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Gastrointestinal symptoms in athletes beyond endurance sports: a scoping review

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Abstract

Background Gastrointestinal symptoms are common in endurance athletes but the prevalence across other sports is unclear.

Methods A scoping review of studies available on Medline and SportDiscus databases (until September 1, 2025) which reported the prevalence of GI symptoms in highly trained and elite athletes was conducted. Keywords were used to identify cross-sectional studies and exclude those exclusively on endurance sports (distance running, cycling, triathlons). Articles were screened for eligibility and data were extracted by independent reviewers. Prevalence was reported according to timing, severity and sex.

Results The search strategy generated 482 articles. After screening, seven studies were included with six different questionnaires utilised to determine prevalence. In total, there were 1087 athletes, of whom 682 were male and 405 female. Prevalence varied widely with 11.5–80.0% of athletes reporting at least one gastrointestinal symptom. The prevalence of any GI symptoms in males was 13.9–61% and females 20–80%. Three studies reported on timing of symptoms around training or competition, which ranged from 24.5–52.0% and this was more common in females (range 37.5–67.0%) than males (range 13.9–52.0%). Diarrhoea and urge to defecate were more common during exercise than at rest.

Conclusion The prevalence of gastrointestinal symptoms in athletes varies widely, which may be due to heterogeneity in screening tools. There is a lack of studies discerning the severity and timing of symptoms, but it appears that around 1 in 2 female and 1 in 3 male athletes may experience gastrointestinal symptoms around competing. Future studies should aim to better standardise methods for assessing GI issues in athletes.

Keywords Gastrointestinal, Stress, Exercise, Performance

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Introduction

The gastrointestinal (GI) tract is an organ system responsible for the digestion and absorption of nutrients that can be utilised for physiological functions [1]. Within the GI tract lies the resident gut microbiome, which performs secondary digestion of undigested nutrients leading to the production of short-chain fatty acids and vitamins, as well as other bioactive metabolites that have been increasingly recognised as important for the regulation of immune and cognitive processes via the gut-brain axis [2].

During exercise, and in particular in the elite sporting environment, the GI system is faced with a number of potential challenges that may increase the risk of GI symptom development and severity including; reduction in blood flow, increased core temperature, potential alterations in GI physiology induced by feeding during exercise [3–5], hypoxia and dehydration, which can lead to increased intestinal permeability [6], and malabsorption of carbohydrates [7]. Anxiety and stress experienced by endurance athletes may also lead to increased gut-brain activity, especially in the build-up to races and increasing GI symptom severity during endurance races [8, 9].

There is limited research to date on the prevalence of GI symptoms outside of endurance sports, despite initial data from the authorship reporting that 86% of athletes from team and technical sports report GI symptoms [10]. Such high prevalence of GI symptoms across a range of athletes is perhaps not surprising given that many of the factors contributing to the symptoms experienced by endurance athletes are also likely to be factors affecting athletes within different sports.

Whilst the prevalence of symptoms in endurance athletes is well documented, it varies widely. A systematic review reported the prevalence of GI symptoms in cyclists (4–7%), marathon runners (4–96%), ultra marathon runners (60–96%) and ironman triathletes (31–93%) [7]. These include upper GI symptoms (nausea, regurgitation, heartburn, belching, bloating, and abdominal cramps) and lower GI symptoms (abdominal pain, constipation, incomplete evacuation, diarrhoea and urge to defecate). The wide range of prevalence values reported can be, in part, attributed to the heterogeneity of methods used to assess symptomology including unvalidated questionnaires with varying Likert scales and cut-offs to define what is "symptomatic".

The presence of GI symptoms matters for performance since it may lead to reduced training quality, impaired competition outcomes, and increased risk of withdrawal [11]. Fundamentally, identifying the prevalence of GI symptoms is the first step, but the impact on performance is the ultimate concern. Therefore, the aim of this scoping review was to assess the prevalence of GI symptoms in non-endurance sport athletes.

Methods

Eligibility criteria

Using the JBI guidelines, eligibility criteria were developed for the PCC mnemonic (population, concept, and context). For "population", athletic research populations of Tier 3 or higher were selected, in which Tier 3 indicated highly trained/national level, Tier 4 indicated elite/international level, and Tier 5 indicated world class level athletes, respectively [12]. For "concept," we searched for prevalence and/or cross-sectional studies. All other study designs were excluded. For "context," articles related to GI symptoms or illness in athletes were included, except articles related to endurance sports (distance running, cycling, triathlons) and those in a clinical setting (e.g. hospital or laboratory), which were excluded.

Search strategy

A comprehensive literature search was conducted on September 1st, 2025. Medline and SportDiscus databases were searched through EBSCO. The search strategy used the keywords: "gastrointestinal" AND "athlete* OR player* OR sport*" AND "prevalence OR frequency OR proportion" AND NOT "animal OR in vitro". All study designs were included in the initial search, including all dates and all languages. Reference lists of eligible studies and review articles were also searched. Where full texts were unavailable, authors were contacted.

Study selection

Search results were exported and imported into Rayyan software for review and screening. Initial screening of titles and abstracts was conducted blinded by two researchers (JH and NB). Discrepancies were resolved by a third researcher (JP). Full-text article review was conducted by two researchers independently (JH and NB) discrepancies were resolved by a third reviewer (JP). Articles were excluded if they did not meet the eligibility criteria described above. A PRISMA flow diagram of the study selection process is shown in Figure 1.

Data extraction and assessment of quality

Data were extracted into a Microsoft excel sheet with respective columns for sport, location, population, study design, sample size, proportions, and study quality based on the NHMRC quality assessment tool where level of evidence for cross-sectional studies is "IV". The data were extracted separately by two reviewers (JH and NB). Any discrepancies were resolved by a third reviewer (JP). Data extracted from the selected articles is shown in Table 1.

Results

A total of 482 articles were found through database searching, of these, 416 were available for export from EBSCO and imported into Rayyan for screening. A

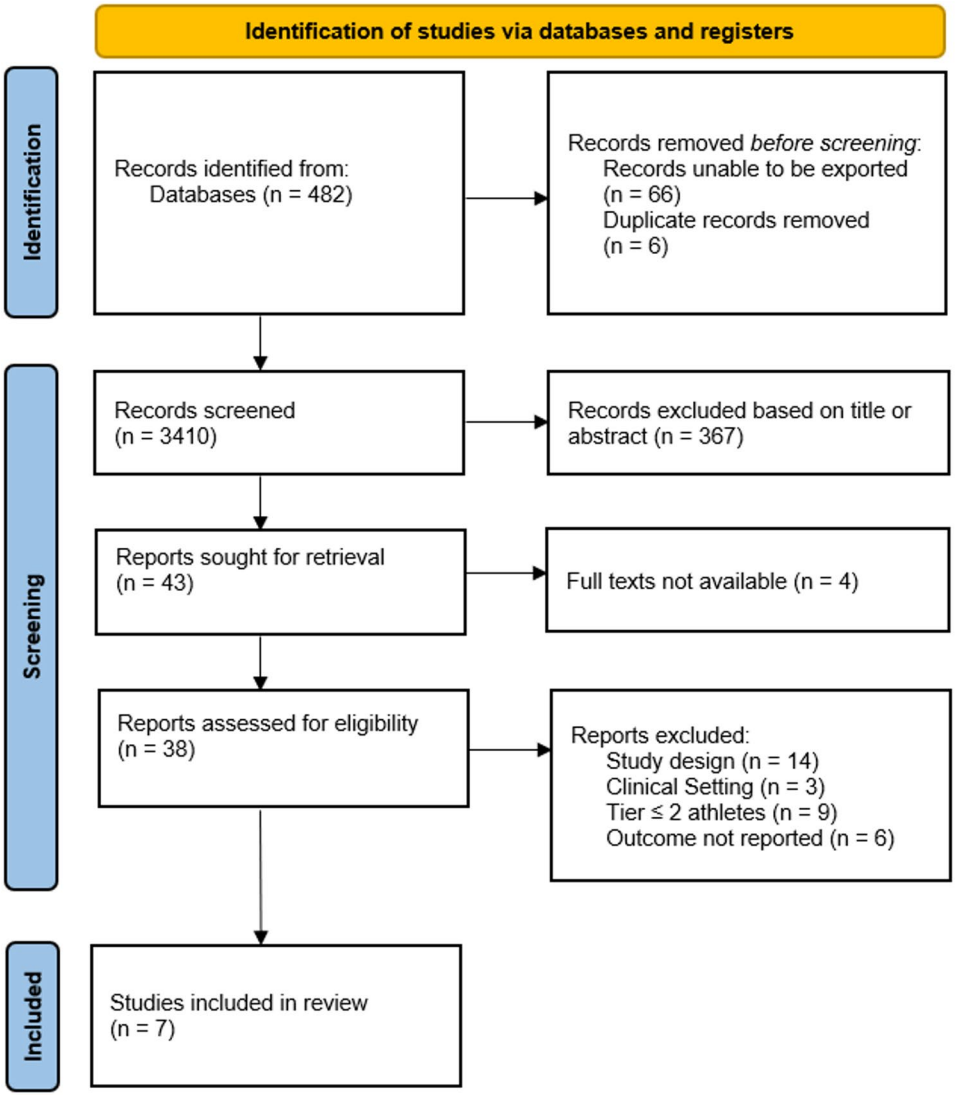

Figure. 1 PRISMA flow chart of study selection

further 6 duplicates were removed prior to screening. Out of the 410 studies screened, 367 were excluded based on title or abstract and 43 were retrieved for full text review. Unfortunately, 4 full texts were not available despite contacting authors. Finally, 30 studies were excluded, either due to study design (experimental, prospective or case-control studies) ($n = 14$), being performed in a clinical setting ($n = 3$), for not using the desired population ($n = 9$), or not reporting any GI symptom prevalence ($n = 6$). Thus, seven articles were included in this review (Fig. 1).

All seven articles reported the prevalence of GI symptoms [13–19], which ranged between 11.5 and 80% (Table 1). The total number of athletes was 1087, with 682 being male and 405 being female. Two studies were in all females across different sports [15, 16]. In aesthetic sports, defined in Tables 1 and 26% of elite female athletes had GI dysfunction [15]. In these studies, GI dysfunction was defined according to the LEAF-Q criteria as reporting ≥ 2 gastrointestinal symptoms outside of menstruation (e.g., bloating, gas burden), consistent with impaired physiological function. According to the same questionnaire in a mixed sport female cohort, the prevalence of GI dysfunction was 47% [16]. One study was in all male American footballers with 61% reporting at least 1 symptom and 52% during exercise [18]. One study reported the prevalence of at least 1 GI symptom in male and female rugby players at 61% and 72%, respectively [13]. One study reported the prevalence difference in anal incontinence between male and female powerlifters or weightlifters at 61.8% vs. 80.0%, respectively [17]. These symptoms were not restricted to exercise. Overall, the prevalence of any GI symptoms in males ranged from 13.9 to 61% and in females ranged from 26% to 80%.

Table 1 GI symptoms prevalence in athletes across different sports

Author	Location	Sport	Level	Population	Age	Study Design	Level of Evidence	Method	Results
Chantler 2024 [13]	UK	Rugby	3	325 (271 male, 54 female)	18+	Cross-sectional	IV	Visual analogue scale (VAS); 13 symptoms within last 12 months at rest, or around training/matches; 7 Likert scale (moderate ≥ 4)	Any gastrointestinal symptom ≥ once per week at rest 61% (60% male vs. 72% female); around rugby 47% (43% male vs. 67% female); any moderate symptom at rest 42% (40% male vs. 72% female); around rugby 33% (29% male vs. 57% female).
Leone 2020 [14]	USA	Multi-sport (track and field, American football, basketball, and baseball)	3 & 4	141 (84 male, 57 female)	18–27	Cross-sectional	IV	Celiac Symptom Index (CSI); 7 symptoms within past 4 weeks; 5 Likert scale (high degree ≥ 45)	Athletes reporting celiac disease 2.99%; athletes 3.85 times (95% CI, 0.42–34.89) more likely to report having celiac disease than general population; athletes with high degree of symptoms 11.5%; athletes were 18.36 (95% CI,2.40-140.48) times more likely to report having a high degree of eliac disease symptoms than general population
Meng 2020 [15]	China	Aesthetic sport (trampolining, rhythmic gymnastics, aerobics, dance sport, cheerleading and dance)	4	52 (all female)	17–23	Cross-sectional	IV	Low Energy Availability in Females Questionnaire (LEAF-Q); 2 symptoms outside of menstruation, 4 Likert scale (≥ 2 gastrointestinal dysfunction)	Gastrointestinal dysfunction in 26% athletes.
Rogers 2021 [16]	Australia	Multi-sport (athletics, U21 rowing, boxing, weightlifting, basketball, triathlon, water polo, netball)	3 & 4	112 (all female)	15–32	Cross-sectional	IV	Low Energy Availability in Females Questionnaire (LEAF-Q); 2 symptoms outside of menstruation, 4 Likert scale (≥ 2 gastrointestinal dysfunction)	Gastrointestinal dysfunction in 47% athletes.
Skaug 2022 [17]	Norway	Powerlifters	3 & 4	384 (204 male, 180 female)	18+	Cross-sectional	IV	International Consultation on Incontinence Questionnaire Anal Incontinence Symptoms and Quality of Life Module (ICIQ-B); Symptoms in past 3 three months; 4 Likert scale (incontinence defined as ≥ 1 on any question)	80% of females report anal incontinence (32.8% liquid, 7.2% solid, 76.7% gas), vs. 61.8% males (25% liquid, 6.9% solid, 56.4% gas).
Wardenaar 2023 [18]	USA	American football	4	44 (all male)	20.7 ± 1.7	Cross-sectional	IV	Gastrointestinal Symptom Rating Scale (GSRS), 15 symptoms during past week, 7 Likert scale (moderate 4, moderately severe ≥ 5)	Moderate gastrointestinal complaints 61%, Moderately severe complaints 16%, Gastrointestinal issues during exercise 52%, (61% 1–2 per week, 17% 3–4 times per week, 22% ≥5 times per week).
Wilson 2023 [19]	USA	American football, rugby, soccer, basketball, hockey, volleyball, ultimate frisbee	3, 4	143 (79 male, 64 female)	< 30	Cross-sectional	IV	VAS 7 symptoms during past month;10 Likert scale (moderate 5)	24.5% athletes reported gastrointestinal symptoms affect performance (13.9% male vs. 37.5% female); Symptoms during training (10.1% men vs. 15.5% female). Symptoms during competition (5.1% male vs. 14.1% female).

Three studies reported on timing of symptoms around training or competition, which ranged from 24.5–52.0% [13, 18, 19]. This was more common in females (37.5–67.0%) than males (13.9–52.0%).

The frequency of specific GI symptoms reported across studies are in Table 2. The symptoms with the highest reported prevalence were flatulence (2.8–48%) followed by stomach cramps or rumbling (5.1–37%) and bloating (2.5–32%), although there was a wide range of rates reported between studies. Diarrhoea and urge to defecate were more common during exercise than at rest (19 and 13% vs. 8 and 11%, respectively). Female athletes were more likely than male athletes to report that any symptom affected their performance, bar heartburn (3.1 vs. 5.1%, respectively).

Discussion

The aim of the present scoping review was to assess the prevalence of GI problems in non-endurance sport athletes. For the first time, we have identified that GI symptoms are reported by athletes across many different sports, with some studies showing GI symptoms being experienced by around half of those athletes screened. However, we also show that there is a large range of overall GI symptom prevalence and symptom types reported between studies with inconsistent reporting of severity. Such heterogeneity may be due to true differences in GI symptoms between sports, the large range of geographical locations of the studies included, or due to the variety of methods used to assess GI symptoms and clinical conditions, including the scales and questioned window.

From the studies included there was wide range of GI symptom prevalence, with 11.5–80% of athletes in each study reporting one or more GI symptom. Similarly, such a wide range of symptom prevalence have been reported in endurance athletes at 4–96% [6]. Many different symptoms were reported, with the most common being gas-related symptoms such as bloating, flatulence and stomach rumbling. These are also common in the general population [20]. GI symptoms were also more prevalent in females (26.0–80.0%) than males (13.9–61.0%). The observed sex differences may reflect several underlying mechanisms, including hormonal fluctuations across the menstrual cycle, differences in gastrointestinal motility and visceral sensitivity, dietary patterns, and psychosocial factors such as stress and anxiety [21, 22]. Biological sex differences in immune function and gut-brain interactions may also contribute to the heightened symptom burden observed in female athletes [21]. These emerging insights highlight the importance of considering sex-specific factors in both research design and clinical management.

The large range of GI symptom prevalence found is likely due to the significant heterogeneity in study design, methods, and data reporting. For example, the number of different GI symptoms assessed ranged from 2 to 15 [12–18]. The studies included also used different Likert scales to assess severity with some between 0 and 4, 0–7, and 0-10 [12–18]. Three studies reported the prevalence of moderate symptoms [12, 17, 18], one study reported high severity only [13], and three studies did not report any symptom severity [14–16]. Importantly, the timing at which symptoms were assessed ranged vastly. Some used questionnaires that refer to symptoms experienced in the past week, without discerning between exercise and non-exercise associated symptoms [17], while some reported symptoms in the past 12 months [12].

Given that symptoms could impact athletes day-to-day, pre-exercise, during exercise, or post-exercise, it is important to discern the timing of GI symptoms [23]. Four studies did not differentiate the timing of symptoms in relation to performance [14–17]. From the three studies in this review which did report symptom timing, around 1 in 2 female athletes and 1 in 3 male athletes experienced GI symptoms around training or competition [13, 18, 19]. The pathophysiology of GI symptoms during exercise is unclear but may be related to numerous factors including: dietary intake, hydration status, environmental conditions (particularly heat stress), circadian variation, biological sex differences and pre-existing GI conditions, as well as gut-brain interaction relating to anxiety and stress [11]. It is also important to note that not all GI symptoms carry the same clinical significance or performance impact. For example, transient bloating may be uncomfortable but less consequential, whereas diarrhoea during competition can directly impair performance and require medical evaluation.

Whilst the aim of this scoping review was to identify GI symptoms, not disorders, a small number of papers also reported GI disorders, including pelvic floor dysfunction in powerlifters and weightlifters [17], and the prevalence of celiac disease in college athletes [14]. Celiac disease, characterised by the Celiac Smptom Index (CSI), was higher in athletes than the general population (2.9% vs. 0.4%) [14]. However, the CSI is only validated in people with confirmed celiac disease on endoscopic biopsy, so this cannot be used to infer the prevalence of celiac disease. Identifying athletes with GI disorders requires validated screening tools and in some cases escalation to medical review and further testing. Based on the questionnaires in this review, it is unclear what degree of symptoms would highlight athletes who require escalation for diagnosis and management. This suggests the questionnaires may only be suitable for research purposes and further supports the need for tool to identify athletes with GI disorders. Whilst our review focused on symptoms rather than diagnosed disorders, prior work suggests athletes may have higher rates of undiagnosed

Table 2 Specific GI symptoms reported by athletes. Data presented as the percentage of athletes reporting any Gastrointestinal symptom [a]at least weekly and [b]at least moderately

Author	Symptoms	Heart-burn / Acid Reflux	Burping	Upper Abdominal Pain	Nausea	Vomiting	Stomach Cramps / Rumbling	Bloating	Lower Abdominal Pain	Flatulence	Constipation	Diarrhoea	Urge to Defecate
Chantler 2024 [13]	At rest[a]	6	27	4	7	1	14	20	6	48	5	8	11
	Around rugby[a]	4	11	4	7	1	15	15	6	28	5	19	13
Wardenaar 2023 [18]	Any[b]	26	16	29	14		37	32	29	30	31	26	13
Wilson 2023 [19]	Impacted performance (male)	5			4		5	3		4			4
	Impacted performance (female)	3			16		22	16		11			13

GI conditions. For example, Killian & Lee (2019) reported that irritable bowel syndrome (IBS) is underdiagnosed among endurance athletes [24]. Future research could consider validated diagnostic criteria such as the ROME IV for IBS to better understand the prevalence of GI disorders in athletic populations.

In line with previous work [11, 25, 26], this study has demonstrated the need for better standardisation of assessing GI symptom severity in athletes. However, while these previous tools have been suggested for use during exercise, there is clearly a need to consider symptoms experienced away from training and competition. Unvalidated questionnaires can lead to concerns with reliability, or inconsistent results over time, and validity, where the questions do no accurately measure what is intended [27]. Whilst unvalidated questionnaires raise concerns about reliability and comparability, some symptoms (e.g., vomiting, diarrhoea) are binary and less dependent on scale validation. Thus, the main limitation may be the small number of published studies rather than solely the heterogeneity of tools.

Even validated questionnaires may not be appropriate to answer the question. For example, the LEAF-Q is a validated tool to identify low energy availability in female athletes but not specifically designed for screening GI conditions, with the only questions relating to bloating and gas burden outside of the menstrual cycle [28]. The GSRS has been validated in athletes by Wardenaar and colleagues [29], and lists a range of upper and lower GI symptoms that can be used to identify athletes who may require medical escalation based on a moderate or severe response. The GSRS has been used in a large number of elite athletes across a range of sports and found that 15% had at least one moderately severe symptom or worse that may require further investigation [10]. Although the GSRS does not capture certain red-flag symptoms (e.g., nocturnal or bloody diarrhoea, haematochezia, and unexplained weight loss), this limitation is not unique to athletes and applies to general populations as well. Therefore, while the GSRS is useful for symptom monitoring, it should not be considered a diagnostic tool for underlying pathology. Additionally, since the timing of questions in the GSRS is related to previous 7 days, it may miss symptoms when athletes are competing outside this window. Therefore, future studies assessing GI symptoms in athletes should distinguish daily symptoms from symptoms around training or competition. Previous studies have tended to group symptoms broadly which has led to a wide range of symptom prevalence across athletes and sports. Finally, there appears to be a need for a tool that can help to screen athletes for clinical GI conditions who may require medical escalation.

Several limitations should be acknowledged. First, the heterogeneity in study design, symptom definitions, and

assessment tools limits comparability across studies and complicates pooled interpretation. Second, methodological quality varied, with some studies relying on unvalidated instruments or failing to report symptom severity and timing, which may reduce reliability. Third, potential publication bias cannot be excluded, as studies reporting high symptom prevalence may be more likely to be published. These limitations underscore the need for cautious interpretation and highlight opportunities for more rigorous, standardised approaches in future research.

Conclusion

We have shown that athletes across different sports report with a myriad of GI symptoms. While the number of studies is limited, we found over 50% of athletes reported moderately severe symptoms at rest and a similar proportion of athletes may experience uncomfortable GI symptoms when exercising or during competition, which is similarly reported in endurance-based sports. There is also evidence to suggest that such symptoms are more prevalent in females than males. However, the overall prevalence is highly varied, which may be due to heterogeneity in methods. This suggests that there is a growing need for future research as well as screening and monitoring of GI symptoms amongst athletes across sports.

Authors' contributions

JH and NB reviewed articles and extracted data independently. JP resolved any discrepancies. JH wrote the manuscript. All authors reviewed the manuscript.

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Data availability

No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate

This research did not obtain consent because it is a synthesis of existing literature and did not include collecting data from human participants.

Competing interests

The authors declare no competing interests.

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