Accepted: 14 December 2022

DOI: 10.1111/1471-0528.17397

BJOG An International Journal of Obstetrics and Gynaecology

RESEARCH ARTICLE

Early adulthood and current physical activity and their association with symptoms of pelvic floor disorders in middle-aged women: An observational study with retrospective physical activity assessment

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Funding information
Suomen Akatemia, Grant/Award Number: 275323, 309504, 314181 and 335249

Abstract

Objective: To investigate associations of early and middle adulthood physical activity (PA) with symptoms of pelvic floor disorders (PFDs), i.e. stress urinary incontinence (SUI), urge urinary incontinence (UUI), faecal incontinence (FI), constipation or defecation difficulties (CDDs) and feeling of pelvic organ prolapse (POP) among middle-aged women.

Design: A cross-sectional, observational study with retrospective PA assessment.

Setting: University Research Laboratory.

Sample: A random population sample of 1098 Finnish women aged 47–55 years.

Methods: Early adulthood PA, current PA, and demographic and gynaecological variables were assessed using self-report questionnaires. Logistic regression analyses were applied to study associations of PA variables with symptoms of PFDs. Potential confounding effects of demographic and gynaecological variables were controlled in multiple logistic regression models.

Main Outcome Measures: Structured questionnaire-assessed retrospective PA assessment at the age of 17–29 years, current PA at middle age, and prevalence of symptoms of CDD, FI, POP, SUI and UUI.

Results: Current PA was not independently associated with the occurrence of the symptoms of PFDs. Middle-aged women with an early adulthood history of competitive sports were more likely to experience symptoms of UUI (OR 2.16, 95% CI 1.10–4.24, $p = 0.025$) but not symptoms of SUI, FI, CDD or POP, whereas women with a history of regular PA were more likely to experience symptoms of FI (OR 4.41, 95% CI 1.05–18.49, $p = 0.043$) but no other symptoms of PFDs.

Conclusions: Competitive sports during early adulthood may increase the risk of UUI in middle age. Regular PA during early adulthood may increase the risk of FI.

KEYWORDS
exercise, menopausal women, pelvic floor function

1 | INTRODUCTION

In women, ageing-related changes in sex hormones accelerate during middle age, leading to the permanent cessation of ovarian function.[1] The menopausal decline in serum estrogen concentration may lead to changes in the pelvic floor tissue and potentially to disorders,[2] such as urinary and faecal incontinences, constipation or defecation difficulties and pelvic organ prolapse.[3–6] In addition to hormonal changes, several factors contribute to pelvic floor disorders, including the natural aging of the connective tissue, reproductive history and lifestyle, as well as factors increasing intra-abdominal pressure.[7,8]

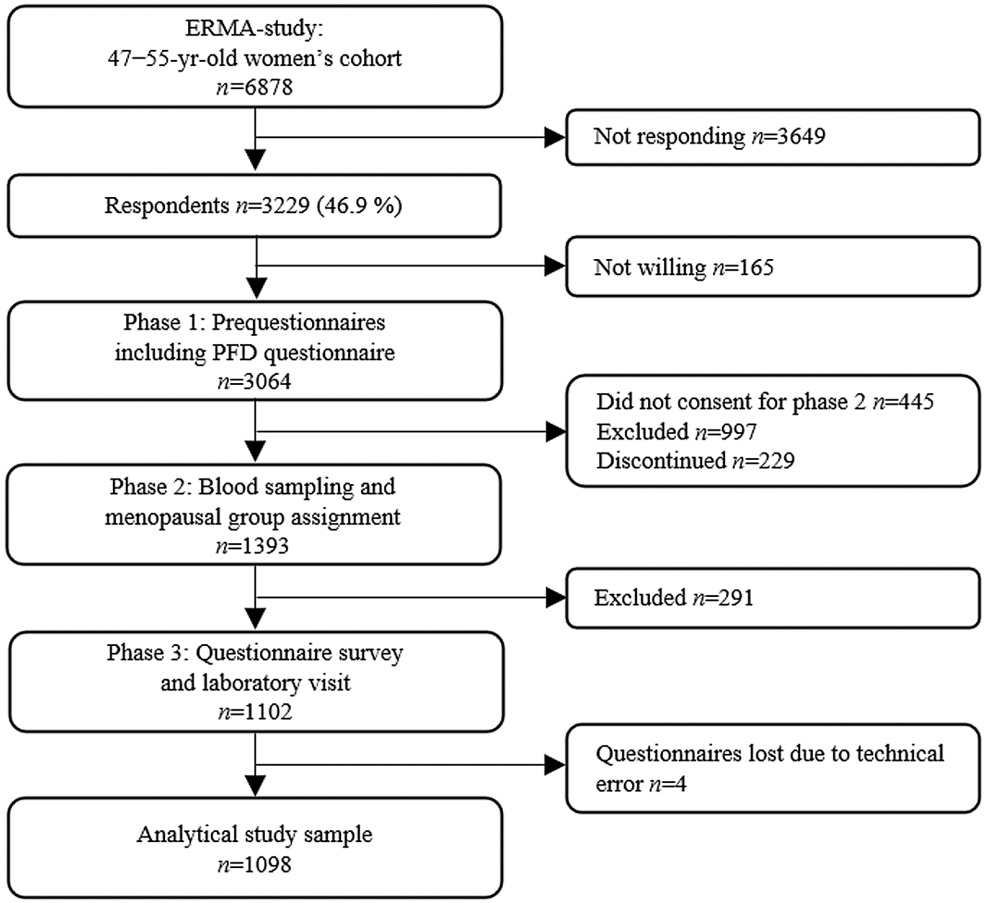

FIGURE 1 Flow chart for the recruitment process.

The significance of physical activity is broadly studied and because of its numerous health benefits it can be recommended for treating a wide range of diseases and conditions.[9] However, the effects of physical activity on a woman's pelvic floor are complicated; the merely positive influence of physical activity has been challenged,[10,11] as pelvic floor disorders are associated with not only reduced but also notably increased physical activity.[12,13] It is debated that although exercise may decrease the risk of incontinence and pelvic organ prolapse by strengthening pelvic floor muscles, it may also overload and stretch the muscles, thus increasing the risk of pelvic floor disorders.[11] As physical activity is a potentially modifiable risk factor for pelvic floor disorders, its associations with pelvic floor symptoms must be studied.

Several studies have been conducted on the associations of pelvic floor disorders and participation in competitive sports in early adulthood,[14–16] but studies on the consequences of strenuous activities during early adulthood to the condition of pelvic floor later in life are scarce. The purpose of the current study is to investigate associations of early and middle adulthood physical activity with symptoms of stress urinary incontinence, urge urinary incontinence, faecal incontinence, constipation or defecation difficulties and the feeling of pelvic organ prolapse. We hypothesised that participation in physical activity during adulthood may be differentially associated with symptoms of pelvic floor disorders occurring at midlife. It is known that at all ages high-intensity physical activity leads to a greater strain on the pelvic floor, and therefore participation in competitive-level sport in early adulthood may enhance the risk of developing symptoms of pelvic floor disorders at midlife. In contrast, in general being physically active at midlife is beneficial for maintaining muscle strength and physical functioning, and thus may be associated with a lower risk of having symptoms of pelvic floor disorders.

2 | METHODS

2.1 | Study design and participants

This study uses data originating from the cross-sectional, observational study Estrogenic Regulation of Muscle Apoptosis (ERMA), which investigated how hormonal differences over menopausal stages affects the physiological and psychological functioning of middle-aged women (data set: https://doi.org/10.17011/jyx/dataset/83491). The study data collection proceeded in three phases, described in detail by Kovanen et al.[17] and summarised in Figure 1. Briefly, a written invitation was sent to 6878 randomly selected women aged 47–55 years living in Central Finland. The response rate was 46.9%. In total, 3064 women were willing

to participate in ERMA phase 1 and, in addition to written consent, they returned a pre-questionnaire that included questions on symptoms of pelvic floor disorders. Thereafter, the exclusion criteria included conditions or use of estrogen-containing medications affecting ovarian function, obesity (self-reported body mass index, BMI > 35 kg/m^2) and chronic diseases or medications affecting muscle function. From the eligible participants (n = 1627), 1393 gave fasting blood samples (phase 2) and 1102 of them answered to the main questionnaire survey (phase 3). The sample size of the present study is 1098, as four main questionnaires were lost through technical error. The study protocol followed good clinical and scientific practice and the Declaration of Helsinki, and was approved by the Ethics Committee of the Central Finland Health Care District (KSSHP Dnro 8U/2014).

2.2 | Pelvic floor disorders

The occurrence of stress urinary incontinence, urge urinary incontinence, faecal incontinence, constipation or defecation difficulties and the feeling of pelvic organ prolapse within the previous month were assessed by a structured questionnaire in ERMA data collection phase 1. The specific questions were as follows: have you had within the last month urinary incontinence during physical effort or coughing; have you had within the last month urge or urgency-related urinary incontinence; have you had within the last month faecal incontinence; have you had within the last month constipation or defecation difficulties; have you had within the last month a feeling that something is falling out of your vagina?

2.3 | Physical activity

Early adulthood physical activity and sport participation was assessed with the question: what kind of regular physical activity have you done at different stages of your life?[18] Participants were asked to specify their participation separately at the age of 17–19 years and 20–29 years by selecting one or more of the following four options: no physical activity; regular independent leisure-time physical activity (regularly going to school or work on foot or by bike, or doing regular exercise or daily incidental physical activity causing sweating, or regular hiking that is not organised by a school, sports club, fitness centre, etc.); regular competitive sport and related training (regular, goal-oriented competitive sport within a sports club, etc., and competing and training for this sport); and regular other supervised physical activity in a sports club, etc. (all regular non-competitive physical activity, organised by a sports club, fitness centre, Girl Scouts, etc.). They were also asked to specify which types of sports they competed in or were otherwise engaged in. Current physical activity was evaluated with a structured questionnaire including four questions about the frequency, intensity and duration of leisure-time physical activity bouts, and the average time spent in active commuting.[19] Based on these answers, a metabolic equivalent of task hours per day (MET-h/d) was calculated to express the intensity and volume of current physical activity.

2.4 | Demographical descriptives

Age was calculated from the date of birth to the date of answering the pre-questionnaire. BMI was calculated as body mass divided by height squared (kg/m^2). Body mass and height were measured in the morning of the phase-3 laboratory visit after overnight fasting and with the participant wearing only undergarments. Level of education was self-reported with a structured question and participants were classified into two groups based on their answers: those with bachelor level or higher education (tertiary) and those with education lower than bachelor level (secondary). Work-related physical activity was also assessed with a structured question. Based on their answers, participants were classified into three groups: mainly sedentary work; work that includes standing and walking; and heavy work that also includes lifting.

2.5 | Gynaecological variables

Participants were assigned to premenopausal, early and late perimenopausal, and postmenopausal groups according to the slightly modified Stages of Reproductive Aging Workshop (STRAW+10) criteria,[20] which takes systemic hormone status and self-reported menstrual cycle into account. Menstrual cycle was assessed based on a menstrual diary for 6–12 months. Follicle stimulating hormone (FSH) and 17β-estradiol (E_2) levels were determined, but only the FSH level was used to define menopausal status because of the high pulsatile variability in E_2 levels. Self-reported data on gynaecological factors, e.g. number of gestations, parity and whether a participant had undergone hysterectomy, were collected.

2.6 | Missing data

The total number of missing data values for the analytical sample including 1098 participants was 419 out of 15 372 (2.5%). The percentage of missing values varied from 0% to 16% among the variables. Data were absent as a result of invalid and missing measurements as well as unclear or incomplete questionnaire responses. Thus, missing data were assumed to occur at random. Multiple imputation was used to create and analyse 50 multiply imputed data sets, and the model parameters were estimated separately for each data set. The number of iterations used for chained equations was 50.[21] Multiple imputation and pooling of the model estimates were carried out in R,[22] using the standard settings of the 'mice' package.[21] For comparison, a complete case analysis was also performed but the results did not notably differ.

2.7 | Statistical analysis

Participant characteristics are shown as percentages or as means and standard deviations. The associations of previous and current physical activity with symptoms of pelvic floor disorders were analysed using logistic regression models. The confounding factors included in the models were age, BMI, education, physical workload, menopausal status, parity and hysterectomy status, as it is known that demographic factors as well as factors related to gynaecological history may affect pelvic floor disorders and physical activity. The model assumptions were tested using correlation analysis and inspecting residual plots as well as scatter plots between each continuous predictor and the logit values. Statistical analyses were performed using R and SPSS Statistics 22.0 (IBM, Armonk, NY, USA). The level of significance was set at $p \leq 0.05$.

3 | RESULTS

Table 1 shows demographic, gynaecological and physical activity status in the total analytical sample and in participants with different symptoms of pelvic floor disorders. The mean age of the participants was 51.2 years (SD 2.0 years). On average, the participants were slightly overweight according to the mean BMI value of 25.5 kg/m^2 (SD 3.7 kg/m^2). Most (59%) participants had an education that was lower than bachelor level and half (53%) reported their work-related physical activity as light, i.e. mainly sedentary work. Based on serum concentrations of circulating hormones and bleeding diaries, 28% of the women were categorised as premenopausal, 18% were categorised as early perimenopausal, 19% were categorised as late perimenopausal and 35% were categorised as postmenopausal. The mean values for number of gestations and parity were 2.5 and 2.0, respectively. About 8% of women had undergone hysterectomy. The groups of women reporting different types of pelvic floor symptoms were fairly similar, except that women with a feeling of pelvic organ prolapse were less likely to report mainly sedentary work (36%), were more likely to be postmenopausal (41%), had a slightly higher number of gestations (3.2, SD 1.8) and were more likely to have had a hysterectomy (20%) than women in other groups. Furthermore, in comparison with other groups, the group of women with faecal incontinence had the highest BMI (27.1 kg/m^2) and lowest education level (74% reported secondary education).

The mean current physical activity was 4.5 MET-h/d (SD 3.9 MET-h/d) for the total analytical sample, and ranged from 3.6 to 4.4 MET-h/d for women reporting different types of pelvic floor symptoms. With regards to previous physical activity, 24% of the women were inactive, 67% took part in regular physical activity and 10% did competitive sports during their early adulthood. Most typically they competed in volleyball (37%), in other ball sports (28%), in track and field or orienteering (15%), in skiing, other winter sports or gymnastics (5%). Most (90%) of the women reporting faecal incontinence had exercised regularly, but only one of them (3%) recalled that she had practiced competitive sports. Women reporting urge urinary incontinence formed the group with the highest number of competitive sport athletes during early adulthood (13%).

Differences in the reported frequencies of symptoms of pelvic floor disorders between the larger phase-1 sample and the smaller phase-3 sample were minor, indicating the good representativeness of the analytical sample (Table 2). About 55% of women reported having any symptoms of disorder and about 19% experienced more than one type of symptom of pelvic floor disorder. The most common disorder symptoms were stress urinary incontinence (40%), constipation or defecation difficulties (17%) and urge urinary incontinence (14%). The feeling of pelvic organ prolapse (5%) and symptoms of faecal incontinence (3%) were less often reported.

Simple logistic regression models indicated higher current physical activity was associated only with lower odds of experiencing symptoms of stress urinary incontinence (OR 0.96, 95% CI 0.93–0.99, $p = 0.023$; Table S1), but not with any other type of pelvic floor disorder. However, the statistical significance of the association was abolished after including early adulthood physical activity, and demographic and gynaecological variables as potential confounding factors in the same model (Table 3).

In comparison with not exercising during early adulthood, women who had engaged in uncompetitive sports were more likely to experience symptoms of urge urinary incontinence according to simple (OR 2.07, 95% CI 1.07–4.00, $p = 0.031$; Table S1) and multiple (OR 2.16, 95% CI 1.10–4.24, $p = 0.025$; Table 3) logistic regression models, controlled for current physical activity and several demographic and gynaecological factors. Participation in competitive sport in early adulthood was not associated with other pelvic floor disorder symptoms. Similarly, women who had engaged in regular physical activity were more likely to experience symptoms of faecal incontinence according to simple (OR 3.92, 95% CI 0.95–16.17, $p = 0.059$; Table S1) and multiple (OR 4.41, 95% CI 1.05–18.49, $p = 0.043$; Table 3) logistic regression models, but no significant associations were found for other symptoms of pelvic floor disorders.

4 | DISCUSSION

4.1 | Main findings

In this study, we focused on the association of previous and current physical activity with symptoms of pelvic floor disorders in middle-aged women. Over half of the women in our total analytical sample had symptoms of urinary or faecal incontinence, constipation or defecation difficulties or pelvic organ prolapse. We found that higher current physical activity tended to be associated with a lower risk of stress urinary incontinence, but was not associated with any other symptoms of pelvic floor disorder. Women who had engaged in competitive sports during early adulthood were more likely to experience symptoms of urge urinary incontinence, but not other pelvic

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TABLE 1 Descriptive data in total analytical sample and in participants with different types of pelvic floor disorder.

	Total analytical sample (*n* = 1098)	Stress urinary incontinence (*n* = 440)	Urge urinary incontinence (*n* = 149)	Faecal incontinence (*n* = 34)	Constipation or defecation difficulties (*n* = 189)	Feeling of pelvic organ prolapse (*n* = 56)
Demographics						
Age (years), mean (SD)	51.2 (2.0)	51.0 (2.0)	51.4 (2.1)	52.0 (2.1)	51.0 (2.0)	51.3 (2.1)
BMI (kg/m^2), mean (SD)	25.5 (3.7)	26.2 (3.8)	25.3 (3.6)	27.1 (3.4)	25.9 (3.4)	25.9 (3.2)
Missing data, *n*	171	77	21	5	35	9
Education, *n* (%)						
Secondary	643 (58.6)	273 (62.0)	92 (61.7)	25 (73.5)	127 (67.2)	39 (69.6)
Tertiary	455 (41.4)	167 (38.0)	57 (38.3)	9 (26.5)	62 (32.8)	17 (30.4)
Physical workload, *n* (%)						
Light	535 (53.0)	204 (50.0)	61 (45.9)	15 (50.0)	88 (51.2)	18 (36.0)
Moderate	203 (20.1)	80 (19.6)	27 (20.3)	6 (20.0)	34 (19.8)	13 (26.0)
Heavy	271 (26.9)	124 (30.4)	45 (33.8)	9 (30.0)	50 (29.1)	19 (38.0)
Missing data, *n*	89	32	16	4	17	6
Gynaecological variables						
Menopausal status, *n* (%)						
Premenopausal	304 (27.7)	136 (30.9)	39 (26.2)	10 (29.4)	58 (30.7)	15 (26.8)
Early perimenopausal	198 (18.0)	94 (21.4)	28 (18.8)	7 (20.6)	35 (18.5)	9 (16.1)
Late perimenopausal	209 (19.0)	68 (15.5)	24 (16.1)	5 (14.7)	41 (21.7)	9 (16.1)
Postmenopausal	387 (35.2)	142 (32.3)	58 (38.9)	12 (35.3)	55 (29.1)	23 (41.1)
Gestations, mean (SD)	2.5 (1.6)	2.7 (1.6)	2.5 (1.4)	2.7 (1.6)	2.6 (1.7)	3.2 (1.8)
Missing data, *n*	7	4	2	0	4	1
Parity, mean (SD)	2.0 (1.2)	2.1 (1.3)	2.1 (1.1)	2.2 (1.4)	2.1 (1.4)	2.5 (1.2)
Missing data, *n*	2	2	0	0	0	0
Hysterectomy, *n* (%)						
No	1007 (91.8)	402 (91.4)	132 (88.6)	30 (88.2)	164 (86.8)	45 (80.4)
Yes	90 (8.2)	38 (8.6)	17 (11.4)	4 (11.8)	25 (13.2)	11 (19.6)
Missing data, *n*	1	0	0	0	0	0
Physical activity						
Previous PA (age 17–29 years), *n* (%)						
No exercise	234 (23.7)	97 (24.3)	24 (17.8)	2 (6.7)	42 (24.3)	17 (34.7)
Regular PA	658 (66.7)	266 (66.7)	93 (68.9)	27 (90.0)	121 (69.9)	30 (61.2)
Competitive sport	94 (9.5)	36 (9.0)	18 (13.3)	1 (3.3)	10 (5.8)	2 (4.1)
Missing data	112	41	14	4	16	7
Current PA (MET-h/d), mean (SD)	4.5 (3.9)	4.2 (3.6)	4.3 (3.4)	3.6 (2.9)	4.4 (3.8)	4.2 (4.7)
Missing data	7	3	0	0	2	0

floor disorder types. Similarly, women who had engaged in regular physical activity were more likely to experience symptoms of faecal incontinence, but no significant associations were found for other symptoms of pelvic floor disorders.

4.2 | Strengths and limitations

The present study had several strengths. It was conducted in a large homogenous cohort of relatively healthy Finnish women, which permits precise measurements without a need to control for potential confounding factors (e.g. ethnicity, health or income). In contrast, our results may not be generalisable to more heterogenous populations. Unique to our study was the exact determination of menopause status of the participants by FSH measurements and menstrual bleeding diaries. This enabled us to adjust the models with menopause status, and reliably evaluate its association with symptoms of pelvic floor disorders. Furthermore, the extent of this study is exceptional: five different symptoms of pelvic

TABLE 2 Frequencies of pelvic floor disorders in the phase-1 sample and in the analytical sample.

Variables	Phase-1 sample ($n = 3064$)	Analytical sample ($n = 1098$)
Any type of disorder, *n* (%)	1671 (54.7)	605 (55.2)
Missing data, *n*	7	2
Stress urinary incontinence, *n* (%)	1179 (38.7)	440 (40.3)
Missing data, *n*	17	6
Urge urinary incontinence, *n* (%)	405 (13.3)	149 (13.6)
Missing data, *n*	24	6
Faecal incontinence, *n* (%)	97 (3.2)	34 (3.1)
Missing data, *n*	17	8
Constipation or defecation difficulties, *n* (%)	593 (19.5)	189 (17.3)
Missing data, *n*	19	6
Feeling of pelvic organ prolapse, *n* (%)	152 (5.0)	56 (5.1)
Missing data, *n*	17	4
Number of pelvic floor disorders, *n* (%)		
None	1386 (45.5)	491 (45.0)
One	1081 (35.5)	397 (36.4)
Two or more	577 (19.0)	202 (18.5)
Missing data, *n*	20	8

floor disorders were studied among the large observational cohort, including retrospective data for early adulthood physical activity.

The study also had some limitations. The pelvic floor disorder symptoms experienced by the women were determined by a postal questionnaire at an early stage of the study. We were not able to study whether this timing has influenced the willingness of the participants to report the conditions that may be considered sensitive. In addition, the threshold to report pelvic floor disorders may vary, as the experience with symptoms is likely to differ from person to person, and the symptoms may also remain unrecognised.[23,24] It is a limitation that we relied on self-report and used a questionnaire for the symptoms of pelvic floor disorders that was not validated. The questionnaire used is simplistic and commonly used in clinics, and thus we estimated it would be understandable and easy to answer in a questionnaire delivered by regular mail. The study was cross-sectional and cannot therefore reveal whether women did not experience symptoms of pelvic floor disorders because they exercised or were able to exercise because they were asymptomatic.

Pelvic floor disorders have been associated with higher BMIs;[25–27] however, women with BMIs > 35 kg/m^2 were excluded from the analytical study sample, and thus the results cannot be generalised to severely obese individuals. However, there were no obvious differences in the prevalence of any type of pelvic floor disorder symptoms in the large phase-1 study sample, in which BMI was not used as an exclusion criterion, and in the analytical sample. Another limitation is that previous and current physical activity were self-reported, which may result in some recall or reporting bias, underestimating the number of low and overestimating the number of high physically active participants.[28]

4.3 | Interpretation

Previous studies on urinary incontinence reveal a population-based prevalence of 25%–45% among women,[29–32] which is in line with the present study, as symptoms of stress urinary incontinence were reported by 40% of participants. In previous studies low-intensity current leisure activities, such as walking, were associated with lower odds of stress urinary incontinence; whereas a lack of exercise increased these odds.[13,25,31,33] Similarly, in the current study, we found that higher current physical activity tended to be associated with a lower risk of stress urinary incontinence. There are a few studies on the association of competitive sports in early adulthood with urinary incontinence later in life. Both Nygaard and Bø and Sundgot-Borgen concluded that former female elite athletes who participated in regular, strenuous, high-impact activity did not have a higher risk of urinary incontinence after approximately 20 years follow-up.[34,35] In contrast, we found that competitive sport in early adulthood was associated with symptoms of urge urinary incontinence in middle adulthood, and this association remained strong when current physical activity and confounding factors were controlled.

The estimated prevalence of faecal incontinence varies widely, as definitions may include flatus in addition to liquid and solid stools (anal incontinence) or exclude flatus (faecal incontinence). Previously, faecal incontinence is estimated to affect 7%–12% of community-dwelling women.[36–38] The prevalence of the symptoms of faecal incontinence was only 3% in our sample. Physical activity affects colonic motor function,[39,40] probably in a manner proportional to the level and duration of activity.[41] Lower physical activity has been associated with faecal incontinence in women aged 62–87 years.[42] In the National Health and Nutrition Examination Study, adults with a greater perceived severity of faecal incontinence engaged in less moderate-to-vigorous physical activity.[43] Furthermore, brisk physical activity, running in particular, may predispose women to gastrointestinal disturbance.[44,45] According to Vitton et al. women aged 18–40 years who engaged in high-intensity sport for over 8 h a week had a significantly higher risk of anal incontinence than less active women.[46] Interestingly, we also found an association of regular physical activity in early adulthood with symptoms of faecal incontinence, and the association became stronger after adding current physical activity and demographic and gynaecological variables in the model. Competitive sports or inactivity in early adulthood or current physical activity in middle age were not associated with these symptoms. It is noteworthy that the small prevalence

TABLE 3 Pooled multiple logistic regression model estimates (n = 1098).

	Stress urinary incontinence		Urge urinary incontinence		Faecal incontinence		Constipation or defecation difficulties		Feeling of pelvic organ prolapse	
	OR (95% CI)	*p*	OR (95% CI)	*p*	OR (95% CI)	*p*	OR (95% CI)	*p*	OR (95% CI)	*p*
Physical activity										
Previous PA (age 17–29 years)										
No exercise (ref.)	1		1		1		1		1	
Regular PA	0.95 (0.69–1.30)	0.746	1.48 (0.92–2.39)	0.104	4.41 (1.05–18.49)	**0.043**	1.03 (0.69–1.54)	0.884	0.57 (0.31–1.08)	0.085
Competitive sport	0.96 (0.58–1.59)	0.868	2.16 (1.10–4.24)	**0.025**	1.57 (1.40–17.57)	0.715	0.56 (0.27–1.20)	0.135	0.28 (0.06–1.28)	0.100
Current PA (MET-h/d)	0.97 (0.94–1.01)	0.143	0.97 (0.92–1.02)	0.243	0.95 (0.85–1.07)	0.394	1.00 (0.95–1.04)	0.828	0.98 (0.91–1.06)	0.641
Demographics										
Age	0.94 (0.88–1.01)	0.071	1.06 (0.97–1.17)	0.219	1.25 (1.03–1.52)	**0.023**	0.95 (0.87–1.03)	0.211	1.01 (0.87–1.17)	0.914
BMI	1.09 (1.05–1.14)	**<0.001**	0.98 (0.93–1.04)	0.517	1.11 (1.00–1.22)	**0.040**	1.03 (0.98–1.08)	0.255	1.03 (0.95–1.12)	0.479
Education										
Secondary (ref)	1		1		1		1		1	
Tertiary	0.90 (0.69–1.18)	0.453	0.95 (0.65–1.40)	0.813	0.55 (0.24–1.25)	0.156	0.65 (0.46–0.93)	**0.017**	0.81 (0.43–1.52)	0.509
Physical workload										
Light (ref.)	1		1		1		1		1	
Moderate	1.11 (0.78–1.56)	0.565	1.18 (0.72–1.95)	0.513	1.05 (0.40–2.79)	0.921	0.98 (0.63–1.52)	0.912	1.77 (0.83–3.77)	0.137
Heavy	1.36 (0.99–1.87)	0.061	1.51 (0.96–2.36)	0.072	0.95 (0.390–2.32)	0.914	0.97 (0.64–1.47)	0.898	1.77 (0.87–3.62)	0.116
Gynaecological variables										
Menopausal status										
Premenopausal (ref)	1		**1**		**1**		**1**		**1**	
Early perimenopausal	1.07 (0.74–1.55)	0.729	1.13 (0.66–1.92)	0.657	0.92 (0.33–2.55)	0.871	0.95 (0.59–1.53)	0.841	0.92 (0.39–2.21)	0.860
Late perimenopausal	0.58 (0.39–0.85)	**0.006**	0.84 (0.48–1.49)	0.554	0.49 (0.15–1.57)	0.230	1.17 (0.73–1.88)	0.505	0.90 (0.37–2.19)	0.808
Postmenopausal	0.77 (0.55–1.10)	0.149	1.06 (0.65–1.73)	0.823	0.58 (0.22–1.54)	0.275	0.79 (0.50–1.23)	0.293	1.14 (0.53–2.44)	0.733
Parity	1.12 (1.01–1.24)	**0.031**	1.03 (0.90–1.19)	0.649	1.14 (0.88–1.47)	0.328	1.07 (0.94–1.22)	0.296	1.30 (1.08–1.57)	**0.007**
Hysterectomy										
No (ref.)	1		1		1		1		1	
Yes	0.94 (0.59–1.49)	0.794	1.48 (0.83–2.63)	0.183	1.18 (0.38–3.61)	0.773	2.03 (1.22–3.39)	**0.007**	3.20 (1.54–6.66)	**0.002**

Values in bold indicate statistically significant results.

of symptoms of faecal incontinence may affect the results and, in addition, the women reporting the symptoms were older, had higher BMIs and lower education levels compared with women who had some other type of pelvic floor disorder symptom.

The global prevalence of constipation is reported to be 14% in the adult population.[47] The risk of constipation is higher in women than in men, and increases with age.[47,48] In addition, the menopausal transition is associated with gastrointestinal symptoms, such as constipation.[49] In our study symptoms of constipation or defecation difficulties were reported by 19% of middle-aged women. As stated before, physical activity affects colonic motor function, and therefore the effect of physical activity on constipation seems likely. However, the study results are inconsistent: in a National Health and Nutrition Examination Survey, recreational physical activity was not strongly associated with constipation on a population level.[50] In a rather small physical activity intervention study, no change in the level of constipation evaluated before and after the intervention was observed.[51] In the current study we did not find an association with previous or current physical activity and symptoms of constipation or defecation difficulties. In contrast, Dukas et al. conclude that moderate physical activity is associated with a substantial reduction in the prevalence of constipation in women,[52] and Tack et al. state that physical inactivity is one of the many causes contributing to constipation.[53]

Higher age and postmenopausal status are risk factors for pelvic organ prolapse.[27,54,55] In epidemiological surveys, the prevalence reported varies widely between 1% and 31% for self-reported symptoms and up to 65% for clinically confirmed prolapse.[56] Explanations for the discrepancies between the clinical signs of pelvic organ prolapse and the symptoms experienced might lie in the personal sphere or in social circumstances.[24] In our sample, 5% of women reported symptoms. We did not find an association between previous or current physical activity and symptoms of pelvic organ prolapse, which is in line with some previous studies.[27,57–59] However, the association between physical activity and pelvic organ prolapse is a somewhat controversial subject, as Braekken et al. concluded that postmenopausal women with pelvic organ prolapse had participated less in exercise when they were younger,[59] whereas according to Nygaard et al., strenuous physical activity during teenage years may result in higher odds of pelvic organ prolapse in middle age.[57]

5 | CONCLUSION

This study has shown that competitive sports during early adulthood may increase the risk of symptoms of urge urinary incontinence, but not the symptoms of stress urinary incontinence, in middle age. Regular physical activity in early adulthood, or the level and duration of current physical activity are not associated with symptoms of urinary incontinence in middle age. Women who engaged in regular physical activity during early adulthood are more likely to experience symptoms of faecal incontinence. Past or current physical activity are not associated with symptoms of constipation or defecation difficulties, or with symptoms of pelvic organ prolapse.

AUTHOR CONTRIBUTIONS

MAK, MH and MK contributed to data analysis, data interpretation and writing the article. SS, PA and EKL contributed to the study design, data interpretation and editing the article. MAK, MH, MK, SS, PA and EKL contributed to critical revision of the article. All authors agree with the final version for publication and agree to be accountable for the integrity of the data published.

ACKNOWLEDGEMENTS

The authors thank laboratory staff in the Faculty of Sport and Health Sciences for their invaluable help with data collection, as well as the participants of the ERMA study who volunteered their time and effort.

FUNDING INFORMATION

The study was supported by the Academy of Finland (grants 275323, 309504, 314181 and 335249).

CONFLICT OF INTEREST STATEMENT

None declared. Completed disclosure of interests form available to view online as supporting information.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author, upon reasonable request.

ETHICS APPROVAL

The Ethics Committee of the Central Finland Health Care District approved the study (9 October 2014, KSSHP Dnro 8U/2014).

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

How to cite this article: Kuutti MA, Hyvärinen M, Kauppinen M, Sipilä S, Aukee P, Laakkonen EK. Early adulthood and current physical activity and their association with symptoms of pelvic floor disorders in middle-aged women: An observational study with retrospective physical activity assessment. BJOG. 2023;00:1–10. https://doi.org/10.1111/1471-0528.17397