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Urinary incontinence and other pelvic floor dysfunctions in female athletes in Brazil: A cross-sectional study

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The pelvic floor (PF) provides support to all pelvic organs, as well as appropriately closure/opening mechanism of the urethra, vagina, and anus. Therefore, it is likely that female athletes involved in high-impact and in strong-effort activities are at risk for the occurrence of urinary incontinence (UI). This study aimed to investigate the occurrence of UI and other PF dysfunctions (PFD) [anal incontinence (AI), symptoms of constipation, dyspareunia, vaginal laxity, and pelvic organ prolapse] in 67 amateur athletes (AT) compared with a group 96 of nonathletes (NAT). An *ad hoc* survey based on questions from reliable and valid instruments was developed to investigate the occurrence of PFD symptoms. The risk of UI was higher in AT group (odds ratio: 2.90; 95% CI: 1.50–5.61), mostly among artistic gymnastics and trampoline, followed by swimming and judo athletes. Whereas, AT group reported less straining to evacuate (OR: 0.46; 95% CI: 0.22–0.96), manual assistance to defecate (OR: 0.24; 95% CI: 0.05–1.12), and a higher stool frequency (OR: 0.29; 95% CI: 0.13–0.64) than NAT group. The occurrence of loss of gas and sexual symptoms was high for both groups when compared with literature, although with no statistical difference between them. Pelvic organ prolapse was only reported by nonathletes. Athletes are at higher risk to develop UI, loss of gas, and sexual dysfunctions, either practicing high-impact or strong-effort activities. Thus, pelvic floor must be considered as an entity and addressed as well. Also, women involved in long-term high-impact and strengthening sports should be advised of the impact of such activities on pelvic floor function and offered preventive PFD strategies as well.

Urinary, anal incontinence (AI), dyspareunia, vaginal laxity, and pelvic organ prolapse (POP) are the most common entities named under the umbrella term as pelvic floor dysfunctions (PFD). These conditions are multifactorial, affect mostly women, reduce their quality of life, and pose high economic burden to public health (MacLennan et al., 2000; Sung & Hampton, 2009). The main factors related to the occurrence of PFD are pregnancy, childbirth injuries, parity, aging, high body mass index (BMI), and pelvic surgery. Also, chronically increased abdominal pressure, such as seen in constipation, respiratory diseases, and in high-impact sports are factors that may contribute to overload and impair pelvic floor function (Sung & Hampton, 2009; Vitton et al., 2011).

Among the PFD, urinary incontinence (UI) is the mostly reported as being related with physical activity (Nygaard et al., 1990, 2008; Bo & Borgen, 2001; Eliasson et al., 2002; Thyssen et al., 2002; Joy et al., 2009; Bo et al., 2011; Vitton et al., 2011; Pauls et al., 2012). The rate of UI in women who exercise regularly ranges from 7% to 38%, depending on the type of exercise (Nygaard et al., 2008; Bo et al., 2011). The prevalence of UI in athletes varies widely, being directly associated not only with the high impact but also with the intensity of the physical activity (Bo & Borgen, 2001; Joy et al., 2009; Pauls et al., 2012). Previous authors have demonstrated that high-impact (landing) sport activities are associated to stress UI in nulliparous women who have competed for prolonged periods (Nygaard et al., 1990; Bo & Borgen, 2001; Eliasson et al., 2002; Thyssen et al., 2002). Trampolinists seem to be at highest risk for UI (80%; Eliasson et al., 2002).

Urine loss in athletes seems to be related to how frequently women are subjected to increased intra-abdominal pressure, which is caused by a contraction of the abdominal muscles in high-impact and strengthening activities without proper awareness of the pelvic floor muscles (PFM). Strenuous physical activity that increases intra-abdominal pressure can overload and chronically damage the perineum (i.e., pelvic floor muscles, ligaments, and fascias) and decrease the contraction force of PFM. The pelvic floor is a structure composed of muscles, ligaments, endopelvic fascia,

aponeurosis. It provides support to the pelvic organs and contributes to maintain continence as part of the urinary and anal sphincters. The pelvic floor muscles also contribute to protect connective tissue from excessive load by constantly maintaining its activity, thus relieving tension on the endopelvic fascia and other connective structures (Ashton-Miller & DeLancey, 2007). The more frequent the impact associated with increased intra-abdominal pressure, the greater the need for restraint and support of the pelvic organs by the PFM, which must be trained to preserve their function (Nygaard et al., 1994; Carls, 2007).

The pelvic floor must be thought as a sole structure, which accounts for urinary and sexual functions as well as anal continence (Bump & Norton, 1998; Sung & Hampton, 2009). Therefore, PFD such as urinary, sexual, POP, and anal dysfunctions are conditions that co-occur, some share and others have unique risk factors in older women (Rortveit et al., 2010; Vitton et al., 2011). Because of it, female athletes might be under risk to develop other PFD than just UI. The only study that addressed other symptoms of PFD more than UI on female athletes was from Vitton et al. (2011) investigating symptoms of PFD in a group of women who trained more than 8 h per week (intensive training) compared with women who trained less than 8 h per week (non-intensive training). They found a statistically higher prevalence of AI as well as the feeling of discomfort or pain during intercourse (dyspareunia) and UI in the intensive training group compared with the control group. These results suggest that sport activities are associated with other symptoms of PFD other than UI and should be further investigated.

Therefore, this study aimed to investigate the influence of the high impact and strengthening physical activities on the occurrence of symptoms of urinary, intestinal, sexual and vaginal dysfunctions, and POP, as well as severity of urinary symptoms in young female athletes and nonathletes. The results of this study might highlight the need for prevention of PFD in athletes and women who perform physical activity in a regular basis.

Materials and methods

Study design and subjects

A cross-sectional study investigated the occurrence of symptoms of PFD (urinary, intestinal and sexual dysfunctions, and POP) among young female nulliparous athletes and nonathletes, paired by BMI. Also, it was investigated the influence of the sport modality on the occurrence and severity of urinary dysfunctions. A convenience sample of athletes and nonathletes represented the studied population. Athletes from a large sports club in the city of Belo Horizonte, Minas Gerais State were selected from four different sports modalities (volleyball, swimming, judo, and artistic gymnastics and trampoline). The group of nonathletes consisted of young women recruited from a teenager health care center and from Physiotherapy/Physical Education graduation programs, all in the same city. Inclusion criteria were women aged from 15 to 29 years. Those who had previous pelvic floor surgery, pelvic trauma, inflammatory bowel, and respiratory diseases/symptoms were excluded.

Data collection

An *ad hoc* survey was developed accordingly to a previous population-based study that investigated multiple PFD symptoms in 1961 women (Nygaard et al., 2008). This was necessary because there is no instrument in the literature to investigate PFD symptoms altogether. Also, the use of questionnaires with a large number of items not related to the scope of the study could reduce participation, as previously observed elsewhere (Vitton et al., 2011). In the present study, questions about all PFD symptoms were literally extracted from validated questionnaires specific to each PFD (Rockwood et al., 1999; Tamanini et al., 2004, 2008; Bharucha et al., 2006; Hentschel et al., 2007; Pereira et al., 2011). We have also considered the recommendations of the International Continence Society (Haylen et al., 2010). Therefore, the survey documented (a) demographic and personal health status (age, educational level, BMI, sports practice characteristics – type and number of sports, weekly frequency, sports onset); and (b) pelvic floor symptoms (UI, frequency, nature and onset of leakage, strategies to control urinary loss, AI, constipation, dyspareunia, vaginal laxity, POP). Symptoms definitions and questions are described as follows:

UI was defined as any involuntary loss of urine (Haylen et al., 2010) and its presence was investigated by questioning if "Do you experience involuntary loss of urine?" If the answer was positive, the occurrence of the following urinary symptoms was further investigated: frequency of urine loss, loss' scenarios and strategies to control urinary loss. The severity of UI was investigated by the frequency of urinary loss enclosed in the Incontinence Severity Index (ISI) (Pereira et al., 2011). The situations of urine loss, characterizing the type of urinary incontinence (if stress, urgency or mixed), were investigated by questions from the International Consultation on Incontinence Questionnaire – Short Form (ICIQ-SF; Tamanini et al., 2004). Questions concerning the onset of symptoms and strategies for control of UI were also included as follows: "how long have you had urinary loss?" and "what do you do to control urinary loss?"

The intestinal symptoms were investigated by constipation and AI symptoms (Rockwood et al., 1999; Bharucha et al., 2006). The occurrence of constipation was investigated following the Rome III criteria (Bharucha et al., 2006): (a) fewer than three defecations per week; (b) straining at stool for more than 25% of defecations; (c) sensation of incomplete rectal emptying for more than 25% of defecations; and (d) manual assistance in perineum to facilitate for more than 25% of evacuations, with symptoms occurring regularly for the last 3 months. In this study, a constipation diagnosis was not established. Rather, symptoms were investigated separately. AI was defined as involuntary loss of gas or feces (either liquid or solid; Haylen et al., 2010). The occurrence of AI was investigated by the question "how often in the past month have you experienced any amount of accidental bowel leakage?" This was from the Fecal Incontinence Severity Index, a validated questionnaire that classifies the frequency of anal loss according to the type of incontinence (gas, mucus, liquid stool, or solid stool incontinence; Rockwood et al., 1999).

The sexual symptoms investigated in this study were dyspareunia (discomfort or pain during vaginal penetration; Basson, 2005; Haylen et al., 2010) and vaginal laxity (feeling of loose or wide vagina; Haylen et al., 2010; Millheiser et al., 2010). These symptoms were investigated only for participants who reported previous sexual activity. Dyspareunia was investigated by asking "how often do you experience discomfort or pain during vaginal penetration?" extracted from the Female Sexual Function Index (Hentschel et al., 2007), a validated scale that assesses sexual function in women. Vaginal laxity was investigated through the

question "Do you feel your vagina is too loose or lax?" extracted from the International Consultation on Incontinence Questionnaire – vaginal symptoms (ICIQ-VS), a module of ICIQ that assesses vaginal symptoms in women with POP (Tamanini et al., 2008).

POP symptoms, defined as a deviation from normal sensation, structure, or function, perceived by women concerning the position of her pelvic organs (Haylen et al., 2010) was investigated by asking "are you aware of/see a lump or bulge coming down in your vagina?" extracted from the International ICIQ-VS (Tamanini et al., 2008).

Before data collection, the investigator explained about the purposes of the study and all women received information about pelvic floor muscle location, function, and pelvic floor muscle training. After the signing of the consent form, the survey was delivered to participants. Participants were free to ask any questions during questionnaire filling. The University Research and Ethics Review Board approved this protocol (026/2008).

Statistical analysis

The characteristics of participants were described by mean/standard deviation (SD), median/interquartile range, and frequency distribution. The equivalence between groups (athletes and nonathletes) regarding age and BMI was tested by the Mann–Whitney test since data did not show normal distribution. To test differences between groups on the occurrence and severity of UI the Chisquare or Fischer's tests were used. Odds ratios (OR) and a 95% confidence interval (CI) for the symptoms of PFD were estimated by their frequencies of occurrence in both groups. For urinary and AI, and constipation symptoms, considering definitions previously described, the two possible and independent answers used to calculate OR were "no" or "yes." To calculate OR concerning the frequency (severity) of loss, in order to study whether urinary loss was more severe among athletes, answers to the ISI question related to urinary loss frequency were dichotomized into two categories: *occasionally*, whenever participants classified the frequency of loss as being "less than or few times a month"; and *frequently*, when they considered as frequent as "few times a week or daily." To calculate OR concerning dyspareunia, vaginal laxity, and POP, answers were dichotomized into two categories as follows. For dyspareunia: *yes*, whenever answers were "always" or "most times" or *no*, when participants answered "*a few times*" or "*never*," as sexual function depends on other factors than pelvic floor function only, such as vaginal lubrication, desire, motivation, etc. (Basson, 2005); for vaginal laxity: *yes* ("a little," "moderately," and "very much") or *no* ("not at all"); for POP: *yes*, whenever participants answered "occasionally," "sometimes," "most of the times," and "all the time" or *no*, when they answered "never."

Athletes were considered as the reference group. Statistical significance was set at $\alpha = 0.05$. Statistical analyses were performed using the SPSS version 19.0 software package (SPSS Inc., Chicago, Illinois, USA).

Results

The study included 67 athletes from four different sports modalities (23 athletes of volleyball, 9 of judo, 9 of artistic gymnastics and trampoline, and 26 swimming athletes) and 96 nonathletes.

The participants' characteristics were summarized in Table 1. All athletes reported that they also did weight training, and eight of them (11.9%) reported that they also did some other activity than weight training (circuit, running, other sports, etc.). Among the nonathletes, 17.7% reported doing some physical activity at least three times a week, for at least 6 months.

Table 1. Participants' characteristics

Variable	Athletes (n = 67) n (%)	Nonathletes (n = 96) n (%)	P-value
Median age (IQD)	18.0 (5)	21.0 (4)	<0.001
Median BMI (IQD)	21.7 (2.6)	20.95 (3.9)	0.266
Mean time of sport practice (SD) (years)	9.1 (3.4)	–	–
Mean frequency of sport practice (SD) (h/week)	19.0 (6.3)	–	–

BMI, body mass index; IQD, interquartile distance; SD, standard deviation.

Symptoms of PFD were reported by most participants (Table 2). The UI was the most prevalent PFD symptom ($P = 0.002$) among the athletes (52.2%) compared with the nonathletes group (27.1%). Athletes had almost three times a chance to present UI than nonathletes (OR = 2.90; 95% CI = 1.50–5.61; $P = 0.002$).

There was a greater proportion of UI among the athletes who practiced artistic gymnastics and trampoline (88.9%), followed by swimming (50.0%), judo (44.4%), and volleyball (43.5%) (Fig. 1).

The most prevalent type of UI was stress urinary incontinence (SUI) and it was more prevalent in the artistic gymnastics and trampoline athletes (87.5%), followed by swimming (84.6%) and judo athletes (75.0%). Among the nonathletes, urinary loss in urgency situations was the most reported symptom (34.6%). Regarding the severity of symptoms of UI, there was no statistical difference between groups concerning frequency of loss (*occasionally* × *frequently*; Table 2). Most athletes reported UI for about 5 years (45.7%), while among the nonathletes, the time of UI was about 6 months (46.2%). About 48% of athletes and 84.0% of nonathletes affirmed to use some strategy for preventing UI episodes. "Emptying the bladder before training" was the most reported strategy among athletes (31.4%) and "emptying the bladder before leaving the house," among the nonathletes (52.0%).

Symptoms of constipation were also reported by most of the study participants (Table 2). Straining to evacuate was the most reported symptom, followed by feeling of incomplete rectal emptying and manual assistance. Nonathletes showed a significant higher occurrence of straining to evacuate ($P = 0.037$). Athletes showed almost half a chance (OR = 0.46, 95% CI = 0.22–0.96; $P = 0.037$) of straining to evacuate and of having lower stool frequency (OR = 0.29, 95% CI = 0.13–0.64; $P = 0.002$) compared with nonathletes. Regarding symptoms of AI, involuntary loss of gas was the only symptom reported by participants (athletes: 64.6% and nonathletes: 58.5%). There was no statistically significant difference between groups ($P = 0.438$; Table 2).

Table 2. Occurrence of symptoms of pelvic floor dysfunctions (PFD) between groups

Pelvic Floor Dysfunction Symptoms		Athletes *n* = 67 *n* (%)	Non-athletes *n* = 96 *n* (%)	OR	95% CI	*P*-value
Urinary incontinence	Presence	35 (52.2)	26 (27.4)	2.90	1.50-5.61	0.002*
	Severity[δ]	11 (31.4)	12 (46.2)	1.87	0.65-5.35	0.241
Constipation	Straining to evacuate	45 (68.2)	79 (82.3)	0.46	0.22-0.96	0.037*
	Feeling of incomplete rectal emptying	43 (65.2)	56 (59.6)	1.27	0.66-2.44	0.474
	Stool frequency (< 3x/week)	10 (14.9)	36 (37.5)	0.29	0.13-0.64	0.002*
	Manual assistance	2 (3.1)	11 (11.8)	0.24	0.05-1.12	0.075**
Anal incontinence	Involuntary loss of gases	42 (64.6)	55 (58.5)	1.29	0.67-2.49	0.438
	Involuntary loss of feces	0 (0)	0 (0)	–	–	–
Sexual dysfunctions		**Athletes *n* = 29**	**Non-atlhetes *n* = 73**	**OR**	**95% Confidence Interval**	***P*-value**
	Dyspareunia *n* (%)	4 (13.8)	16 (21.9)	0.57	0.17-1.88	0.351
	Vaginal laxity *n* (%)	4 (13.8)	14 (19.2)	0.67	0.51-2.25	0.520
Pelvic organ prolapse		**Athletes *n* = 48**	**Non-atlhetes *n* = 88**	**OR**	**95% CI**	***P*-value**
	Bulge or lump in vagina *n* (%)	0 (0)	2 (2.3)	–	–	0.540

*Statistically significant difference between groups. **Fischer's Exact Test. [δ]Cases with *frequently* UI.

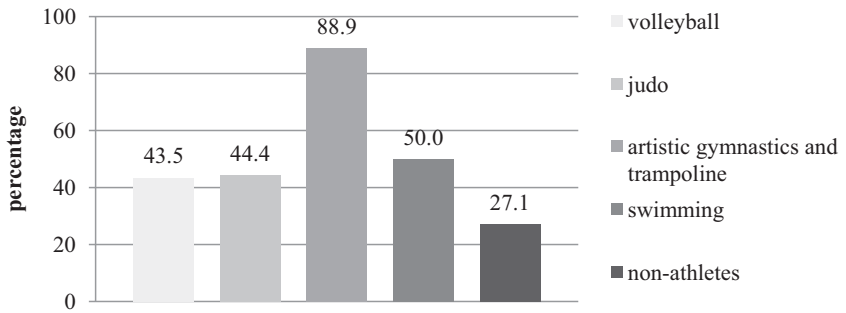

Fig. 1. Occurrence of urinary incontinence (UI) according to sport modality.

Among the participants who reported previous sexual activity (43% of athletes and 76% of nonathletes), the occurrence of discomfort or pain during vaginal penetration (dyspareunia) was reported by 13.8% of athletes and by 21.9% of nonathletes with no statistical difference between groups ($P = 0.351$). Concerning vaginal laxity, 13.8% in athletes, 19.2% in nonathletes complained of such symptom ($P = 0.520$; Table 2).

Not all participants answered the question related to POP symptoms (AT = 71.6%; NAT = 91.7%). Only two women in NAT reported having such symptoms occasionally (2.3%) ($P = 0.540$; Table 2).

Discussion

This study investigated the influence of the practice of four different sports modalities on the occurrence and severity of UI, intestinal, sexual dysfunctions, and prolapse symptoms in female athletes.

PFD in women such as those investigated in this study are multifactorial and are mostly related to parity, childbirth injury, pelvic trauma or surgery, and increased age (MacLennan et al., 2000; Sung & Hamptom, 2009). As we dealt with young nulliparous women, it was expected that the rate of PFD would be similar to the nonathlete sample, as these women presented no classical risk factors to PFD. Nevertheless, chronically increased abdominal pressure displays as a strong factor impacting pelvic floor functioning among young women. In our study, UI was the most prevalent PFD, with severity of urine loss being statistically similar, between groups. The occurrence of UI among the athletes lies within the range of prevalence (28–68%) reported in previous studies (Nygaard, 1997; Nygaard et al., 1990; Bo & Borgen, 2001; Eliasson et al., 2002; Thyssen et al.,

2002; Carls, 2007; Jácome et al., 2011). In the present study, SUI was the most frequent form of UI experienced by athletes. SUI is also the most prevalent form of UI in women and has a direct relationship with physical effort such as that involved in high-impact physical activities and increased intra-abdominal pressure (Ashton-Miller & DeLancey, 2007). Urine loss in athletes is related to the chronically increased intra-abdominal pressure during strenuous high-impact physical activities without proper awareness of the contraction of the pelvic floor muscles (Joy et al., 2009; Vitton et al., 2011). Every tensile force within the body, such as increased intra-abdominal pressure caused by abdominal muscle contractions generated during sports activities without proper support of the PF muscles, will gradually stretch fascia and ligaments, which may overcome connective tissue viscoelastic properties (by exceeding its elastic capacity), causing irreversible deformation and, as a consequence, pelvic organs prolapse and other PFD (Ashton-Miller & DeLancey, 2007; Joy et al., 2009; Vitton et al., 2011). Indeed, higher odds of POP in women who engaged in strenuous activities during teenage years were reported (Nygaard et al., 2014). Thus, deficiency in PF bracing caused by overstretched connective tissue seems to account for incompetence in urethral support and sphincteric systems leading to PFD such as SUI. This may explain such high prevalence of UI among the young nulliparous female athletes investigated in the present and other studies. On the other hand, it is expected muscles should be stronger as they are frequently under contraction during sports training. Actually, the cross-sectional area and thickness of the levator ani and puborectalis, measured by 2D and 3D ultrasound, were increased in female athletes engaged in long-term, high-impact sports. Yet, they also presented greater bladder neck descend and a larger hiatal area during the Valsalva maneuver (Goldstick & Constantini, 2014). Differences in connective tissue may contribute to such results, and should be investigated. At any rate, female athletes should perform PF muscle training (PFMT; Dumoulin & Hay-Smith, 2014) as part of their regular training routine. The PFMT is recommended as the first-line treatment for women with UI (Dumoulin & Hay-Smith, 2014), and has been proven effective to prevent and treat PF dysfunctions in athletes (Rivalta et al., 2010).

The rate of UI in female athletes depends on the type of physical activity. High-impact sport activities are related to the higher prevalence of UI, mainly SUI (Nygaard et al., 1990; Nygaard, 1997; Bo & Borgen, 2001). In the present study, SUI was the most prevalent form of UI among artistic gymnastics and trampoline athletes (87.5%), which are activities that impose excessive load on the PF. But also swimming (84.6%) and judo athletes (75.0%) highly complained of SUI. Both activities involve increased intra-abdominal pressure, but not much impact. This stresses the need to train the correct contraction of PFM, especially during high-impact and strength-related sport activities to guard connective tissue from overstretching, since more than 30% of women cannot contract their PF muscles correctly because these muscles are rarely consciously used (Bo & Sherburn, 2005).

Measures to prevent UI are not included as a routine of the physical training (Carls, 2007) leading to high prevalence of UI in female athletes. Therefore, women with UI symptoms use strategies such as wearing absorbent pads, urinating before practice, reducing liquid intake, adapting athletic technique, or even bypassing sports to minimize the consequences of this condition (Thyssen et al., 2002). In the present study 46.7% of all participants who complained of UI used some strategy to prevent leakage. These findings suggest that participants are not aware of treatment options for UI, thus, as stated previously, do not commonly seek treatment or professional advice (Carls, 2007). This may induce young women, such as the ones enrolled in this study, to miss optimal timing to address UI and pelvic floor muscle training. In the future, UI and other PF dysfunctions will negatively impact the quality of life of those women and increase their health-related costs (MacLennan et al., 2000). Therefore, it seems mandatory to establish an approach to technical staff and female athletes concerning preventive and treatment options for PF dysfunctions.

Constipation symptoms were reported by many study participants, mainly by nonathletes. Nonathletes presented almost a twofold reduction in stool frequency as compared with athletes and a 2.51 times higher straining to evacuate. Physical activity was a protective factor to emptying bowel symptoms. There is evidence that physical activity in a regular basis increases gas clearance, reduces bloating, and constipation symptoms and, for those with irritable bowel syndrome, improves quality of life (Bharucha et al., 2013). Exercises favor propulsive movements of large intestine. Likewise, mechanical effects and hormonal changes may account to its proper functioning (Dukas et al., 2003). Although many participants of the present study complained of feeling of incomplete rectal emptying, there was no difference between groups. The constipation symptoms observed in athletes could be related to deficiency in the PF support mechanisms due to connective tissue overstretch. This hypothesis needs to be further investigated in future studies.

More than a half of the athletes and the nonathletes presented AI in the form of involuntary loss of gases. This is a high prevalence, as only nulliparous women were investigated and the main risk factor for AI is the sphincter injuries that might occur during vaginal delivery and episiotomy (MacLennan et al., 2000; Vitton et al., 2011). In the literature, the real prevalence of AI is not well known because of the constraint that hinders the approach to the problem. It is estimated that 6% to 15%

of adults are affected by AI (MacLennan et al., 2000; Landefeld et al., 2008). When considering only gas incontinence, the prevalence in literature varies from 5.3% in young nulliparous (Kang et al., 2012) up to 19% in older parous women (Ng et al., 2002; Eva et al., 2003). Another important cause of AI is the bowel constipation with chronic straining to evacuate (Markwell & Sapsford, 1995). In the present study, such symptom was frequent in both groups, but statistically higher among the nonathletes, which may be associated to AI. The impact of the sport activity on the prevalence of AI is barely investigated. The only study we have found demonstrated that high-level sport activity is a significant risk factor for AI, with its prevalence nearly three times higher in the intensive training group compared with the non-intensive group (Vitton et al., 2011). These results are different from ours. Albeit we, like them, have found a high prevalence of gas incontinence among all study participants, we did not find statistical difference between groups. While, for the nonathletes, straining to evacuate and lower stool frequency may be related to AI; for the athletes, increased intra-abdominal pressure might be the contributing factor for the occurrence of AI. Yet, their sample included parous and older women, which may account for other risk factors associated to sport activities. Ours dealt only with nulliparous athletes who trained, in average, 19 h per week and nulliparous nonathletes, even though 17.7% of these were not sedentary. It can also explain why we have also found a higher prevalence of involuntary loss of gases in both groups (64.6% and 58.5%, respectively). In conjunction, these results stress out the need for more studies to clarify the association between the practice of sports activities and the occurrence of AI.

In regard to the occurrence of sexual dysfunction symptoms, the frequency of dyspareunia and vaginal laxity in both groups was similar, with no statistically significant difference between them ($P = 0.351$). In contrast, Vitton et al. (2011) reported significantly higher occurrence of dyspareunia in an intensive training group compared with a non-intensive group of young women (20.1% vs 9.4%, $P = 0{,}002$). In order to test potential influences of the sport activity on sexual dysfunction, our sample was comprised of only 29 AT and 73 NAT. As we were investigating young women, we have selected from the initial cohort, only those participants who had reported previous sexual experience. This low sample size leads to a low power (0.39). However, even with a small sample, we did document a relatively high occurrence of dyspareunia when comparing with literature, especially in NAT. The rate of dyspareunia in premenopausal women in the general population varies from 3.7% to 17.0% (Kao et al., 2008). The pelvic floor muscles contribute to protect connective tissue from excessive load by constantly maintaining its activity and, thus relieving tension on the endopelvic fascia and other connective structures (Ashton-Miller & DeLancey, 2007). Possible increased PF muscle activity to compensate deficiency in the PF overstretch connective tissues might be responsible for the occurrence of symptoms of dyspareunia among AT.

There was also a high complaint (AT = 13.8% AT and NAT = 19.2%) of loose or wide vagina in both groups, although statistical significance was not attained ($P = 0.520$). Prevalence in literature lie in a wide range, varying from 2.9% (MacLennan et al., 2000) to 48% (Millheiser et al., 2010), since such symptom is not well defined and/or understood. It might be related either to stretching of the vaginal introitus caused by vaginal delivery or to a loss of sensitivity and reduced sexual satisfaction during sexual intercourse (Millheiser et al., 2010). In athletes, connective tissue overstretching of pelvic floor may be the contributor factor. Further research is needed to investigate the impact of sports activities on the occurrence of sexual dysfunction symptoms on female athletes.

Not all participants (83.4%) answered the question related to POP symptoms. Hereof, such symptoms were reported only by 2.3% of the NAT group with no difference between groups. Nygaard et al. (2014) found higher odds of POP in older women who, in their teenage years, practiced high-impact activities. As we have not found any complaint among athletes, either symptoms were not intense enough to be evident, or they might be a long-term effect on pelvic floor structure. Future studies to address this issue should be conducted.

We have used a convenience sample of athletes and nonathletes that might pose a selection bias on the present results, as their willingness to participate could be related to pelvic floor symptoms they might have presented at the time. Also, as physiotherapy students made part of the NAT group, these women either could have more knowledge related to general measures that could impact any of the PFD or they might present better awareness and knowledge about their pelvic floor muscles, influencing the lower occurrence of PFD symptoms in the NAT group.

As this study intended to investigate exclusively PFD symptoms, instead of quality of life, for example, the authors decided to extract questions related to the symptoms of interest from validated questionnaires, rather than using the original tools. Analysis was focused on the answers *per se* instead of a final score in order to allow acknowledgement of the specific bothering symptoms, and to favor decision making about preventative and therapeutic strategies for the studied population. Also, the use of questionnaires with a large number of items not related to the scope of the study would reduce participation, as previously observed elsewhere (Vitton et al., 2011). We believe that this procedure did not interfere in the validity of the items itself nor on the reliability of the answers. However, not using the original scores limited conclusions on quality of life.

Perspectives

Considering the characteristics of the investigated sample (young and nulliparous women), the occurrence of PFD symptoms was high in both groups compared with literature. In athletes, the occurrence of UI complaints was higher among the practitioners of artistic gymnastics and trampoline followed by, swimming and judo athletes, indicating that both high-impact and strong-effort activities seem to favor such occurrences. As athletes use strategies to prevent urine loss other than seek for professional help, it is likely they are not aware of treatment options for UI. Such attitude may account for missing the optimal timing to address UI and PFM training.

Also, symptoms of intestinal and sexual dysfunction were reported by the participants confirming the assumptions that PFD symptoms co-occur. Straining to evacuate was significantly higher among NAT, implying that physical activity is beneficial to bowel function. Albeit PFD other than UI seem frequent among young athletes, only the Vitton et al. (2011) study addressed such issue. The concomitant occurrence of urinary, sexual, and anal dysfunctions suggests that PF must be investigated as an entity, and addressed as well. More studies are necessary to clearly establish risk factors and guide athletes and technical staff to a comprehensive approach of those quality of life-threatening conditions.

Our results reinforce literature findings and add new and worrisome information on how pelvic floor function in female young athletes has been damaged. It is imperative to establish protocols to be used as part of the regular care and sports training program, aiming at PFD prevention and treatment. Future studies should be carried out to investigate the relation between PFD and pelvic floor muscle functions in a probabilistic sample of athletes. Also, on how to effectively manage PFD by means of long-lasting pelvic floor muscle training and educational programs.

Key words: Female athletes, pelvic floor dysfunction, epidemiology, women's health, urinary incontinence, anal incontinence, dyspareunia, vaginal laxity, pelvic organ prolapse.

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