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Prevalence and characteristics of abnormal eating behaviours among young judo athletes in Poland – an analysis of sex differences

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Abstract

Introduction and Objective. Young matial arts sports athletes may be particularly vulnerable to developing abnormal eating behaviours. To date, no studies on eating disorders among young judo athletes have been conducted in Poland. The aim of the study is to assess the prevalence of abnormal eating behaviours among young judo athletes, with emphasis on dietary restraint, uncontrolled eating, and emotional eating.

Materials and Method. A cross-sectional study was conducted among 150 judo athletes aged 12–17 years (70 girls, 80 boys). Participants completed a demographic questionnaire, the TSJ Questionnaire assessing emotional eating and eating in response to external stimuli, and the TFEQ-13 assessing dietary restraint, uncontrolled eating, and emotional eating.

Results. Girls showed higher emotional eating than boys on both measures (TFEQ-13: d=0.57, p<.001; TSJ: d=0.45; p=0.007). Using the 75th percentile cutoff, 31.4% of girls versus 12.5% of boys exceeded the threshold for elevated emotional eating on the TFEQ-13 (p=0.005). A sex × age interaction (p=0.017) revealed elevated emotional eating in girls aged 14–15 years (M=3.55) versus boys (M=1.40, d=1.13). No sex differences were observed in dietary restraint, uncontrolled eating, or external eating. Dietary restraint did not correlate with other behaviours (r≤0.10). Despite equivalent weight control (75%) and competition participation (97%), girls reported greater body dissatisfaction (p=0.015) and lower multi-sport participation (21% vs 46%, p=0.001), suggesting that sex differences reflect divergent psychological responses to shared sport pressures.

Conclusions. Emotional eating is the primary vulnerability among young judo athletes, with marked sex differences and peak risk at ages 14–15 for girls. Findings support sex-specific prevention targeting emotion regulation and body image resilience.

Key words

eating disorders, adolescents, sex differences, combat sports, emotional eating, judo athletes, abnormal eating behaviours

INTRODUCTION AND OBJECTIVE

Eating disorders in the general population remain difficult to estimate due to diagnostic obstacles, including shame, lack of illness awareness, and limited screening tools, with self-report measures often underestimating symptom frequency compared to interview-based assessments [1]. Although the Three-Factor Eating Questionnaire (TFEQ) has been validated for Polish adolescents [2], and local studies have documented nutritional irregularities among Polish teenagers [3], no large-scale studies on eating disorders among school-aged children and adolescents have been conducted in Poland to date, constituting a significant gap in public health knowledge. This gap is particularly concerning for young athletes in weight-class sports, who face additional pressures related to body weight management. Notably, while adult Polish judokas demonstrate healthy eating behaviours [4], younger athletes may face different pressures related to weight control during critical developmental periods, making monitoring of this high-risk group particularly important.

Judo is practised worldwide by diverse age groups, from children to adults, and research demonstrates its numerous benefits, including aggression reduction, fostering discipline, and promoting balanced physical development in adolescents [5]. However, despite these positive aspects, young combat/martial arts sports athletes, including those practising judo, may be particularly vulnerable to developing abnormal eating behaviours and eating disorders due to the weight-class competition requirements. Research on elite athletes has shown that disordered eating is more common in weight-class sports, with 70% of weight-class athletes reported to fast or display abnormal eating behaviours to lose weight before competition [6]. This elevated risk has been confirmed across multiple studies, with aesthetic disciplines showing the highest prevalence, followed by weight-class sports, including wrestling and combat sports [7]. Moreover, athletes engaged in weight-class sports have been found to have a higher level of eating disorder diagnosis [6]. This results from a range of factors specific to this discipline, primarily the necessity to

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maintain a specific body weight to compete in the appropriate weight category, pressure related to achieving high sporting results, intensive training requiring an appropriate diet, and sporting culture that may promote risky weight control practices. Consequently, understanding the psychological mechanisms underlying these risky practices is crucial for prevention efforts.

Notably, emotion regulation strategies play a significant role in the development of abnormal eating behaviours in young athletes. The affect regulation model of eating disorders proposes that disordered eating behaviours result from attempts to decrease negative emotions, with emotion dysregulation being an important predictor of binge eating and a core factor in eating disorder onset [8]. Research has shown that maladaptive strategies, such as rumination and expressive suppression, are associated with abnormal eating behaviours, including elevated drive for slimness and bulimic symptoms in adolescents [1, 7], while cognitive reappraisal shows protective effects [7]. Studies specifically examining youth athletes have confirmed that greater use of cognitive reappraisal and less use of expressive suppression are associated with more favourable emotional and psychological outcomes in competitive sport contexts [9, 10], with cognitive reappraisal also linked to enhanced mental well-being in athletes [11]. Among weight-class athletes, emotional eating and social physique anxiety are prevalent concerns, with national-level athletes showing higher tendencies towards emotional eating than other athletes [6]. These psychological vulnerabilities are particularly pronounced during adolescence, a developmental period characterised by heightened susceptibility to eating disorders.

Adolescence represents a critical period for the emergence of an eating disorder, with increases in the drive for slimness, and body dissatisfaction during this developmental stage, particularly in middle adolescence [7, 12]. Multiple studies have shown that girls are more likely to exhibit body dissatisfaction, which begins to emerge among girls aged 5–7 years [1, 13], and this dissatisfaction is particularly pronounced when combined with poor emotion regulation strategies [1]. Sex differences have been observed among young athletes in weight-class sports, with female athletes showing higher levels of emotional eating and greater concerns about weight control compared to male athletes [6]. Research among Polish adolescents has confirmed that girls demonstrate higher levels of dietary restraint, uncontrolled eating, and emotional eating compared to boys [2], with these sex differences particularly pronounced among older adolescents [14]. The intersection of these developmental and sex-specific vulnerabilities with recent environmental stressors, such as the COVID-19 pandemic, has created a particularly challenging context for adolescent mental health and eating behaviours. Accordingly, recent post-pandemic studies show elevated depression (34.4%) and anxiety (47.2%) among adolescents, with 10.6% displaying risky eating behaviours, highlighting the association between mental health symptoms and eating patterns [15].

Within this broader context of adolescent vulnerability, the issue of abnormal eating behaviours among young people practising combat sports/martial arts, including judo, is of significant importance from the perspective of public health and sports medicine. Young athletes in weight-class sports constitute a group particularly vulnerable to risky practices related to weight control, including restrictive diets, excessive food restriction, binge eating episodes, and emotional eating [6, 7]. Simultaneously, the influence of coaches, peer environment, and type of sport practised plays a significant role in shaping health behaviours in this population [4]. However, while these phenomena may lead to long-term health consequences, both physical and psychological, their scale in the Polish population of young athletes remains insufficiently researched.

Given the convergence of sport-specific pressures [6, 7], developmental vulnerabilities [7, 12], sex differences [2, 6], and emotion regulation challenges [1, 8] in this specific population, the main objective of this study is to assess the prevalence of abnormal eating behaviours among young judo athletes, with particular emphasis on behaviours related to dietary restraint, uncontrolled eating, and emotional eating. To the best of the authors' knowledge, to date, no studies specifically examining the prevalence and characteristics of abnormal eating behaviours among young judo athletes have been conducted in Poland, making this research the first of its kind in the Polish context.

Understanding the scale and characteristics of these behaviours in this specific population is crucial for developing targeted prevention programmes and early intervention strategies, which could help protect young athletes' physical and psychological health while maintaining their sporting performance. Furthermore, identifying sex-specific patterns in abnormal eating behaviours will enable coaches, sports medicine professionals, and parents to implement more effective, tailored approaches to support healthy development in young judo practitioners. Therefore, this study addresses a significant gap in Polish sport and public health research, providing baseline data essential for future surveillance and intervention efforts in this vulnerable population.

MATERIALS AND METHOD

Participants and procedure. This cross-sectional study included 150 young judo athletes aged 12–17 years (birth years 2008–2013), comprising 70 female and 80 male participants, all of whom were actively training in the sport. Participants were eligible for inclusion if they were aged 12–17 years old, actively training in judo with regular participation in sports club sessions at least twice weekly, in good health enabling participation in the questionnaire study, and had obtained consent from their parent or legal guardian, as well as providing their consent to participate. Exclusion criteria comprised lack of active judo training, age below 12 or above 17 years, absence of consent from parent, legal guardian or participant, and inability to independently complete questionnaires due to cognitive, health or language limitations. Participants trained in judo at various locations throughout Poland, including major cities (Warsaw, Kraków, Wrocław, Poznań, Gdańsk), medium-sized cities (Rzeszów, Bielsko-Biała, Tarnów, Bytom, Rybnik, Ełk), and smaller towns and villages (Bochnia, Myślenice, Tuchów, Wolbrom, Sułkowice, Krzyszkowice, Kocmyrzów).

The study was conducted in 2025 during judo training camps and events organised by various sports clubs and institutions operating in youth sport. Data collection took the form of completion of a single questionnaire by participants, exclusively during time free from training or competition activities. Following recruitment, participants

and their parents or legal guardians received comprehensive information about the purpose and procedures of the study, and asked to sign an informed consent form. Each participant received a paper questionnaire package for independent completion in the presence of a research team member. Questionnaire completion took approximately 10 minutes, on average.

Ethical issues. The study received a positive opinion from the Bioethics Committee of the Tarnów Academy (Decision No. 29/2025). The research was entirely non-invasive and involved no medical intervention or risk to participants' physical or psychological health. All procedures were conducted in accordance with the guiding principles of the Declaration of Helsinki, including ethical standards for research involving minors. Data collection occurred exclusively during participants' free time from training or competition activities, ensuring no interference with sporting education or organisational activities of clubs or facilities.

Prior to participation, all participants and their parents or legal guardians received complete information about the study and were asked to provide informed consent. The procedure ensured complete voluntariness, anonymity and absence of any organisational burden for entities where the research was conducted. All data were coded and stored in a manner ensuring participant anonymity, with access restricted to authorised research team members only.

Measures. The study employed three standardised research instruments. The proprietary questionnaire, developed by the research team, contained questions regarding basic socio-demographic data, including age, sex, height, and body weight; training characteristics, such as training experience, number of weekly training sessions and competition participation; and selected eating behaviours, including diet use, weight control methods and body perception. This questionnaire served a supplementary function to the standardised psychometric tools, and enabled the collection of contextual data necessary for result interpretation.

The TSJ Questionnaire (Test of Eating Situation Style; author: Brytek-Matera, 2010) [16] was used to assess tendencies to eat in response to specific emotional and social situations. The instrument consists of a series of statements, i.e., 9 items, describing various eating circumstances, such as eating when sad, angry, bored or in the company of others. Responses are provided on a frequency scale of 'often', 'sometimes' and 'rarely', enabling identification of predispositions to emotional eating and eating in response to external stimuli. The questionnaire has been validated in the Polish population and demonstrates satisfactory psychometric properties. In the present study, internal consistency was acceptable for the Emotional Eating subscale (McDonald's $\omega = 0.842$) and for the External Eating subscale (McDonald's $\omega = 0.656$).

The TFEQ-13 (Three-Factor Eating Questionnaire), a shortened version of the original TFEQ created by Stunkard and Messick, Polish adaptation [2], measures 3 dimensions of eating behaviours. Restricting food intake represents conscious control of food consumption for weight regulation purposes. Uncontrolled eating indicates a tendency to overeat in response to internal or external signals. Emotional eating refers to food consumption in situations influenced by emotions, especially negative ones. The TFEQ-13 comprises 13 items rated on a 4-point response scale from 'definitely yes' to 'definitely no', with one item using an 8-point scale. This widely used instrument in research on eating habits of adolescents and adults has documented validity and psychometric reliability, with its Polish adaptation enabling use in national conditions. In the present study, internal consistency (McDonald's ω) was 0.787 for Dietary Restraint, 0.761 for Uncontrolled Eating, and 0.844 for Emotional Eating.

Statistical analyses. All analyses were conducted using R statistical software (version 4.3.2; R Core Team, 2024), with statistical significance set at $p < 0.05$.

Data were first screened for outliers and distributional properties (normality, skewness, and kurtosis). For the TSJ and TFEQ-13 subscales, skewness values ranged from -0.08 – 1.1 and kurtosis from -0.55 – 1.6, which are within the commonly accepted range (±2), indicating no substantial deviations from normality [17]. There were no missing data points in the analysed dataset.

Descriptive statistics (means, standard deviations, ranges, and percentiles) were calculated for all variables. To determine the prevalence of elevated eating behaviours within this sample, the 75th and 90th percentile values derived from the current sample distribution were used as cutoffs for each eating behaviour dimension. The 75th percentile (upper quartile) was selected as a conventional threshold for identifying individuals with elevated scores, while the 90th percentile was additionally applied to capture more pronounced elevations in the upper tail of the distribution. Notably, these represent relative elevations within this athletic population rather than clinical diagnostic thresholds.

Sex differences in eating behaviours were examined using independent-samples t-tests, with Levene's test applied to verify the assumption of homogeneity of variances. Effect sizes were expressed as Cohen's d. For the ordinal variable assessing body satisfaction (measured with a single-item Likert-type scale), the non-parametric Mann–Whitney U test was applied. Effect size (r) was calculated as Z divided by the square root of the total sample size ($\sqrt{N}$). For categorical variables (e.g., competition participation, dieting, weight control, participation in other sports), chi-square tests or Fisher's exact tests were used, with φ (phi) or Cramer's V as effect-size measures.

Intercorrelations among eating behaviour dimensions were assessed using Pearson correlation coefficients. The use of Pearson correlations in this study was based on several considerations: (1) data meeting normality assumptions (skewness -0.09 to 1.61, kurtosis -0.55 to 2.00, well within acceptable ranges of ≤ 2), (2) widespread acceptance in the eating behaviour literature for Likert-type composite scores, and (3) validated instruments treating scales as continuous variables. However, to verify robustness, supplementary analyses were also conducted using Spearman's rho; absolute differences between coefficients ranged from approximately 0.00 – 0.09. All correlations that were statistically significant using Pearson's r remained statistically significant when Spearman's rho was applied, confirming that the analytical choice in the study did not affect substantive conclusions.

The interaction between sex and age group (12–13, 14–15, and 16–17 years) on emotional eating was examined using 2-way ANOVA, with Tukey's HSD *post-hoc* tests for pairwise comparisons. Partial eta-squared ($\eta^2 p$) was reported as the effect size measure.

The categorical age grouping was chosen because (1) it corresponds to theoretically meaningful developmental periods (early, middle, and late adolescence), (2) ANOVA allows detection of non-linear developmental patterns with interpretable group comparisons, and (3) it aligns with common practices in adolescent eating behaviour research. Importantly, visual inspection of the interaction pattern and *post-hoc* comparisons indicated non-monotonic age-related trends, including a pronounced peak in emotional eating among girls aged 14–15 years, and divergent age trajectories across sexs. Modelling age as a single continuous linear predictor would therefore be insufficient to capture these non-linear developmental effects.

RESULTS

Participants' characteristics. The study included 150 young judo athletes (70 girls, 80 boys) aged 12–17 years (M=14.40, SD=1.62). Participants were divided into 3 age groups: 12–13 years (n=46), 14–15 years (n=71), and 16–17 years (n=33). The mean training experience was 7.17 years (SD=2.78), with an average training frequency of 4.58 sessions per week (SD=1.45). The vast majority of participants (96.7%, n=145) participated in judo competitions, with no significant sex differences in competition participation (χ^2=0.09, p=0.761).

Girls and boys did not differ significantly in age (p>0.05) or training characteristics (i.e., training experience and training frequency; p>0.05). However, boys had a higher mean BMI (M=21.7, SD=3.48) compared to girls (M=19.7, SD=2.35), although both groups fell within the normal range for their age. Detailed participant characteristics are presented in Table 1.

Table 1. Participants' characteristics by sex

Variable	Total (N=150)	Girls (N=70)	Boys (N=80)
Demographics			
Age (years), M (SD)	14.4 (1.62)	14.2 (1.71)	14.5 (1.54)
Range	12.0–17.0	12.0–17.0	12.0–17.0
BMI (kg/m^2), M (SD)	20.8 (3.15)	19.7 (2.35)	21.7 (3.48)
Range	14.2–31.7	14.5–25.8	14.2–31.7
Training characteristics			
Training experience (years), M (SD)	7.17 (2.78)	6.82 (2.71)	7.48 (2.82)
Range	1.0–13.0	1.0–11.0	2.0–13.0
Training frequency (sessions/week), M (SD)[a]	4.58 (1.45)	4.51 (1.68)	4.63 (1.25)
Range	1.0–11.0	1.0–11.0	2.0–10.0
Competition participation			
Yes, N (%)	145 (96.7%)	68 (97.1%)	77 (96.3%)

[a] N = 118 (51 girls, 67 boys). Although all participants reported their training routines, 32 provided descriptive (non-numeric) responses that were not suitable for quantitative analysis.

Descriptive statistics for eating behaviours. Descriptive statistics for all eating behaviour dimensions are presented in Table 2. Across the entire sample, external eating (EXE) showed the highest mean score (M=8.87, SD=1.74), followed by emotional eating measured by TSJ (EE-TSJ: M=6.59, SD=2.31) and uncontrolled eating (UE: M=6.11, SD=2.98). Dietary restraint (DR: M=4.51, SD=2.73) and emotional eating measured by TFEQ-13 (EE-TFEQ: M=2.10, SD=2.05) showed the lowest mean levels.

Table 2. Descriptive statistics for eating behaviour dimensions in the examined group of judo competitors

Eating behaviour	Total (N=150)	Girls (N=70)	Boys (N=80)
	M (SD) [Range]	M (SD) [Range]	M (SD) [Range]
EE-TSJ	6.59 (2.31) [5–15]	7.13 (2.57) [5–15]	6.11 (1.95) [5–13]
EXE	8.87 (1.74) [4–12]	9.00 (1.80) [4–12]	8.75 (1.69) [6–12]
DR	4.51 (2.73) [0–12]	4.59 (2.66) [0–12]	4.45 (2.81) [0–12]
UE	6.11 (2.98) [0–15]	6.00 (3.07) [0–15]	6.20 (2.91) [0–13]
EE-TFEQ	2.10 (2.05) [0–9]	2.70 (2.39) [0–9]	1.57 (1.52) [0–6]

EE-TSJ = Emotional eating (TSJ); EXE = External eating (TSJ); DR = Dietary restraint (TFEQ-13); UE = Uncontrolled eating (TFEQ-13); EE-TFEQ = Emotional eating (TFEQ-13)

Prevalence of abnormal eating behaviours. Table 3 presents the prevalence of elevated (>75th percentile) and high (>90th percentile) levels of abnormal eating behaviours. Approximately one-fifth to one-quarter of participants exceeded the 75th percentile cutoff across different eating behaviour dimensions, with prevalence rates ranging from 20.0% (EXE) – 25.3% (EE-TSJ). At the more stringent 90th percentile cutoff, prevalence rates were substantially lower, ranging from 6.0% – 8.7%.

Table 3. Prevalence of abnormal eating behaviours among young judo competitors by sex

Eating behaviour	Cutoff	Total	Girls	Boys	p	φ
		% (N/150)	% (N/70)	% (N/80)		
EE-TFEQ	>75c	21.3% (32)	31.4% (22)	12.5% (10)	**0.005**	0.231
	>90c	6.0% (9)	11.4% (8)	1.2% (1)	**0.013**	0.214
EE-TSJ	>75c	25.3% (38)	32.9% (23)	18.8% (15)	0.060	0.262
	>90c	6.0% (9)	8.6% (6)	3.8% (3)	0.305	0.101
EXE	>75c	20.0% (30)	22.9% (16)	17.5% (14)	0.423	0.067
	>90c	6.7% (10)	5.7% (4)	7.5% (6)	0.751	0.036
DR	>75c	20.7% (31)	21.4% (15)	20.0% (16)	0.843	0.018
	>90c	8.0% (12)	8.6% (6)	7.5% (6)	1.000	0.020
UE	>75c	22.7% (34)	22.9% (16)	22.5% (18)	1.000	0.004
	>90c	8.7% (13)	8.6% (6)	8.8% (7)	1.000	0.003

EE-TFEQ = Emotional eating (TFEQ-13); EE-TSJ = Emotional eating (TSJ); EXE = External eating (TSJ); DR = Dietary restraint (TFEQ-13); UE = Uncontrolled eating (TFEQ-13). Cutoff values: 75c = 75th percentile; 90c = 90th percentile. p-values from Fisher's exact test. Bold indicates p < 0.05. φ – effect-size measure in Fisher's test.

Significant sex differences in prevalence were observed for emotional eating. For EE-TFEQ, significantly more girls (31.4%) than boys (12.5%) exceeded the 75th percentile (p=0.005), with this pattern persisting and becoming even more pronounced at the 90th percentile (11.4% vs 1.2%, p=0.013). A similar trend was observed for EE-TSJ, where girls showed higher prevalence at both cutoffs (75th: 32.9% vs 18.8%; p=0.060; 90th: 8.6% vs 3.8%; p=0.305), though the difference reached only marginal significance at the 75th percentile.

No sex differences were found in the prevalence of dietary restraint (DR), uncontrolled eating (UE), or external eating (EXE) at either cutoff point (all p>0.40).

While these prevalence rates indicate statistical elevations relative to the sample distribution, they do not represent diagnoses of a clinical eating disorder. The absence of

clinical diagnostic interviews limits conclusions about eating disorder pathology. However, the identified patterns suggest meaningful psychological vulnerabilities warranting monitoring and support, particularly for girls in middle adolescence.

Sex differences in eating behaviours. Independent samples of t-tests revealed significant sex differences in emotional eating dimensions (Tab. 4). Girls reported significantly higher levels of both EE-TFEQ (M=2.70, SD=2.39 vs M=1.57, SD=1.52; t=3.48; p<0.001, d=0.57) and EE-TSJ (M=7.13, SD=2.57 vs M=6.11, SD=1.95; t=2.75; p=0.007, d=0.45), representing medium to large effect sizes according to Cohen's conventions.

No significant sex differences were observed in external eating (EXE: t=0.88, p=0.382, d=0.14), dietary restraint (DR: t=0.30; p=0.763, d=0.05), or uncontrolled eating (UE: t=-0.41; p=0.683, d=-0.07).

Table 4. Sex differences in eating behaviours among young judo competitors

Eating behaviour	Girls (N=70)	Boys (N=80)	t	p	Cohen's d
	M (SD)	M (SD)			
EE-TFEQ	2.70 (2.39)	1.57 (1.52)	3.48	**<0.001**	0.57
EE-TSJ	7.13 (2.57)	6.11 (1.95)	2.75	**0.007**	0.45
EXE	9.00 (1.80)	8.75 (1.69)	0.88	0.382	0.14
DR	4.59 (2.66)	4.45 (2.81)	0.30	0.763	0.05
UE	6.00 (3.07)	6.20 (2.91)	-0.41	0.683	-0.07

E-TFEQ = Emotional eating (TFEQ-13); EE-TSJ = Emotional eating (TSJ); EXE = External eating (TSJ); DR = Dietary restraint (TFEQ-13); UE = Uncontrolled eating (TFEQ-13). Bold indicates p < 0.05.

Intercorrelations among eating behaviours. Table 5 presents the intercorrelations among eating behaviour dimensions. The 2 measures of emotional eating, i.e., EE-TSJ and EE-TFEQ, were very strongly correlated (r=0.74; p<0.001), confirming convergent validity between instruments. Both emotional eating measures showed moderate to strong positive correlations with uncontrolled eating (UE: r=0.38 and 0.47, both p<0.001) and weak to moderate correlations with external eating (EXE: r=0.26, p<0.01 and r=0.35; p<0.001). External eating also correlated strongly with uncontrolled eating (r=0.53; p<0.001).

Notably, dietary restraint (DR) showed no significant correlations with any other eating behaviour dimension (all p>0.05), suggesting it represents an independent construct that operates separately from emotional, external, and uncontrolled eating patterns.

Sex × age interaction in emotional eating. A 2-way ANOVA examining the effects of sex and age group on EE-TFEQ revealed a significant main effect of sex ($F(1,144)=8.86$; $p=0.003$, $\eta^2p=0.058$) and a significant sex and age interaction ($F(2,144)=4.20$; $p=0.017$, $\eta^2p=0.055$). The main effect of age group was marginally significant ($F(2,144)=3.01$; $p=0.053$, $\eta^2p=0.040$).

Table 5. Intercorrelations among eating behaviour dimensions in the examined group of judo competitors

Variable	1	2	3	4	5
1. EE-TSJ	—				
2. EXE	0.26**	—			
3. DR	0.02	-0.01	—		
4. UE	0.38***	0.53***	0.10	—	
5. EE-TFEQ	0.74***	0.35***	0.10	0.47***	—

EE-TSJ = Emotional eating (TSJ); EXE = External eating (TSJ); DR = Dietary restraint (TFEQ-13); UE = Uncontrolled eating (TFEQ-13); EE-TFEQ = Emotional eating (TFEQ-13). **p<0.01, ***p<0.001

As illustrated in Figure 1, the sex × age interaction was driven by markedly elevated emotional eating among girls aged 14–15 years (M=3.55, SD=2.50), which was significantly higher than that of boys of the same age (M=1.40, SD=1.35; $p_{Tukey}<0.001$, d=1.13), representing a very large effect size. *Post-hoc* comparisons also revealed that girls aged 14–15 years had significantly higher emotional eating than girls aged 12–13 years (M=1.68, SD=2.25; $p_{Tukey}=0.005$, d=0.98) and than boys aged 12–13 years (M=1.52, SD=1.54; $p_{Tukey}=0.003$, d=1.06).

In contrast, boys showed no significant variation in emotional eating across age groups (all $p_{Tukey}>0.50$), with relatively stable and low levels throughout adolescence. No significant sex differences were observed in the 12–13 or 16–17 age groups (both $p_{Tukey}>0.60$).

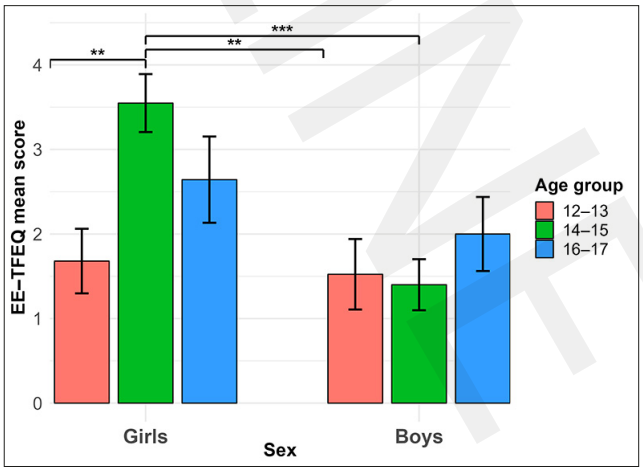

Figure 1. Sex × age group interaction for emotional eating (TFEQ-13)
Error bars represent standard errors. Asterisks denote significant differences (**p<0.01; ***p<0.001)

Body image, weight control, and sports participation. Body image satisfaction differed significantly between sexs. Girls reported lower body satisfaction (M=2.29, SD=1.08) compared to boys (M=1.85, SD=0.75; U=2187; p=0.015, r=0.22), indicating greater body dissatisfaction among female athletes. However, the desire to change appearance did not differ significantly by sex (girls: 55.7% vs boys: 48.8%; $\chi^2=0.73$; p=0.394), with approximately half of all participants expressing a wish to modify their appearance.

Regarding weight control behaviours, approximately three-quarters of all participants (75.3%, N=113) reported controlling their weight before competitions, with no sex differences (girls: 72.9% vs boys: 77.5%; $\chi^2=0.43$; p=0.510). Similarly, formal dieting behaviour was uncommon in both sexes (girls: 5.7% vs boys: 11.3%; $\chi^2=1.45$ p=0.229), with only 8.7% (N=13) of the total sample reporting engagement in special diets.

Participation in additional sports differed significantly by sex. Boys were more than twice as likely as girls to engage in other sports beyond judo (46.3% vs 21.4%; $\chi^2=10.2$, p=0.001, $\varphi=0.26$), representing a small to medium effect size.

DISCUSSION

The main objective of this study was to assess the prevalence of abnormal eating behaviours among young judo athletes in Poland, with particular emphasis on sex-specific patterns. To the best of the authors' knowledge, this is the first study examining these issues in young Polish judo athletes. The findings revealed 3 key patterns: marked sex differences in emotional eating, a critical vulnerability period during middle adolescence for girls, and the functional independence of dietary restraint from other eating behaviours.

The most striking finding was that girls demonstrated significantly higher levels of emotional eating than boys across both measurement instruments (d=0.45–0.57), with approximately one-third of girls exceeding elevated eating behaviour thresholds compared to only 12–19% of boys. These differences were specific to emotional eating; no sex differences emerged in dietary restraint, uncontrolled eating, or external eating. This pattern aligns with previous research demonstrating higher emotional eating among female athletes in weight-class sports [6], as well as studies of Polish children and adolescents showing that girls demonstrate significantly higher levels of both restrictive and emotional eating compared to boys, with these sex differences particularly pronounced among older adolescents [14]. All in all, these findings indicate that females are more likely to use eating as an emotion regulation strategy than males, a sex difference that emerges in the general population during adolescence and may be intensified in the context of weight-class sports. Consistent with the affect regulation model [8], the results of the current study suggest that emotional eating may serve to manage negative affect among female athletes facing the dual pressures of sport demands and normative developmental challenges related to body image.

The convergent validity between the 2 emotional eating measures (r=0.74) provides robust evidence for this sex difference. Moreover, girls' significantly greater body dissatisfaction (p=0.015) may represent a mechanism linking sex to emotional eating, consistent with findings that body dissatisfaction emerges as early as ages 5–7 years in girls [13], combined with poor emotion regulation associated with intensified eating-related problems [1]. Evidence demonstrates that expressive suppression is linked to elevated eating disorder risk in adolescent athletes, whereas cognitive reappraisal demonstrates protective associations [7, 9, 10]. This is consistent with broader evidence that cognitive reappraisal is positively associated with mental well-being in athletes, whereas suppression shows negative associations [11], suggesting that interventions targeting emotion regulation skills may be particularly important for young female judo athletes.

The sex × age interaction revealing dramatically elevated emotional eating among girls aged 14–15 years (M=3.55) compared to boys of the same age (M=1.40, d=1.13) and girls in other age groups, represents a clinically significant finding. This very large effect size identifies middle adolescence as a critical risk period for girls, consistent with literature demonstrating heightened vulnerability to eating disorders during this developmental stage [7, 12]. For female judo athletes, normative developmental challenges, including pubertal changes, hormonal fluctuations, heightened body awareness, and increased social pressures, are compounded by sport-specific weight management demands. Meanwhile, boys showed no such developmental trajectory, maintaining stable and low emotional eating levels across all age groups, suggesting that prevention efforts should be particularly intensive for girls aged 14–15 years.

An unexpected finding was that dietary restraint showed no correlations with other eating behaviours (all $|r| \leq 0.10$), no sex differences, and no age variations. In weight-class sports, some degree of dietary monitoring is functionally necessary, and data in the current study suggest that restraint may represent an adaptive behaviour distinct from emotional eating and uncontrolled eating. Thus, approximately three-quarters of participants (75%) reported controlling weight before competitions, with no sex differences, indicating that weight management is normative and sport-required in this population. However, caution is warranted, because while moderate restraint may be adaptive, extreme or rapid weight loss methods can escalate into eating disorders. Studies of adolescent judo competitors show that rapid weight loss is highly prevalent (80%), achieved through increased physical activity, skipped meals, and fasting, with eating disorder pathology in weight-dependent sports associated with increased psychosocial burden [18, 19].

Importantly, sex differences in emotional eating cannot be attributed to differential exposure to sport pressures, as girls and boys showed equivalent rates of competition participation (97%), weight control (73% vs 78%), and dieting (6% vs 11%). Instead, the differences reflect divergent psychological responses to shared pressures. This finding underscores that interventions may benefit from focusing on enhancing emotion regulation skills alongside addressing sport demands, recognising that some weight management is inherent to competitive judo.

Furthermore, the significantly higher participation of boys in additional sports (46% vs 21%, p=0.001) may have protective implications. Multi-sport engagement could provide additional opportunities for emotion regulation, peer support, and identity diversification, whereas girls' greater specialisation in judo may intensify psychological pressures, consistent with evidence linking sport specialisation to increased mental health risks and eating disorders [20]. The link between greater specialisation in judo and psychological stressors, however, needs more targeted future investigation.

Limitations of the study. Several limitations of this study should be noted. First, the cross-sectional design precluded causal inferences; longitudinal research is needed to confirm directional relationships and developmental trajectories. Second, the sample was drawn from selected judo clubs across various regions of Poland, ranging from major cities to smaller towns and villages, which still may limit generalisability to the broader population of Polish judo athletes, particularly those from under-represented regions or different training contexts. Cultural factors related to eating, body image, and emotion expression may also differ across populations. Third, reliance on self-report measures may introduce bias, although validated questionnaires were used [2, 16]. Fourth, while data was collected on training experience (M=7.17 years, SD=2.78), exploratory analyses revealed no significant moderation of sex differences by this variable in emotional eating (p>0.05). Notably, training experience in adolescent athletes is strongly intertwined with chronological age, which was a crucial variable in the present study. Concurrently, the competitive level (e.g., regional, national, or international) or

performance achievements were not assessed in this study, which could have differentiated psychological pressures experienced by athletes at different levels. Fifth, specific emotion regulation strategies (e.g., cognitive reappraisal, suppression), perfectionism, or coach/parental pressures, which could have further elucidated mechanisms, were also not analysed. And finally, the relatively small subgroup sizes (particularly ages 16–17) may have limited statistical power for detecting additional interactions.

Despite these limitations, the findings have important implications. Theoretically, the results support an integrated model wherein sport-specific pressures create environmental stressors affecting all athletes, but sex-based vulnerabilities in emotion regulation and body image, intensified during middle adolescence in girls, moderate responses to these pressures, with emotional eating emerging as a maladaptive coping strategy among those with limited regulation skills. Hence, this integrates the affect regulation theory [8] with developmental and sport psychology perspectives.

Practically, screening for eating problems should prioritise girls aged 14–15 years, who demonstrate the highest risk. Prevention programmes should be sex-specific, focusing on adaptive emotion regulation skills, body image resilience, and alternative stress coping strategies for girls, ideally introduced before vulnerabilities peak (ages 12–13). Coaches, parents, and sports medicine professionals should be educated about signs of emotional eating and the heightened vulnerability of mid-adolescent female athletes, emphasising the distinction between necessary weight management and problematic emotional eating. Given that coaches are the most influential figures in adolescent judo athletes' decisions regarding pre-competition weight loss [18], their role in promoting safe weight management practices and recognising problematic eating behaviours is particularly critical. At the same time, for families where eating disorders are identified, targeted carer assessments may support treatment engagement [21]. Significantly, encouraging multi-sport participation, particularly for girls, may provide protective benefits.

Overall, interventions should adopt a holistic approach addressing emotion regulation, stress management, body image, and mental health rather than focusing solely on weight management education. Monitoring expressive suppression and promoting cognitive reappraisal strategies may serve as supportive components in psychoeducation and early intervention within sports settings, enhancing emotional flexibility and potentially reducing eating disorder risk, with cognitive reappraisal also offering broader mental health benefits, including improved well-being and stress management in athletes [7, 11].

Future research should employ longitudinal, multi-method designs, including clinical interviews, to track developmental trajectories across adolescence and identify critical transition points and risk factors. Investigation of specific emotion regulation strategies and body dissatisfaction as potential mediators would clarify mechanisms underlying sex differences. Whether the protective effect of multi-sport participation reflects pre-existing differences in coping strategies (e.g., use of physical activity for emotion regulation) or results from sport diversification itself warrants further investigation. Moreover, cross-cultural research would establish generalisability and identify culturally specific risk and protective factors. Critically, given longitudinal [1, 13] and intervention [9–11] evidence that eating-related vulnerabilities are modifiable in adolescent athletes, randomised controlled trials are needed to test whether emotion regulation, body image, or mental health interventions reduce emotional eating and improve overall well-being in young weight-class sport athletes [7].

Summing up, this study identifies emotional eating as the primary eating-related vulnerability among young judo athletes, with marked sex differences and a critical risk period during middle adolescence for girls. These findings provide an evidence base for developing targeted, developmentally sensitive prevention and intervention strategies to support the mental health and well-being of young athletes in weight-class sports.

CONCLUSIONS

In addressing a significant gap in Polish sport and public health research, this study provides the first evidence on abnormal eating behaviours among young judo athletes, revealing several key findings with important practical implications:

- Emotional eating, rather than dietary restraint, emerged as the primary eating-related vulnerability, with marked sex differences favouring higher levels in girls, particularly at ages 14–15 years, identifying middle adolescence as a critical risk period for female athletes.
- Sex differences reflect divergent psychological responses to equivalent sport pressures, as girls and boys showed comparable competition participation and weight control behaviours, suggesting emotion regulation differences, rather than differential sport exposure, drive these disparities.
- Findings support the need for sex-specific, developmentally sensitive prevention programmes prioritising emotion regulation skills training and body image resilience, particularly for girls aged 14–15 years.
- Screening efforts should target mid-adolescent female athletes, with prevention programmes ideally implemented before vulnerabilities peak (ages 12–13).

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