

## Physical activity and wellness in Polish older women practicing Pilates and non-exercising women: a cross-sectional analysis

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### Abstract:

Physical activity (PA) and limited sedentary behaviors are vital factors for developing and maintaining health and play an important role in healthy aging. Wellness is the result of an intentionally chosen lifestyle assuming risk avoidance and healthier behaviors in the process of achieving a dynamic balance of body, mind, and spirit. Participation in the Pilates mind-body exercises may prove to be beneficial for the higher sense of wellness in older women. The study aimed to analyze and compare physical, psychological, social, and spiritual dimensions of wellness, and total wellness in Polish females aged 60-70 years (n=91) who practice the Pilates method (PP) (n=30) and those who do not practice Pilates (NP) (n=61), using additional criterion of meeting the World Health Organization (WHO) guidelines on moderate to vigorous intensity physical activity (MVPA) (WHO-Yes and WHO-No). An online cross-sectional survey collected sociodemographic data, self-reported height (cm), and weight (kg) and included the Global Physical Activity Questionnaire and Wellness Inventory. The results showed that 73.3% of PP and 37.7% of NP met the WHO MVPA recommendations. An explorative Mann-Whitney U test indicated that physical, psychological, social, and spiritual dimensions, and total wellness, were significantly higher in PP than in NP females ( $p < 0.001$ ). Furthermore, all considered wellness dimensions and total wellness were significantly higher in the WHO-Yes group than the WHO-No group across the total sample ( $p < 0.001$ ). Additional analysis using a Kruskal-Wallis test showed that physical, psychological, social, spiritual, and total wellness significantly differentiated four subsamples established based on simultaneous Pilates participation and meeting WHO MVPA recommendations ( $p < 0.001$ ). However, statistically significant differences only occurred between Pilates participants and those females who did not practice Pilates. PP/WHO-YES were characterized by significantly higher score of physical, spiritual and total wellness than both NP/WHO-Yes and NP/WHO-No, and significantly higher score of psychological and social dimensions of wellness than NP/WHO-No. PP/WHO-No achieved higher score of spiritual wellness from both NP/WHO-Yes and NP/WHO-No, and higher score of physical, psychological, social, and total wellness from NP/WHO-No. The results of the present study provide further support for PA participation being included in older females' lifestyles more often to promote a higher sense of wellness and highlight the comprehensive benefits of mind-body Pilates participation for physical, psychological, social, spiritual, and total wellness. These findings could be useful for health promotion and fitness professionals, and institutions responsible for developing valid wellness programs for older people.

**Key Words:** lifestyle, mind-body exercises, healthy aging, wellbeing

### Introduction

Physical activity (PA), defined by the World Health Organization (WHO) as “any bodily movement produced by skeletal muscle that requires energy expenditure” (WHO, 2018), and limited sedentary behaviors (SBs) are vital factors for developing and maintaining physical fitness and mental health in adults of all ages and play an important role in healthy aging (Garber, Blissmer, Deschenes, Franklin, Lamonte, Lee, Nieman, & Swain, 2011; Daskalopoulou, Stubbs, Kralj, Koukounari, Prince, & Prina, 2017; Andrieieva, Hakman, Kashuba, Vasylenko, Patsaliuk, Koshura, & Istyniuk, 2019). According to WHO recommendations, for health benefits, older adults should systematically undertake at least 150 to 300 minutes of moderate-intensity aerobic PA, at least 75 to 150 minutes of vigorous-intensity aerobic PA (MVPA), or an equivalent combination per week, reduce time spent on SBs by replacing them with PA of any intensity, and do muscle-strengthening exercises on all major groups on two or more days per week. Furthermore, older adults should do functional balance and strength training three or more days a week (WHO, 2020a). Regular PA decreases the risk of all-cause mortality (Samitz, Egger, & Zwahlen, 2011), cardiovascular disease, cardiovascular mortality (Kraus, Powell, Haskell, Janz, Campbell, Jakicic, Troiano, Sprow, Torres, & Piercy, 2019), certain cancers (Wu, Zhang, & Kang, 2013), and type-2 diabetes (Hamasaki, 2016). Moreover, PA benefits mental health (Guure, Ibrahim, Adam, & Said, 2017) and weight loss management (Jakicic, & Otto, 2005).

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Polish people are among a group of European societies with the highest level of physical inactivity that declare not doing exercise or playing sports and are in the middle of the rankings for not engaging in other PAs such as cycling from one place to another, dancing, and gardening (EC, 2018). Gomes, Figueiredo, Teixeira, Poveda, Paúl, Santos-Silva, & Costa (2017) indicated that increasing age, depression, physical limitations, a poor sense of meaning in life, social support, and memory loss were significant factors associated with physical inactivity in people aged 55 and older across 16 European countries. In Poland, people aged 60 and older comprised one-quarter of the overall population in 2021, of which 58.2% were females. The process of old age feminization of the Polish population has been described as an important demographic problem in the context of public health (Kamińska-Gawryluk, Wyszowska, Gabińska, & Romańska, 2022). The mean healthy life years of Polish females was 63.1, four years longer than for males (GUS, 2022). However, behavioral lifestyle-related risk factors are responsible for the loss of 27% of healthy life years of Polish females. The percentage of females who declare non-engagement in any form of recreational PA increases from 65.7% in the 45-64 years range to 80.1% in those 65 and older. Simultaneously, the proportion of overweight and obese females increases from 45.3% and 9.5%, respectively, in 45-64-year-olds, to 54% and 10.5% in those 65 and older (Poznańska, Rabczenko, & Wojtyniak, 2020).

As defined by the WHO, health is a state of complete physical, mental, and social well-being, and not merely the absence of disease or infirmity (WHO, 2020b). This definition and other interpretations of health existing in the scientific literature are related to a holistic understanding of human well-being, including experiential and functional elements and physical, mental, and social dimensions (McCartney, Popham, McMaster, & Cumbers, 2019). Dunn (1961) first defined the term “wellness” as “an integrated method of functioning which is oriented toward maximizing the potential of which the individual is capable” and is the result of an intentionally chosen lifestyle based on an optimal health model assuming risk avoidance and healthier behaviors in the process of achieving and maintaining a dynamic balance of body, mind, and spirit (O’Donnell, 2009). Furthermore, wellness is a subjective multidimensional state based on the quality of life (Corbin, & Pangrazi, 2001; Travis, & Ryan, 2004), with a wide range of wellness dimensions recognized and defined by researchers. These include physical, psychological/emotional, social, intellectual, spiritual, occupational, environmental, cultural, economic, and climate (Miller, & Foster, 2010). The present study considers four dimensions of wellness, including physical, which concerns regular participation in PA, healthy eating, self-care through the use of health and medical systems, and avoiding harmful behaviors. The psychological dimension involves mental, emotional, and intellectual capacities, a positive/realistic approach to self, relationships, and problem-solving, and degree of optimism. The social dimension includes the degree and quality of interactions with others, the community, and the environment. Lastly, the spiritual dimension concerns creating personal values and beliefs about life goals and relation to others, the community, the environment, and the universe (Miller, & Foster, 2010; Smith, Tang, & Nutbeam, 2006). However, the wellness framework for older adults has been conceptualized only recently and is still awaiting further development with adequate measurement instruments related to the age group’s needs (Fullen, 2019).

The Pilates method, named after its creator Joseph Pilates, is a recommended form of PA for older adults in the context of healthy aging, and the benefits of practicing this method are well-grounded in the literature (Pereira, Mendes, Mendes, Martins, Gomes, Gama, Dias, & Castro, 2022). The Pilates method encompasses the whole person and is oriented toward holistic and complete coordination of body, mind, and spirit using the following principles: concentration, which relates to the cognitive attention required to perform an exercise, the control of posture and movement during exercise, centering of all body movements so that they emanate from between the pelvic floor and the ribcage during exercises, using flowing movement for the smooth transition of movements within the exercise sequence, precision and accuracy of exercise technique, and breathing by moving air into and out of lungs in coordination with the exercise (Latey, 2001; Wells, Kolt, & Bialocerkowski, 2012). In addition, the method focuses on strength, core stability, flexibility, muscle control, and posture using mats or specialized equipment (Wells, Kolt, & Bialocerkowski, 2012). Previous publications demonstrated the effects of the Pilates method on physical fitness, balance improvement, reduction of fall risk (Długosz-Boś, Filar-Mierzwa, Stawarz, Ścisłowska-Czarnecka, Jankowicz-Szymańska, & Bac, 2021), improvement in general functional condition, an increase of total lean body mass (Carrasco-Poyatos, Rubio-Arias, Ballesta-García, & Ramos-Campo, 2019), improvement in the quality of life (Gandolfi, Corrente, De Vitta, Gollino, & Mazeto, 2020), life satisfaction (Curi, Haas, Alves-Vilaca, & Fernandes, 2018; Honório, Batista, Petrica, Santos, Serrano, & Martins, 2021), and mental health (Mokhtaria, Nezakatalhossainib, & Esfarjanic, 2013), in females aged over 60 years.

An analysis of the literature in scientific databases indicates a lack of studies investigating the wellness of older Polish females who practice the Pilates method in the context of meeting the WHO MVPA recommendations. Thus, the present study aimed to analyze and compare physical, psychological, social, and spiritual dimensions of wellness, and total wellness, in Polish females aged 60 to 70 who practice the Pilates method and those who do not engage in mind-body exercises or other forms of PA conducted by a qualified instructor. In addition, subsamples were formed based on the criteria of meeting the recommended WHO pro-health MVPA dose in a typical week in two groups of women to highlight the wellness advantages of participation in the Pilates method and undertaking PA for older females.

## Material & methods

### *Participants*

A total of 91 females volunteered to participate in this cross-sectional online survey conducted between April and December 2022. Of this total, 30 were recruited from Pilates studios and systematically practiced certified instructor-led Pilates “for all” (mean experience:  $3.5 \pm 1.9$  years) one to two times per week for between 45 minutes and one hour (floor-based exercises: mat, stability ball, mini stability ball, TheraBand, ring, foam roller, and foam block). The remaining 61 participants did not practice Pilates. The inclusion criteria for the enrolment of Pilates participants (PP) were: practicing Pilates at least once a week for at least six months and with no break longer than two weeks in the previous three months; no systematic participation in other group/individual mind-body/fitness exercises over the last six months; age range between 60 and 70 years. The inclusion criteria for the group of females who did not practice Pilates (NP) were: no systematic participation in Pilates exercises or other mind-body/fitness group/individual instructor-led exercises over the last six months; no hospitalization in the previous six months; a resident of a Polish city with a population  $>100,000$ ; age range between 60 and 70 years. The sample size was determined by the number of females who volunteered to participate in the study. Only complete data were taken into consideration.

### *Procedure*

The Bioethics Committee of the Regional Medical Chamber in Krakow, Poland, approved the study protocol (No. 268/KBL/OIL/2022). Google Forms was used to design the survey posted on social media (Facebook and Twitter), made available via an online link, to recruit the certified instructor-led Pilates “for all” practitioners and participants who do not practice Pilates and other mind-body/fitness exercises. The electronic survey included information on the aims of the research, an informed consent form, questions on sociodemographic details and anthropometry, the Global Physical Activity Questionnaire (GPAQ), and the Wellness Inventory. Respondents could complete the survey only once. Completing the survey was voluntary and anonymous.

### *Sociodemographic Data and Anthropometry*

The first part of the survey gathered respondents’ age, level of education, occupational status, size of city of residence, and years of experience in Pilates exercises. The respondents self-reported height (cm) and weight (kg), which were used to calculate body mass index (BMI) by dividing body mass (kg) by height (m<sup>2</sup>). Participants were classified based on their BMI as normal weight (18.50 - 24.99), overweight (25.00 - 29.99), or obese (30.00 - 39.99) according to WHO BMI cut-off values (WHO, 2000). None of the participants were classified as underweight (BMI  $< 18.50$ ).

### *Global Physical Activity Questionnaire (GPAQ)*

Data from the Polish version of the self-administered GPAQ determined the recommended PA level achieved and SBs (hours per day) in a typical participant’s week (Bergier, Wasilewska, & Szepeluk, 2019). The questionnaire showed good test-retest reliability and poor-fair validity (Bull, Maslin, & Armstrong, 2009). The GPAQ contains 16 questions on four independent domains, including work-related activity (six questions), transportation activity (three questions), recreational activity (six questions), and SBs (one question). The collected data were computed according to the GPAQ Guide (WHO, 2012). The level of moderate and vigorous intensity PA was calculated based on the GPAQ answers on the duration and frequency of PA (min/day) from the first three domains. Participants were then classified according to WHO recommendations for a pro-health dose of PA in a normal active week in group that fulfill at least 150 minutes of moderate-intensity aerobic PA or at least 75 minutes vigorous-intensity aerobic PA, or an equivalent combination per week (WHO-Yes), or in group that don’t fulfill WHO recommendations (WHO-No) (WHO, 2020).

### *Wellness Inventory*

The Polish version of the Wellness Inventory (EMS, 2008), which is based on the same structure and procedure previously adapted and employed by Sterkowicz et al. in Polish respondents (Sterkowicz, Rukasz, Weiss, & Sertić, 2008; Sterkowicz, & Sterkowicz, 2008, 2009), was used to determine participant wellness. Consisting of four parts, this short 20-item self-reported inventory was designed to measure four dimensions of wellness. Each part contains five items measuring a particular dimension of wellness, including physical wellness (e.g., “I eat regular meals [not excessive] rich in nutrients consisting of fresh food and healthy snacks”), psychological wellness (e.g., “I achieve the goals I set for myself”), social wellness (e.g., “I am satisfied with my relationship with my family”), and spiritual wellness (e.g., “I spend time alone and consider what is important to me”). Responses were recorded on a six-point scale from 0 (no, never) to 5 (almost always). The internal consistency (Cronbach’s alpha) was within acceptable levels (0.62 to 0.77). The scores of particular dimensions of wellness and total wellness score were calculated as a sum of all the values divided by the number of items.

### *Statistical analysis*

The basic descriptive statistics of PP and NP females were computed for age, height, weight, BMI, SBs, wellness in each separate dimension, and total wellness. The Shapiro-Wilk test was used to verify the normality of distributions. Student’s independent samples t-test was employed to compare normally distributed data, with the level of significance set at  $p < 0.05$ . Cohen’s d-effect size was calculated and considered as follows: 0.2 = small, 0.5 = medium, and 0.8 = large (Cohen, 1988). A Chi-squared test of independence compared BMI classifications and the fulfillment of WHO recommendations for a pro-health dose of PA, with the effect size

determined by Crammer's V as follows: negligible < 0.10, weak < 0.20, moderate < 0.40, relatively strong < 0.60, strong < 0.80, or very strong < 1.00 (Rea, & Parker, 1992). Due to the results of the normality of distributions analysis, Wellness Inventory data were calculated as medians (Mdn) and interquartile ranges (IQR, 25% to 75%). For comparisons between PP and NP, and between WHO-Yes and WHO-No from total sample, the Mann-Whitney U test was used, with a level of significance of  $p < 0.05$ . The r-effect size was computed based on the equation:  $r = z/\sqrt{N}$ , where z is the value of the z statistic, N is the group size, and r is interpreted as follows: small effect for  $r = 0.10$ , medium for  $r = 0.30$ , and high for  $r = 0.50$  or higher.

Four subgroups were established according to the combined criteria of Pilates participation or not Pilates participation and meeting WHO guidelines (Yes) or not meeting WHO guidelines (No) for a pro-health dose of PA, based on the GPAQ results. As such, groups included PP/WHO-Yes, PP/WHO-No, NP/WHO-Yes, and NP/WHO-No, and were compared using the Kruskal-Wallis H test, with a level of significance of  $p < 0.05$ , followed by post hoc Bonferroni test at the 95% confidence level (CI) for pairwise comparisons between the average ranks of the four subgroups, with the statistical significance set at  $p = 0.013$ .

The eta squared, based on the H-statistic, was used as the measure of the Kruskal-Wallis test effect size, which was calculated as follows:  $\eta^2 = (H - k + 1) / (n - k)$ , where H is the value obtained in the Kruskal-Wallis test, k is the number of groups, and n is the total number of observations (Tomczak, & Tomczak, 2014). The effect size ( $\eta^2$ ) was interpreted as follows: 0.01 = small, 0.06 = medium, and 0.14 = large (Cohen, 1988). Statistical analysis employed the Statgraphics Centurion software package, version XVIII (Statpoint Technologies, Warrenton, VA, USA).

## Results

The educational and occupational characteristics of PP and NP females are presented in Table 1. In the total sample, University and Secondary school levels of education were represented equally. However, the frequency of University level education prevailed over Secondary school education in the PP group and occurred more often than in the NP group. Meanwhile, Primary school education level only occurred among the NP group. The predominance of "Employed" occupational status over "Unemployed/Retired" was observed in both groups.

**Table 1.** Educational and occupational characteristics of the Pilates participants and females not participating in Pilates exercises.

Variables	Total (n=91)		PP (n=30)		NP(n=61)	
Level of education						
	n	%	n	%	n	%
University	41	45.1	19	63.3	22	36.7
Secondary School	42	46.1	11	36.7	31	50.8
Primary school	8	8.8	-	0	8	13.1
Occupational status						
	n	%	n	%	n	%
Employed	54	59.3	17	56.7	37	60.7
Unemployed/Retired	37	40.4	13	43.3	24	39.3

Note: PP-Pilates participants; NP-females not participating in Pilates exercises

The comparison of age, weight, and height between the PP and NP groups showed no statistically significant differences. The PP were characterized by significantly lower BMI values than the NP group (Table 2).

**Table 2.** Age and anthropometric characteristics of the Pilates participants and females not participating in Pilates exercises.

Variables	Total (n=91)		PP (n=30)		NP (n=61)		Statistics		
	M	SD	M	SD	M	SD	t	p	d-effect size
Age (years)	64.5	2.9	64.3	3.3	64.7	2.8	0.54	0.593	0.13
Height (cm)	165.8	7.14	165.2	6.9	165.0	7.3	-0.10	0.917	0.03
Weight (kg)	74.4	10.3	71.7	12.2	75.7	9.0	1.75	0.082	0.06
BMI (kg/m <sup>2</sup> )	27.2	3.3	26.2	4.0	27.6	2.7	1.99	0.049*	0.49

Note: PP-Pilates participants; NP-females not participating in Pilates exercises; \* significant difference between PP and NP

A relatively strong association was determined between weight status and group, with half of the PP group characterized by normal weight. The PP had a higher percentage of normal weight and obesity and a lower percentage of overweight than the NP group. Overweight was the most represented weight status in the total sample (Table 3).

**Table 3.** Body mass index classification of the Pilates participants and females not participating in Pilates exercises.

Weight status	Total (n=91)		PP (n=30)		NP (n=61)		Statistics		
	n	%	n	%	n	%	Chi <sup>2</sup> =15.37; df=2; p=0.000; V=0.411		
Normal weight	25	27.5	15	50	10	16.4			
Overweight	56	61.64	10	33.3	46	75.4			
Obese	10	11.0	5	16.7	5	8.2			

Note: PP-Pilates participants; NP-females not participating in Pilates exercises

The mean length of time spent lying down or sitting during a typical day at work, at home, behind a desk, with friends, watching TV, and eating meals, or while moving to and from places by driving a car, or riding a bus or train, was summed up by respondents (Table 4). SBs did not differ significantly between the PP and NP groups, with both spending around 4.5 hours a day on SBs.

**Table 4.** Sedentary behaviors of the Pilates participants and females not participating in Pilates exercises (GPAQ).

SBs (hours per day)	Total (n=91)		PP (n=30)		NP (n=61)		Statistics		
	M	SD	M	SD	M	SD	t	p	d-effect size
	4.6	1.6	4.9	1.5	4.4	1.6	-1.41	0.162	0.332

Note: SBs- sedentary behavior; PP-Pilates participants; NP-females not participating in Pilates exercises

Table 5 presents the distribution of females classified according to fulfillment of the minimal pro-health PA dose recommended by the WHO, based on GPAQ answers for a typical week. Those who fulfilled and who did not fulfill the WHO recommendations were distributed almost equally between groups, with a moderate association determined between the fulfillment of minimal pro-health MVPA dose and group. The PP had a higher percentage of fulfillment and a lower percentage of not fulfilling WHO MVPA recommendations than NP. However, 26.7% of PP did not fulfill the recommended pro-health PA dose during their typical week.

**Table 5.** Fulfillment of World Health Organization pro-health physical activity recommendations in the Pilates participants and females not participating in Pilates exercises (GPAQ).

Meet WHO MVPA guidelines	Total (n=91)		PP (n=30)		NP (n=61)		Statistics		
	n	%	n	%	n	%	Chi <sup>2</sup> =10.12; df=1; p=0.001*; V=0.335		
Yes	45	49.4	22	73.3	23	37.7			
No	46	50.6	8	26.7	38	62.3			

Note: PP-Pilates participants; NP-females not participating in Pilates exercises

Wellness dimensions and total wellness score comparisons between the PP and NP groups and those who did not meet the WHO MVPA guidelines are presented in Table 6. An exploratory Mann-Whitney U test indicated that physical, psychological, social, and spiritual dimensions and total wellness were significantly higher in PP than in NP females. The predominance of WHO-Yes over WHO-No was also significant in all considered wellness dimensions and total wellness.

**Table 6.** Comparison of wellness dimensions and total wellness in groups formed according to Pilates participation and meeting World Health Organization physical activity guidelines.

Wellness score	PP (n=30)		NP (n=61)		Statistics			WHO-Yes (n=45)		WHO-No (n=46)		Statistics		
	Mdn (IQR)	Mdn (IQR)	U	p	r-effect size	Mdn (IQR)	Mdn (IQR)	U	p	r-effect size				
Physical (pts)	3.6 (3.0-3.8)	2.2 (1.8-2.8)	1545.5	<0.001*	0.32	3.1 (2.2-3.8)	2.4 (1.6-3.0)	1462.5	<0.001*	-0.21				
Psychological (pts)	3.2 (2.6-3.8)	2.0 (1.8-2.8)	1487.0	<0.001*	-0.28	2.8 (2.0-3.6)	2.0 (1.6-2.8)	1461.5	<0.001*	-0.17				
Social (pts)	3.4 (2.8-4.0)	2.2 (2.0-3.0)	1447.0	<0.001*	-0.30	3.0 (2.6-3.8)	2.2 (1.8-3.0)	1476.0	<0.001*	-0.13				
Spiritual (pts)	3.7 (3.0-4.2)	2.5 (2.2-3.0)	1643.0	<0.001*	-0.31	3.0 (2.8-3.6)	2.6 (2.2-3.0)	1389.0	<0.001*	-0.14				
Total Wellness (pts)	3.5 (3.2-3.7)	2.3 (1.9-2.7)	1625.5	<0.001*	-0.29	3.0 (2.5-3.7)	2.4 (1.9-2.9)	1515.0	<0.001*	-0.16				

Note: PP-Pilates participants; NP-females not participating in Pilates exercises; WHO-Yes – females meeting WHO MVPA guidelines; WHO-No females not meeting WHO MVPA guidelines; \* significant differences at p<0.001

The comparison of specific dimensions of wellness and total wellness between the four groups, formed by taking into account both Pilates participation and fulfillment of WHO recommendations on the minimal dose of PA in a typical week, is presented in Table 7. The Kruskal-Wallis test showed significant differences between physical, psychological, social, and spiritual dimensions of wellness and total wellness ( $p < 0.001$ ). The PP/WHO-Yes group was characterized by significantly higher values of physical and spiritual dimensions of wellness and total wellness than the NP/WHO-Yes and NP/WHO-No groups and significantly higher psychological and social dimensions of wellness values than the NP/WHO-No group. The PP/WHO-No group had significantly higher values of spiritual wellness than the NP/WHO-Yes and NP/WHO-No groups, and significantly higher values of physical, psychological, and social dimensions of wellness and total wellness than the NP/WHO-No group. No differences were found in wellness dimensions or total wellness between the PP/WHO-Yes and PP/WHO-No, or between the NP/WHO-Yes and NP/WHO-No groups.

**Table 7.** Comparison of wellness dimensions and total wellness in groups formed according to combined criteria of Pilates participation and meeting WHO MVPA guidelines.

Wellness score	PP/WHO-Yes	PP/WHO-No	NP/WHO-Yes	NP/WHO-No	Statistics		
	(n=22)	(n=8)	(n=23)	(n=38)	H	p	$\eta^2$ - effect size
	Mdn (IQR)	Mdn (IQR)	Mdn (IQR)	Mdn (IQR)			
<b>Physical (pts)</b>	3.6 <sup>ab</sup> (3.2-3.8)	3.2 <sup>a</sup> (3.0-3.7)	2.4 (2.0-2.6)	2.2 (1.6-2.6)	23.03	0.000	0.334
<b>Psychological (pts)</b>	3.4 <sup>a</sup> (2.6-3.8)	3.0 <sup>a</sup> (2.8-3.6)	2.2 (2.0-3.0)	1.8 (1.6-2.6)	27.8	0.000	0.285
<b>Social (pts)</b>	3.5 <sup>a</sup> (2.8-4.8)	3.2 <sup>a</sup> (2.7-4.0)	3.0 (2.2-3.6)	2.2 (1.8-2.8)	27.22	0.000	0.278
<b>Spiritual (pts)</b>	3.4 <sup>ab</sup> (3.0-4.2)	4.1 <sup>ab</sup> (3.9-4.4)	2.8 (2.2-3.2)	2.6 (2.2-3.0)	40.3	0.000	0.429
<b>Total Wellness (pts)</b>	3.6 <sup>ab</sup> (3.0-3.8)	3.4 <sup>a</sup> (3.3-3.6)	2.5 (2.3-3.0)	2.2 (1.9-2.6)	40.4	0.000	0.430

Note: PP/WHO-Yes: Pilates participants meeting WHO MVPA guidelines; PP/WHO-No Pilates participants not meeting WHO MVPA guidelines; NP/WHO-Yes: females not participating in Pilates exercises and meeting WHO MVPA guidelines; NP/WHO-No: females not participating in Pilates exercises and not meeting WHO MVPA guidelines; <sup>a</sup> = different from NP/WHO-No; <sup>b</sup> = different from NP/WHO-Yes

## Discussion

This study examined differences in wellness dimensions and total wellness among PP and NP females who self-reported PA to be grouped according to meeting or not meeting WHO MVPA recommendations. All respondents were residents of Polish cities with more than 100,000 inhabitants to equalize opportunities to participate in Pilates exercises that are widely available in large Polish cities. Demographic characteristics of the sample showed that more than half of the PP had a University education, which contrasted with the NP group who mostly had a secondary school education. The percentage distribution of educational level represented in the present study vicariously confirms its moderating role in regular PA participation (Shaw, & Spokane, 2008). In both groups of females, the "Employed" Occupational status was more frequent than "Unemployed/Retired," even though 60-year-old Polish females acquire the right to a pension, though they have the statutory right to continue professional work (Jurek, 2022).

BMI values were significantly dependent on the group factor, with half of the PP classified as normal weight. In contrast, 83.6% of NP females were classified as overweight or obese, though the difference in BMI classifications cannot be considered an effect of Pilates. Other research indicated that undertaking Pilates training three times a week for 8 - 24 weeks had a positive effect on body fat percentage, fat mass, and lean body mass but did not decrease body mass or BMI in females over 60 (Fourie, Gildenhuis, Shaw, Shaw, Toriola, & Goon, 2013; Ruiz-Montero, Castillo-Rodriguez, Mikalački, Nebojsa, & Korovljev, 2014). The percentage distribution of weight status in the NP group, with only 16.5% in the normal range, was similar to data obtained in the Multi-Center National Population Health Examination Survey in which 17.7% of 65-74.9-year-old Polish females were classified as normal. However, in comparison to the present study, overweight was lower (34.6%), and obese was higher (48%) (Stepaniak, Micek, Waśkiewicz, Bielecki, Drygas, Janion, Kozakiewicz, Niklas, Puch-Walczak, & Pająk, 2016).

No difference in SBs was observed between the PP and NP groups in the present study. The daily sedentary time was similar to Czech males and females over 65 years old, who spend an average of four or more hours a day being sedentary (Hamrik, Sigmundová, Kalman, Pavelka, & Sigmund, 2014). Sagarra-Romero, Vicente-Rodríguez, Pedrero-Chamizo, Vila-Maldonado, Gusi, Villa-Vicente, Espino, González-Gross, Casajús, Ara, & Gómez-Cabello (2019) demonstrated that spending longer than four hours a day sedentary negatively influenced the physical fitness of elderly females, who had reduced balance, strength, agility, walking speed, and

aerobic endurance. However, some sedentary activities such as reading, using the internet and socializing positively impacted measures of psychosocial wellness in older adults (O'Neill, & Dogra, 2016).

The likelihood of meeting the standards of the WHO health-enhancing PA was higher in the PP than in the NP group. However, Pilates mat exercises, due to their specificity, may partly meet the WHO guidelines when considering muscle strengthening and functional balance activities. Curi Pe' rez et al. (Curi Pérez, Haas, & Wolff, 2014) showed that 12 weeks of Pilates exercises improved performance efficiency in the daily activities of older females. On the other hand, the results of the NP group were similar to those aged over 65 in a cross-sectional survey of 28 European countries in which 63.3% of participants did not meet WHO recommendations for PA in a typical week (Wicker, & Frick, 2016).

The values of all wellness dimensions and total wellness were significantly higher in PP than in the NP, with a difference of 1.4 points for physical, 1.2 for psychological, 1.2 for social, 1.2 for spiritual, and 1.2 for total wellness. Comparison of wellness between subgroups, grouped from the total sample based on meeting WHO MVPA recommendations, showed significantly higher values of all wellness dimensions and total wellness in the WHO-Yes than the WHO-No, with scores greater by 0.7 points, 0.8 points, 0.8 points, 0.4 points, and 0.6 points, for physical, psychological, social, spiritual, and total wellness, respectively. Further analysis showed that all considered wellness dimensions and total wellness differed between subsamples established based on the combined criteria of Pilates participation and WHO MVPA recommendation fulfillment, but only when comparing the Pilates group and the females not participating in Pilates exercises. Thus, no significant differences occurred between PP/WHO-Yes and PP/WHO-No, and NP/WHO-Yes and NP/WHO-No. The gradation from the lowest to the highest results of wellness across the four established groups, NP/WHO-No < NP/WHO-Yes < PP/WHO-No < PP/WHO-Yes was observed for physical, psychological, social dimensions of wellness and total wellness, and NP/WHO-No < NP/WHO-Yes < PP/WHO-Yes < PP/WHO-No for spiritual wellness dimension.

Strout, Ahmed, Sporer, Howard, Sassatelli, & Mcfadden, (2018) demonstrated that physical, social, and emotional dimensions of wellness are the most important, followed by intellectual and spiritual, with occupational less important for adults over 65, based on a Wellness Assessment Tool. Roh (2016) highlighted the effects of a 12-week Pilates exercise program in a group of elderly Korean males and females aged over 65, and the results showed statistically significant improvements in physical, social, spiritual, and emotional wellness, though no effect on spiritual wellness, using a lifestyle assessment inventory for wellness. In the present study, the PP/WHO-Yes subgroup's physical, psychological, social, and spiritual dimension scores were close to those of a group of young female university students, whose scores were: 3.6, 3.4, 4.0, and 3.7, respectively (Sterkowicz, Rukasz, Weiss, & Sertić, 2008) Pilates participation, as it is usually organized in groups, allows both PA and social connection and can be included in community wellness programs that are highly appreciated by older people (Weselman, Naseri, Vaz, Beilby, Garswood, O'Connell, & Hillet, 2023). The promotion of multidimensional wellness should focus not only on the physical dimension but be extended on the psychological, social, and spiritual dimensions, and this approach should be taken by fitness professionals when promoting positive health-related lifestyle behavior changes in their clients (Beauchemin, Gabana, Ketelsen, & McGrath, 2019).

The limitations of the present study mainly relate to the survey's electronic self-registered design, available to complete by persons with sufficient digital literacy. Additionally, males were not included in the study because of their small representation in Pilates exercises. The larger sample size with males participants inclusion should be considered in further research.

## Conclusions

A cross-sectional analysis showed that Polish older females who practiced Pilates were more likely to enjoy a higher sense of wellness than those non-participating in Pilates or other mind-body/fitness instructor-led exercises. Simultaneously, women who met minimal WHO MVPA recommendations in their typical active week were characterized by higher score of wellness dimensions and total wellness in comparison to those who declared not meeting these guidelines. Moreover, comparison of four subgroups established according to combined criteria of Pilates participation and meeting WHO MVPA recommendations showed significant differences in wellness scores.

The study indicates that Pilates participation and undertaking a minimal recommended by WHO level of PA based on domains included in the GPAQ are potentially beneficial for particular wellness dimensions and total wellness in older females. The findings provide further support for PA participation to be included in the lifestyle of older females to promote a higher sense of wellness. Furthermore, the results highlight the comprehensive benefits of mind-body Pilates participation for physical, psychological, social, spiritual, and total wellness. These findings could be useful for health promotion professionals, fitness professionals, physical therapists, the general public, and institutions responsible for developing valid wellness programs for older people.

## Conflicts of interest

The authors declare no conflict of interest.

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