sports: 52.2±9.5; football: 56.2±7.2). The corresponding subscale scores of the MCS were significantly higher in the Football group compared with the other groups.

Conclusions Findings suggest that middle-aged and older men who are registered football players had better HRQOL in the mental aspect compared with those without any exercise habits and to those who engage in individual sports, although the cross-sectional design could not establish causality.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ There is sufficient evidence to support a positive association between sport participation and health among middle-aged and older men.

⇒ It is not clear whether participation in football in middle-aged and older men provides further benefit to subjective health compared with individual sport or no sport engagement.

WHAT THIS STUDY ADDS

⇒ This study provides cross-sectional evidence with a large sample for a relationship between participation in football and health-related quality of life, especially in the mental aspect, in middle-aged and older men.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Findings of this study support public health practices that encourage individuals to engage in sports/exercise in their later life to maintain their subjective health, and sporting organisations can play a pivotal role in these practices by encouraging participation in sports and adapting rules to accommodate people of different ages.

INTRODUCTION

Sport is a form of leisure-time physical activity in which participants aim to achieve a defined goal individually or as a team while adhering to common rules and often requires participants to engage in moderate-intensity physical activity. Substantial evidence has demonstrated the health benefits of sport participation with various objective health outcomes.[1 2] A systematic review revealed that participation in any type of sport may have positive impacts on cardiopulmonary fitness and physical function in people aged 60 years and over.[1] Another systematic review focusing on the effects of community-based, recreational-level group sports on cardiometabolic risk reduction concluded that group sport participation improves cardiometabolic and fitness parameters in adults.[2]

In addition to objective health outcomes, subjective health outcomes such as a person's view or perception of their health are also important for giving a comprehensive picture of an individual's health status.[3] A prior systematic review indicated that sport participation was positively associated with enhanced subjective psychological outcomes.[4] Health-related quality of life (HRQOL) represents

subjective well-being and has gained acceptance as an important measure for assessing health in various research fields.[5] A recent scoping review revealed the potential benefits of sport participation on HRQOL.[6] Sport participation, especially in team settings, can be a means of social engagement.[7] This inherent social nature of team sports is expected to yield additional positive subjective health outcomes, alongside physical health benefits.[8]

Among team sports, football receives the most media coverage globally and captures the attention of large audiences worldwide. Football is characterised as an intermittent and rapid intensity-varying sporting activity, involving multiple turns, jumps and sprints with accelerations and decelerations.[9] These characteristics of football, containing a variety of physical activities, are similar to those of multicomponent exercise programmes, which have been reported to improve health outcomes.[10] Football has been used as a training modality in previous studies focusing on the impact of sport on health.[8] Evidence indicates that football training, or even just participation in football, has beneficial effects on objective health outcomes.[11–14] For example, a systematic review demonstrated that playing football has beneficial effects on multiple aspects of physical health, such as improvements in blood pressure and bone mineral density.[11 12] Another systematic review focusing on the effects of football on health in middle-aged and older adults concluded that football may have the potential to mitigate age-related changes in physical and physiological functions.[14] However, the effects of football on subjective health outcomes have not yet been established, and HRQOL has only been studied in a randomised controlled trial in patients with prostate cancer.[15] Therefore, it is essential to investigate the link between HRQOL and football.

Sporting organisations play a crucial role in promoting active sport participation, potentially contributing to an evidence-based approach to address physical inactivity, which is recognised as one of the major global public health challenges.[16] The Japan Football Association (JFA) is the governing body responsible for the administration of football in Japan and organises annual competitive football tournaments for middle-aged and older men. We hypothesised that these tournaments serve dual roles for middle-aged and older men: first, providing opportunities for engagement in leisure-time physical activity, and second, offering a platform for fostering social connectedness. Hence, the aim of the current cross-sectional survey was to investigate the relationship between football participation and HRQOL in middle-aged and older men.

METHODS

This is a cross-sectional survey, and this paper was written following the Checklist for Reporting Of Survey Studies checklist.[17]

Participants

We conducted an online survey of HRQOL in men engaged in football from December 2021 to November 2022. The inclusion criteria in the survey were men aged 40 years or older and players from senior football teams registered with the JFA. The JFA holds annual national tournaments in the 40s, 50s and 60+ age groups. The tournament structure follows a hierarchical progression from prefectural to national levels. Initially, prefectural-level league matches are held in each age group over several months, typically on weekends, to determine the representative teams for each prefecture. Subsequently, these prefectural representatives participate in regional tournaments in their respective regions, leading to the selection of regional representative teams. The final stage comprises a national tournament in each age group, organised annually by the JFA. Eligible 16 teams in total, including the nine regional representatives and seven additional teams such as a host prefectural representative, participate in the tournaments. Under this competition system, players engage in regular training sessions and matches throughout the year according to official competition rules. We approached all the players who participated in the national tournaments and distributed the research description with a quick response code that can access the survey form (online supplemental file 1). Additionally, we approached representatives of the teams registered with the JFA to disseminate the survey form to their team members. Participation in this survey was voluntary, and players who chose to respond answered the questions. The survey was conducted using a Research Electronic Data Capture system among players who were informed and consented to the aim of the survey.

In August 2022, another online survey was performed with Japanese men who registered with a survey company to collect data for comparisons with football players. Inclusion criteria were Japanese men aged 40 years and over and those who were not registered with JFA as players. Data were collected using an online panel through non-probability convenience sampling with quota controls for sports/exercise engagement. The sample consisted of 4000 men in total, comprising two groups (n=2000 each): individuals engaged in sports/exercise activities and those not engaged. Participants were recruited from the panel until the predetermined quotas for each group were filled. It should be noted that this convenience sample, despite the quota controls, may not be representative of the general population.

After data collection, participants were excluded if they self-reported having dementia, reported actively engaging in team sports or had incomplete data. Participants were then classified into three groups on the basis of their current engagement in sports/exercise activities: None (those who were not engaged in sports/exercise activities), Individual sports (those who were actively engaged in individual sports), and Football (those who registered with a football team as players).

Health-related quality of life

HRQOL was evaluated using the Medical Outcomes Study 36-Item Short Form Health Survey (SF-36), which is widely used for assessing HRQOL internationally. On the basis of individuals' responses on the SF-36, four subscale scores regarding physical aspects of health (physical functioning, role physical, bodily pain and general health) and four subscale scores regarding mental aspects (vitality, social functioning, role emotional and mental health) of health were calculated.[18] The Japanese version of the SF-36 has been validated for use in the general population[19] and provides physical component summary (PCS) and mental component summary (MCS) scores. The norm-based scoring method was used on the basis of Japanese population norms, and in this method, scores are standardised with a mean of 50 and an SD of 10 in general Japanese population. Higher scores indicate better HRQOL, and the minimally important difference was reported as almost 0.5 SD in clinical settings.[20]

Measures

The following sociodemographic characteristics were included as covariates: age, height, weight, years of education, marital status, smoking status, the number of family members living together, self-rated health and chronic conditions (hypertension, stroke, diabetes, heart diseases, diabetes mellitus, respiratory diseases, cancer, knee osteoarthritis and depression). Age was measured in years and categorised (40–49, 50–59, and≥60) for the analysis. Body mass index (BMI) was calculated as follows: BMI (kg/m^2)=weight(kg)/(height(m^2)). Participants were categorised into three groups according to BMI status: underweight (<18.5), normal (18.5–24.9) and overweight/obese (≥25.0). The last educational degree was measured with five options (junior high school, high school, college, undergraduate and graduate school) and categorised into three groups (≤ 12, 13–16 and>16) for the analysis. Marital status was reported using the following options: (1) married, (2) widowed or divorced and (3) never married. Occupational status was assessed using the following options: (1) self-employment, (2) paid employment and (3) no employment. Smoking status was measured using the following options: (1) currently smoking, (2) quit and (3) never. Living arrangement was classified by whether participants lived alone or not according to the number of family members living together. Self-rated health was assessed using an item from the SF-36: 'Overall, how would you rate your health?' with the response categories 'excellent,' 'very good,' 'good,' 'fair' and 'poor.' The total number of chronic conditions was calculated, and based on this number, participants were classified into three groups (none, single and multiple).

Statistical analysis

Participants' characteristics were described as percentages. Descriptive analyses were performed using χ^2 tests. Analysis of variance (ANOVA) and analysis of covariance (ANCOVA) were used to compare each subscale and summary component score of the SF-36 across sports groups. Bonferroni corrections for multiple comparisons were conducted, and p values <0.05 were considered to indicate significance. Age, BMI, years of education, marital status, smoking status, living arrangement and the number of chronic conditions were included in ANCOVA as potential confounders. Outcomes of the ANCOVA analyses were expressed as estimated marginal means with 95% CIs. Multivariate regression analyses were performed, with each summary component score of the SF-36 as the dependent variable and sports groups as the independent variable. Sports groups were used as dummy variables (none=0, individual sport=1, football=2; reference=none). Potential confounders included in the regression analyses were the same as those in ANCOVA. Beta (B) and 95% CI were calculated by the regression analyses. We conducted all statistical analyses in RStudio software (V.2023.09.0+463) using the programming language R (V.4.3.1) and SPSS V.28.0.1.0 for Windows (SPSS Japan).

Equity, diversity and inclusion statement

Our research and author team included a woman and ten men, senior and less-experienced investigators from a variety of disciplines in Japan. The study population included a spectrum of ages, demographics and comorbidities. In discussing the generalisability of our results and limitations of the findings, we acknowledge that this study may exclude individuals of a lower socioeconomic status because participants in this study can spare their leisure time not to work but to play football.

RESULTS

In total, 5761 men, with a mean age of 55.3±9.6 years, participated in this study. Of these, 1988 men (34.5%) were classified into the none group, 1776 (30.8%) were classified into the individual sport group and 1997 (34.7%) were classified into the football group. Detailed descriptive characteristics of all participants and each group according to daily sport participation are summarised in table 1.

Table 2 shows the mean scores of SF-36 subscales in all participants and their comparisons among the three groups. In terms of the physical aspects of health, the individual sport group exhibited higher scores across all subscales compared with the none group. Importantly, the football group exhibited higher scores in physical functioning, role physical and general health compared with the other two groups. Conversely, the score for bodily pain in the football group was lower than that in the other two groups. Regarding the mental aspects of health, all subscale scores in the football group were higher than those in the other two groups.

In terms of the summary component scores, the PCS scores were 51.2±11.1 in the none group, 51.9±8.9 in the individual sport group and 52.1±5.6 in the football group. MCS scores were 48.9±10.1 in the none group, 52.2±9.5

Table 1 Demographic, clinical and health characteristics of participants in this study

Variables	Total (n=3764)		None (n=1988)		Individual-sports (n=1776)		Football (n=1997)	
Age, mean (SD)	55.6	(9.5)	55.4	(9.4)	55.9	(9.6)	54.8	(9.7)
Age, n (%)								
40–49	1211	(32.2)	657	(33.0)	554	(31.2)	692	(34.7)
50–59	1320	(35.1)	698	(35.1)	622	(35.0)	662	(33.1)
≥ 60	1233	(32.8)	633	(31.8)	600	(33.8)	643	(32.2)
Body mass index, n (%)								
Underweight (< 18.5)	160	(4.3)	100	(5.0)	60	(3.4)	8	(0.4)
Normal (18.5–24.9)	2573	(68.4)	1249	(62.8)	1324	(74.5)	1522	(76.2)
Overweight/obese (≥ 25.0)	1031	(27.4)	639	(32.1)	392	(22.1)	467	(23.4)
Years of education, n (%)								
≤ 12	1072	(28.5)	668	(33.6)	404	(22.7)	546	(27.3)
13–16	2389	(63.5)	1183	(59.5)	1206	(67.9)	1320	(66.1)
> 16	303	(8.0)	137	(6.9)	166	(9.3)	131	(6.6)
Marital status, n (%)								
Married	2420	(64.3)	1187	(59.7)	1233	(69.4)	1801	(90.2)
Widowed or divorced	273	(7.3)	139	(7.0)	134	(7.5)	102	(5.1)
Never married	1071	(28.5)	662	(33.3)	409	(23.0)	94	(4.7)
Occupational status, n (%)								
Self-employment	446	(11.8)	222	(11.2)	224	(12.6)	195	(9.8)
Paid employment	2508	(66.7)	1277	(64.2)	1231	(69.3)	1602	(80.2)
No employment	810	(21.5)	489	(24.6)	321	(18.1)	200	(10.0)
Smoking status, n (%)								
Current	1072	(28.5)	592	(29.8)	480	(27.1)	456	(22.8)
Quit	1055	(28.0)	525	(26.4)	530	(29.8)	393	(19.7)
Never	1637	(43.5)	871	(43.8)	766	(43.1)	1148	(57.5)
Living arrangement, n (%)								
Alone	774	(20.6)	454	(22.8)	320	(18.0)	168	(8.4)
With others	2990	(79.4)	1534	(77.2)	1456	(82.0)	1829	(91.6)
Self-rated health, n (%)								
Excellent, very good, or good	2801	(74.4)	1289	(64.9)	1512	(85.1)	1851	(92.7)
Fair or poor	963	(25.6)	699	(35.1)	264	(14.9)	146	(7.3)
Self-reported chronic conditions, n (%)								
Hypertension	910	(24.2)	484	(24.3)	426	(24.0)	362	(18.1)
Stroke	44	(1.2)	26	(1.3)	18	(1.0)	9	(0.5)
Heart disease	162	(4.3)	91	(4.6)	71	(4.0)	92	(4.6)
Diabetes mellitus	316	(8.4)	187	(9.4)	129	(7.3)	72	(3.6)
Respiratory disease	133	(3.5)	68	(3.4)	65	(3.7)	81	(4.1)
Cancer	148	(3.9)	71	(3.6)	77	(4.3)	93	(4.7)
Knee osteoarthritis	67	(1.8)	31	(1.6)	36	(2.0)	130	(6.5)
Depression	228	(6.1)	141	(7.1)	87	(4.9)	30	(1.5)
Number of chronic conditions, median(min - max)	0	(0–7]	0	(0–7]	0	(0–5]	0	(0–4]
Number of chronic conditions, n (%)								
None (0)	2291	(60.9)	1206	(60.7)	1085	(61.1)	1336	(66.9)
Single (1)	1059	(28.1)	543	(27.3)	516	(29.1)	490	(24.5)
Multiple (≥ 2)	414	(11.0)	239	(22.0)	175	(9.8)	171	(8.6)

Data are expressed as mean (SD), median (min-max), or number (%).

Table 2 Comparisons of subscale scores of health-related quality of life

	Total (n=5761)	None (n=1988)	Individual-sports (n=1776)	Football (n=1997)	P value*	Post-hoc analysis†
Physical functioning	52.5 (8.0)	50.1 (10.2)	52.7 (7.7)	54.7 (4.1)	< 0.01	None<Individual-sports, Football; Individual-sports<Football
Role physical	52.2 (8.7)	50.6 (10.3)	51.9 (8.7)	54.0 (6.3)	< 0.01	None<Individual-sports, Football; Individual-sports<Football
Bodily pain	49.8 (9.8)	50.3 (10.7)	51.2 (9.4)	48.0 (8.8)	< 0.01	Football<None, Individual-sports; None<Individual-sports
General health	53.1 (9.9)	48.1 (9.7)	52.9 (9.2)	58.3 (7.8)	< 0.01	None<Individual-sports, Football; Individual-sports<Football
Vitality	52.7 (9.6)	48.9 (10.1)	52.5 (9.3)	56.6 (7.6)	< 0.01	None<Individual-sports, Football; Individual-sports<Football
Social functioning	51.9 (9.1)	50.8 (10.1)	51.8 (9.1)	53.0 (7.7)	< 0.01	None<Individual-sports, Football; Individual-sports<Football
Role emotional	52.3 (8.5)	51.2 (9.8)	51.9 (8.7)	53.7 (6.4)	< 0.01	None<Football; Individual-sports<Football
Mental health	53.0 (9.6)	49.7 (10.3)	52.4 (9.6)	56.8 (7.2)	< 0.01	None<Individual-sports, Football; Individual-sports<Football

Data are expressed as mean (SD).
*One-way analysis of variance.
†Bonferroni post-hoc tests.

in the individual sport group and 56.2±7.2 in the football group. Figure 1 shows the comparisons of PCS and MCS among the three groups using ANOVA. The PCS score in the football group was significantly higher than that in the none group, although there was no significant difference between the football group and the individual sport group. Additionally, the football group had a higher MCS score compared with the other two groups, while the individual sport group exhibited a higher MCS score than the none group.

Table 3 demonstrates the comparisons of subscale and summary component scores of SF-36 among three groups using ANCOVA. All subscale scores showed similar trends, as observed in the ANOVA results. In terms of the PCS score, the significant difference between the football group and the none group disappeared after adjusting for covariates. However, the differences in the MCS score among the three groups remained statistically significant even after accounting for covariates.

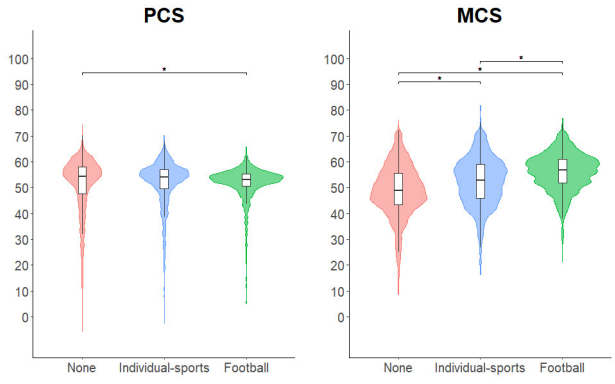

Figure 1 Comparisons of health-related quality of life (HRQOL) among groups categorised based on their sports participation using analysis of variance with Bonferroni post hoc corrections. Violin plots demonstrate the distribution of physical component summary (PCS) and mental component summary (MCS) scores of HRQOL. *Statistical significance in the Bonferroni post hoc correction test.

Figure 2 shows the differences in each summary component score of the SF-36 between the individual sports and football groups when those in the none group are used as the reference. The differences in PCS score relative to the none group in both the individual sports and the football groups were not significant (individual sports: B=0.4, 95% CI −0.2 to 1.0; football: B=0.5, 95% CI −0.1 to 1.1), whereas those of MCS score were statistically significant (individual sports: B=2.9, 95% CI 2.4 to 3.5; football: B=6.4, 95% CI 5.9 to 7.0).

DISCUSSION

This cross-sectional study aimed to explore the relationship between participation in football, as a representative team sport, and HRQOL in middle-aged and older men. The investigation involved comparisons among three groups: individuals without any sport participation, those engaged in individual sport and those engaged in football. No differences were identified in the comprehensive physical aspect of HRQOL among the three groups. However, HRQOL subscales regarding the physical aspects of health varied among groups, and different trends were exhibited for each subscale. Notably, individuals who regularly engaged in football exhibited higher scores in both the comprehensive mental health aspects of HRQOL and the corresponding subscales compared with individuals in the other two groups.

Our findings indicated that participation in football was not related to an increase in the level of comprehensive physical well-being. The corresponding subscales regarding physical well-being showed different trends.

Table 3 Estimated marginal means of health-related quality of life across groups

	None (n=1988)	Individual-sports (n=1776)	Football (n=1997)	Post-hoc analysis*
Subscale score				
Physical functioning	48.5 (47.9–49.1)	50.7 (50.1–51.4)	52.5 (51.8–53.1)	None<Individual-sports, Football; Individual-sports<Football
Role physical	49.1 (48.5–49.7)	49.9 (49.2–50.6)	51.7 (51.0–52.5)	None<Football; Individual-sports<Football
Bodily pain	49.0 (48.3–49.7)	49.7 (48.9–50.4)	46.4 (45.5–47.2)	Football<None, Individual-sports
General health	45.6 (44.9–46.2)	49.7 (49.0–50.4)	54.4 (53.7–55.1)	None<Individual-sports, Football; Individual-sports<Football
Vitality	47.2 (46.5–47.9)	50.3 (49.6–51.0)	53.9 (53.1–54.6)	None<Football; Individual-sports<Football
Social functioning	49.7 (49.0–50.4)	50.4 (49.6–51.1)	51.5 (50.7–52.3)	None<Individual-sports, Football; Individual-sports<Football
Role emotional	49.7 (49.1–50.3)	50.1 (49.4–50.7)	51.7 (51.0–52.4)	None<Football; Individual-sports<Football
Mental health	48.1 (47.4–48.7)	50.4 (49.7–51.1)	54.3 (53.6–55.1)	None<Individual-sports, Football; Individual-sports<Football
Summary score				
Physical component summary	49.7 (49.1–50.4)	50.1 (49.4–50.8)	50.2 (49.5–51.0)	
Mental component summary	47.2 (46.5–47.8)	50.1 (49.4–50.8)	53.6 (52.9–54.4)	None<Individual-sports, Football; Individual-sports<Football

Values are expressed as estimated marginal means (95% CI). Age, BMI, education, marital status, smoking habits, living arrangement, and number of chronic conditions are included as covariates.
*Bonferroni post hoc tests.
BMI, body mass index.

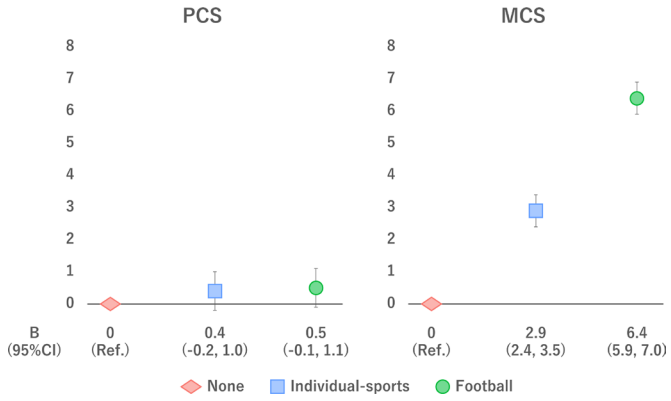

Figure 2 Beta and 95% CI for PCS and MCS scores shown as between-group differences from the none group. MCS, mental component summary; PCS, physical component summary.

Middle-aged and older individuals who actively engaged in football exhibited better subscale scores in physical functioning, role physical and general health, whereas they reported worse scores in the bodily pain subscale. Participants in the football group were middle-aged and older men who were registered as players with the JFA. The competitive tournament structure of the JFA, which spans a significant portion of the year, suggests that these players maintain a long-term commitment to competitive football, rather than engaging in occasional recreational play. Competitive football is classified as a vigorous-intensity physical activity, associated with improved scores in physical functioning, role physical and general health subscales. However, under competitive rules, players engage in physical contact, including tackles and sliding challenges, potentially offsetting these health benefits. From middle to old age, physical and physiological functions decline gradually. Additionally, pain occurs more often and takes longer to recover among middle-aged and older people compared with younger individuals,[21 22] as indicated by the bodily pain subscale score results in the current study. Prospective injury surveillance should be explored to clarify the potential injuries contributing to a worse score in the bodily pain subscale.

Participants in the football group exhibited a higher MCS score and higher corresponding subscale scores compared with those in other groups in this study. Notably, their scores were even higher than those of men who actively engaged in individual sports. An important characteristic of team sports is that they are social in nature[23] and have the potential to facilitate social interaction, as well as enhancing the sense of community among individuals. A study comparing footballers and runners revealed differences in the aspects they valued when engaging in their respective sports. The study reported that footballers were more oriented towards ludic (play-related) aspects, while runners tended to focus on personal health-related benefits.[7] Among team sports, football further requires close on-field communication between players, without real-time coaching instructions, because play continues uninterrupted except during halftime. This competitive characteristic of football may further enhance the inherent social aspects of team sports. Although a consensus has not been reached regarding the link between participation in team sports and subjective health outcomes,[4 8] our findings provide further support for the link, particularly in relation to the mental aspects of health. Additionally, the national tournament held by JFA is a competitive football tournament. Sports, except for recreational sports, are more or less competitive in their nature, and the competitive aspect of sports motivates and encourages players to pursue better performance through increased effort,[24] thereby contributing to an increase in self-esteem. Our findings showed that men aged 40 years or over showed a higher MCS score if they were actively engaged in sports; however, active engagement in individual sports could not achieve the minimally important difference in clinical setting (5.0 points) compared with those who were not engaged in any sports. The characteristics of football as both a team sport and a competitive sport are likely to contribute to an increase in subjective mental health in middle-aged and older men.

Within the life course, middle age is characterised as a stressful period involving the holding of key roles or responsibilities in the family, the workplace and the community.[25] Consequently, many individuals experience poor subjective health during this period.[26] As individuals transition from middle age to old age, their physical activity typically decreases, and they may experience a rapid decline in physical function, although subjective health often recovers slightly.[26] Participation in sports, especially team sports, has the potential to address both objective and subjective health challenges faced by middle-aged and older individuals.[27] A previous qualitative study identified various barriers to sport participation in middle-aged and older individuals, which were categorised into three domains: intrapersonal (physical health and lack of sports skills), interpersonal (time constraints, societal factors and perceived concerns) and organisational (lack of appropriate playing opportunities, cost, lack of knowledge and inappropriate facilities and location).[28] Sporting organisations play a pivotal role in engaging middle-aged and older individuals in sports. The JFA, for example, sets rules for senior-age tournaments that include: shortened playing times (20–25 min) for both halves, unlimited substitutions and the ability to re-enter players who have been substituted. This unique set of rules from middle age may enable individuals to continue playing football into older age. A prospective cohort study investigating the tracking and predictability of physical activity in old age on the basis of activities in middle age revealed a strong association between playing sports in middle age and being active 20 years later, surpassing other domains of physical activity.[29] Therefore, sporting organisations can contribute effectively to achieving healthy ageing through two key strategies: promoting earlier engagement in sports and

implementing a set of rules that take participants' physical functions into consideration.

One strength of this study lies in the relatively large sample size of middle-aged and older men who engaged in football. Additionally, the SF-36, a structured assessment tool for HRQOL, was used in this study. However, the current study involved several limitations that should be considered. First, the cross-sectional design was not able to reveal the causal relationship between sport participation and HRQOL. Additionally, we did not collect the data about the details of sport participation such as the intensity, frequency and duration. Future longitudinal studies should use wearable devices to collect objective measurements of sports participation, including intensity, frequency and duration. Sampling bias should also be corrected in future studies. Individuals who chose to respond answered questions, which introduce self-selection bias. Caution should be exercised when generalising findings in this study due to the nature of self-selected sampling. Additionally, those in the none and individual sport groups were registered with a survey company. The data obtained in this study were from a self-reported questionnaire, which may have resulted in recall bias. We asked participants about the sport they mostly engaged in and categorised them into the individual sport group; therefore, it is possible that those in the individual sport group also engaged in other sports, including team sports and football.

In conclusion, our findings demonstrated that participation in team sports was related to higher levels of subjective well-being, particularly regarding the mental aspects of health. Although the cross-sectional design was unable to establish causality, our findings suggest that participation in team sports may play a role in maintaining subjective health during middle and old age, as a period that typically involves a high physical and mental burden in the life course. Sporting organisations, not just football-related organisations, can contribute to healthy ageing by encouraging participation in sports and adapting rules to accommodate people of different ages.

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Patient and public involvement Patients and/or the public were involved in the design, or conduct, or reporting, or dissemination plans of this research. Refer to the Methods section for further details.

Patient consent for publication Consent obtained directly from patient(s).

Ethics approval This study involves human participants and was approved by the Research Ethics Committee of the Graduate School of Health and Sports Science, Juntendo University (approval number: 2021-69).This study was conducted according to the guidelines proposed by the Declaration of Helsinki. Participants gave informed consent to participate in the study before taking part.

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REFERENCES

1 S Oliveira J, Gilbert S, Pinheiro MB, *et al*. Effect of sport on health in people aged 60 years and older: a systematic review with meta-analysis. *Br J Sports Med* 2023;57:230–6.
2 Bellissimo MP, Galaviz KI, Paskert MC, *et al*. Cardiometabolic Risk Reduction Through Recreational Group Sport Interventions in Adults: A Systematic Review and Meta-analysis. *Mayo Clin Proc* 2018;93:1375–96.
3 Cleary PD. Subjective and objective measures of health: which is better when? *J Health Serv Res Policy* 1997;2:3–4.
4 Sivaramakrishnan H, Gucciardi DF, McDonald MD, *et al*. Psychosocial outcomes of sport participation for middle-aged and older adults: a systematic review and meta-analysis. *Int Rev Sport Exerc Psychol* 2024;17:398–419.
5 Zheng S, He A, Yu Y, *et al*. Research trends and hotspots of health-related quality of life: a bibliometric analysis from 2000 to 2019. *Health Qual Life Outcomes* 2021;19:130.
6 Blake HT, Buckley JD, Stenner BJ, *et al*. Sport Participation and Subjective Outcomes of Health in Middle-Aged Men: A Scoping Review. *Am J Mens Health* 2022;16:15579883221084493.
7 Ottesen L, Jeppesen RS, Krustrup BR. The development of social capital through football and running: studying an

intervention program for inactive women. *Scand J Med Sci Sports* 2010;20 Suppl 1:118–31.
8 Andersen MH, Ottesen L, Thing LF. The social and psychological health outcomes of team sport participation in adults: An integrative review of research. *Scand J Public Health* 2019;47:832–50.
9 Krustrup P, Dvorak J, Junge A, *et al*. Executive summary: the health and fitness benefits of regular participation in small-sided football games. *Scand J Med Sci Sports* 2010;20 Suppl 1:132–5.
10 Bruderer-Hofstetter M, Rausch-Osthoff A-K, Meichtry A, *et al*. Effective multicomponent interventions in comparison to active control and no interventions on physical capacity, cognitive function and instrumental activities of daily living in elderly people with and without mild impaired cognition - A systematic review and network meta-analysis. *Ageing Res Rev* 2018;45:1–14.
11 Milanović Z, Pantelić S, Čović N, *et al*. Broad-spectrum physical fitness benefits of recreational football: a systematic review and meta-analysis. *Br J Sports Med* 2019;53:926–39.
12 Milanović Z, Čović N, Helge EW, *et al*. Recreational Football and Bone Health: A Systematic Review and Meta-analysis. *Sports Med* 2022;52:3021–37.
13 Zouhal H, Hammami A, Tijani JM, *et al*. Effects of Small-Sided Soccer Games on Physical Fitness, Physiological Responses, and Health Indices in Untrained Individuals and Clinical Populations: A Systematic Review. *Sports Med* 2020;50:987–1007.
14 Luo H, Newton RU, Ma'ayah F, *et al*. Recreational soccer as sport medicine for middle-aged and older adults: a systematic review. *BMJ Open Sport Exerc Med* 2018;4:e000336.
15 Bjerre ED, Petersen TH, Jørgensen AB, *et al*. Community-based football in men with prostate cancer: 1-year follow-up on a pragmatic, multicentre randomised controlled trial. *PLoS Med* 2019;16:e1002936.
16 Bull FC, Al-Ansari SS, Biddle S, *et al*. World Health Organization 2020 guidelines on physical activity and sedentary behaviour. *Br J Sports Med* 2020;54:1451–62.
17 Sharma A, Minh Duc NT, Luu Lam Thang T, *et al*. A Consensus-Based Checklist for Reporting of Survey Studies (CROSS). *J Gen Intern Med* 2021;36:3179–87.
18 Ware JE, Gandek B. Overview of the SF-36 Health Survey and the International Quality of Life Assessment (IQOLA) Project. *J Clin Epidemiol* 1998;51:903–12.
19 Fukuhara S, Ware JE, Kosinski M, *et al*. Psychometric and Clinical Tests of Validity of the Japanese SF-36 Health Survey. *J Clin Epidemiol* 1998;51:1045–53.
20 Norman GR, Sloan JA, Wyrwich KW. Interpretation of changes in health-related quality of life: the remarkable universality of half a standard deviation. *Med Care* 2003;41:582–92.
21 Baker BA. An Old Problem: Aging and Skeletal-Muscle-Strain Injury. *J Sport Rehabil* 2017;26:180–8.
22 Fernandes JFT, Lamb KL, Norris JP, *et al*. Aging and Recovery After Resistance-Exercise-Induced Muscle Damage: Current Evidence and Implications for Future Research. *J Aging Phys Act* 2021;29:japa.2020-0201:544–51:.
23 Nielsen G, Wikman JM, Jensen CJ, *et al*. Health promotion: the impact of beliefs of health benefits, social relations and enjoyment on exercise continuation. *Scand J Med Sci Sports* 2014;24 Suppl 1:66–75.
24 Dionigi RA, Baker J, Horton S. Older Athletes' Perceived Benefits of Competition. *The International Journal of Sport and Society* 2011;2:17–28.
25 Lachman ME, Teshale S, Agrigoroaei S. Midlife as a Pivotal Period in the Life Course: Balancing Growth and Decline at the Crossroads of Youth and Old Age. *Int J Behav Dev* 2015;39:20–31.
26 Steptoe A, Deaton A, Stone AA. Subjective wellbeing, health, and ageing. *The Lancet* 2015;385:640–8.
27 Pedersen MT, Vorup J, Nistrup A, *et al*. Effect of team sports and resistance training on physical function, quality of life, and motivation in older adults. *Scand J Med Sci Sports* 2017;27:852–64.
28 Jenkin CR, Eime RM, Westerbeek H, *et al*. Sport for Adults Aged 50+ Years: Participation Benefits and Barriers. *J Aging Phys Act* 2018;26:363–71.
29 Aggio D, Papacosta O, Lennon L, *et al*. Association between physical activity levels in mid-life with physical activity in old age: a 20-year tracking study in a prospective cohort. *BMJ Open* 2017;7:e017378.