Viref Revista de Educación Física
Instituto Universitario de Educación Física y Deporte
ISSN 2322-9411 • Octubre-Diciembre 2023 • Volumen 12 Número 4
UNIVERSIDAD DE ANTIOQUIA 1803

The relationship of pre-racing food restrictions and gastrointestinal symptoms in master athletes

Osman Emir Sarac[1], Günay Eskici[2]

[1] Department of Sports Science, Graduate Education Institute, Çanakkale Onsekiz Mart University, Turkey.
https://orcid.org/0000-0001-5392-7115 emirsarac8@gmail.com

[2] Department of Coaching, Faculty of Sports Science, Çanakkale Onsekiz Mart University, Turkey.
https://orcid.org/0000-0002-4349-4704

Abstract

Objective: to evaluate the relationship between food restriction and gastrointestinal symptoms in master athletes. **Method:** totally, 246 master athletes (185 men, 61 women) who participated in training and racing at 5, 6-10 and 11-21km, marathon, and ultra-marathon took part in this research. To determine the relationship between food restrictions and gastrointestinal symptoms of master athletes, this research drew on the *Food Restriction in Running Questionnaire* which was developed by Parnell et al. (2019). The Fisher's exact test determined significant differences between groups (gender, race distance, performance level) in the percent of master athletes who avoided pre-racing foods and experienced gastrointestinal symptoms. In all statistical analyzes, the level of statistical significance was set at $p<0,05$. **Results:** the most restricted foods pre-racing included high-fat foods (79%), junk foods (63%), spicy foods (58%), milk (54%) and red meat (44%). This study concluded that the most common gastrointestinal symptoms experienced during racing were gas (51%), stomach pain/cramp (43%), intestinal problems (pain) (42%), reflux/heartburn (39%) and nausea/vomiting (39%). On the gastrointestinal symptoms by gender, significant differences were found in constipation, gas, fullness/heaviness and burping, which were more commonly observed in the female athletes ($p<0,05$). This study also revealed that intestinal problems (pain) and gas increased with race distance and performance level ($p<0,05$). **Conclusion:** increasing the race distance and performance level increased the food restriction rates and incidence of gastrointestinal symptoms in master athletes. Furthermore, food restriction and the incidence of gastrointestinal symptoms were observed more in the female athletes.

Keywords: food, food restrictions, gastrointestinal symptoms, master athletes, racing.

Introduction

Master athletes are defined as middle-aged adults who are actively take part in sports, exercise at a high level and participate in competitions specifically designed for older athletes (Eskici & Ersoy, 2014; Tso & Kim, 2020). The age of being a master athlete varies according to the branch of sports. However, people over the age of 35 are generally considered as master athletes (Rosenbloom & Bahns, 2006).

The diet strategies of master athletes who participated in endurance sports are critical particularly in the racing period (Thurecht & Pelly, 2020). In this process, athletes experience some health problems depending on the exercise intensity and nutritional status. One of such common problems during long distance racing such as half-marathon, marathon and ultra-marathon is linked to the symptoms that occur in the gastrointestinal tract (de Oliveira et al., 2014).

Gastrointestinal symptoms refer to disturbances of gastrointestinal integrity and function which are related to exercise intensity (Costa et al., 2017). Symptoms in the upper and lower gastrointestinal tract negatively affect performance of athletes, especially during intense endurance exercises (Lis, 2019). One of the most known causes of poor performance in endurance athletes is gastrointestinal symptoms. Depending on the intensity of exercise, the prevalence of gastrointestinal symptoms varies between 30-70% among long-distance runners (Waterman & Kapur, 2012). The most reported symptoms include stomach pain, nausea, intestinal cramps, vomiting, reflux, feeling of fullness, constipation, and diarrhea (Jeukendrup, 2011).

The principal causes of gastrointestinal symptoms experienced during exercise are exercise type and intensity, nutritional factors, physiological and psychological factors (Waterman & Kapur, 2012). Despite many other factors that cause these symptoms, the probable cause of gastrointestinal symptoms experienced by athletes is foods consumed before or during exercise (Eskici, 2020). Nutritional factors determine an athlete's food choice before exercise and have the potential to reduce or increase gastrointestinal symptoms depending on the intensity of exercise. Nutritional strategies are essential to alleviate exercise-induced gastrointestinal symptoms, especially in long-distance runners (de Oliveira et al., 2014).

However, limited information is available about the foods restricted by athletes before exercise (Parnell et al., 2020). In general, low-fiber, low-fat, moderate protein and lactose-free dairy products are recommended before exercise to prevent and alleviate gastrointestinal symptoms during exercise (Lis, 2019). In addition, athletes are advised to avoid trying a new diet plan before the racing, and to continue their usual plans that do not cause any gastrointestinal symptoms (de Oliveira et al., 2014). Also, to prevent gastrointestinal symptoms and alleviate their severity, it is recommended that athletes determine their sensitivity to foods and create personalized diet plans (Pfeiffer et al., 2012).

Consumption of certain foods and restriction of certain foods is of paramount importance for risk of gastrointestinal symptoms, particularly in master athletes who compete in exercises that require high endurance. For this reason, it is necessary to examine the food restrictions preferred by master athletes and to evaluate their relationship with gastrointestinal symptoms. In the literature, pre-exercise food restrictions and gastrointestinal symptoms experienced by athletes have been understudied. To fill this gap, this study aims to evaluate the relationship between pre-racing food restriction and gastrointestinal symptoms in master athletes.

Method

Participants

The population of this research included 246 master athletes (185 men, 61 women) who attended training and racing at 5, 6-10, and 11-21km, marathon, and ultra-marathon. The age of the master athletes varied between 35-74 years. Master athletes who resided in various cities of Turkey, most notably in Istanbul, participated in this research.

Data collection tool

The data were obtained using the survey method. To determine the relationship between food restrictions and gastrointestinal symptoms of master athletes, this study drew on the *Food Restriction in Running Questionnaire* which was developed by Parnell et al. (2019). For the conduct of this research, Jill A. Parnell, who developed the Questionnaire, was contacted via e-mail and necessary permissions were obtained for use of this questionnaire. While preparing the Turkish form of the questionnaire, three academicians who are experts in the field of English, two dietitians who are experts in the field of sports nutrition and an academician who are an expert in the field of sports sciences, were consulted. Since data collection process was carried out during the Covid-19 pandemic, some data were collected through face-to-face interviews and online. Interview face-to-face was performed during the participation of the athletes in the Turkish Masters Athletics Championships. Questionnaires of the participants who were interviewed face-to-face were filled out by the researcher using the question-answer technique. To collect the data of the participants who could not be interviewed face-to-face, the survey link created through Google forms was sent to master athletics associations and various running groups in Turkey via social media, WhatsApp groups and e-mail. The form containing information about this research was digitally sent to the participants, and their consent was obtained. This research was approved by the Ethics Committee of Çanakkale Onsekiz Mart University Scientific Research on 7-9-2020.

Data analysis

All data obtained from the *Food Restriction in Running Questionnaire* administered to master athletes were analyzed through Statistical Package for Social Sciences (SPSS) version 26.0. For descriptive statistics, mean, standard deviation, minimum and maximum values, and percentage

were used. This study used the Fisher's exact test to identify significant differences between groups (gender, race distance, performance level) in the percent of master athletes who avoided pre-exercise foods and gastrointestinal symptoms experienced. In all statistical analyzes, the level of statistical significance was set at $p<0,05$.

Results

A total of 246 master athletes, including 185 (75,2%) male and 61 (24,8%) female athletes, participated in this research. The mean age of the master athletes was determined as 46,35±9,07. The mean age, body weight, height and BMI of the male athletes were 47,61±9,44 years, 74,68±8,60 kg, 175,2±6,59 cm, 24,31±2,30 kg/m^2 , respectively. The mean age, body weight, height and BMI of the female athletes were 42,55±6,56 years, 59,37±7,64 kg, 164,93±7,33 cm, 21,80±2,16 kg/m^2 respectively.

Table 1. Pre-racing food restrictions.

Foods	n	%	Foods	n	%
Grain	29	11,8	Poultry	89	36,2
Starchy vegetables	34	13,8	Fish/seafood	87	35,4
Cereals	45	18,3	Milk	134	54,5
Yoghurt	81	32,9	Lactose-free milk	75	30,5
High-fat foods	196	79,7	Coconut milk	66	26,8
Junk foods	156	63,4	High fiber foods	66	26,8
Legumes	107	43,5	Spicy foods	143	58,1
Red meat	109	44,3	Energy drink	75	30,5

The most restricted foods pre-racing included high-fat foods (79%), junk foods (63%), spicy foods (58%), milk (54%) and red meat (44%). 7,3% of the athletes stated that they did not avoid consuming any food before the racing (Table 1).

The restricted foods were analyzed by gender, race distance and performance level as well. Analyzing the foods restricted pre-racing by gender, this study revealed statistically significant differences in legumes ($p=0.000$), milk ($p=0.005$) and high-fiber foods ($p=0.031$), which were more commonly restricted in the female athletes. Analyzing the foods restricted pre-racing by race distance, this study found out statistically significant differences in high-fat foods ($p=0,000$), lactose-free milk ($p=0,028$), spicy foods ($p=0,024$) and energy drinks ($p=0,013$), which were more commonly restricted in long distance runners. Also, analyzing the foods restricted pre-racing by performance level, this study indicated statistically significant differences in grain ($p=0,044$), starchy vegetable ($p=0,001$), cereals ($p=0,003$), high-fat foods ($p=0,019$), lactose-free milk ($p=0,037$) and coconut milk ($p=0,046$), which were more commonly restricted in competitive runners.

Table 2. Gastrointestinal symptoms that may occur in during racing.

Symptoms	n	%
Stomach pain/cramp	108	43,9
Nausea/vomiting	97	39,4
Intestinal problems (pain)	105	42,7
Reflux/heartburn	98	39,8
Diarrhea	36	14,63
Constipation	14	5,69
Urge to defecate	74	30
Gas	127	51,6
Fulness/heaviness	24	9,75
Burping	66	26,82

Master athletes chiefly reported gas (51%), stomach pain/cramp (43%), intestinal problems (pain) (42%), reflux/heartburn (39%) and nausea/vomiting (39%) if they consumed a triggering food pre-racing (Table 2). 7,3% of the athletes stated that they did not experience any gastrointestinal symptoms during the racing.

Table 3. Gastrointestinal symptoms that may occur during racing by gender.

Symptoms	Male n (%)	Female n (%)	p
Stomach pain/cramp	80 (43,2)	28 (45,9)	0,767
Nausea/vomiting	71 (38,4)	26 (42,6)	0,651
Intestinal problems (pain)	77 (41,6)	28 (45,9)	0,655
Reflux/heartburn	68 (36,8)	30 (49,2)	0,098
Diarrhea	24 (13)	12 (19,7)	0,213
Constipation	7 (3,8)	7 (11,5)	0,049*
Urge to defecate	54 (29,2)	20 (32,8)	0,630
Gas	88 (47,6)	39 (63,9)	0,028*
Fulness/heaviness	11 (5,9)	13 (21,3)	0,002**
Burping	43 (23,2)	23 (37,7)	0,031*

*($p<0,05$), **($p<0,01$).

On the gastrointestinal symptoms that may occur during racing by gender, this study yielded statistically significant differences in constipation (p=0,049), gas (p=0,028), fulness/heaviness (p=0,002) and burping (p=0,031), which were more commonly observed in the female athletes (Table 3).

Table 4. Gastrointestinal symptoms that may occur during racing by race distance.

Symptoms	5 km n (%)	6-10 km n (%)	11-21 km n (%)	22+ km n (%)	p
Stomach pain/cramp	7 (35)	22 (43,1)	42 (48,3)	36 (45,6)	0,743
Nausea/vomiting	4 (20)	24 (47,1)	38 (43,7)	29 (36,7)	0,153
Intestinal problems (pain)	4 (20)	22 (43,1)	34 (39,1)	42 (53,2)	0,041*
Reflux/heartburn	6 (30)	21 (41,2)	32 (36,8)	34 (43)	0,691
Diarrhea	1 (5)	5 (9,8)	14 (16,1)	16 (20,3)	0,259
Constipation	2 (10)	6 (11,8)	2 (2,3)	4 (5,1)	0,091
Urge to defecate	4 (20)	16 (31,4)	30 (34,5)	23 (29,1)	0,651
Gas	10 (50)	23 (45,1)	48 (55,2)	41 (51,9)	0,723
Fulness/heaviness	1 (5)	7 (13,7)	6 (6,9)	9 (11,4)	0,523
Burping	4 (20)	16 (31,4)	26 (29,9)	19 (24,1)	0,667

Note. Athletes, who selected “don’t compete” as their race distance were removed from the analyses. *(p<0,05).

The gastrointestinal symptoms were analyzed by race distance and performance level as well. Analyzing the gastrointestinal symptoms that may occur during racing by race distance, this study found out statistically significant differences in intestinal problems (pain) (p=0,041), which were more commonly seen in long distance runners (Table 4).

Table 5. Gastrointestinal symptoms that may occur during racing by performance level.

Symptoms	Provincial n (%)	National n (%)	International n (%)	Recreational n (%)	p
Stomach pain/cramp	22 (44)	44 (44,4)	32 (49,2)	10 (31,2)	0,420
Nausea/vomiting	23 (46)	37 (37,4)	27 (41,5)	10 (31,2)	0,562
Intestinal problems (pain)	24 (48)	43 (43,4)	29 (44,6)	9 (28,1)	0,322
Reflux/heartburn	19 (38)	43 (43,4)	27 (41,5)	9 (28,1)	0,479
Diarrhea	6 (12)	14 (14,1)	13 (20)	3 (9,4)	0,539
Constipation	0 (0)	5 (5,1)	5 (7,7)	4 (12,5)	0,063
Urge to defecate	12 (24)	30 (30,3)	22 (33,8)	10 (31,2)	0,724
Gas	17 (34)	54 (54,5)	40 (61,5)	16 (50)	0,027*
Fulness/heaviness	3 (6)	7 (7,1)	9 (13,8)	5 (15,6)	0,238
Burping	11 (22)	28 (28,3)	20 (30,8)	7 (21,9)	0,685

Note. Athletes who selected "don’t compete" as their performance level were included in the recreational group. *(p<0,05).

Also, analyzing the gastrointestinal symptoms that may occur during racing by performance level, it revealed statistically significant differences in gas (p=0,027), which were more commonly observed in competitive runners (Table 5).

Discussion

Food restrictions

An athlete's diet strategy before exercise plays an important role in maximizing athletic performance. For this reason, athletes make food choices that increase performance before exercise. At the same time, athletes avoid consuming certain foods so that performance is not adversely affected (Black et al., 2012). This study investigates the relationship between pre-racing food restrictions and gastrointestinal symptoms in master athletes. It reveals that the most restricted foods to avoid gastrointestinal symptoms were high-fat foods (79%), junk foods (63%), spicy foods (58%), milk (54%) and red meat (44%). In addition, it shows that the female master athletes have a higher rate of food restriction compared to the male master athletes.

In the literature, 388 long-distance runners participated in a study investigating pre-racing food restrictions. All of these athletes stated that they restricted food before racing. It was observed that athletes mostly restricted red meat (32%), dairy products (31%), fish/seafood (28%), poultry (24%), and high-fiber foods (23%) (Parnell et al., 2020). Another research studying food restrictions before racing was conducted among 465 athletes. 375 athletes who did not suffer from any gastrointestinal system disease, 53 athletes who have irritable bowel syndrome (IBS) and 37 athletes who have reflux participated in the study. The findings of the study indicate that athletes who did not have any gastrointestinal system disease mostly restricted dairy products (37%), red meat (33%) and fish/seafood (30%). It also reveals that athletes with IBS mostly restricted dairy products (53%), legumes (37%) and red meat (31%). It concludes with the finding that athletes with reflux mostly restricted dairy products (38%), red meat (36%) and high-fiber foods (33%) (Erdman et al., 2021). In another study on food restrictions, the participants were 81 athletes from 24 different sports. It looked into the foods restricted by the athletes before, during and after the racing. The study determined that the athletes generally preferred macronutrients in their meals. Whereas, in food restrictions, the athletes mostly restricted legumes (91%), fruit juice (85%), fruit (80%) and dairy products (65%) (Pelly & Thurecht, 2019).

In pre-racing food restrictions, the findings obtained from this research and the findings of the studies in the relevant literature are similar to each other in terms of both restricted foods and restriction rates. However, especially in endurance athletes where gastrointestinal symptoms are common, food restrictions may vary depending on the person’s food allergy, food intolerance and gastrointestinal system disease.

Gastrointestinal Symptoms

Gastrointestinal symptoms that occur during exercise are a common problem, especially for endurance athletes. Although many factors cause gastrointestinal symptoms, it is stated that foods consumed before or during exercise are the most likely cause of gastrointestinal symptoms (de

Oliveira & Burini, 2009). This study has probed into the relationship between the foods restricted by master athletes pre-racing and gastrointestinal symptoms.

Based on the findings obtained from this research, 92.7% of the athletes stated that they may experience gastrointestinal symptoms during the racing if they consumed a triggering food pre-racing. This study further concluded that the most common gastrointestinal symptoms experienced during racing were gas (51%), stomach pain/cramp (43%), intestinal problems (pain) (42%), reflux/heartburn (39%) and nausea/vomiting (39%).

A study on the incidence and types of gastrointestinal symptoms examined 272 ultra-marathon athletes and observed that 96% of the athletes reported gastrointestinal symptoms. The most frequently reported gastrointestinal symptoms by athletes were gas, burping, nausea, stomach pain, and urge to defecate, respectively (Stuempfle & Hoffman, 2015). A yet another study conducted with 29 triathlon athletes, showed that the incidence of gastrointestinal symptoms reached 93%. It also revealed that 43% of the athletes experienced severe symptoms and 7% of the athletes stopped competing. It further reported that the most common gastrointestinal symptoms experienced by athletes were nausea, urge to defecate, burping, heartburn/reflux, gas, and stomach pain (Jeukendrup et al., 2000). In another research with 76 marathon athletes, the findings demonstrated that the incidence of gastrointestinal symptoms in athletes participating in multi-stage ultra-marathon was 85%, and the incidence of gastrointestinal symptoms in athletes participating in 24-hour continuous ultra-marathon was 73%. The most frequently reported gastrointestinal symptoms by athletes were nausea, urge to defecate, burping, gas, stomach pain, reflux/heartburn, and diarrhea (Costa et al., 2016). In an Internet-based observational study among recreational runners, the participants were 1281 long-distance runners. 45% of runners reported that they experienced at least one gastrointestinal symptom during racing. The study indicated that the most common gastrointestinal symptoms experienced by athletes were nausea, burping, stomach pain, urge to defecate, gas and diarrhea (ter Steege et al., 2008).

In gastrointestinal symptoms experienced during the racing, the findings obtained from this research and the findings of the studies in the relevant literature are similar to each other in terms of both the incidence of gastrointestinal symptoms and symptom types. It is known that gastrointestinal symptoms which are common especially in endurance athletes, seriously affect the performance and health of athlete. However, it should be noted that the incidence and types of these symptoms may vary depending on gender, age, diet strategy, training status, intensity of exercise and environmental conditions.

Conclusions

An athlete's diet is crucial for sports performance because of its potential to trigger gastrointestinal symptoms. This research has revealed that food groups such as high-fat foods, high-fiber foods, spicy foods, and milk were restricted by master athletes in pre-racing. It also determined that the most common gastrointestinal symptoms experienced during racing were gas, stomach pain/cramp, intestinal problems (pain), reflux/heartburn and nausea/vomiting. Increased race distance and performance level also elevated the food restriction rates and incidence of gastrointestinal symptoms in master athletes. In addition, it is observed that food restriction and incidence of gastrointestinal symptoms were at a higher rate in the female master athletes compared to the male master athletes. As a result, to enhance their performance, athletes need to create a personalized diet program by determining their sensitivity to the foods they consume. Yet, to make the right and effective choices, it would be advantageous to create diet strategies together with a sports dietitian who is an expert in the field.

Declaration of conflicting interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

References

Black, K. E., Skidmore, P., & Brown, R. C. (2012). Case study: nutritional strategies of a cyclist with celiac disease during an ultraendurance race. *International Journal of Sport Nutrition and Exercise Metabolism, 22*(4), 304–310. https://doi.org/10.1123/ijsnem.22.4.304

Costa, R. J., Snipe, R. M., Kitic, C. M., & Gibson, P. R. (2017). Systematic review: exercise-induced gastrointestinal syndrome-implications for health and intestinal disease. *Alimentary Pharmacology & Therapeutics, 46*(3), 246–265. https://doi.org/10.1111/apt.14157

Costa, R. J., Snipe, R., Camões-Costa, V., Scheer, V., & Murray, A. (2016). The ımpact of gastrointestinal symptoms and dermatological ınjuries on nutritional ıntake and hydration status during ultramarathon events. *Sports Medicine - Open,* 2, 16. https://doi.org/10.1186/s40798-015-0041-9

de Oliveira, E. P., & Burini, R. C. (2009). The impact of physical exercise on the gastrointestinal tract. *Current Opinion in Clinical Nutrition and Metabolic Care,* 12(5), 533–538. https://doi.org/10.1097/MCO.0b013e32832e6776

de Oliveira, E. P., Burini, R. C., & Jeukendrup, A. (2014). Gastrointestinal complaints during exercise: prevalence, etiology, and nutritional recommendations. *Sports Medicine, 44* Suppl 1(Suppl 1), S79–S85. https://doi.org/10.1007/s40279-014-0153-2

Erdman, K. A., Jones, K. W., Madden, R. F., Gammack, N., & Parnell, J. A. (2021). Dietary patterns in runners with gastrointestinal disorders. *Nutrients, 13*(2), 448. https://doi.org/10.3390/nu13020448

Eskici G. (2020). Egzersizle ilişkili gastrointestinal problemlerde düşük FODMAP diyet yaklaşımı. *Türkiye Klinikleri Spor Bilimleri Dergisi, 12*(2), 233-240. http://doi.org/10.5336/sportsci.2019-72526

Eskici, G., & Ersoy, G. (2014). *Yaşlanma sürecinde egzersiz ve sağlıklı beslenmenin kazandırdıkları.* Türkiye İşçi Emeklileri Derneği: Ankara.

Jeukendrup A. E. (2011). Nutrition for endurance sports: marathon, triathlon, and road cycling. *Journal of Sports Sciences, 29*(Suppl 1), S91–S99. https://doi.org/10.1080/02640414.2011.610348

Jeukendrup, A. E., Vet-Joop, K., Sturk, A., Stegen, J. H., Senden, J., Saris, W. H., & Wagenmakers, A. J. (2000). Relationship between gastro-intestinal complaints and endotoxaemia, cytokine release and the acute-phase reaction during and after a long-distance triathlon in highly trained men. *Clinical Science, 98*(1), 47–55.

Lis D. M. (2019). Exit gluten-free and enter low FODMAPs: a novel dietary strategy to reduce gastrointestinal symptoms in athletes. *Sports Medicine, 49*(Suppl 1), 87–97. https://doi.org/10.1007/s40279-018-01034-0

Parnell, J. A., Lafave, H., Wagner-Jones, K., Madden, R. F., & Erdman, K. A. (2019). Development of a questionnaire to assess dietary restrictions runners use to mitigate gastrointestinal symptoms. *Journal of the International Society of Sports Nutrition, 16*(1), 11. https://doi.org/10.1186/s12970-019-0278-7

Parnell, J. A., Wagner-Jones, K., Madden, R. F., & Erdman, K. A. (2020). Dietary restrictions in endurance runners to mitigate exercise-induced gastrointestinal symptoms. *Journal of the International Society of Sports Nutrition,* 17(1), 32. https://doi.org/10.1186/s12970-020-00361-w

Pelly, F. E., & Thurecht, R. (2019). Evaluation of athletes' food choices during competition with use of digital ımages. *Nutrients,* 11(7), 1627. https://doi.org/10.3390/nu11071627

Pfeiffer, B., Stellingwerff, T., Hodgson, A. B., Randell, R., Pöttgen, K., Res, P., & Jeukendrup, A. E. (2012). Nutritional intake and gastrointestinal problems during competitive endurance events. *Medicine and Science in Sports and Exercise,* 44(2), 344–351. https://doi.org/10.1249/MSS.0b013e31822dc809

Rosenbloom, C., & Bahns, M. (2006). What can we learn about diet and physical activity from master athletes?. *Holistic Nursing Practice, 20*(4), 161–168. https://doi.org/10.1097/00004650-200607000-00002

Stuempfle, K. J., & Hoffman, M. D. (2015). Gastrointestinal distress is common during a 161-km ultramarathon. *Journal of Sports Sciences, 33*(17), 1814–1821. https://doi.org/10.1080/02640414.2015.1012104

ter Steege, R. W., Van der Palen, J., & Kolkman, J. J. (2008). Prevalence of gastrointestinal complaints in runners competing in a long-distance run: an internet-based observational study in 1281 subjects. *Scandinavian Journal of Gastroenterology, 43*(12), 1477–1482. https://doi.org/10.1080/00365520802321170

Thurecht, R., & Pelly, F. (2020). Key factors ınfluencing the food choices of athletes at two distinct major ınternational competitions. *Nutrients*, *12*(4), 924. https://doi.org/10.3390/nu12040924

Tso, J., & Kim, J. H. (2020). Master endurance athletes and cardiovascular controversies. *Current Sports Medicine Reports, 19*(3), 113–118. https://doi.org/10.1249/JSR.0000000000000695

Waterman, J. J., & Kapur, R. (2012). Upper gastrointestinal issues in athletes. *Current Sports Medicine Reports, 11*(2), 99–104. https://doi.org/10.1249/JSR.0b013e318249c311