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ORIGINAL ARTICLE

Symptoms of pelvic organ prolapse in women who lift heavy weights for exercise: a cross-sectional survey

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Abstract

Introduction and hypothesis The aim of the study was to determine the prevalence of symptoms of pelvic organ prolapse (POP), defined as the sensation of a vaginal bulge, and associated risk factors in women over 18 years of age who lift light (≤15 kg), moderate (16–50 kg), and heavy (>50 kg) weights for exercise, and those who do not lift weights for exercise.

Methods Women completed an online survey about risk factors for pelvic floor dysfunctions, physical activity history, and pelvic floor symptoms. A question about a vaginal bulge sensation from the validated Pelvic Floor Distress Inventory (PFDI-20) was used to indicate symptoms of POP. Relationships between symptoms of POP and possible risk factors were assessed through logistic regression analysis.

Results Of the 3,934 survey participants, the total prevalence of POP symptoms was 14.4% ($n = 566$). Category of weight lifted, age, vaginal parity, history of constipation or hemorrhoids, and family history of POP were significantly associated with symptoms. Physically active women lifting weights ≤15 kg were more likely to report symptoms of pelvic organ prolapse than women lifting weights greater than 50 kg (59.7% vs 15.2%; adjusted odds ratio 2.1; 95% confidence interval 1.7–3.4). There was no relationship between POP symptoms and body mass index, forceps delivery, cesarean section, hysterectomy, or menopausal status.

Conclusion Physically active women who lift heavy weights for exercise do not have an increased prevalence of POP symptoms. Advice on the contribution of heavy weight lifting as part of a physical activity regime to the pathophysiology of POP requires further investigation.

Keywords Pelvic organ prolapse · Prolapse · Bulge · Heavy weight lifting · Exercise · POP

Introduction

Strength training is an essential component of recommended adult physical activity guidelines worldwide [1]. It has important health benefits for women and has been shown to reduce the risk of metabolic and cardiac diseases and improve musculoskeletal pain, psychological well-being, body composition, and bone mineral density [2]. Despite these known benefits, women at risk of developing (or worsening) pelvic organ prolapse (POP) are often advised to avoid heavy lifting [3]. This advice is based on the idea that increases in intra-abdominal pressure (IAP) and subsequent transmission of pressure to pelvic organ support structures during lifting contributes to pelvic floor dysfunction (PFD) [4]. Physiological studies examining IAP during physical activities in women have found a positive association with lifting weights and increases in IAP [5–8]; however, the relationship between heavy lifting and symptoms of POP has not been investigated in epidemiological studies.

The role of lifting heavy weights for exercise as a risk factor in the multifaceted pathophysiology of POP is unclear and leaves clinicians and patients confused surrounding exercise advice for women at risk of POP progression or development. Research suggests that multi-joint, high-load exercise

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(heavy weight lifting) in conjunction with impact training is necessary to sufficiently stimulate bone tissue adaptation in postmenopausal women with osteopenia and osteoporosis [9]. Precise loading requirements to produce adaptions to bone density are 85–90% of an individual's one-repetition maximum (the amount of weight that can be lifted only once) [9]. Thus, as heavy lifting will have a positive impact on bone health, there is a need to understand its relationship with POP so that a safe and appropriate load can be prescribed to women.

The aim of this study was to determine the prevalence of symptoms of POP and associated risk factors in women who lift light, moderate, and heavy weights for exercise and those who do not lift weight for exercise. POP symptoms were defined as the sensation of a vaginal bulge, which is a validated means of identifying POP on clinical examination [10].

Materials and methods

Participants

Women over the age of 18 years and proficient in the English language were invited through social media sites shared globally (e.g., Facebook, Instagram, and Twitter) to complete an anonymous online survey (SurveyMonkey) from August to November 2017. To increase recruitment of both physically active and non-exercising women, in addition to women with and without pelvic floor dysfunction symptoms, survey marketing highlighted the inclusion of women who neither participated in exercise nor experienced pelvic floor dysfunction in addition to stating the focus of understanding pelvic health in physical activity. The study was approved by the institutional Human Research Ethics Committee (approval #2017000580) and all participants provided informed consent prior to study participation.

Data collection

The online survey contained questions about symptoms of POP, risk factors for PFD, current and previous physical activity, and weight lifting participation, in addition to general demographics (age, height, weight).

Symptoms of POP were assessed using the Pelvic Floor Distress Inventory Short Form, PFDI-20, which is a 20-question, condition-specific validated questionnaire for PFD [11]. It contains three subscales relating to symptoms of urinary, vaginal, and bowel dysfunction and bother over the previous 3 months. The POP subscale (POPDI-6) is composed of six questions relating to vaginal symptoms associated with POP, including lower abdominal pressure, pelvic heaviness, sensation of a vaginal bulge, splinting for voiding or emptying bowels, and incomplete bladder emptying. A response scale of 0–4 is used for each question, with "0" indicating no symptom presence and "1" through "4" indicating symptom presence and increasing bother.

Participants were asked about factors proposed to be associated with POP. Based on the Epidemiology of Prolapse and Incontinence Questionnaire (EPIQ) [12], participants were asked about parity (number of deliveries); mode of delivery (vaginal/cesarean); forceps use in childbirth (yes/no/do not know); family history of POP (yes/no/do not know); previous hysterectomy (yes/no); and menopausal status (yes/no/do not know). As the presence of constipation or the history of hemorrhoids [13] has been found to be associated with POP, participants were also asked to indicate if they had ever been diagnosed with constipation or hemorrhoids.

Participants were asked about their physical activity participation. Women who indicated that they participated in physical activity were asked whether they lifted "weights that are greater than 15 kg (33 lb), excluding any children." Those who answered "yes" to this question were asked to indicate the approximate maximum amount of weight lifted in any exercise. Those who answered "no" were asked to indicate why they did not lift greater than 15 kg (excluding children) with multiple response options including current/previous pelvic floor dysfunction symptoms, fear of experiencing symptoms, lack of interest or confidence in lifting weights, and advice from a health professional not to lift heavy weights.

Data analysis

Body mass index (BMI) was calculated from weight and height and categorized as underweight (<18.49 kg/m^2), normal (18.50–24.99 kg/m^2), overweight (25.00–29.99 kg/m^2), and obese (>30 kg/m^2) [14]. Owing to low numbers in the underweight category ($n = 40$), the underweight and normal categories were combined for statistical analysis. Weight-lifting categories were grouped into a light-lifting group (0–15 kg), moderate-lifting group (16–50 kg), and a heavy-lifting group (>50 kg). Women who indicated that they do not participate in exercise were categorized as inactive.

Previous research has identified that the sensation of a vaginal bulge is the symptom with the greatest association with anatomical POP (defined as pelvic organ descent to the hymen or ≥ stage 2 as per the Pelvic Organ Prolapse-Quantification, POP-Q assessment) [10, 15, 16]. Therefore, the following POPDI-6 question was used to define the presence of symptoms of POP: "Do you usually have a bulge or something falling out that you can see or feel in your vaginal area?" As per the questionnaire, symptoms of POP were considered to be absent with a score of 0 and present with a score >0.

Statistical analysis

Statistical analysis was conducted using SPSS software (release 2017, IBM SPSS Statistics for Windows, version 25.0; IBM, Armonk, NY, USA). Descriptive statistics were performed for continuous and categorical data. Continuous variables are presented as mean (standard deviation [SD]) and categorical data are presented as number (percentage). The Chi-squared test for homogeneity was used to analyze the relationship between categorical variables and the presence of POP. Regression diagnostics were used to evaluate multicollinearity prior to the use of logistic regression to analyze the association between independent variables and symptoms of POP. A binomial logistic regression was performed to ascertain the effects of lifting weights, along with specific risk factors for POP, on the likelihood of participants having symptoms of POP (see Table 2). A Bonferroni correction was applied using all 13 terms in the model, resulting in statistical significance being accepted when $p < 0.05$. Variables found to be significant in the initial regression model were entered into the final regression model.

Results

Participant demographics

Of the 4,573 respondents to the survey, 3,934 were included in the study after exclusion of women who did not provide data on the POPDI subscale ($n = 637$), parity ($n = 1$) and amount of weight lifted during exercise ($n = 1$). The mean age of study participants was 40.3 years (range 18–88 years). Data for BMI is missing for 289 women owing to missing height ($n = 85$) or weight ($n = 209$) data (Table 1). There were differences in BMI between the lifting groups, with a greater proportion of obese women in the inactive group compared with all lifting groups ($p < 0.001$), and a higher proportion of overweight women in the heavy-lifting group compared with the light-lifting group ($p < 0.001$; Table 1). A greater number of women in the inactive group had vaginal deliveries than in the heavy-lifting group ($p < 0.001$; Table 1). More women were postmenopausal in the light-lifting group compared with the moderate- and heavy-lifting groups ($p < 0.001$; Table 1).

Among the women in the light-lifting group, 13.7% ($n = 239$) reported current or previous pressure/heaviness/vaginal bulge sensation as the reason for not lifting greater than 15 kg. Almost half of women in the light-lifting group (49.2%) indicated that lifting heavier weight was not their exercise priority.

Presence of POP

Of the total study participants, 14.4% reported the presence of symptoms of POP, defined as a vaginal bulge sensation. The proportion of participants with symptoms of POP in the heavy-lifting group (7.1%) was significantly lower than both the inactive group (21.3%) and light-lifting group (19.4%, $p < 0.001$; Fig. 1). There was no significant difference in the prevalence of symptoms of POP between the inactive and light-lifting groups, and the moderate- and heavy-lifting groups (all $p > 0.05$).

Risk factors for POP

All unadjusted risk factors except for BMI ($p = 0.71$) were associated with symptoms of POP (Table 2). Forceps delivery, cesarean section, hysterectomy, and menopausal status were not significantly associated with the presence of a vaginal bulge in the adjusted regression analysis (Table 2). Vaginal parity (compared with no vaginal delivery) had the strongest association with symptoms of POP (OR 5.41; 95% CI 4.10–7.14). The final logistic regression model consisted of vaginal parity, history of constipation and/or hemorrhoids, family history of POP, age, and category of weight lifted ($\chi^2 = 473.77$, $p < 0.001$; Table 2). This final regression model explained between 11.2% (Cox and Snell R^2) and 20.2% (Nagelkerke R^2) of the outcome variability. Sensitivity was very low at 1.8%, but specificity was very high at 99.7%. Positive predictive value was 50.0% and negative predictive value was 74.3%.

When vaginal parity, history of constipation and/or hemorrhoids, family history of POP, and age were included as covariates, inactive women and women in the light-lifting group were more likely to report symptoms of POP than women in the heavy-lifting group (Table 2). There was no significant difference in symptoms of POP between the moderate- and heavy-lifting groups.

Discussion

The aim of this study was to determine the prevalence of symptoms of POP, as defined by the sensation of a vaginal bulge, and associated risk factors in women who lift light, moderate, and heavy weights for exercise, in addition to women who do not lift any weights for exercise. This study found that symptoms of POP were more prevalent in inactive women and physically active women lifting ≤15 kg compared with women lifting heavier weights. Lifting light or no weights for exercise, vaginal parity, increasing age, family history of POP, and a history of constipation and/or hemorrhoids were associated with an increased risk of reporting symptoms of POP. No association was identified between symptoms of POP and forceps delivery, cesarean section, hysterectomy, menopausal status or BMI in this population of women.

Although there is a discrepancy in the evidence for the effects of strenuous exercise on POP, there is limited literature

Table 1 Participant characteristics

Characteristic	Total ($n = 3,934$)	Inactive group ($n = 394$)	Light-lifting group ($n = 1,739$)	Moderate-lifting group ($n = 597$)	Heavy-lifting group ($n = 1,204$)
Age, years[a]	40.3 (11.3)	41.1 (11.9)	42.6 (12.5)	38.8 (10.2)	37.3 (8.8)
BMI, kg/m^2[a]	25.8 (5.3)	28.3 (6.7)	25.6 (5.3)	24.9 (4.3)	25.9 (5.1)
BMI categories, *n* (%)					
Underweight/normal	1,987 (50.5)	135 (34.3)	906 (52.1)	337 (56.4)	609 (50.6)
Overweight	1,008 (25.6)	93 (23.6)	415 (23.9)	159 (26.6)	341 (28.3)
Obese	650 (16.5)	125 (31.7)	284 (16.3)	63 (10.6)	178 (14.8)
Missing	289 (7.3)	41 (10.4)	134 (7.7)	38 (6.4)	76 (6.3)
Vaginal parity, *n* (%)					
0	1,701 (43.2)	130 (33.0)	635 (36.5)	277 (46.4)	659 (54.7)
1	678 (17.2)	87 (22.1)	309 (17.8)	95 (15.9)	187 (15.5)
2	987 (25.1)	106 (26.9)	498 (28.6)	141 (23.6)	242 (20.1)
3+	567 (14.4)	71 (18.0)	296 (17.0)	84 (14.1)	116 (9.6)
Missing	1 (0.1)		1 (0.1)		
Forceps delivery, *n* (%)	405(10.3)	56 (14.2)	216 (12.4)	56 (9.4)	77 (6.4)
Cesarean delivery, *n* (%)	277 (7.0)	36 (9.1)	116 (6.7)	48 (8.0)	77 (6.4)
Postmenopausal, *n* (%)	684 (17.4)	85 (21.6)	423 (24.3)	74 (12.4)	102 (8.5)
Hysterectomy, *n* (%)	201 (5.1)	30 (7.6)	117 (6.7)	24 (4.0)	30 (2.5)
Family history of POP, *n* (%)	714 (18.1)	84 (21.3)	360 (20.7)	106 (17.8)	164 (13.6)
Missing	1 (0.1)		1 (0.1)		
Constipation/hemorrhoids, *n* (%)	1,081 (27.5)	112 (28.4)	526 (30.2)	168 (28.1)	275 (22.8)

Light-lifting group 0–15 kg, *Moderate-lifting group* 16–50 kg, *Heavy-lifting group* > 50 kg, *Underweight* < 18.49 kg/m^2, *Normal* 18.5–24.9 kg/m^2, *Overweight* 25–29.9 kg/m^2, *Obese* > 30 kg/m^2 *BMI* body mass index, *POP* pelvic organ prolapse

[a] Values expressed as mean (standard deviation)

specifically assessing the prevalence of POP in women participating in lifting heavy weights for physical activity, as opposed to occupational heavy lifting [17]. A study investigating the relationship between non-obstetric risk factors and symptomatic POP (diagnosed via the POP-Q) found that women who reported engaging in high-impact physical activities (which included running, weight-lifting, tennis, and other ball sports) had a lower prevalence of symptomatic POP than women engaging in low-impact physical activity [13]. Our data are consistent with this finding, and further extend our

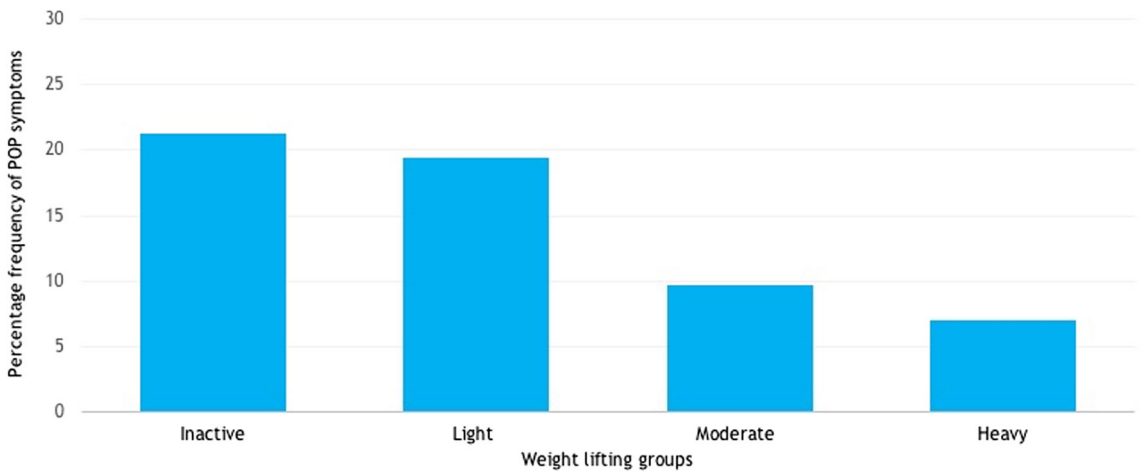

Fig. 1 Total prevalence of symptoms of POP. Weight-lifting groups: *light*, 0–15 kg; *moderate*, 16–50 kg; *heavy*, >50 kg *POP*, pelvic organ prolapse

Table 2 Odds ratios for the relationship between risk factors and symptoms of pelvic organ prolapse

Risk factor	Symptoms of POP ($n = 566$)	Unadjusted OR (95% CI)	p value	Adjusted[b] OR (95% CI)	p value
Age, years*	45.9 (12.7)	1.05 (1.04–1.06)	<0.001	1.02 (1.01–1.03)	0.004
BMI, kg/m^2	25.7 (5.1)	1.00 (0.98–1.01)	0.71	NS	–
Underweight/normal, *n* (%)	303 (53.5)	1.0 (Reference)	0.37	NS	–
Overweight, *n* (%)	135 (23.9)	0.86 (0.69–1.07)	0.18	NS	–
Obese, *n* (%)	99 (17.5)	1.00 (0.78–1.28)	0.99	NS	–
Vaginally parity, *n* (%)*[a]	507 (88.7)	7.43 (5.68–9.72)	<0.001	5.34 (4.02–7.11)	<0.001
Forceps delivery, *n* (%)[a]	103 (18.2)	2.26 (1.80–2.88)	<0.001	1.00 (0.77–1.31)	0.981
Cesarean delivery, *n* (%)[a]	64 (11.3)	1.89 (1.41–2.54)	<0.001	1.23 (0.90–1.68)	0.194
Postmenopausal, *n* (%)[a]	182 (32.2)	2.78 (2.27–3.41)	<0.001	1.20 (0.84–1.71)	0.327
Hysterectomy, *n* (%)[a]	50 (8.8)	2.06 (1.48–2.88)	<0.001	0.91 (0.63–1.33)	0.631
Family history of POP, *n* (%)*[a]	161 (28.4)	2.73 (2.15–3.45)	<0.001	2.21 (1.72–2.84)	<0.001
Constipation/hemorrhoids, *n* (%)*[a]	192 (33.9)	1.43 (1.18–2.73)	<0.001	1.27 (1.03–1.55)	0.022
Inactive group, *n* (%)*	84 (14.8)	3.52 (2.54–4.88)	<0.001	2.43 (1.72–3.42)	<0.001
Light-lifting group, *n* (%)*	338 (59.7)	3.14 (2.44–4.03)	<0.001	2.13 (1.63–2.77)	<0.001
Moderate-lifting group, *n* (%)	58 (10.2)	1.40 (0.99–1.98)	0.059	1.15 (0.80–1.65)	0.446
Heavy-lifting group, *n* (%)	86 (15.2)	1.0 (Reference)		1.0 (Reference)	–

Values expressed as means (SD) or numbers of cohort (percentage)

Light-lifting group 0–15 kg, *Moderate-lifting group* 16–50 kg, *Heavy-lifting group* > 50 kg, *BMI* body mass index, *CI* confidence interval, *NS* not significant, *OR* odds ratio, *POP* pelvic organ prolapse, *SD* standard deviation

*Significant in final regression analysis

[a] Reference category consists of the absence of risk factor

[b] Adjusted for all factors except BMI

understanding of the relationship between amount of weight lifted for exercise and symptoms of POP. A recent study in young, nulliparous women with a minimum 6-month history of lifting heavy weights for exercise reported a low prevalence of symptoms of POP, with only one of the 70 study participants reporting symptoms of POP [18]. Although this study did not consider different amounts of weight lifted, it supports our findings of a low prevalence of symptoms of POP in women who lift moderate and heavy weight for exercise.

In contrast to our results, a significant association between heavy lifting and POP in rural, low-income countries has been established [17, 19]. There are a number of important differences between these populations and the participants in our study, which may explain these differences in findings. In many rural areas in low-income countries, women spend a large amount of time carrying and lifting heavy objects during farming, trading, and housework. A recent study of 1,047 women in a rural Tanzanian community found that the median hours spent heavy lifting were 2 h per day, with an upper limit of 10 h per day. This study also found a relationship between POP ≥1 cm below the hymen and carrying heavy objects for ≥5 h per day [19]. The participants in our study, who were lifting weights as part of an optional exercise program, would have considerably lower daily and weekly exposure to lifting and carrying loads.

It has been suggested that vaginal symptoms such as increased sensitivity may be the cause of hormonal changes during the menopause [20]. Given the higher percentage of postmenopausal women in both the inactive and light-lifting groups in our study (21.6% and 24.3% respectively), there is a possibility that the higher prevalence of symptoms of POP reported in these groups may be, in part, due to an increased awareness of a vaginal bulge sensation. Although our final logistic regression model did not find an association between postmenopausal women and symptoms of POP, there was a significant association found in the unadjusted analysis (Table 2).

Adjusted data from our regression analysis indicated that among the factors investigated in our study, vaginal parity had the strongest association with symptoms of POP and inactivity had the second strongest association. Previous research has established a relationship between vaginal parity and symptoms of POP, which is suggested to be related to structural trauma to the pelvic floor during a vaginal delivery [21, 22]. To the best of our knowledge, relationships between inactivity and symptoms of POP have not previously been studied. Consistent with other research [13, 23], a family history of POP and a history of constipation or hemorrhoids were also associated with reporting symptoms of POP in our study. A family history of POP has been proposed as a risk factor for POP owing to the genetic make-up of the connective tissue matrix of the fascial support of pelvic organs [13, 23]. Constipation may be associated with repeated straining to empty the bowels, which in turn may contribute to hemorrhoids and POP [24].

Although literature shows the use of forceps during childbirth to be a significant risk factor for POP [25, 26], our study only found a significant relationship with the symptom of a vaginal bulge in univariate analysis (Table 2). This suggests that other factors, such as vaginal parity, might be responsible for the previously reported association between forceps use and POP. Our data did not identify an association between BMI and symptoms of POP. A recent systematic review and meta-analysis found a positive association between high BMI and subjective POP [27]; however, the literature surrounding this relationship is mixed with other studies reporting no relationship [28] or a weak negative relationship [29].

The prevalence of symptoms of POP in our study (14.4%) is higher than previous population studies, which report a prevalence of up to 11.4% [28]. This difference may be due to the recruitment of our study population, which was largely through social media groups connected to health and fitness professionals working in the area of women's health. Thus, pelvic floor dysfunction and symptoms of POP may be more common in our study participants because of these connections.

Although key strengths of our study include the large number of participants and use of validated questionnaires to assess symptoms of POP and risk factors, there are also limitations that must be considered. First, as this was an online survey study, only subjective complaints of POP were examined without confirmation of actual anatomical descent. Whereas the symptom of a vaginal bulge has been correlated with objective findings of anatomical POP [10, 15, 16], some studies have not found an association between symptoms and anatomical descent [30]. Second, there were no exclusion criteria for study participation so as to recruit a diverse population of women. It is possible that women may have been pregnant or early postpartum and may have been inactive or had higher BMI for these reasons, rather than because of sedentary lifestyles. We did not ask *why* women in the inactive group were not physically active. As reported by 13.7% of the light-lifting group, it is possible that POP symptoms may have been a reason for inactivity, potentially influencing the prevalence of POP symptoms in inactive women. Further, although our study focused on POP, it is important to recognize that many women report urinary incontinence as a barrier to exercise [31]. These women, who may also have POP, may self-select lighter physical activity choices or opt out of any physical activity owing to fear or embarrassment associated with leaking. More research is needed to understand if symptoms of POP is a reason why women do not lift heavy weights. We also did not ask about vocational lifting and lifting of children, to focus on symptoms of POP within purposeful exercise. Third, classification of heavy lifting was based on reports of the maximum weight used in any exercise, which may not have represented genuine heavy training loads of >80% one-repetition maximum (1RM). It is also possible that some women in the moderate-lifting group (16–50 kg) may have been lifting at or above 80% of their 1RM. We did not determine the type or frequency of exercise during which heavy weight was lifted, nor the overall history of heavy lifting. Certain exercises (such as very low squats) may have a greater impact on the pelvic floor musculature and pelvic organs than others, as could frequency and duration of heavy lifting. Fourth, as data collection was undertaken online, only women with access to the internet were able to participate. Although this facilitated global participation from a large sample, it may have limited the demographic range of respondents.

Interestingly, our data indicate that women who lift heavy weights for exercise do not have an increased prevalence of symptoms of POP, whereas inactivity and lifting light weight were associated with symptoms of POP. This is in contrast to research on stress urinary incontinence (SUI) that suggests a higher prevalence of SUI in individuals who participate in high-impact compared with low-impact activities (58.1% vs 12.5% respectively) [32]. These findings challenge the assumption that heavy lifting should be avoided owing to the risk of developing symptoms of POP.

Conclusion

Strength training is essential for the overall health and wellbeing of women. Our findings provide novel insight into the prevalence of symptoms of POP in women lifting weight for exercise. Further longitudinal research is needed to better understand the immediate and long-term consequences of heavy lifting on POP in women with and without POP risk factors. This information will guide professionals in the provision of advice on lifting restrictions in healthy and potentially vulnerable populations, and facilitate safe participation in strength training for a healthy lifestyle.

Author contributions L.B. Forner: project development, data collection, data analysis, manuscript writing; E.M. Beckman: project development, data collection, data analysis, manuscript writing; M.D. Smith: project development, data collection, data analysis, manuscript writing.

Compliance with ethical standards

Conflicts of interest L.B. Forner is a private practice physiotherapist. E.M. Beckman and M.D. Smith declare that they have no conflicts of interest.

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