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Menstrual status and perceived coaching strategy and training methodology in high-performance female swimmers from Slovenia - Preliminary study

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Abstract

Female swimmers participate in intensive swimming training during their menstrual periods, and they may appreciate additional understanding and flexibility regarding their training volume/intensity. Male coaches often view menstruation contemptuously as an unfortunate state that "is not a disease," and high-performance female swimmers perceive coaching methods differently. Our study aimed to examine menstrual status and perceived coaching and training methodology. In a cross-sectional study, members of the Slovenian women's national swim team (n = 14, age: 16.6 ± 3.1 years, body mass index: 20.1 ± 1.9 kg/m^2) competing at international and national levels were included. The menstrual status (i.e., regularity, duration, perceived pain before and during menstruation, bleeding) and the opinion of these female swimmers regarding training during their menstrual periods were assessed via our in-depth questionnaire, and the athletes responded to additional questions pertaining to the motivation of swimming, coaching strategy and training methods via a questionnaire. All swimmers included in our study had experienced their first menstrual period, and the majority (85%) reported moderate or heavy menstrual bleeding. Most swimmers (93%) reported that their swimming training was "undisturbed" during their menstrual period; however, 64% of swimmers requested a reduction in training frequency or at least the usual training volume/intensity. In terms of the motivation for swimming, 74% of swimmers reported that they like swimming and like spending time with their friends. In terms of coaching and training methods, the swimmers reported polarized responses, probably because most of them are members of two major swimming clubs with different coaching styles. To conclude, when executed correctly, a similar kind of systematic screening method (i.e., anonymously and perhaps by experienced psychologists) may serve as a valuable tool to further modify training methods at a high-performance level. Moreover, unpleasant issues related to menstrual periods from the athlete's perspective (i.e., pain, bleeding, malaise, discomfort, inability to achieve maximum effort) should not be ignored, left for swimmers to handle alone, or taken for granted. Male coaches need to seek to understand the impact of menstruation and work with athletes to maximize training.

Keywords swimming • female athletes • high-performance level • menstrual status • coaching strategy • training methodology.

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Introduction

The effect of menstruation on female athletes goes far beyond biology. Undoubtedly, it plays an integral part in the development of female athletes' body image (Chrisler et al., 2015), which is freque-

ently ignored in science, as it is an extremely sensitive topic that female athletes usually address with silence, restraint, and the feeling of being "alone." In addition, adolescence is a time when a young person is extremely vulnerable, which may be magnified by social pressures to look and perform a certain way; moreover, menstrual cycle (MC) development affects physical, mental, and sexual health (Huhmann, 2020). In a recent study of nine elite-level female swimmers, menstruation within the MC was shown to limit their personal freedom, and its clinical signs and symptoms may have implications on the physical and emotional well-being but may also reflect social and cultural prejudices (Caballero-Guzmán & Lafaurie-Villamil, 2020).

Although the results of previous studies are not conclusive, menstrual periods are commonly considered to alter physical or sports performance notably (García-Pinillos et al., 2021). Some studies on high-performance athletes suggest that performance is improved or not affected during the menstrual period (Carmichael et al., 2021; Statham, 2020). However, most research on changes in cognitive behavior proposes that in the majority of female athletes, cognitive behavior is detrimentally affected to varying degrees in the premenstrual period and menstrual period (Caballero-Guzmán & Lafaurie-Villamil, 2020; Statham, 2020). These conflicting results may be a consequence of heavy menstrual bleeding and accompanying anemia, which further decrease the athletic performance of some athletes (Bruinvels et al., 2016).

Swimming is an individual, mono-structural, cyclic sport primarily performed in systematically controlled indoor environments (Colwin, 2002). The problems faced by high-performance female swimmers regarding the MC are related to physical aspects (e.g., sensitive breasts, menstrual cramps, back and abdominal pain, bleeding), psychological aspects (e.g., depression and irritability), and social aspects (e.g., how to hide menstruation) (Caballero-Guzmán & Lafaurie-Villamil, 2020; Kishali et al., 2006; Ozbar et al., 2016). In a study on the sample of 241 high-performance female athletes of various disciplines (i.e., taekwondo, judoka, volleyball, basketball), many participants reported painful menstruation (36.9%) and sometimes painful menstruation (45.6%). However, when comparing non-menstruation to menstruation, nearly two-thirds of these athletes (62.2%) reported that their performance did not change (Kishali et al., 2006). Therefore, swimmers' negative perception of menstruation should be recognized as a serious problem and should be adequately discussed by their coaches and families to provide them with emphatic understanding and consensual solutions throughout their sports development. In addition, in Slovenia, the majority of swim coaches of female swimmers are men. Sufficient research has not been conducted to determine whether there is any difference in coaching issues related to MC and menstruation pertinent to the coach's sex.

For female swimmers, health, in addition to elite performance, are important. Therefore, coaches must adjust their training methods, such that when trying to "develop" a top-level swimmer, they do not forget that young female swimmers, particularly adolescents, are psychosocial beings. For this reason, coaching strategy and training methodology are also essential tools that coaches use in the training process to improve athletes' physiological capacities and sport-specific skills (Bompa & Haff, 2009; Liposek et al., 2018).

When working with adolescent athletes, the coach's primary role is to guide the individual's learning process within the group (i.e., in physical, cognitive, and emotional attitudes), which can be successfully achieved through purposeful pursuits to stimulate the mind of the young female athlete via planned and strategic coaching methods (Nugent et al., 2017). Furthermore, the coach plays a vital role in the youth sports experience through his or her behaviors, standards, and swimmers' goals, which may further and significantly contribute to shaping the motivational climate, and through promoting sport as an enjoyable process, while simultaneously pursuing progress in athletic performance (Conroy & Coatsworth, 2007).

The perspectives of high-performance female swimmers regarding menstrual status is a quite underexplored phenomenon or at least insufficiently investigated in the current scientific literature. Furthermore, there is a lack of information on high-performance athletes' perspectives on coaching style and training methods. Therefore, our descriptive survey aimed to examine menstrual status, and perceived coaching and training methodology with additional questions pertaining to the motivation for swimming. In this way, from the obtained results and the results of other future surveys, we can deliberately recommend a more cooperative and understanding relationship between female swimmers and their coaches. Our study is a part of a more extensive cross-sectional study on the nutritional and cardiovascular health status of high-performance female gymnasts

and swimmers (i.e., matched according to age, competition level, and competition period) (Jakse et al., 2019; Jakše, Jakše, Fidler Mis, et al., 2021; Jakše, Jakše, Čuk, et al., 2021).

Method

Study design and eligibility

The current study protocol was reviewed and approved by the Slovenian Medical Ethics Committee (approval document no. 0120-177/2018), and the trial was registered at https://clinicaltrials.gov (approval document no. NCT03584256). The research was carried out in accordance with the Helsinki Declaration. For inclusion in our study, all participants and/or the parents/legal guardians provided written informed consent and did not receive any financial incentive to participate. The study was conducted from April 5-6, 2018 (during the competition period) at two locations, in Maribor and Slovenj Gradec Medical Centre.

The swimmers completed the printed questionnaires (the method for doing so was explained by the lead author) while waiting for other measurements (e.g., blood sample draws, anthropometric, body composition (BC), and bone mineral density measures by an 8-electrode medically approved and calibrated bioelectrical impedance BC monitor (Tanita 780 S MA, Tanita Corporation, Tokyo, Japan) for BC assessment and dual-energy X-ray absorptiometry (Hologic DXA, model Discovery W, with software Hologic Apex, model 4.5.3.1)) performed in accordance with the recommendations and by experienced experts (e.g., nurse, first author, and qualified practitioner). All the assessments in the study were funded by the Slovenian Research Agency.

Subjects

In our study, 14 participants from the Slovenian women's national swim team, with a mean age of 16.6 ± 3.1 years, were enrolled. The female swimmers were recruited through personal contacts with the national team coach. Notably, the swimmers were coached by a male coach both in their local clubs and the national team. However, the questions in the questionnaire were related to the coach at the local club with whom they spent most of the time. The inclusion criteria for the study were as follows: competing at the international and national levels, currently fully and actively involved in a training program, and not using prescribed medication that affects bone metabolism. All recruited swimmers completed the study without missing data (100%), and none of the participants were excluded from the final analysis.

Outcome

The variables included the detailed characteristics of the participants, their menstrual status, and perceived coaching strategy and training methodology (e.g., swimming motivation, enjoyment in swimming, sports beliefs, and various psychosocial aspects of coaching style and training methods). It should be noted that nutritional status (i.e., BC and dietary intake), serum micronutrients, and cardiovascular health status are presented in detail in separate articles (Jakše, Jakše, Fidler Mis, et al., 2021).

Characteristics of the participants

The detailed characteristics of the swimmers (i.e., age, training years, preferred discipline, education status, competition level, International Swimming Federation (FINA) points, and type of diet) were evaluated by a questionnaire developed by the authors.

Menstrual status

The menstrual status of the swimmers (i.e., mean age at first menstruation, regularity and duration of the MC, perceived severity of menstrual pain before (yes/no) and during the menstrual period (yes/no), perceived intensity of menstruation (i.e., heavy, moderate or barely noticeable), training during menstruation, perception of training during menstrual period and previous gynecological procedure (ordinal in nature: "yes-no" statements) were evaluated using a detailed questionnaire developed by the authors. The structure and content of the menstrual status questionnaire were primarily based on the lead author's testimonials, previous interviews with female swimmers, and extensive 30 years of experience with swimming (e.g., as a swimmer, coach, professor of swimming at university level and the head of new swimming training programs). The judgment of heavy, moderate, or barely noticeable menstrual bleeding and regularity of MC was clearly defined (explained under Table 2) and communicated with each swimmer to avoid different interpretations.

Perceived coaching strategy and training methodology

To access the perception of coaching strategy and training methodology (e.g., swimming motivation included), we used a modifiable and adaptable questionnaire (Bompa & Haff, 2009) that has been

used on high-performance swimmers of both sexes older than 18 years from Slovenia (Liposek et al., 2018). The questionnaire was based on (i) a method of assessing the motivation for swimming (i.e., reasons for participating in swimming), (ii) sport-related opinion and intrinsic satisfaction (i.e., perceived ability, satisfaction, and enjoyment in sport), and (iii) coaching strategy and training methodology (i.e., coach's approach to coaching) (Bompa & Haff, 2009; Liposek et al., 2018).

Anthropometric parameters and BC parameters

All basic anthropometric and BC indices were included (e.g., body height, body mass, body mass index (BMI), body fat percentage (BF %), fat-free mass (FFM), and whole-body phase angle (PhA)) and measured by an experienced investigator (first author), according to the manufacturers' recommendations for each instrument (Tanita, 2015). Height (cm) was measured using a standardized medically approved professional personal floor scale with a stand (Kern, MPE 250K100HM, Kern & Sohn, Balingen, Germany), whereas BC (BF %, FFM, and PhA) was assessed with an eight-electrode medically approved and calibrated bioelectrical impedance BC monitor (Tanita 780 S MA, Tanita Corporation, Japan). Body mass index (kg/m²) was calculated from body height and body mass.

Statistical analysis

Statistical analysis was performed with the R 3.5.2 dplyr (Wickham et al., 2019), ggplot2 (Wickham, 2016), and arsenal (Heinzen et al., 2019) packages. The dplyr package was used for data transformation, the ggplot2 package was used for data visualization, and the arsenal package was used for statistical analysis. As the total number of high-performance athletes is extremely small, in our sample, we included all female members of the Slovenian national swim team (the entire population) that met our inclusion criteria. All invited swimmers who met the criteria accepted our invitation. No data were missing or lost. Therefore, only descriptive statistics are used to present the results. No sensitivity analyses were performed. The data are presented as the mean ± standard deviation (SD). For non-continuous data, frequencies (number of observations - n) and percentages (%) were calculated.

In addition, the validity of the menstrual status questionnaire was established by experts working together on it with the aim of covering the most specific and objective aspects of the field and avoiding self-selective answers. Therefore, regardless of the limitations due to the small and specific population (i.e., not a sample) and the limitations of nominal data, the reliability of the questionnaire was relatively acceptable (Cronbach's alpha = 0.6) for the 9-item scale used in the 14-item questionnaire.

Results

Characteristics of the swimmers

The basic characteristics of the swimmers are presented in Table 1. At the time of our study, they swam, on average, 45.4 ± 3.5 km each week. Seven (50%) of the swimmers specialized in two competition disciplines. Moreover, the majority of the swimmers (86%) specialized in short- (50-100 meters) and middle-distance disciplines (200-400 meters), whereas five swimmers (36%) also competed in long-distance disciplines (800-1500 meters). According to the inclusion/exclusion criteria, all swimmers at least attended the national championship, and four and five of them (29% and 36%) qualitatively deviated from the others (i.e., based on competition level and FINA points, respectively).

Table 1. Characteristics of the study participants (mean ± SD, n (%))

Variables	N = 14
Age (years)	16.6 ± 3.1
Training (years)	8.5 ± 3.5
Start swimming training (years)	9.3 ± 1.9
Weekly training volume (km/week)†	45.4 ± 3.5
Preferred discipline (n (%))††	
Short distance (up to 50–100 m)	7
Middle distance (up to 200–400 m)	9
Long distance (800–1500 m)	5
Education status (n (%))	
Elementary school (attending/completed)	11 (79)
High school/Gymnasium	3 (21)
Competition level (n (%))‡	
EC or WC medalist/finalist/attendee	5 (36)
NC medalist/finalist/attendee	12 (64)
FINA points‡‡	
> 850	4 (29)
< 850	10 (71)
Type of diet (n (%))‡‡‡	
Vegetarian or occasionally vegetarian	2 (14)
Omnivorous	12 (86)

†The training volume reflected the competition period over the research period and the type of specialization. ††Several

swimmers competed in several preferred disciplines (e.g., 50 and 200 meters or 200 and 800 meters). ‡‡The FINA Points Table allows comparisons of results among different competitive swimming events. The FINA Points Table assigns point values to swimming performances; more points for world-class performances (typically 1000 points or more) and fewer points for slower performances (International Swimming Federation, 2021). We set 850 FINA points as an arbitrarily selected internal criterion by which we demarcated more successful swimmers from less successful swimmers. ‡Competition level: EC (European Championship), WC (World Cup), and NC (National Championship). ‡‡‡Dietary intake was assessed using a validated food frequency questionnaire (FFQ) enabled us to distinguish subpopulations with different dietary patterns (Jakše, Jakše, Fidler Mis, et al., 2021).

Menstrual status

All swimmers had already experienced their first menstrual period. Furthermore, the first menstruation of twelve swimmers (86%) occurred at ≤ 14 years of age. Most swimmers (79%) had a regular MC, and only five swimmers (45%) did not have a 28-day MC. Approximately one-third (36%) of swimmers perceived pain before menstruation and 43% perceived pain during menstruation. As many as 85% of swimmers reported moderate or heavy bleeding. It should be emphasized that only one swimmer did not train during the menstrual period; however, 64% would skip training or reduce training volume/intensity during menstruation. Furthermore, a sub-analysis of the five most successful swimmers shows specificities: specifically, four swimmers (80%) reported moderate bleeding (one perceived pain) during the menstrual period and that their training during the menstrual period is as usual. However, three of those five would have liked to reduce training volume/intensity during the menstruation but would not have wanted to skip the training altogether. Surprisingly, three swimmers (21%) had already experienced a gynecological procedure (e.g., surgery; one of them was from the group of the top five). The menstrual status of our participants is presented in Table 2.

Table 2. Menstrual status (mean ± SD, n (%))

Variables	N = 14
Mean age of the first menstruation (years)	13.4 ± 1.4
Regularity of the cycles (n (%))†	
Regular (eumenorrhea)	11 (79)
Not regular (amenorrhea)	3 (21)
Irregular (oligomenorrhea)	0
Duration of the menstrual cycle (n (%))††	
At 20 < 28 days	1 (9)
At 28 days	6 (54)
At 30 days	4 (36)
Perceived pain before the menstrual	
Yes	5 (36)
No	9 (64)
Perceived pain during the menstrual	
Yes	6 (43)
No	8 (57)
Perceived intensity of menstruation (n	
Heavy bleeding	2 (14)
Moderate bleeding	10 (71)
Barely noticeable	2 (14)
Training during the menstruation (n (%))	
Yes	13 (93)
No	1 (8)
Opinion about training during	
Training volume/intensity should be	7 (58)
No training should be on the first and	1 (8)
Training should run smoothly if no pain	4 (33)
Oral contraceptive use (n (%))‡‡	
Yes	10 (71)
No	4 (36)
Gynecological procedure (n (%))	
Yes	3 (21)
No	11 (79)

†Regular MC (eumenorrhea) was defined by 12 MC per (calendar) year. Not regular MC (amenorrhea) was defined as a lack of menstruation for 3 to 6 MC per year. Irregular MC (oligomenorrhea) was defined by 6 to 9 MC per year (Beck & Drysdale, 2021; De Souza et al., 2014). ††Included swimmers with regular MC (n = 11), ‡Heavy bleeding was considered (subjective assessment of blood loss) as losing 80 ml (used 15 or more normal-sized tampons or pad) of blood during the period or bleeding for longer than a week. Moderate bleeding was considered as losing 10 to 35 ml of blood (used 1 to 7 normal-sized tampons or pads) or bleeding from 4 to 6 days. Barely noticeable bleeding was considered as losing less than 10 ml of blood or that tampons or pads are not required. ‡‡The type of oral contraception had not been included in the questionnaire.

Perceived coaching strategy and training methodology

Regarding swimming motivation and perceived coaching strategy and training methodology, swimmers reported diverse swimming motivation. The most-reported swimming motivation was they like swimming (48% of responses), followed by they like being with friends (26% of responses) and that they want to be the best and/or win (18% of responses). Health motivation or engaging in swimming at their parents' wishes were not among the answers. However, a sub-analysis of the five most successful swimmers shows specificities, with three swimmers reporting that the main motivation for

swimming at a high-performance level was a desire to be the best and/or win.

Swimmers' perception of the content of training was polarized; 44% of swimmers reported that they swim the same training sets all the time, and 37% of swimmers reported that training sessions are interesting and exciting. Their answers regarding coaching strategy varied. We found that most swimmers agreed that technique is an important part of their training (39%), while 30% of the swimmers perceived coaches as being capable of assessing progress, and 30% of the swimmers perceived that the coach prefers to explain each task and each goal of training as well as evaluates training performance and completion. Significantly, none of the swimmers believed that (i) the coach did not explain the aim of the individual exercise and the entire training and that (ii) training was mostly volume-oriented.

In terms of coaching style and training methods, 50% of all swimmers' responses indicated that > 30% of training time was devoted to swimming technique, whereas nearly a third of responses (28%) indicated that technique was structured during each exercise. Moreover, the majority of responses regarding training volume were consistent with reported data on average weekly swimming volume (45.4 km/w). Forty-three percent of swimmers reported that the average training volume totaled 40-50 km per week, whereas the same number (43%) reported that the training volume exceeded 60 km per week. The swimmers mostly perceived high-intensity swimming as swimming that consisted of repeated sets of maximal intensity (50% of responses) and more than 6 km in one sequence (21% of responses). However, 17% of responses indicated that high focus on stroke technique, speed, and force corresponded with high-intensity swimming. Finally, for the majority of swimmers (57%), the preferred swimming style was front crawl, followed by backstroke (21%), butterfly (14%), and breaststroke (8%).

Table 3. Perceived coaching strategy and training methodology (n, %)

Variables	N = 14
Motivation of swimming (n)[†]	
I like swimming	13 (48)
I like being with friends	7 (26)
I want to be the best and/or win	5 (18)
I swim because the coach encourages me	2 (7)
I swim to be healthier	0
I swim at my parents' wish	0
Perceived opinion about the content of training (n)[†]	
I swim the same training sets all the time	7 (44)
The training sessions are interesting and exciting	6 (37)
I'm training like that	3 (19)
I find training boring	0
Perceived coaching strategy (n)[†]	
Technique is an important part of their training	9 (39)
Coaches as capable of assessing progress	7 (30)
The coach prefers to explain each task and each goal of training as well as evaluates training	7 (30)
The coach did not explain the aim of the individual exercises and the entire training	0
Training was mostly volume-oriented	0
The importance of practicing technique (n)	
Technique was practiced in < 10% of training time	3 (21)
Technique was practiced in > 30% of training time	7 (50)
Technique was structured during each exercise	4 (28)
Technique was not important at all	0

Table 3 (continued). Perceived coaching strategy and training methodology (n, %)

Variables	
Training volume (n)	
The training volume totaled 20–30 km per week	0
The volume totaled 30–40 km per week	1 (7)
The volume totaled 40–50 km per week	6 (43)
The volume totaled 50–60 km per week	1 (7)
The volume exceeded 60 km per week	6 (43)
Perceived high-intensity swimming (n)[†]	
More than 6 km in one sequence	5 (21)
More than 2 km in one sequence	2 (8)
Repeated sets of maximal intensity	12 (50)
High focus on stroke technique, speed and force	4 (17)
Sets I have never/rarely performed before	1 (4)
Preferred swimming style (n (%))[†]	
Front crawl	8 (57)
Breaststroke	1 (8)
Backstroke	3 (21)
Butterfly	2 (14)
Medley	0

[†]Variables with multiple possible answers.

Anthropometric and BC measurements

The average values of body height, body mass, BMI, BF %, FFM, and PhA were 173.0 ± 5.5 cm, 60.4 ± 7.0 kg, 20.1 ± 1.9 kg/m², 22.8 ± 3.7%, 46.6 ± 5.5 kg, and 6.0 ± 0.4°, respectively. The mean BMI, BF %, and PhA of the four best FINA swimmers who competed at the highest level before our study (WC) were lower than the average BMI, BF %, and PhA of the entire study population (i.e., 20.8 kg/m², 21.5% and 5.9 ± 0.2°), while the mean body height, body mass, FFM were higher (i.e., 179 cm, 66.7 kg, and 52.3 kg) (Jakše, Jakše, Fidler Mis, et al., 2021).

Discussion

Menstrual status

Our results highlight several significant findings. First, there was a diverse MC status among swimmers. Second, although responses regarding the sensation of pain during the menstrual period were polarized, the responses regarding menstrual bleeding were not (85%). Most swimmers (93%) trained "smoothly" during their menstrual period, which means that they dealt with menstrual bleeding in their own way. Indeed, the following facts should be noted: (i) high-performance swimmers bled during the menstrual period, (ii) they trained normally during the menstrual period, and (iii) if they could choose, they would certainly reduce the training volume/intensity during their menstrual period. In addition, no swimmers were anemic in regard to hemoglobin, serum iron, or serum vitamin B12 status (Jakše, Jakše, Fidler Mis, et al., 2021). Relevant for an overall view of swimmers' status, dietary intake analysis showed ample room for improvement; specifically, free sugars and saturated fat exceeded the upper limit of acceptable intakes, whereas fiber, polyunsaturated fatty acids, vitamin D, calcium, potassium, and selenium were below recommended intakes (Jakše, Jakše, Fidler Mis, et al., 2021). Furthermore, it should be noted that 71% of swimmers in our study used oral contraceptive pills, but because of their young age (11 out of 14 were 16 years of age or younger), we assumed that the use of contraception did not serve primarily as protection against unwanted pregnancy.

In an older review article, the authors suggested that regularly menstruating female athletes competing in strength-specific sports and intense anaerobic/aerobic sports do not need to adjust for the MC to maximize their performance, although this does not apply for prolonged exercise performance (Janse De Jonge, 2003). Furthermore, in a recent review paper that examined the impact of MC on athletes' performance, the authors concluded that they found no consistent effect of the impact of MC

on physical performance; therefore, there are many questions related to the effect of MC on athletes that still need to be investigated (Carmichael et al., 2021). In addition, in a recent study on 1,250 eumenorrheic active women from different sports and levels of competition, the researchers found that the MC affected the physical performance of a high percentage of women. Furthermore, active women in this study reported feeling pain during menstruation, while most of them reported making no changes to their training programs during the MC, with no modifications in training volume or intensity during the menstruation (García-Pinillos et al., 2021).

When considering only menstrual period issues, the results of a study on a sample of high-performance female athletes of various sports show the following: 71% of the athletes did not feel well immediately before menstruation, 83% experienced painful or sometimes painful menstruation (43% in our study), but 61% of the athletes in this study stated that during the competition, their pain significantly decreased. Notably, 12% of the athletes in the study could not avoid the regular use of analgesics during the menstrual period (Kishali et al., 2006), although in our study, medications were not included as a variable. In addition, the most recent study on a sample of nine elite-level female swimmers from Colombia revealed that an unpleasant menstrual period might have a negative impact on the well-being of athletes (i.e., physical discomfort, possible embarrassment if bleeding is not resolved unnoticed, fear/discomfort for some athletes when using menstrual hygiene methods such as tampons) (Caballero-Guzmán & Lafaurie-Villamil, 2020). One significant difference between the results from this study with Colombian swimmers and our study was that the Colombian swimmers were between 18–29 years, whereas our study was completed with adolescent athletes. Compared to older athletes, adolescent swimmers may experience even more pronounced issues related to physical aspects (e.g., menstrual cramps and back pain), psychological aspects (e.g., depression and irritability), and social aspects (e.g., concerns about keeping wanting to keep menstruation to themselves). A properly trained coach can have a generally positive impact and help swimmers with their MC problems.

These remarkable and variable challenges during the menstrual period show that the athletes have not only accepted but actively respond to this phase (e.g., not feeling well, discomfort, pain, fatigue, and bleeding) in their own way and to their best abilities (i.e., use of different menstrual hygiene methods, use of analgesics, reduction in the volume/intensity of training or, in some cases, train smoothly and perceived pain relief at the end of the training session). Future research may investigate whether there are differences in attitudes toward MC, facing the issues of menstrual period and training during menstruation in swimmers when trained by female or male coaches.

Perceived coaching strategy and training methodology

Our study identified an important aspect of swimming motivation among high-performance female athletes: 74% of responses indicated that the primary motivation of swimming at a high-performance level was I like swimming and in order to spend time with their friends, and only the third of responses (18%) indicated a desire to be the best and/or win. In addition, three of the five most successful swimmers reported that the primary motivation for swimming at a high-performance level was a desire to be the best and/or win. With better-achieved results, the ranking of swimming of motivation seems is inclined towards the direction of greater competition and the desire to win. Although this study included the Slovenian Women's national swim team and only four to five swimmers stood out at the quality level (i.e., they competed and were finalists or medal recipients at the EC and WC or had more than 850 FINA points (an arbitrarily selected internal criterion by which we demarcated more successful swimmers from less successful swimmers)), there was still a strongly present motivation associated with the triad of developmental phase. Surprisingly, swimming motivation related to the health benefits of swimming or the fulfillment of parents' wishes were not among the chosen motivation. In terms of the coaching strategy and training methodology, the swimmers included in this study reported outstandingly polarized opinions, which corresponds with the fact that they joined the national team from two major clubs with different coaching (leadership) and training styles (autonomous-supportive vs. controlling).

Regarding perceived general coaching strategy, the responses were divided between the importance of practice technique; the coach accepts that the swimmer is assessing progress and that the coach explains each task and each goal of training and evaluates training performance and completion. Considering the importance of practicing techniques, as many as 78% of swimmers reported that the technique was practiced in over 30% of training time

or during each exercise. Interestingly, the swimmers perceived high-intensity swimming differently. Fifty percent of all responses indicated that repeated sets of maximal intensity were associated with high-intensity swimming, whereas 21% stated that completing more than 6 km in one sequence, and 17% stated that being highly focused on stroke technique, speed, and force was associated with high-intensity swimming.

A previous study performed on adult high-performance swimmers of both sexes in Slovenia (n = 94) showed some differences in the perception of coaching strategy, most likely because the sample was larger, and the swimmers came from several clubs in Slovenia and were trained by different training styles (Liposek et al., 2018). In short, more than three quarters of all responses indicated that technique was an important part of training. Furthermore, considering the importance of practicing technique, the responses were much more divided; however, only 35% (compared with 78% in our study) of examined swimmers reported that technique was practiced during more than 30% of the training time, which is most likely due to the larger sample and the consequent greater diversity in several aspects, (i.e., the quality (in proportion) of swimmers that competed at the international level), the sex differences (i.e., both sex in the compared study) and the coaching style (e.g., they come from several clubs compared to our study where swimmers mainly came (except one) from two major swimming clubs). Finally, 74% of responses (approx. 25% more) regarding how swimmers perceived maximum effort were repeated sets of maximal intensity (Liposek et al., 2018).

It is widely known that coaching style is highly recognized as an important predictor of the behavioral development of young swimmers (Choi et al., 2020; Coatsworth & Conroy, 2009) and that it further establishes their experiences within sports and can have significant developmental effects later in life (Coatsworth & Conroy, 2009; Smoll et al., 2007). In addition, within coaching style, communication strategies may significantly contribute not only to the development of high-quality coach-athlete relationships but also to continuous sports participation, which is both rewarding and satisfying (Davis et al., 2019). In a broader context, every high-performance level athlete must eventually face the question of whether to continue competitive swimming or finish their sports career. In a previous study, Finnish researchers studied a sample of 34 competitive swimmers (17 females) and explored the transition in careers from the junior to senior level and whether they were considering ending or continuing their careers. These researchers suggest that collaboration between organizational and environmental factors (e.g., school-club communication) and, most importantly, appropriate social support (especially from family) can prevent the premature career termination of competitive athletes (Siekanska & Blecharz, 2020).

The main strength of our study was that the women's national swimming team was included in our study, as it is often challenging to find subjects willing to participate in the study. In addition, because of the significant and general lack of current results on high-performance female swimmers regarding this sensitive theme that is not often discussed, where two-way communication between the female athlete and coach does not always exist, we consider our data to be a significant research contribution.

However, the study has some obvious limitations inherent to the small number of participants. Unfortunately, this could not be avoided, as this is the reality of the representative quota of national teams, especially of smaller countries such as Slovenia. In addition, the applied menstrual status questionnaire was created to make the first step towards further research in the process in high-performance level female swimmers, and it calls for further consideration of appropriate instruments for the next step of the research. Therefore, the current situation may be why it is necessary to deal with this population in order to understand the processes that may affect its dropout in later development stages. However, more than the validity of the results obtained due to the study participants' limitations, we would like to emphasize that for female athletes, a major challenge exists, as they have to solve their problems on their own.

Conclusions

The results of our study suggest that for the majority of the national team athletes, menstruation is a very important individual health and training challenge that has been handled anonymously, without the involvement of a coach. If participants were able to decide whether to train during menstruation (i.e., when they perceived malaise, pain, bleeding, discomfort), they would certainly request necessary training adjustments towards reducing the

volume/intensity of the training in this sensitive period.

With regard to the motivation for swimming, based on reported answers about the primary motivation for swimming that were not related to the highest level of competition (e.g., to win or to be the best), with the exception of three of the top five swimmers, it seems that the high-performance competition level remains a sensitive stage in the further careers of female swimmers. In addition, the aforementioned motivation for swimming translated reasonably to perceived opinions about the training program, the coaching strategy, and the training methods. In addition, there is a great responsibility on coaches to support their swimmers further in their development and later in life by establishing a positive attitude towards sports in general and towards a healthy and active lifestyle. Therefore, especially due to a healthy attitude towards sports and later life, we recommend that coaches adopt and use an autonomous-supportive coaching style.

It is imperative to note that athletes perceive high-intensity swimming very differently. Specifically, a clear trend was observed in those swimmers who competed in long-distance swimming events; these swimmers perceived training consisting of repeated long distances as high-intensity swimming, whereas swimmers who competed in short-distance swimming perceived repeated sets of maximal intensity or focus on stroke technique, speed, and force as high-intensity swimming.

In our opinion, future studies on female swimmers, especially at sensitive ages and high competition and performance levels, should also include (within the characteristic section) information about menstrual health challenges and coaching style (e.g., also whether the coach is male or female). This would offer a more objective view of the existing situation, providing potential warnings and guidance to a wider group of coaches working with the female sports population. Menstrual period issues should definitely not be ignored, as female athletes deal with them stressfully and to the best of their abilities.

Authors' contributions

Conceptualization, B.J. and D.Š.; methodology, B.J., D.Š.; formal analysis, B.J.; investigation, B.J. in D.Š.; resources, B.J.; writing—original draft preparation, B.J.; writing—review and editing, B.J. in D.Š.; supervision, B.J. and D.Š.; project administration, B.J. and D.Š.; funding acquisition, B.J. Both authors have read and agreed to the published version of the manuscript.

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Institutional Review Board Statement

This cross-sectional study was approved on March 28th 2018 by the Slovenian Medical Ethics Committee of the Republic of Slovenia (approval document no. 0120-177/2018) and registered at https://clinicaltrials.gov (approval document no. NCT03584256).

Informed Consent Statement

All participants and/or the parents/legal guardians of athletes signed an informed consent form for inclusion in the study.

Data Availability Statement

The data used to support the findings of this study are included within the article.

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Conflict of interest

The authors declare no conflict of interests related to this manuscript.

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