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Anxiety perception in BMX cross athletes based on gender and competition levels: A descriptive analysis using SAS-2

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ABSTRACT

Background: Many BMX cross athletes experience high levels of anxiety before competing. While there is a wealth of research on anxiety in other sports, research specifically examining anxiety perceptions in BMX cross-athletes, taking gender and competition level into account, is limited. **Objectives:** This study aims to analyse the perception of anxiety of BMX cross-athletes in competition, viewed from gender and competition class. **Methods:** The method used is quantitative descriptive using the Sport Anxiety Scale-2 (SAS-2), which consists of 15 items and is divided into three main subscales, namely somatic, worry, and concentration disorders. Data analysis was conducted using SPSS Version 29 to determine the percentage of anxiety perception and differences in each gender and competition level. Subjects involving 18 BMX cross athletes in Bandung City aged 16.94 ± 3.404 years. Data analysis was carried out by presenting the percentage of results. **Results:** The results showed that BMX Cross athletes had a moderate level of anxiety, with a mean score of 2.43 ± 0.58 based on the SAS-2 scale (1-4). Descriptively, female athletes showed slightly higher mean anxiety scores than male athletes. Based on competition class, athletes in higher categories (U-23 and elite) tended to have higher mean anxiety scores compared to junior and challenge levels. However, these findings are descriptive only and should be interpreted with caution. **Conclusion:** This study concluded that BMX cross athletes have moderate levels of anxiety. Coaches and sports psychologists are encouraged to implement mental management training to further support athletes in stressful situations. Future studies should include larger, more diverse samples and examine additional factors to deepen our understanding of anxiety in BMX cross athletes.

Keywords: Anxiety; bicycle racing; BMX athletes



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Authors' Contribution: a – Study Design; b – Data Collection; c – Statistical Analysis; d – Manuscript Preparation; e – Funds Collection

INTRODUCTION

Sports psychology examines athletes' thoughts, emotions, and behaviours during training and competition (Stolarski et al., 2019). In BMX Cross, anxiety is a particularly influential psychological factor because athletes must perform high-risk technical movements within seconds, where small errors can result in crashes or loss of position (Daneshfar et al., 2021; Martinho et al., 2024). Anxiety characterised by emotional tension,

physiological arousal, and worry Frame and Reichin (2019) can disrupt focus, impair decision-making, and reduce performance during highly dynamic race situations (Phillips-Wren & Adya, 2020). This makes psychological readiness as essential as physical conditioning for BMX Cross athletes (Camilleri et al., 2025).

BMX Cross presents unique situational pressures that distinguish it from traditional or endurance sports, such as explosive start-gate demands, close physical contact, unpredictable collision risks, and intense crowd proximity (Adi et al., 2024; Wilson et al., 2019). These conditions heighten anxiety levels and amplify their impact on performance. Athletes must maintain speed, strength, technical precision, and tactical decision-making on a 300-400 m track with complex obstacles, including jumps and berms, starting from an 8-metre-high ramp (Di Rienzo et al., 2017). Such high-intensity environments require athletes to regulate anxiety effectively to maintain concentration, confidence, and consistency (Bayani et al., 2024; Boltobaev et al., 2022).

Athletes differ in how they perceive and manage anxiety due to variations in experience, confidence, psychological skills, and social support (Palazzolo, 2020; Irwanto & Romas, 2019). Techniques such as visualisation, controlled breathing, and pre-race routines help athletes reduce anxiety and maintain optimal focus—skills especially critical in extreme sports where errors occur in fractions of a second. Understanding these psychological demands is essential for coaches and sport psychologists who aim to build effective mental preparation programmes (Simandjuntak et al., 2024).

Despite increasing interest in psychological factors in extreme sports, the existing literature still exhibits important methodological and contextual limitations. First, there is a lack of subgroup analyses. No study to date has specifically examined how BMX cross athletes differ in their anxiety levels based on gender and competition level. Although previous research shows that self-confidence and anxiety interact to influence performance (Conde-Ripoll et al., 2024; Purnamasari & Novian, 2021), existing studies have not compared anxiety patterns across male and female athletes nor across junior and elite competitive categories in BMX Cross. Second, research on extreme sport psychology, especially in BMX cross, remains underexplored compared to mainstream sports. In addition, most SAS-2 research has focused on mainstream sports such as soccer, basketball, and swimming, while evidence in extreme cycling sports remains limited.

Because BMX Cross athletes are exposed to unique psychological stressors, this creates a clear knowledge gap regarding how anxiety manifests across demographic and competitive groups within this sport. Addressing this gap is essential for developing targeted psychological strategies to improve readiness, emotional control, and race performance. Therefore, the purpose of this study is to describe and examine patterns in anxiety perception among BMX Cross athletes based on gender and competition level using the Sport Anxiety Scale-2 (SAS-2).

METHOD

Research Design

The method employed in this study was a quantitative descriptive approach (Fraenkel, 2022), aiming to describe the perception of anxiety among BMX Cross athletes based on gender and competition levels. However, it is important to note that this methodological choice limits the ability to establish causal relationships or conduct more complex inferential testing, thus reducing the generalisability of the findings.

Participants

This study involved 18 BMX Cross athletes from Bandung City (age = 16.94 ± 3.40 years) who were actively competing at regional and national levels. Participants were selected using purposive sampling based on the following inclusion criteria: active competition status, availability during data collection, and willingness to provide informed consent. The small total sample ($n = 18$) and the uneven distribution across competition categories—such as the U-23 group with only two athletes—indicates a very small sample size with low statistical power and an unbalanced distribution of subgroups. Represent notable methodological limitations. These conditions introduce potential comparison bias and directly affect both internal and external validity. Such constraints are common in studies involving specialised competitive sports where the accessible athlete population is limited.

Instrument

The instrument used was the Sport Anxiety Scale-2 (SAS-2), developed by (Smith et al., 2006), and adapted by (Tomczak et al., 2022). SAS-2 consists of 15 items divided into three subscales: somatic anxiety, worry, and concentration disruption. The scale uses a 4-point Likert scale, ranging from 1 (not at all) to 4 (very much). The validity value (.279) and reliability value (.708) were cited from previous studies and were not re-tested in this study due to the limited sample size. This constitutes another methodological weakness, as the psychometric properties were not directly confirmed in the present population. Nevertheless, the values are within acceptable thresholds for psychological instruments used in exploratory research (Purnamasari & Novian, 2021).

Data Collection Procedures

The questionnaire was distributed once using Google Forms and was completed independently by participants under supervision during a scheduled training session. Participants were briefed on the purpose of the study and instructed on how to complete the questionnaire. The data collection took place over one week in May 2025, coinciding with the athletes' scheduled non-competition training days to minimise performance related-bias.

Ethical Considerations

This study was carried out in accordance with the ethical principles outlined in the Declaration of Helsinki. Prior to completing the questionnaire, participants received detailed information about the study's objectives, potential benefits, and their right to withdraw at any time without penalty. Participation was entirely voluntary, and all collected data were treated with strict confidentiality and used exclusively for research purposes.

Data Analysis

Data were analysed using SPSS Version 29. Descriptive statistics (mean, standard deviation, and percentage distribution only) were used to summarise anxiety levels across gender and competition classes. No inferential statistical analyses were performed, and no p-values, confidence intervals, or effect sizes are reported. All findings are presented descriptively, focusing on distributions and patterns without making claims about differences or relative levels between groups. This analytical decision was made due to the small and uneven sample distribution, which limits the feasibility and interpretive value of inferential testing.

RESULTS AND DISCUSSION

Results

Participant Characteristics

The demographic characteristics of the participants are presented in Table 1. The majority of participants were male athletes (67%), while female athletes accounted for 33% of the sample. In terms of competition class, the challenge category represented the largest proportion (39%), followed by junior (33%), elite (17%), and U-23 (11%). The unequal distribution across competition levels, particularly the small number of U-23 athletes, should be considered a limitation, as it may affect the reliability of subgroup comparisons.

Table 1. Demographic Data

		Total	Percentage
Gender	Male	12	67%
	Female	6	33%
	Challenge	7	39%
Competition Class	Junior	6	33%
	U-23	2	11%
	Elite	3	17%

²⁸ **Table 2** presents the overall descriptive statistics of anxiety scores among the participants. The mean total anxiety score was 26.06 ± 5.79 , with values ranging from 17 to 35, indicating moderate variability in anxiety levels within the sample.

²⁴ **Table 2. Overall Descriptive Statistics of Anxiety Scores**

Variable	Mean \pm SD	Min	Max.
Total Anxiety Score	26.06 ± 5.79	17	35

Table 3 presents descriptive anxiety scores by gender. ¹⁰ male athletes demonstrated higher mean scores across all anxiety dimensions, including somatic anxiety, worry, concentration disruption, and total anxiety, compared to female athletes. The observed variability within each group was moderate, as indicated by the standard deviations. The 95% confidence intervals (CI) intervals provide an estimate of the ⁶ precision of the mean scores. However, given the absence of inferential statistical testing and the relatively ² small sample size, these findings should be interpreted as descriptive trends rather than statistically significant differences.

Table 3. Descriptive Anxiety Scores by Gender

Gender	n	Somatic Anxiety (Mean \pm SD)	Worry (Mean \pm SD)	Concentration Disruption (Mean \pm SD)	Total Anxiety (Mean \pm SD)	95 % CI
Male	12	14.8 ± 3.1	16.2 ± 2.7	13.5 ± 3.4	44.5 ± 7.2	[41.0-47.9]
Female	6	17.9 ± 2.8	18.8 ± 3.1	15.9 ± 2.6	52.6 ± 6.3	[49.1-56.2]

Table 4 presents descriptive anxiety scores across competition levels. Athletes in higher competition categories, particularly the U-23 and elite groups, tended to show higher mean ²⁹ anxiety scores compared to those in the challenge and junior levels. This pattern was consistent across ³ somatic anxiety, worry, and ⁴ concentration disruption dimensions. However, due to the small and uneven sample sizes across groups, especially in the U-23 category, these findings should be interpreted with caution and considered exploratory.

Table 4. Descriptive Anxiety Scores by Competition Class

Competition Class	n	Somatic Anxiety (Mean \pm SD)	Worry (Mean \pm SD)	Concentration Disruption (Mean \pm SD)	Total Anxiety (Mean \pm SD)	95 % CI
Challenge	7	16.1 ± 3.2	18.4 ± 2.9	14.2 ± 3.1	48.7 ± 6.8	(42.4-55.0)
Junior	6	15.3 ± 2.7	17.9 ± 3.0	15.1 ± 2.8	48.3 ± 7.1	(41.0-55.6)
U-23	2	17.5 ± 2.1	19.2 ± 2.4	15.8 ± 2.0	52.5 ± 5.4	(18.2-86.8)
Elite	3	15.9 ± 2.6	16.8 ± 2.3	17.2 ± 2.5	49.9 ± 6.2	(34.5-65.3)

Referring to **Table 2**, the total anxiety scores ranged from 17 to 35, with a mean of 26.06 ± 5.79 , indicating variability ³⁰ in anxiety levels among participants. Descriptive comparisons by gender (**Table 3**) show that ⁵ male athletes demonstrated higher mean anxiety scores across all dimensions compared to female athletes. The mean \pm standard deviation (SD) and 95% confidence intervals (CI) further indicate that female athletes consistently showed higher central tendency values than male athletes, although some overlap between intervals is observed. **Table 4** presents descriptive anxiety scores by competition class. Athletes in higher competition levels, particularly the U-23 and elite categories, tended to show higher mean total anxiety scores compared to those in the challenge and junior levels. The results are reported as mean \pm SD for each group, with 95% confidence intervals indicating considerable overlap between competition classes, suggesting variability and limited precision in group estimates. Across most competition classes, worry emerged as the highest-scoring anxiety dimension. This pattern is also visually supported by **Figure 1**, where error bars (± 1 SD) illustrate the distribution and variability of scores across groups. However, given ²⁷ small and uneven sample sizes across groups, particularly in the U-23 and elite categories, these findings should be interpreted with caution and considered exploratory rather than conclusive. The wide confidence intervals observed in smaller groups (e.g., U-23) further highlight the uncertainty of these estimates.

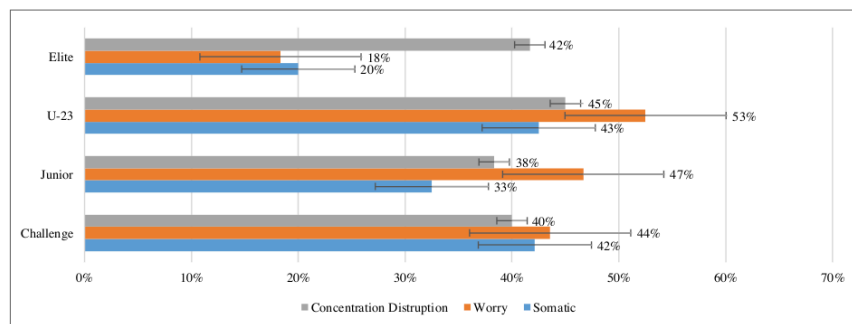


Figure 1. Mean SAS-2 Anxiety Scores (\pm SD) Across Competition Classes for Somatic, Worry, and Concentration Indicators

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Based on Figure 1, it can be seen that athletes in the challenge competition class have the highest percentage of worry, followed by somatic and concentration disturbance. Athletes in the junior competition class have the highest percentage of worry, followed by concentration disturbance and somatic. Athletes in the U-23 competition class have the highest percentage of worry, then concentration disturbance, and somatic. Athletes in the elite competition class have the highest percentage of concentration disturbance, then somatic, and worry. These percentages indicate that athletes in the challenge, junior, and U-23 competition classes have higher levels of worry than other sub-indicators, while athletes in the elite competition class have higher levels of concentration disturbance than other sub-indicators.

Discussion

The results of this study provide an overview of the demographic characteristics, age distribution, and anxiety levels of BMX Cross athletes when facing competition. BMX Cross is an extreme sport that requires explosive power, high start speed, technical accuracy, and mental readiness, making anxiety an important psychological factor that can influence performance (Saputra et al., 2022). The wide variation in participant ages (12-25 years), together with the large standard deviation, indicates diversity in experience and athlete maturity. Because this study used descriptive statistics only, these patterns should be interpreted cautiously and viewed as general tendencies rather than statistically tested group differences.

Younger athletes are still developing competitive experience compared to senior athletes (Bezuglov et al., 2022), and age-related factors may influence physical and mental readiness when facing competition pressure (Kaplánová, 2024). Although the present study did not measure specific developmental or experiential variables, previous literature suggests that anxiety patterns may vary across ages and levels of experience due to limited exposure to competitive situations, whereas older athletes may face performance-maintenance pressures. Studies using the SAS-2 in other sports report similar age-related patterns, which helps contextualise the descriptive findings of this study.

Based on the descriptive distribution, anxiety scores appear to vary across gender groups. However, because no inferential statistics were conducted and the sample was small, these observations should be treated as descriptive trends rather than confirmed group differences. Prior literature indicates that female athletes may face different social expectations and psychological demands, which can influence anxiety perception (González-Hernández et al., 2024). While this study did not assess social pressure, confidence, or biomechanical factors directly, these elements have been proposed in earlier studies as potential contributors to gender-related differences in anxiety. From a practical standpoint, gender-sensitive mental training

programmes have been recommended to support athletes' psychological readiness (Goorevich & LaVoi, 2024), and the descriptive patterns observed here align with this broader body of evidence.

The descriptive distribution across competition classes indicates variation in anxiety scores among categories. These observations are descriptive in nature, and no causal or comparative conclusions can be drawn from the available data. Nevertheless, previous research in extreme and high-performance sports suggests that transitions to higher levels often involve increased technical demands, higher expectations, and more intense competitive environments, which may influence anxiety (Schinke et al., 2018). Although the present study did not measure track characteristics or decision-making demands, such factors may help contextualise why athletes at different competitive levels may experience varying psychological demands. These interpretations should be considered tentative and informed primarily by existing literature rather than the direct findings of this study.

Overall, the results indicate descriptive patterns of anxiety distribution across gender and competitive levels. Given that no inferential tests were conducted, these patterns should be interpreted as preliminary and exploratory. Even so, the findings may help inform coaches and sport psychologists in developing training approaches that consider age, experience, and competitive context. A more holistic integration of psychological and technical preparation may assist athletes in managing anxiety more effectively during competition.

This study has several limitations that should be acknowledged. It is among the first to apply the Sport Anxiety Scale-2 (SAS-2) to BMX Cross athletes, underscoring its novelty and contribution. However, the small and unrepresentative sample size substantially limits generalisability and prevents robust statistical comparisons between groups. The cross-sectional design restricts causal interpretation, and reliance on self-reported data may introduce response bias. Additionally, the psychometric properties of the SAS-2 were not re-evaluated for this specific athlete population, representing another methodological limitation. Future research should involve larger and more diverse samples; apply inferential statistical tests; consider longitudinal designs; and incorporate physiological measures such as heart rate variability or cortisol. Investigating psychological interventions tailored to gender and competition levels would also provide valuable practical insights for BMX Cross athlete development.

CONCLUSION

This study concludes that BMX Cross athletes have anxiety levels that are not too high and not too low. This means that athletes still have good anxiety management skills when facing matches. Descriptive patterns show variations in perceptions of anxiety across gender and competition categories. These descriptive findings highlight the importance of considering individual and contextual factors in psychological interventions. The author suggests implementing mental management training between core training sessions, allowing athletes to control the anxiety they experience under pressure and to apply this skill when competing. These findings contribute to coaches, sports organisations, and sport psychologists in designing targeted mental training programmes tailored to gender and competition level by providing a descriptive overview of anxiety perception across gender and competition categories. It is recommended that coaches incorporate mental conditioning techniques, such as visualisation, self-talk, and relaxation strategies, during regular training sessions. Sports organisations should provide access to psychological support services, while sport psychologists are encouraged to conduct routine assessments and individualised interventions to enhance athlete readiness.

In addition, these findings contribute to the field of extreme sports psychology by demonstrating how anxiety perceptions differ based on gender and competition level in BMX Cross, a sport characterised by high intensity, technical demands, and short duration. However, this study has certain limitations, including a relatively small sample size and reliance on self-reported data, which may limit generalisability and overlook physiological aspects of anxiety. Future studies are encouraged to expand on this research by testing intervention programmes, including larger and more diverse populations, and integrating physiological measures such as heart rate variability or cortisol levels alongside self-reported data to deepen the understanding of anxiety in extreme sports.

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CONFLICT OF INTEREST

We declare no conflict of interest in this study.

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