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ORIGINAL ARTICLE

Quality of life and associated lifestyle factors in former throwing athletes

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ABSTRACT

Objectives: Research on former athletes has primarily focused on collision sports such as rugby and American football. Limited information is available regarding the long-term health and quality of life (QOL) of athletes from non-contact sports, particularly throwing events in track and field. Methods: A cross-sectional questionnaire survey was conducted among 84 former male throwing athletes in Japan who had participated in official competitions. Data were collected on demographic characteristics, athletic history, smoking and drinking habits, exercise habits, medical history, and satisfaction with athletic career. Quality of life was assessed using the WHOQOL-BREF questionnaire. Multiple linear regression analysis was performed to identify independent factors associated with QOL. Results: The mean WHOQOL-BREF score among former throwing athletes was 3.67 ± 0.63. Athletes who reported satisfaction with their athletic careers had significantly higher QOL scores than those who were not satisfied ($p < .01$). Participants with regular exercise habits also demonstrated significantly higher QOL scores ($p = .009$). Multiple regression analysis revealed that career satisfaction and exercise habits were independently associated with QOL. Conclusions: Former throwing athletes demonstrated relatively good quality of life. Career satisfaction and continued exercise habits appear to be important factors associated with maintaining QOL after athletic retirement.

Keywords: health science; retired athletes; throwing events; career satisfaction; exercise habits; cross-sectional study; sports health.

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INTRODUCTION

Participation in sport is widely recognized as beneficial for both physical and psychological health (Eime et al., 2013; Malm et al., 2019). Regular physical activity has been associated with improved cardiovascular fitness, reduced risk of chronic diseases such as diabetes and hypertension, and enhanced psychological well-being (Eather et al., 2023; Oja et al., 2015; Oja et al., 2024). Engagement in sport may also contribute to the development of social relationships, self-efficacy, and long-term healthy lifestyle habits (Eather et al., 2023). However, competitive sports also involve high training loads, repetitive physical stress, and injury risks that may influence long-term health outcomes after athletic retirement (Eckard et al., 2018; Pardiwala et al., 2020; Bengtsson et al., 2018; Hopkins et al., 2022).

In recent years, increasing attention has been paid to the health status and quality of life (QOL) of former athletes. Previous studies have reported both positive and negative health outcomes following athletic retirement. While former athletes may benefit from long-term physical fitness and social advantages gained through sport participation (Filbay et al., 2017; Laine et al., 2015), some studies have reported increased prevalence of musculoskeletal disorders, chronic pain, and psychological challenges among former athletes (Cowee & Simon, 2019; Filbay et al., 2019). Importantly, most of the existing literature has focused on athletes from collision sports such as rugby, American football, and ice hockey, where repeated physical contact and head impacts are common (Kerr et al., 2014; West et al., 2023; Gard et al., 2020).

In contrast, relatively little research has examined former athletes from non-contact sports (Filbay et al., 2017). Track and field throwing events—including shot put, discus throw, hammer throw, and javelin throw—represent a unique athletic population with specific physical and training characteristics. Throwing athletes typically engage in intensive resistance training to develop high levels of muscular strength and explosive power. In addition, athletes in these events often maintain relatively high body mass compared with athletes in endurance sports. These characteristics may potentially influence long-term health outcomes, lifestyle behaviours, and quality of life after retirement.

Despite these distinctive features, limited information is available regarding the quality of life of former throwing athletes and the lifestyle factors associated with their well-being. Understanding these factors may provide insights into the long-term health trajectories of athletes from strength- and power-based sports. Therefore, the purpose of this study was to investigate the quality of life and associated lifestyle factors in former throwing athletes.

METHODS

Study design and participants

This study employed a cross-sectional design using a questionnaire survey. Participants were former male throwing athletes in Japan who had previously competed in official track and field competitions. Athletes who had not participated in organized competitions for at least one year were considered retired.

Participants were recruited through personal networks, university alumni associations, and contacts within track and field communities. A total of 84 former throwing athletes agreed to participate in the study and completed the questionnaire. Participation in the study was voluntary, and all respondents provided informed consent prior to participation.

Data collection

Data were collected using a self-administered questionnaire distributed through an online survey platform (Google Forms). The questionnaire included items related to demographic characteristics, athletic career history, lifestyle behaviours, and health status.

Participants reported their age, height, body weight, and body weight during their athletic career. Body mass index (BMI) was calculated as body weight divided by height squared (kg/m²). Additional information collected included years of participation in throwing events, and competitive level. Competitive levels of the participants were evaluated using a 4-point scale based on their highest level of achievement during their active careers: 1 point for regional or prefectural competition level or below; 2 points for national-level competition appearance; 3 points for placing in the top 8 at a national-level competition; and 4 points for international competition appearance or above.

Lifestyle-related variables included smoking habits, alcohol consumption, and exercise habits after retirement. Exercise habit was defined as engaging in regular physical activity at least once per week.

Participants were also asked to evaluate their overall satisfaction with their athletic career using a 4-point Likert scale (satisfied, somewhat satisfied, somewhat dissatisfied, or dissatisfied). To ensure statistical robustness and account for the sample distribution, these responses were dichotomized into two groups for analysis in accordance with established methodological practices: participants who responded "*satisfied*" or "*somewhat satisfied*" were classified into the satisfied group, whereas those who responded "*somewhat dissatisfied*" or "*dissatisfied*" were compiled into the dissatisfied group.

Quality of life assessment

Quality of life was assessed using the WHOQOL-BREF questionnaire developed by the World Health Organization (The WHOQOL Group, 1998). The WHOQOL-BREF consists of 26 items and evaluates four domains of quality of life: physical health, psychological health, social relationships, and environmental conditions. Each item is rated on a five-point Likert scale, with higher scores indicating better perceived quality of life. Domain scores were calculated according to the scoring guidelines provided by the World Health Organization. In addition, the overall QOL score used in the analysis was operationally defined as the mean value across all 26 items. This scoring rationale was chosen to provide a single, consolidated, and intuitive metrics of overall perceived well-being on the original 1–5 scale.

Statistical analysis

Descriptive statistics were calculated for all variables. Continuous baseline characteristics (e.g., age, height, weight, BMI, and years of competitive experience) are presented as means ± standard deviations (SD). Categorical variables are presented as frequencies and percentages. The normality of the data was assessed using the Shapiro–Wilk test and visual inspection of Q-Q plots. Because the WHOQOL-BREF scores violated the assumption of normality, these variables are presented as medians and interquartile ranges (IQR).Group differences in QOL scores according to career satisfaction and exercise habits were analysed using the non-parametric Mann–Whitney U test (Rank Sum Test). To provide fuller statistical estimates, the Mann–Whitney U statistic, standardized Z-score, and standardized effect size ($r = |Z| / \sqrt{N}$) were calculated and reported for each group comparison. To identify independent factors associated with QOL, a multiple linear regression analysis was performed using the overall WHOQOL score as the dependent variable. Independent variables included age, BMI, career satisfaction, exercise habits, smoking habits, and competitive level. Standard diagnostic procedures were conducted to verify the assumptions required for the linear regression analysis. Multicollinearity was assessed using variance inflation factors (VIF), with a VIF < 5.0 indicating the absence

of significant multicollinearity. The independence of residuals was confirmed via the Durbin–Watson statistic, using the automated diagnostic feature of the statistical software to ensure no critical autocorrelation was present. The normality and homoscedasticity of residuals were justified through residual plot analysis. Two-tailed statistical significance was set at $p < .05$.

Ethical approval

This study was conducted in accordance with the principles of the Declaration of Helsinki. The study protocol was approved by the Ethics Committee of Juntendo University Graduate School of Health and Sports Science (Approval No. 2025-51, 2026-99). All participants provided informed consent prior to participation.

RESULTS

Participant characteristics

A total of 84 former male throwing athletes participated in the study. The mean age of the participants was 42.1 ± 17.3 years. The mean height and body weight were 178.1 ± 5.2 cm and 87.3 ± 14.2 kg, respectively, resulting in a mean BMI of 27.5 ± 4.31 kg/m². The mean duration of athletic participation in throwing events was 10.7 ± 6.1 years, and the mean competitive level score was 2.36 ± 0.93 (Table 1).

Table 1. Participant characteristics (n = 84).

Variable	Mean ± SD or n (%)
Age (years)	42.1 ± 17.3
Height (cm)	178.1 ± 5.2
Body weight (kg)	87.3 ± 14.2
BMI (kg/m²)	27.5 ± 4.31
Participation in throwing events (years)	10.7 ± 6.1
Competitive level	2.36 ± 0.93
Career satisfaction (yes)	71 (84.5%)
Exercise habit (yes)	63 (75.0%)
Smoking habit (yes)	44 (52.9%)
Alcohol consumption (yes)	56 (67.1%)

Note: Values are presented as mean ± standard deviation or number (%). BMI = body mass index. Competitive level was evaluated on a 4-point scale (scores ranging from 1 to 4; see Methods for details).

Regarding lifestyle and career-related characteristics, 71 participants (84.5%) reported satisfaction with their athletic careers, and 63 participants (75.0%) reported maintaining regular exercise habits after retirement. Smoking habits were reported by 44 participants (52.9%), followed by alcohol consumption in 56 participants (67.1%).

Career satisfaction and quality of life

Participants who reported satisfaction with their athletic careers demonstrated significantly higher overall QOL scores compared with those who were not satisfied (3.80 [3.40–4.08] vs. 3.34 [2.59–3.57]; Mann–Whitney U = 189.0, Z = -3.364, $p < .001$, effect size r = .367) (Table 2). When examining WHOQOL domain scores, significant differences were observed in the psychological domain (3.83 [3.33–4.33] vs. 3.00 [2.42–3.58]; U = 190.5, Z = -3.355, $p < .001$, r = .366), social relationships domain (3.66 [3.33–4.00] vs. 3.00 [2.50–3.50]; U = 194.0, Z = -3.346, $p < .001$, r = .365), and environmental domain (3.88 [3.50–4.13] vs. 3.13 [2.88–3.81]; U = 231.0, Z = -2.853, $p = .004$, r = .311). However, no statistically significant difference was observed in the physical health domain, although a trend toward significance was present (3.71 [3.29–4.14] vs. 3.29 [2.86–3.79]; U = 306.0, Z = -1.927, $p = .054$, r = .210).

Table 2. WHOQOL-BREF domain scores according to career satisfaction.

Domain	Satisfied (n = 71)	Not satisfied (n = 13)	*p*-value	U	Z-score	r
Overall QOL score	3.80 [3.40-4.08]	3.34 [2.59-3.57]	**<.001*** **	189.0	-3.364	.367
Physical	3.71 [3.29-4.14]	3.29 [2.86-3.79]	.054	306.0	-1.927	.210
Psychological	3.83 [3.33-4.33]	3.00 [2.42-3.58]	**<.001*** **	190.5	-3.355	.366
Social relationships	3.66 [3.33-4.00]	3.00 [2.50-3.50]	**<.001*** **	194.0	-3.346	.365
Environment	3.88 [3.50-4.13]	3.13 [2.88-3.81]	**.004** **	231.0	-2.853	.311

*Note: Values are presented as medians and interquartile ranges (IQR). Differences between groups were analysed using Mann-Whitney Rank Sum Test. U = Mann–Whitney U, r = effect size r. WHOQOL-BREF = World Health Organization Quality of Life questionnaire - BREF. **p < .01, ***p < .001.*

Exercise habits and quality of life

When evaluated based on exercise habits, participants with regular exercise habits demonstrated significantly higher overall QOL scores compared with those without exercise habits (3.81 [3.50–4.08] vs. 3.10 [2.93–3.89]; Mann–Whitney U = 405.0, Z = -2.646, p = .008, effect size r = .289) (Table 3). Regarding the specific WHOQOL domains, significant differences in favour of the active group were observed in the physical health domain (3.71 [3.43–4.14] vs. 3.43 [2.79–3.71]; U = 392.0, Z = -2.795, p = .005, r = .305), psychological domain (3.83 [3.50–4.33] vs. 3.33 [2.75–4.17]; U = 460.0, Z = -2.082, p = .037, r = 0.227), and environmental domain (3.67 [3.33–4.33] vs. 3.25 [2.81–3.75]; U = 352.5, Z = -3.215, p = .001, r = .351). In contrast, no statistically significant difference was found between the groups in the social relationships domain (3.75 [3.38–4.13] vs. 3.67 [3.00–4.00]; U = 551.5, Z = -1.135, p = .257, r = .124).

Table 3. Quality of life according to exercise habits.

Domain	Exercise habit (n = 63)	No exercise habit (n = 21)	*p*-value	U	Z-score	r
Overall QOL score	3.81 [3.50-4.08]	3.10 [2.93-3.89]	**.008** **	405.0	-2.646	.289
Physical	3.71 [3.43-4.14]	3.43 [2.79-3.71]	**.005** **	392.0	-2.795	.305
Psychological	3.83 [3.50-4.33]	3.33 [2.75-4.17]	**.037** *	460.0	-2.082	.227
Social relationships	3.75 [3.38-4.13]	3.67 [3.00-4.00]	.257	551.5	-1.135	.124
Environment	3.67 [3.33-4.33]	3.25 [2.81-3.75]	**.001** **	352.5	-3.215	.351

Note: Values are presented as medians and interquartile ranges (IQR). Differences between groups were analysed using Mann-Whitney Rank Sum Test.

Table 4. Multiple linear regression analysis for factors associated with overall QOL score.

Variable	β	*SE*	*t*	*p*-value	VIF
Age	0.001	0.01	0.308	.759	1.589
BMI	-0.03	0.02	-1.654	.102	1.095
Competitive level	-0.03	0.07	-0.384	.702	1.151
Career satisfaction	0.532	0.18	2.939	**.004** **	1.104
Exercise habit	0.514	0.15	3.335	**.001** **	1.148
Smoking	-0.02	0.14	-0.120	.904	1.260

Note: Multiple linear regression analysis was performed to identify factors associated with QOL. SE: standard error; β: standardized coefficient; t: t-statistic; p: p-value; VIF: variance inflation factor.

Multiple regression analysis

Multiple linear regression analysis was conducted to identify independent factors associated with QOL (Table 4). The regression model was statistically significant (F (6, 77) = 4.412, p < .001) and explained 25.6% of the variance in QOL scores (R^2 = .256, adjusted R^2 = .198). Multicollinearity was assessed using variance inflation factors (VIF); all VIF values were below 5.0 (ranging from 1.095 to 1.589), indicating no significant multicollinearity among the independent variables. Career satisfaction (β = 0.532, p = .004) and exercise

habits (β = 0.514, *p* = .001) were independently associated with higher QOL. In contrast, age, BMI, smoking habits, and competitive level were not significantly associated with QOL.

DISCUSSION

The present study investigated quality of life and associated lifestyle factors among former throwing athletes. The main findings of this study were that former throwing athletes demonstrated favourable levels of QOL and that career satisfaction and continued exercise habits were independently associated with higher QOL. In contrast, competitive level, BMI, smoking status, and age were not significantly associated with QOL.

First, the overall QOL score observed in this study appeared to be generally satisfactory within the context of previous literature on retired sports populations, compared with values reported in general populations (Nakane et al., 1999). However, because this study lacks a direct healthy control group or definitive national normative data for explicit statistical comparison, these descriptive levels should be interpreted with caution. Similar observations have been reported in studies of other former athletes. A qualitative study of former professional cricketers reported that most participants remained satisfied with their quality of life despite experiencing chronic pain or physical limitations. The authors suggested that psychological characteristics developed through sport participation, such as resilience, positive attitudes, and strong body awareness, may help former athletes adapt to physical limitations and maintain well-being after retirement (Filbay et al., 2017). Participation in sport may provide long-term benefits that extend beyond the athletic career itself. These benefits may include physical fitness, social relationships developed through sport participation, and psychological resilience cultivated through competitive experiences. These factors are conceptualized to support long-term well-being, which may partially explain the favourable QOL scores observed in our specific cohort.

Second, career satisfaction emerged as an important factor associated with QOL. Participants who reported satisfaction with their athletic careers showed significantly higher scores in psychological, social, and environmental domains of QOL. Interestingly, no significant difference was observed in the physical health domain. This finding suggests that the psychological meaning attributed to one's athletic career may play a more important role in long-term well-being than purely physical outcomes. The association between career satisfaction and psychological and social aspects of QOL may reflect the broader life experiences gained through sport participation. Athletes who perceive their athletic careers positively may retain stronger social connections, a greater sense of achievement, and more positive memories related to their sport experience. These psychological factors may potentially underly the significantly higher psychological and social QOL scores reported by the satisfied group in this study.

Third, continued exercise habits were also associated with higher QOL among former athletes. Participants who maintained regular physical activity after retirement reported significantly higher QOL scores. This finding is consistent with previous research indicating that continued engagement in physical activity is associated with improved psychological health, stress reduction, and overall well-being (Thornton et al., 2023; Thornton et al., 2024). Interestingly, competitive level was not significantly associated with QOL in this study. This finding suggests that long-term well-being after athletic retirement may depend more on the subjective evaluation of one's athletic experience rather than objective competitive success. Another characteristic of the present study is that the participants were former athletes from throwing events, which are strength- and power-based sports. Athletes in these events typically engage in intensive resistance training and often maintain relatively high body mass during their competitive careers. Despite these characteristics, BMI was not significantly associated with QOL in the present study. This finding may suggest

that body composition characteristics commonly observed in throwing athletes do not necessarily translate into poorer perceived quality of life after retirement. Instead, psychological and lifestyle factors such as career satisfaction and continued exercise habits may play a more important role in maintaining well-being. Even athletes who did not achieve the highest levels of competitive success may experience positive long-term outcomes if they perceive their athletic careers as meaningful and fulfilling (Filbay et al., 2017).

Another finding was the prevalence of smoking among former throwing athletes. Although smoking habits was not significantly associated with QOL in the present study, the results simply describe the descriptive status of lifestyle behaviours in this specific cohort. Interestingly, a similar pattern has been reported in the general Japanese population; a previous study conducted in a rural Japanese cohort found that smoking habits were not strongly associated with health-related quality of life (Funahashi et al., 2011). Similarly, while alcohol consumption was highly prevalent in this cohort (67.1%), it did not demonstrate a significant association with overall QOL or individual domains, remaining a baseline descriptive characteristic of this athletic population.

Furthermore, the considerable heterogeneity in the age distribution of our participants (mean age: 42.1 ± 17.3 years) warrants careful consideration as a potential underlying source of variability in the QOL outcomes. Former athletes at different chronological ages face distinct post-retirement transitions, lifestyle demands, and health statuses. For instance, younger retired athletes may experience unique psychosocial stressors related to vocational career transitions, whereas older individuals may encounter natural, age-related physical declines and shifting life priorities that affect specific QOL domains, such as physical health. Although our multiple linear regression analysis did not identify age as a statistically significant independent predictor of the overall QOL score, the wide age range inherently introduces diverse baseline perspectives and expectations regarding overall well-being. This demographic diversity likely accounts for some of the broad variability observed within the QOL domain scores, suggesting that the long-term impact of sports retirement is a dynamic process shaped by one's broader life-course stage.

Limitations

Several limitations of this study should be acknowledged:

First, the cross-sectional design limits the ability to determine causal relationships between lifestyle factors and QOL.

Second, the data were based on self-reported questionnaires and may be subject to recall bias.

Third, in this study, an exercise habit was defined as engaging in regular physical activity at least once per week; however, this definition does not account for the diversity of exercise behaviours, such as the specific intensity, frequency, or type of exercise performed.

Fourth, the study focused exclusively on male throwing athletes in Japan, which may limit the generalizability of the findings to female athletes or those in other sports disciplines.

Fifth, due to the relatively small sample size (n = 84), we could not include all potential confounding factors—such as athletic career length and alcohol consumption—into the multiple linear regression model to avoid overfitting. Given that a substantial proportion of participants reported alcohol consumption (67.1%) and a positive medical history (61.2%), the potential residual effects of these variables remain unmeasured.

Sixth, the recruitment strategy employed in this study relied on convenience sampling through personal networks, university alumni associations, and track and field communities, which may introduce selection bias. Participants who maintain active social connections within these sports communities might systematically differ in their post-retirement quality of life, psychological resources, and lifestyle habits compared with those who have distanced themselves from such networks. Consequently, our sample may overrepresent individuals with more favourable perceptions of their athletic careers or higher social support. To address these limitations, future studies with larger cohorts and longitudinal designs are needed to comprehensively evaluate the long-term health risks and potential implications of lifestyle behaviours among athletes from strength- and power-based sports.

Seventh, another limitation stems from the wide age distribution and chronological heterogeneity of the sample. While this broad recruitment approach captured a comprehensive overview of former throwing athletes across multiple generations, it inherently combines individuals with substantially different life-stage contexts. Due to the modest sample size, we were unable to perform robust age-stratified subgroup analyses to isolate age-specific nuances in QOL. Future research utilizing larger cohorts with targeted age stratification is required to systematically evaluate how the determinants of QOL change over the life course of retired athletes.

Despite these limitations, this study provides valuable insights into the quality of life of former throwing athletes and highlights the importance of psychological and lifestyle factors in maintaining well-being after athletic retirement.

AUTHOR CONTRIBUTIONS

All authors meet the criteria for authorship in accordance with established ethical guidelines. Contributions are specified according to the CRediT (Contributor Roles Taxonomy) as follows: Conceptualisation: Hatase S., Takanashi Y., Methodology: Hatase S., Takanashi Y., Formal analysis: Takanashi Y., Investigation: Hatase S., Takanashi Y., Data curation: Hatase S., Takanashi Y., Writing – original draft: Takanashi Y., Writing – review & editing: Hatase S., Takanashi Y., Supervision: Takanashi Y.

All authors have critically reviewed and approved the final version of the manuscript and agree to be accountable for all aspects of the work.

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CONFLICT OF INTEREST

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this manuscript.

AI USE DISCLOSURE

In accordance with current publishing ethics and transparency recommendations, artificial intelligence (AI) tools were used solely to assist with translation and language editing, with the aim of improving clarity and

readability. No AI tools were used in the generation of scientific content, including the study design, data collection, analysis, interpretation of results, or the formulation of conclusions. The authors retain full responsibility for the content of the manuscript and confirm its originality, integrity, and accuracy.

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