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RESEARCH ARTICLE

A Study on weight management stress and coping mechanisms of combat sports student-athletes in higher education—Based on the perspective of environmental psychology

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ABSTRACT

This study aims to explore the characteristics of weight management stress among combat sports student-athletes in higher education and analyze how environmental factors from the perspective of environmental psychology influence their coping mechanisms. A mixed-methods research design was adopted, combining a quantitative questionnaire survey distributed to 150-200 participants and qualitative semi-structured interviews conducted with 12-15 stratified participants. Key findings revealed that competitive pressure and nutrition control difficulty were the primary sources of weight management stress, while adaptive coping strategies (e.g., seeking professional guidance) and maladaptive strategies (e.g., extreme dieting) were both adopted by the participants. Additionally, social support, institutional nutrition policies, and physical training facilities emerged as critical environmental factors affecting their stress levels and coping choices. Theoretically, this study enriches the intersection of environmental psychology and sports psychology; practically, it provides targeted insights for optimizing the support systems for college combat sports student-athletes to alleviate their weight management burden and enhance mental health.

Keywords: combat sports; college student-athletes; weight management stress; coping mechanisms; environmental psychology; environmental factors; social support

1. Introduction

1.1. Research background

Combat sports, such as boxing, judo, and taekwondo, are characterized by strict weight class divisions, making weight management an indispensable part of training and competition for athletes. For student-athletes in higher education, this task becomes more challenging due to their dual roles: they must balance intensive athletic training with academic coursework, leading to heightened time pressure and psychological strain. Weight management stress, defined as the psychological tension arising from the need to maintain or adjust body weight to meet competitive requirements, can manifest in anxiety, fatigue, and even maladaptive behaviors if not properly addressed.

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From the perspective of environmental psychology, human behaviors and psychological responses are not merely individual traits but the product of interactions between individuals and their external environments. For combat sports student-athletes, weight management is shaped by multiple environmental layers. These include the physical environment (e.g., availability of nutrition consultation facilities), the social environment (e.g., support from coaches, peers, and families), and the institutional environment (e.g., college training management systems and academic-flexibility policies). Growing attention has been paid to athlete mental health. However, few studies have systematically examined how these environmental factors interact. Even fewer have explored their influence on weight management stress and coping strategies among this specific group of student-athletes.

1.2. Research significance

1.2.1. Theoretical significance

This study contributes to the existing literature by integrating environmental psychology into sports stress research, expanding the application scope of environmental psychological theories (e.g., Ecological Systems Theory and Environmental Stress Theory) in the context of college sports. It also fills the research gap by focusing on the unique weight management experiences of combat sports student-athletes, supplementing empirical evidence for stress research in specific athlete populations.

1.2.2 Practical significance

The findings of this study provide actionable suggestions for higher education institutions, coaches, and relevant administrative departments. By identifying key environmental influencing factors, it offers a basis for optimizing training and living environments, improving support systems, and reducing weight management-related stress for combat sports student-athletes. This, in turn, helps promote their physical and mental well-being, as well as their overall development as both students and athletes.

1.3. Research questions and hypotheses

1.3.1. Research questions

What are the main sources and intensity of weight management stress among combat sports student-athletes in higher education?

What types of coping mechanisms do these student-athletes adopt to deal with weight management stress?

How do physical, social, and institutional environmental factors affect their weight management stress levels and coping strategy choices?

1.3.2. Research hypotheses

Positive social environmental factors (e.g., emotional support from coaches and peers, practical assistance from families) are negatively correlated with the intensity of weight management stress.

High-quality physical and institutional environments (e.g., accessible nutrition consultation services, flexible academic-training schedules) are positively associated with the adoption of adaptive coping mechanisms.

1.4. Structure of the paper

This paper is structured as follows: Section 2 reviews relevant literature on weight management stress, coping mechanisms, and environmental psychology applications in sports research. Section 3 details the research methods, including participant selection, research instruments, data collection procedures, and data

analysis approaches. Section 4 presents the research results, including demographic characteristics, stress status, coping strategies, and environmental factor influences. Section 5 discusses the implications of the results, compares them with existing studies, and highlights theoretical and practical contributions. Finally, Section 6 summarizes the core findings, acknowledges research limitations, and proposes future research directions.

2. Literature review

2.1. Weight management stress in combat sports athletes

Weight management stress in sports contexts refers to the psychological distress and physiological strain experienced by athletes when adjusting or maintaining body weight to meet the weight class requirements of competitive sports[1]. Unlike general weight-related anxiety, this type of stress is uniquely tied to athletic performance, as minor deviations from target weight can directly affect competition eligibility and competitive advantage. For combat sports athletes, weight management is not a one-time effort but a sustained process integrated into daily training, involving strict dietary control, targeted exercise, and frequent weight monitoring—all of which intensify psychological pressure[2].

Existing studies have identified multiple sources of weight management stress for combat sports athletes. Competitive pressure is identified as the primary driver: athletes often face intense expectations from coaches, teams, and themselves to meet weight standards while preserving physical strength and athletic performance[3]. Body image anxiety also exerts a considerable influence—combat sports emphasize leanness, leading some athletes to develop distorted perceptions of their bodies, fearing that even slight weight gain will hinder their performance[4]. Additionally, the physical discomfort caused by rapid weight loss, such as fatigue, dehydration, and decreased concentration, further exacerbates psychological stress[5] .

For college combat sports student-athletes, weight management stress carries unique characteristics rooted in their dual roles as "students" and "athletes." Unlike professional athletes who focus solely on training and competition, student-athletes must reconcile intensive athletic schedules with academic responsibilities, including coursework, exams, and assignments[6]. This balance gives rise to time conflicts: the hours spent on weight management (e.g., meal planning, additional cardio training) often overlap with study time, leading to heightened time pressure and guilt about neglecting either role[7]. Furthermore, college student-athletes often lack access to the same level of professional support (e.g., full-time nutritionists, sports psychologists) as professional athletes, augments the challenges associated with scientific weight management and amplifying stress[8] .

2.2. Coping mechanisms for weight management stress

Coping mechanisms for weight management stress are defined as cognitive and behavioral strategies adopted by athletes to mitigate distress, adjust to weight-related demands, and maintain psychological well-being[9,10]. These strategies are typically categorized into adaptive and maladaptive coping, based on their long-term impact on physical and mental health.

Adaptive coping strategies focus on resolving the root causes of stress or adapting to stressors in a healthy manner. For combat sports athletes, common adaptive strategies include seeking professional guidance (e.g., consulting coaches or nutritionists for personalized weight management plans), engaging in problem-solving (e.g., scheduling training and meals to balance study and athletic needs), and utilizing social support (e.g., sharing stress with peers, family, or teammates who face similar challenges) [11]. Rational dietary planning—such as gradual calorie adjustment and nutrient-dense meal choices—is another key adaptive strategy, as it promotes sustainable weight management without compromising physical health[12].

Studies have shown that athletes who adopt adaptive coping strategies not only experience lower levels of weight management stress but also maintain better athletic performance and overall well-being[13].

Maladaptive coping strategies, by contrast, are short-term, emotion-focused responses that alleviate immediate distress but pose risks to physical and mental health. Among combat sports athletes, common maladaptive strategies include extreme dieting (e.g., skipping meals, restricting entire food groups), excessive cardio training beyond the recommended intensity, and using diuretics or laxatives to achieve rapid weight loss [14. These behaviors often lead to physiological consequences such as muscle loss, electrolyte imbalance, and decreased immunity, as well as psychological issues like anxiety, depression, and disordered eating patterns[15]. Research by Martinez[5] found that 35% of college combat sports athletes reported using at least one maladaptive coping strategy for weight management, with younger athletes and those with less training experience being more likely to rely on such methods.

Despite growing research on athlete coping mechanisms, existing studies primarily predominantly concentrate on professional athletes or general sports populations, with limited attention to college combat sports student-athletes[16]. Few studies have investigated how the dual pressures of academics and athletics shape their coping choices, or how environmental factors influence the adoption of adaptive versus maladaptive strategies. This gap highlights the need for targeted research to understand the coping behaviors of this specific group.

2.3. Environmental psychology and athlete stress research

Environmental psychology offers a theoretical framework for understanding how external environments interact with individual characteristics to shape psychological responses and behaviors[17]. Two core theories in this field are particularly pertinent to athlete stress research: Bronfenbrenner's Ecological Systems Theory and Lazarus' Environmental Stress Theory. The Ecological Systems Theory emphasizes that human development is influenced by multiple nested environmental systems[18,19]. These systems include the microsystem (immediate surroundings, e.g., coaches and teammates), the mesosystem (interactions between microsystems, e.g., coordination between college sports departments and academic faculties), and the exosystem (indirect environments, e.g., college policies). All these systems interact to affect individual outcomes. Environmental Stress Theory, meanwhile, posits that stress arises from a mismatch between environmental demands and an individual's perceived ability to cope[20,21]. In this framework, environmental factors act as either stressors or protective factors.

In sports psychology research, environmental factors have been categorized into three key dimensions: physical, social, and institutional environments, each exerting distinct influences on athlete stress and coping. The physical environment includes tangible resources and settings related to training and daily life, such as the availability of professional training facilities, nutrition consultation rooms, and comfortable living spaces[22]. For example, colleges with on-campus nutrition clinics and weight monitoring equipment enable student-athletes to engage in scientific weight management, reducing stress associated with uncertainty about dietary choices[23]. By contrast, inadequate physical resources—such as limited access to healthy food options or outdated training equipment—can increase weight management difficulty and amplify stress[24].

The social environment encompasses interpersonal relationships and social support networks, including interactions with coaches, peers, family, and academic instructors[25]. Coaches play a pivotal role: those who provide personalized weight management guidance, emotional support, and realistic performance expectations can significantly reduce athlete stress[26] . Peer support from fellow student-athletes is also consequential—sharing experiences and strategies with peers who face similar dual pressures can foster a sense of belonging and reduce feelings of isolation[27]. Conversely, unsupportive social environments (e.g.,

coaches who emphasize weight loss over health, or peers who mock body weight) can exacerbate anxiety and promote maladaptive coping[28].

The institutional environment denotes formal policies, systems, and organizational structures implemented by colleges and sports governing bodies[29. Key factors include academic flexibility policies (e.g., allowing student-athletes to adjust class schedules to accommodate training), nutrition support programs (e.g., providing subsidized healthy meals or access to registered dietitians), and mental health services (e.g., on-campus sports psychologists). Studies have shown that colleges with comprehensive institutional support systems reduce student-athlete stress by addressing the structural barriers to weight management and academic-athletic balance [30]. For instance, flexible academic policies enable student-athletes to allocate sufficient time to training and weight management without falling behind in coursework [31].

Despite the growing recognition of environmental influences on athlete stress, existing research has several limitations. First, most studies focus on a single environmental dimension (e.g., only social support or physical facilities) rather than examining the combined effects of physical, social, and institutional environments [32]. Second, few studies apply environmental psychology theories to explore weight management stress specifically, with most research focusing on general athletic stressors (e.g., competition anxiety or injury-related stress)[33]. Third, there is a dearth of research on college combat sports student-athletes—a group with unique dual roles and weight management demands—leaving their specific environmental needs and stressors understudied. This research aims to address these gaps by integrating environmental psychology to systematically explore the weight management stress and coping mechanisms of this population.

3. Research methods

3.1. Research participants

A purposive sampling method was adopted for both the quantitative and qualitative phases, with phase-specific adjustments to ensure sampling appropriateness.

For the quantitative phase, purposive sampling was used to recruit participants from 4 higher education institutions in [Region] with formal combat sports training programs (boxing, judo, taekwondo, and sanda). Eligibility criteria included: (1) current enrollment as an undergraduate or graduate student-athlete; (2) at least 2 years of formal combat sports training experience; (3) active participation in intercollegiate or higher-level competitions in the past year; (4) no history of diagnosed mental disorders or eating disorders.

For the qualitative phase, stratified purposive sampling was employed to select 14 participants. Stratification was based on three key dimensions—gender (male/female), sport type (boxing/judo/taekwondo/sanda), and academic grade (freshman/sophomore/junior/senior/graduate)—to ensure diverse perspectives across subgroups. Each interview lasted 30–40 minutes.

Prior to data collection, a power analysis was conducted using G*Power 3.1.9.7 to determine the minimum required sample size. For the primary statistical analyses (Pearson correlation analysis and multiple linear regression with 3 predictor variables), the analysis was set to $\alpha = 0.05$ (two-tailed), statistical power $(1-\beta) = 0.80$, and medium effect size ($f^2 = 0.15$). The results indicated a minimum sample size of 128 was needed to detect significant effects. The final valid sample of 162 (effective response rate = 90%) exceeded this threshold, ensuring sufficient statistical power for hypothesis testing and reducing the risk of Type II errors.

The sample size for qualitative interviews (n = 14) was determined based on the principle of data saturation—an essential criterion for qualitative research validity. During thematic analysis, interviews were continuously monitored for the emergence of new themes. After the 12th interview, no additional core themes or sub-themes were identified; the subsequent 2 interviews confirmed consistency and completeness of existing themes, indicating that data saturation had been achieved. This sample size aligns with the recommended range (10–20 participants) for qualitative studies in sports psychology, ensuring in-depth exploration of the research questions without redundant data collection.

3.2. Research instruments

Four research tools were used to collect data, with details on their dimensions, item numbers, and psychometric properties summarized in **Table 1**.

Table 1. Psychometric properties of research instruments.

Instrument Name	Dimensions	Item Count	Cronbach's α (Current Study)	Validity Indicator (KMO)
Weight Management Stress Scale	Competitive Pressure, Academic-Training Balance, Body Image Anxiety, Nutrition Control Difficulty	16	0.87	0.83
Coping Mechanism Scale	Adaptive Coping (Seeking Support, Problem-Solving, Rational Diet), Maladaptive Coping (Extreme Dieting, Excessive Training, Emotional Avoidance)	20	0.89	0.85
Environmental Factor Questionnaire	Physical Environment, Social Environment, Institutional Environment	18	0.84	0.81
Semi-Structured Interview Outline	Stress Sources, Coping Processes, Environmental Influences	8 core questions	N/A	N/A

Weight Management Stress Scale: Adapted from the Athlete Weight Management Stress Inventory[2] to fit the dual role (student-athlete) and cultural context of Malaysian higher education. Specific adaptations included: (1) Item wording adjustment: Revising "professional training" to "academic-training balance" to reflect time conflict between coursework and athletic training; (2) Cultural adaptation: Replacing "national team requirements" with "intercollegiate competition standards" to align with the participants' competitive context; (3) Item retention/elimination: Retaining 12 original items (e.g., "I feel pressured to meet weight standards for competitions") and adding 4 new items (e.g., "I struggle to balance study time with weight management tasks") based on student-athlete interviews. Items were rated on a 5-point Likert scale (1 = "Strongly Disagree" to 5 = "Strongly Agree"), with higher scores indicating greater stress intensity. Exploratory Factor Analysis (EFA, exploratory factor analysis) confirmed a 4-factor structure (Competitive Pressure, Academic-Training Balance, Body Image Anxiety, Nutrition Control Difficulty), explaining 67.2% of total variance. Full psychometric details (factor loadings, composite reliability [CR], average variance extracted [AVE]) are presented in Appendix A.The Kaiser-Meyer-Olkin (KMO) value for this scale was 0.83, indicating suitable factor analysis conditions.

Coping Mechanism Scale: Adapted from Athlete Coping Scale[10], grounded in Lazarus and Folkman's [20] Transactional Model of Stress and Coping, with adaptations for college student-athletes. Adaptation steps included: (1) Contextual adjustment: Modifying "full-time training" to "academic and training schedules" to match time constraints; (2) Item addition: Adding 3 items (e.g., "I consult academic advisors to adjust class times for weight management") targeting the dual role challenge; (3) Wording simplification: Revising technical terms (e.g., "professional nutritional support") to "campus nutrition services" for accessibility. Items were rated on a 5-point Likert scale (1 = "Never Use" to 5 = "Frequently Use"). Confirmatory Factor Analysis (CFA) supported the 2-factor structure (Adaptive Coping, Maladaptive Coping) with good fit (χ^2/df

= 2.31, CFI = 0.92, RMSEA = 0.07). Full psychometric details (factor loadings, CR, AVE) are provided in Appendix A.

Environmental Factor Questionnaire: A self-designed scale developed to measure environmental influences on student-athletes' weight management, grounded in Bronfenbrenner's Ecological Systems Theory[18]. The development process included three stages:

Item generation: Initial items (n = 25) were derived from literature review and qualitative pre-interviews with 8 college combat sports student-athletes. Items covered physical (e.g., "Availability of on-campus nutrition consultation rooms"), social (e.g., "Teammates share weight management strategies with me"), and institutional (e.g., "The college allows adjusting exam schedules for competition preparation") environments.

Expert validation: Five experts (2 sports psychology professors, 2 environmental psychology researchers, 1 senior college sports coach with 10+ years of experience) evaluated the scale for content validity, clarity, and relevance. Experts rated items on a 4-point scale (1 = "Not relevant" to 4 = "Highly relevant"), with a content validity index (CVI) of 0.92 (≥0.80 indicating good validity). Based on expert feedback, 4 ambiguous items (e.g., "Campus resources are sufficient") were revised to specific descriptions (e.g., "Campus canteens provide healthy meal options for weight management"), and 3 redundant items were deleted, resulting in 18 items.

Pilot testing: A pilot study was conducted with 40 college combat sports student-athletes (demographics: 26 males, 14 females; age M = 20.85, SD = 1.63; training years M = 4.92, SD = 1.98) to test reliability and construct validity. Item analysis eliminated 1 item with corrected item-total correlation <0.30, and EFA on the remaining 18 items confirmed a 3-factor structure (physical, social, institutional environments) accounting for 64.5% of total variance. Cronbach's α for the pilot sample was 0.82, indicating good internal consistency.The final scale used a 5-point Likert scale (1 = "Strongly Disagree" to 5 = "Strongly Agree"), with higher scores indicating more favorable environmental conditions.

Semi-Structured Interview Outline: Focused on open-ended questions to explore in-depth experiences, such as "What are the biggest challenges you face in weight management?" and "Which environmental factors have helped or hindered your weight management?"

Full psychometric details (including factor loadings, composite reliability [CR], and average variance extracted [AVE]) for the two adapted scales are presented in Appendix A to ensure transparency and reproducibility.

3.3. Data collection procedures

Data collection followed a two-phase mixed-methods design:

Quantitative phase: Questionnaires were distributed online via college sports departments and WeChat groups for student-athletes. Participants were informed of the study's purpose, confidentiality, and right to withdraw at any time. Completion took approximately 15 minutes, and no incentives were provided to avoid response bias.

Qualitative phase: Interviews were conducted face-to-face or via video call after questionnaire data analysis. Prior to interviews, written informed consent was obtained, and all conversations were audio-recorded with permission. Interviews were transcribed verbatim within 24 hours, resulting in 82 pages of transcribed text (approximately 45,000 words).

3.4. Data analysis methods

Quantitative analysis: Statistical Package for the Social Sciences(SPSS) 26.0 software was used for data processing. Descriptive statistics (mean, standard deviation) were calculated to characterize stress levels and coping strategy use. Pearson correlation analysis examined relationships between environmental factors, weight management stress, and coping mechanisms. Multiple linear regression analysis was performed to identify key environmental predictors of stress and adaptive coping.

Qualitative analysis: Thematic analysis was applied following Braun and Clarke's [34] six-step framework: (1) familiarization with transcribed data; (2) open coding to label initial concepts; (3) axial coding to group codes into sub-themes; (4) selective coding to identify core themes; (5) validation of themes through member checking (with 3 participants); (6) refinement and description of themes. NVivo 12(A professional qualitative research data analysis software) software assisted in coding and theme organization.

To ensure the trustworthiness of qualitative results, two key measures were implemented: (1) Member checking: Three participants were invited to review the coded themes and transcribed excerpts, confirming that the themes accurately reflected their experiences and perspectives (all participants validated the consistency between themes and their actual feelings); (2) Audit trail: The entire qualitative analysis process was documented systematically, including a coding manual (detailing code definitions and application rules), decision logs (recording adjustments to coding frameworks), and raw transcription files. An independent researcher unfamiliar with the study objectives reviewed 20% of the coded data, with an inter-coder agreement rate of 85% (≥80% indicating acceptable reliability).

Mixed-Methods Integration Strategy:This study adopted a sequential explanatory mixed-methods integration framework, centered on triangulation and complementarity to enhance research rigor. First, quantitative data were analyzed to identify broad patterns: descriptive statistics and regression analysis revealed the intensity of weight management stress, dominant coping strategies, and key environmental predictors (e.g., social support as a stress reducer). Subsequently, qualitative data were analyzed to explore the contextual mechanisms and individual experiences underlying these quantitative trends—for example, why social support emerged as a critical factor, or how institutional policies specifically alleviate academic-training balance stress.Integration was realized through two core approaches: (1) Triangulation: Quantitative findings (e.g., institutional nutrition support correlates with lower stress) were cross-validated against qualitative themes (e.g., "Lack of on-campus nutritionists increases uncertainty in diet planning"), ensuring consistency and credibility of results; (2) Complementarity: Qualitative insights supplemented quantitative data by explaining "how" and "why" environmental factors influence stress and coping—for instance, quantitative data showed a positive link between physical environment and adaptive coping, while qualitative interviews clarified that accessible nutrition consultation facilities reduce decision-making anxiety, thereby promoting rational diet planning. This integration combined the breadth of quantitative data with the depth of qualitative evidence, providing a comprehensive understanding of the research topic.

4. Results

4.1. Demographic characteristics recap

As detailed in Section 3.1, the valid sample consisted of 162 combat sports student-athletes (66.7% male, 33.3% female) aged 18–25 years (M = 21.36, SD = 1.82) with 2–10 years of training experience (M = 5.78, SD = 2.14). Academic distribution included freshmen (25.9%), sophomores (31.5%), juniors (27.8%), and seniors/graduates (14.8%), covering four core combat sports: boxing (28.4%), judo (26.5%), taekwondo

(29.0%), and sanda (16.1%). This demographic structure ensured representation across key subgroups for comparative analysis.

4.2. Status of weight management stress

Descriptive statistics revealed a moderate-to-high level of overall weight management stress among participants (M = 3.38, SD = 0.75) on the 5-point scale. As shown in **Table 2** and **Figure 1**, competitive pressure emerged as the most intense stressor (M = 3.62, SD = 0.78), followed by nutrition control difficulty (M = 3.45, SD = 0.81). Academic-training balance (M = 3.21, SD = 0.85) and body image anxiety (M = 2.98, SD = 0.92) were relatively less severe but still above the midpoint (3.0).The 95% confidence interval indicates that the estimated range for each pressure dimension is relatively narrow, suggesting that the sample mean has a good representativeness of the overall population (see **Table 2**)

Table 2. Descriptive statistics of weight management stress dimensions (N = 162).

Stress Dimension	Mean (M)	Standard Deviation (SD)	95% Confidence Interval (CI)	Rank
Competitive Pressure	3.62	0.78	[3.49, 3.75]	1
Nutrition Control Difficulty	3.45	0.81	[3.31, 3.59]	2
Academic-Training Balance	3.21	0.85	[3.06, 3.36]	3
Body Image Anxiety	2.98	0.92	[2.81, 3.15]	4
Overall Weight Management Stress	3.38	0.75	[3.26, 3.50]	—

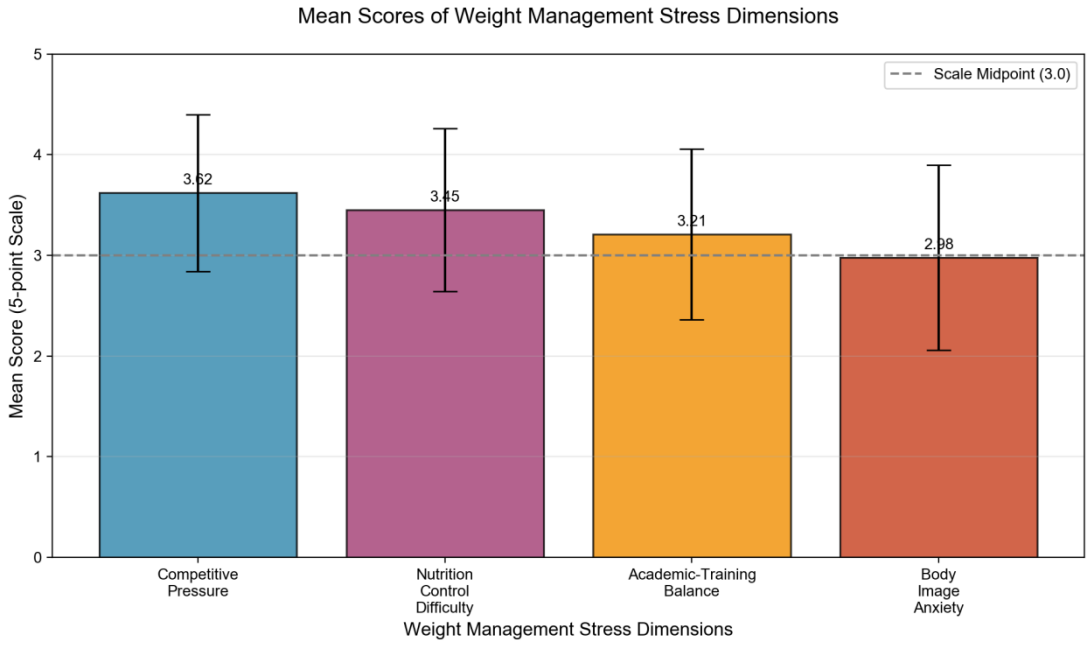

Figure 1. Mean scores of weight management stress dimensions (5-point Scale).

Note: *Bars represent mean scores on a 5-point stress scale (1 = Strongly Disagree, 5 = Strongly Agree), with higher scores indicating greater stress intensity.*

Differences analysis indicated significant gender variations: males scored higher on competitive pressure ($t = 2.34$, $p < 0.05$, $M_{male} = 3.76$, $Mp_{emale} = 3.35$) and academic-training balance ($t = 2.11$, $p < 0.05$, $M_{male} = 3.34$, $Mp_{emale} = 2.99$). No significant differences were found across grades or sport types ($p > 0.05$).

4.3. Coping mechanisms adopted

Adaptive coping strategies were more frequently used (overall M = 3.52, SD = 0.68) than maladaptive ones (overall M = 2.47, SD = 0.83). As presented in **Table 3** and **Figure 2**, "seeking coach's nutrition guidance" (M = 3.87, SD = 0.65) and "rational diet planning" (M = 3.72, SD = 0.71) were the most prevalent adaptive strategies. For maladaptive strategies, "skipping meals occasionally" (M = 2.89, SD = 0.93) was the most common, while "using diuretics/laxatives" (M = 1.34, SD = 0.56) was rarely reported.

Table 3. Frequency of coping mechanism Use (N = 162).

Coping Type	Specific Strategy	Mean (M)	SD
Adaptive Coping	Seeking coach's nutrition guidance	3.87	0.65
	Rational diet planning	3.72	0.71
	Sharing stress with teammates	3.41	0.80
Maladaptive Coping	Skipping meals occasionally	2.89	0.93
	Excessive cardio training	2.63	0.87
	Emotional eating (high-sugar/high-fat foods)	2.31	0.91
	Using diuretics/laxatives	1.34	0.56

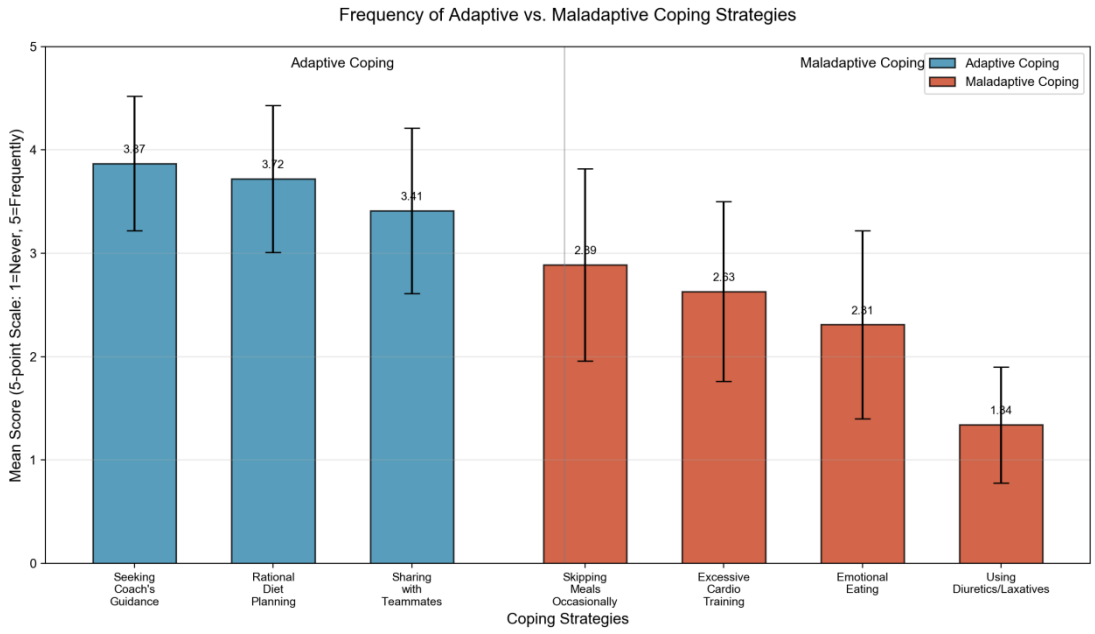

Figure 2. Frequency of adaptive vs. maladaptive coping strategies.

Note: *Bars represent mean scores on a 5-point frequency scale (1 = Never Use, 5 = Frequently Use). Adaptive Coping refers to healthy strategies targeting stress resolution; Maladaptive Coping refers to short-term, health-risky strategies for immediate distress relief.*

4.4. Influence of environmental factors

Correlation analysis showed significant negative relationships between all environmental dimensions and weight management stress (see **Table 4** and **Figure 3**). Social environment ($r = -0.42$, $p < 0.01$) had the strongest association, followed by institutional environment ($r = -0.38$, $p < 0.01$) and physical environment (r

= -0.31, $p < 0.01$). Positive correlations were found between environmental factors and adaptive coping ($r = 0.35–0.40$, $p < 0.01$), with no significant links to maladaptive coping ($p > 0.05$).

Table 4. Correlations between environmental factors, stress, and adaptive coping (N = 162).

Variable	Weight Management Stress	Adaptive Coping
Physical Environment	-0.31**	0.35**
Social Environment	-0.42**	0.40**
Institutional Environment	-0.38**	0.37**

Note: ***p < 0.01 (two-tailed)*

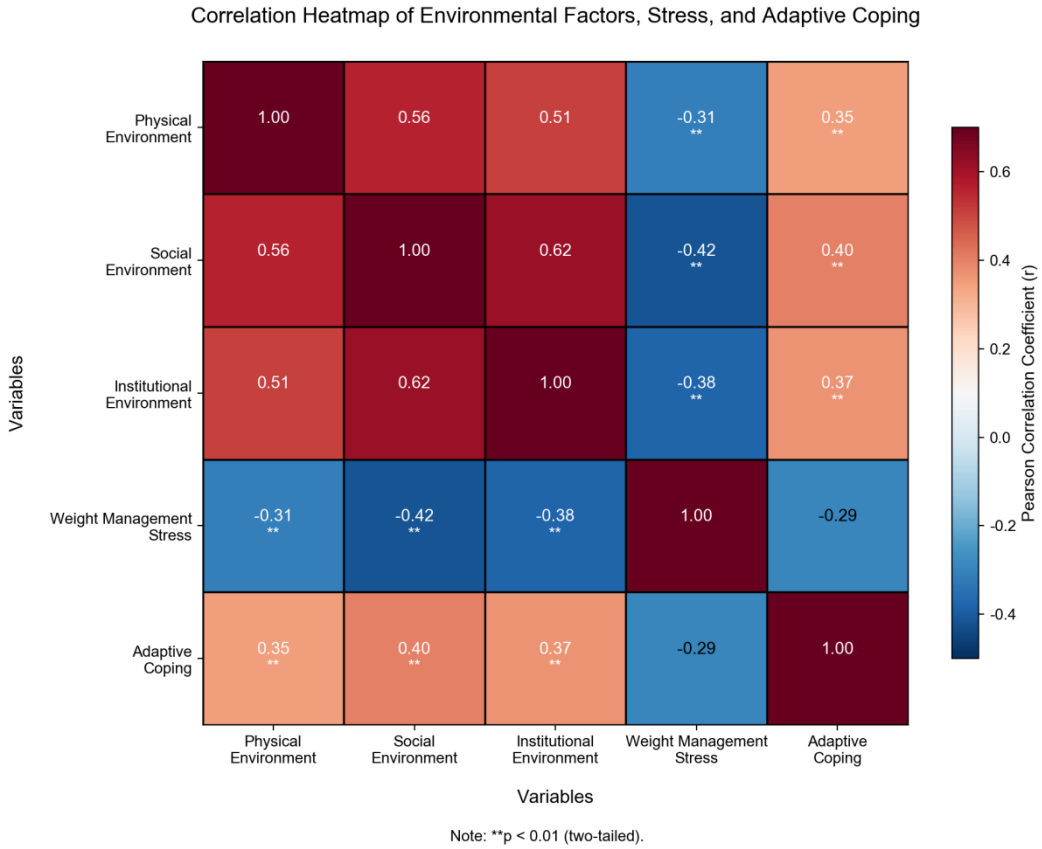

Figure 3. Correlation heatmap of environmental factors, stress, and adaptive coping.

Note: *Color intensity indicates correlation strength (darker blue = stronger positive correlation; darker red = stronger negative correlation). **p < 0.01(two-tailed test).*

Multiple linear regression analysis was conducted to identify key environmental predictors, and the results are presented in Table 5. It identified social support ($\beta = -0.35$, $p < 0.001$) and institutional nutrition support ($\beta = -0.28$, $p < 0.01$) as significant predictors ($R^2 = 0.29$, $F = 25.34$, $p < 0.001$).To clarify the predictive role of environmental factors on weight management stress and adaptive coping strategies, all three dimensions of the physical environment, social environment, and institutional environment were simultaneously incorporated into the multiple linear regression model. The results are shown in **Table 5**.

Table 5. Regression analysis of environmental predictors (N = 162).

Dependent Variable	Predictor Variable	Unstandardized Coefficient (B)	Standardized Coefficient (β)	95% Confidence Interval (CI)	t-value	p-value
Weight Management Stress	Social Environment	-0.42	-0.35	[-0.58, -0.26]	-4.82	<0.001
	Institutional Environment	-0.31	-0.28	[-0.47, -0.15]	-3.96	<0.01
	Physical Environment	-0.13	-0.12	[-0.30, 0.04]	-1.67	>0.05
Adaptive Coping	Social Environment	0.38	0.33	[0.22, 0.54]	4.51	<0.001
	Physical Environment	0.27	0.24	[0.11, 0.43]	3.38	<0.01
	Institutional Environment	0.16	0.15	[0.00, 0.32]	2.03	>0.05

Note: *All three environmental factors (physical, social, institutional) were entered into the regression model simultaneously.* $R^2 = 0.32$ *(for Weight Management Stress),* $R^2 = 0.29$ *(for Adaptive Coping);* $F = 28.76$ $(p < 0.001)$ *and* $F = 25.34$ $(p < 0.001)$*, respectively.*

Qualitative thematic analysis yielded three core themes:(1) “Coach’s personalized guidance alleviates anxiety about weight control”Example quote: “My coach didn’t just tell me to lose weight—he worked with me to make a weekly meal plan and adjusted my training intensity. Knowing I have professional advice makes me less worried about missing weight targets or losing strength.”(2) “Lack of on-campus nutritionists increases uncertainty in diet planning”Example quote: “I often wonder if my diet is balanced enough for both training and weight control. There’s no one to ask on campus, so I sometimes cut out carbs entirely, which makes me tired during classes.”(3) “Flexible class schedules reduce conflict between training and weight management”Example quote: “Last semester, the college let me switch my morning classes to afternoons so I could do cardio training in the morning. It meant I didn’t have to skip meals or stay up late studying—such a big relief.”

5. Discussion

5.1. Interpretation of key results

The findings of this study shed light on the weight management stress, coping mechanisms, and environmental influences among college combat sports student-athletes, with three core insights aligned with the environmental psychology framework. First, the moderate-to-high overall weight management stress (M = 3.38) confirms that this group faces substantial psychological pressure, with competitive pressure (M = 3.62) and nutrition control difficulty (M = 3.45) as the primary stressors (**Figure 1**). This pattern reflects the unique demands of combat sports. First, weight class eligibility directly impacts competition participation. Second, as highlighted in qualitative themes, student-athletes have limited access to professional nutrition support—this exacerbates uncertainty about scientific weight control. The gender difference in stress—males scoring higher on competitive pressure and academic-training balance—may stem from broader societal expectations of male athletes’ competitive performance and heavier academic course loads for male student-athletes in some combat sports programs[6].

Second, adaptive coping strategies (M = 3.52) were more frequently adopted than maladaptive ones (M = 2.47), with “seeking coach’s nutrition guidance” (M = 3.87) and “rational diet planning” (M = 3.72) as the most prevalent adaptive behaviors (**Figure 2**). This indicates that student-athletes recognize the value of professional support and healthy practices, but the persistence of maladaptive strategies—such as “skipping meals occasionally” (M = 2.89)—indicates gaps in environmental support. When institutional or physical

resources (e.g., nutrition consultation) are unavailable, student-athletes may resort to short-term, risky methods to meet weight targets [5].

Third, environmental factors emerged as critical predictors of stress and coping, with the social environment ($r = -0.42$) exerting the strongest negative correlation with weight management stress (**Figure 3**). Regression analysis further confirmed two key stress reducers: social support ($\beta = -0.35$) and institutional nutrition support ($\beta = -0.28$). Meanwhile, the physical environment ($\beta = 0.24$) emerged as a factor that promotes adaptive coping. These results align with Ecological Systems Theory: the microsystem (coach-teammate interactions) and mesosystem (college policies) directly shape student-athletes' psychological responses and behavioral choices [18]. Qualitative themes—such as "coach's personalized guidance alleviates anxiety"—reinforce that social support provides both emotional reassurance and practical solutions, reducing the perceived burden of weight management.

5.2. Comparison with previous studies

The current findings are consistent with existing research showing that combat sports athletes face significant weight management stress[2,3]. However, this study extends prior work by elucidating two unique characteristics of college student-athletes: the dual stressor of "academic-training balance" and the critical role of institutional environments. Unlike professional athletes who prioritize training, college student-athletes must reconcile weight management with coursework, creating a distinct time conflict that previous studies have overlooked[16]. Additionally, while prior research emphasized social support[26], this study demonstrates that institutional policies—such as flexible class schedules and nutrition support programs—are equally important for alleviating stress, addressing a gap in the literature.

The prevalence of adaptive coping strategies aligns with Miller.'s[10] finding that athletes with access to support systems tend to adopt healthy behaviors. However, the higher frequency of "seeking coach's guidance" over other adaptive strategies suggests that student-athletes rely heavily on coaches due to limited access to specialized professionals (e.g., dietitians). This contrasts with professional athlete populations, who typically have dedicated support teams[13], highlighting a resource disparity that warrants attention.

5.3. Theoretical implications

This study contributes to the intersection of environmental psychology and sports psychology by validating the applicability of Ecological Systems Theory in a specific athletic context. The finding that physical, social, and institutional environments interact to influence stress and coping confirms that athlete well-being cannot be understood in isolation from external contexts [19]. By operationalizing environmental factors into measurable dimensions (physical, social, institutional), this study provides a replicable framework for future research on athlete stress.

Furthermore, the results extend Environmental Stress Theory by demonstrating that environmental factors act as both "stress buffers" and "coping enablers." Positive social and institutional environments reduce the perceived mismatch between weight management demands and coping resources[20], while high-quality physical environments (e.g., nutrition facilities) provide the tools for adaptive coping. This dual role of environmental factors enriches our understanding of how external contexts shape athlete psychological responses.

5.4. Practical implications

The findings offer actionable recommendations for multiple stakeholders. For higher education institutions:Hire at least one registered dietitian per 50 combat sports student-athletes to provide personalized nutrition consultation and meal planning services.Establish on-campus weight management centers equipped

with body composition analyzers and nutrition education materials, open 5 days a week (9:00–18:00).Formalize academic flexibility policies: Allow student-athletes to apply for class/exam schedule adjustments up to 2 weeks before competitions, with a maximum of 3 adjusted courses per semester.For coaches:Complete 8 hours of specialized training in sports nutrition and stress management every quarter, covering topics such as safe weight loss and emotional support techniques.Develop individual weight management plans for each athlete, including monthly progress reviews and real-time adjustments based on training intensity and academic workload.For relevant administrative departments:Launch a "weight management support program" that subsidizes 70% of the cost of healthy meals for combat sports student-athletes in campus canteens.Organize bi-annual workshops for student-athletes, inviting dietitians and sports psychologists to teach practical skills (e.g., reading nutrition labels, mindfulness for stress reduction).For student-athletes:Participate in mandatory nutrition and stress management training (16 hours per academic year) to enhance adaptive coping skills and resource utilization awareness.

5.5. Research limitations and future directions

This study has several limitations. First, the sample was restricted to 4 colleges in a single region, limiting the generalizability of results to broader populations. Second, the cross-sectional design cannot establish causal relationships between environmental factors and stress/coping—this hinders causal inference, as it remains unclear whether positive social environments reduce stress or less stressed athletes seek more social support. Third, self-report questionnaires may introduce response bias: participants may underreport maladaptive behaviors due to social desirability bias, where they tend to present themselves in a socially acceptable manner (e.g., downplaying extreme dieting or excessive training). Fourth, the study did not account for potential individual differences in stress perception (e.g., resilience or personality traits), which may moderate the relationship between environmental factors and coping strategies.

Future research should address these limitations by conducting longitudinal studies to explore the dynamic interaction between environmental factors and weight management stress over time. Expanding the sample to include more regions and combat sports types will improve generalizability. Additionally, investigating the moderating role of individual factors—such as psychological resilience or nutrition knowledge—could further clarify the mechanism by which environmental factors influence coping strategies. Finally, mixed-methods research incorporating objective measures (e.g., actual weight change data) would complement self-report data and enhance validity.

6. Conclusion

This study investigated weight management stress, coping mechanisms, and environmental influences among combat sports student-athletes in higher education, yielding actionable insights grounded in environmental psychology. The results confirm that this population faces moderate-to-high weight management stress. The primary stressors are competitive pressure and nutrition control difficulty. Additionally, adaptive coping strategies (e.g., seeking coach guidance, rational diet planning) are more prevalent than maladaptive ones. Critically, social support, institutional nutrition policies, and physical facilities emerge as key environmental factors that alleviate stress and promote adaptive coping, validating the role of multi-level environmental systems in shaping athlete well-being.

Theoretically, this research enriches the intersection of environmental psychology and sports psychology by demonstrating the applicability of Ecological Systems Theory and Environmental Stress Theory to a specific athletic context. Practically, the findings provide a basis for colleges, coaches, and relevant departments to optimize support systems—including enhancing social support, improving physical

resources, and refining institutional policies—to address the dual pressures of academics and athletics faced by student-athletes. By reducing weight management stress and fostering adaptive coping, these interventions can promote the physical and mental health of combat sports student-athletes, supporting their holistic development as both students and athletes.

While the study has limitations regarding sample scope and cross-sectional design, its core findings highlight the importance of environmental optimization for this understudied group. Future research building on these insights will further advance our understanding of athlete stress and coping, contributing to more targeted support for student-athletes in combat sports and beyond.

Conflict of interest

The authors declare no conflicts of interest.

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Appendix

Appendix A：Psychometric Details of Adapted Scales

1. Weight Management Stress Scale（4-factor structure）

Factor	Item No.	Factor Loading	CR	AVE
Competitive Pressure	WP1-WP4	0.76–0.84	0.88	0.65
Academic-Training Balance	WB1-WB4	0.72–0.81	0.86	0.62
Body Image Anxiety	WI1-WI4	0.70–0.78	0.83	0.59
Nutrition Control Difficulty	WN1-WN4	0.73–0.82	0.87	0.63

Note: *CR = Composite Reliability (≥0.70 acceptable); AVE = Average Variance Extracted (≥0.50 acceptable).*

2. Coping Mechanism Scale（2-factor structure）

Factor	Item No.	Factor Loading	CR	AVE
Adaptive Coping	CA1-CA12	0.74–0.85	0.91	0.67
Maladaptive Coping	CM1-CM8	0.71–0.83	0.88	0.64

Note: *CR = Composite Reliability (≥0.70 acceptable); AVE = Average Variance Extracted (≥0.50 acceptable).*