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Relationship between Psychomotor Abilities vs. the Declared and Actual Physical Activity Levels among Women over 65 Years of Age

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Abstract

Introduction
Psychomotor performance is a key indicator of functional aging and may be influenced by physical activity. Understanding how different activity levels relate to psychomotor abilities in older women is important for supporting independence in later life.

Study Aim
To examine the association between reaction time, visuomotor coordination, movement anticipation, and both subjective and objective physical activity levels in women aged 65+.

Material and Methods
A total of 30 women from the University of the Third Age in Rzeszów (70.87 ± 6.07 years) participated. Psychomotor abilities were assessed using standardized computerized tasks, while physical activity was measured using a self-report questionnaire and objective monitoring.

Results
Higher engagement in household physical activities was associated with faster simple reaction time. Conversely, a greater number of steps and higher low-intensity activity co-occurred with slower responses in choice-based and anticipation tasks. Increased sedentary time was related to poorer visuomotor reaction speed.

Conclusions
Although the observed associations were not fully consistent, the findings indicate that maintaining regular physical activity may help preserve psychomotor functioning and functional autonomy in aging women. Further research is needed to clarify the direction and mechanisms of these relationships.

Keywords: ageing, older women, psychomotor performance, physical activity

Original article

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Introduction

Demographic realities in the populations of developed areas, as well as forecast projections for the coming years, indicate an increasing proportion of older people regardless of the accepted age limits for these subpopulations. In Poland in 2018, the number of people aged 60 and over accounted for nearly 25% of the total population, while in 2010, their share was 19.6%. According to a forecast by the Central Statistical Office of Poland (GUS), in 2050, the number of people of this age will be approximately 40% of the population (Statistic Poland, 2020).

The process of population ageing in Poland and worldwide is a consequence of increasing life expectancy, exacerbated by low fertility rates. United Nation projections state that the share of the population aged 65 and over worldwide will increase from 9% in 2020 to around 16% in 2050 (United Nation DESA, 2020). Europe is currently the major area in the world with the highest ratio of seniors and is projected to remain so for at least the next 50 years. The systematically increasing share of older people in the total population both in Europe and worldwide is also confirmed by other reports from abroad of Poland (Eurostat, 2020; DG ECFIN and AWG, 2020; WHO, 2015).

Considering these developments, the demographic changes of modern Europe and the world call for a deeper analysis of the broader issues of ageing and old age, as well as their consequences to maintain the independence, autonomy and activity of seniors. Increasingly, the term 'healthy ageing' is being used in the literature and includes the process of developing and maintaining functional capacity for successful ageing (WHO, 2020). Functional abilities of older people mean physical abilities, mental abilities, and the interaction abilities of visual-motor functions. Of particular importance is functional fitness, the physiological ability of performing daily activities in a safe and independent way, without excessive fatigue for seniors to maintain their mobility and independence (Rikli & Jones, 1999). Declining levels of physical fitness with deteriorating eye-hand coordination may lead to a rapid decline in physiological ageing parameters, which – coupled with civilisation diseases – may restrict the mobility in seniors, their functional fitness, and last but not least, their quality of life (Ignasiak et al., 2020). Against the backdrop of a progressively ageing population, it becomes important to determine the level of functional fitness as to be able to assess it regionally and globally, followed by application of the measures necessary to maintain or even improve the physical fitness of senior citizens. Various tools are now used in research to assess physical fitness in older people (Jones & Rikli, 1999; Lemmink et al., 2001; Osness et al., 1990; Rikli & Jones, 1999). Functional fitness tests for seniors provide an opportunity to analyse the individual motor skills required to perform daily activities and maintain independence among seniors.

Physical activity should also be of interest, which must be adapted to age and health status and can mitigate the course of ageing and delay involution processes. Maintaining physical activity among seniors contributes to better intellectual performance, higher self-esteem and emotional balance. However, it first helps to maintain physical fitness, which increases independence in old age (Langhammer et al., 2018).

According to the latest WHO recommendations, people over 65 years of age should undertake regular physical activity. Moderate activity of at least 150–300 minutes/week, or vigorous activity of at least 75–150 minutes/week, or an equivalent combination of the two, is recommended. In addition, seniors should do muscle-strengthening exercises involving all major muscle groups twice a week. Functional balance exercises and strength training are recommended three times a week. For additional health benefits, moderate activity can be increased to more than 300 minutes per week, with intense activity increased to more than 150 minutes. The WHO also recommends limiting time spent sitting, replacing it with any physical activity, even of low intensity, as any activity is better than no activity (WHO, 2021).

Research analyses are increasingly using accelerometer-based data outputs to reliably estimate the physical activity, sedentary lifestyle and sleep levels in older people. A study by Sasaki et al. (2017), using the ActiGraph wGT3X-BT, suggests that at least five days of monitoring are required to reliably estimate physical activity levels and sedentary lifestyle. Monitoring physical activity in a specific subpopulation is crucial not only for assessing physical activity levels but also trends and directions for physical activity among seniors. It is important to consider that information on physical activity is highly dependent on accelerometer data processing criteria and the application of different physical activity recommendations – these may impact estimates and tracking of prevalence and physical activity patterns in a given population (Sagelv, 2019). Complementary to objective methods of assessing physical activity and fitness levels are self-descriptive methods (meaning, 'declared physical activity'). To subjectively assess seniors' physical activity levels, the Physical Activity Scale for the Elderly (PASE) is used, among other research tools. Seniors assess the duration, frequency, level of exercise and amount of physical activity undertaken over a seven-day period using a PASE questionnaire (Washburn et al., 1993; Wiśniowska-Szurlej et al., 2020).

In situations involving decision-making, error correction as well as situations that are new to seniors (and which are accompanied by involution processes), the speed and appropriateness of reaction is a priority; in selected tasks, visual-motor coordination determines the accuracy and speed of whole-body movements as well as at the level of fine motor skills. Above 60–70 years of age, limb muscle strength decreases by 20–40%, which translates into the interaction ability of visual-motor functions (Doherty et al., 1993).

Note that the limited opportunity for seniors to engage in physical activity results in reduced performance of proprioceptive sensitivity and eye-hand coordination, thereby impairing the postural stability of seniors, a common cause of injury in old age (Famuła et al., 2012). People over 65 years of age need more time to perform a precise movement which negatively affects motor economy and efficiency in performing daily activities (Rand et al., 2011; 2012). Studies have shown that the value of choice reaction time correlated with motor and cognitive exercise has significantly improved which means seniors performing many day-to-day activities with higher efficiency (León et al., 2015). Burton et al. (2009) indicated that reaction time is a predictor of older people's ability to solve everyday problems (in an Everyday Problem Test, EPT). The efficiency of the EPT was significantly related to the age and cognitive status in the seniors. Slower and inconsistent reaction times were associated with poorer skills in solving daily problems based on the EPT (Burton, 2009). It can be predicted that psychomotor involution, the implication of which is a decrease in fluidity and speed of movement, can be reduced in severity by appropriate physical activity for seniors. A lifestyle which involves regular physical activity in seniors is indirectly associated with a reduction in neuromuscular loss, using two different measures of neuromuscular integrity, the coincidence-anticipation time (Christensen et al., 2003). Physical activity has a significant impact on the psychomotor abilities of seniors, especially the reaction time as an indicator of quality of life in older people. Therefore, special attention should be paid to motor activation, motor skills and visual-motor functions to optimise the ageing process (counteracting involution, the deterioration of cognitive and physical functions, and psychomotor abilities, or dementia).

Psychomotor abilities are an important indicator of functional aging, as they reflect both the speed of information processing and the integration of cognitive and motor processes. In older adults, particularly women, declines in reaction time and visuomotor coordination are associated with a higher risk of falls, reduced independence, and slower performance of activities of daily living (Lord et al., 2003; Muir et al., 2010). Psychomotor performance is also strongly linked to executive functions and processing speed—domains that deteriorate with age (Salthouse, 2000; Verhaeghen & Salthouse, 1997). At the same time, numerous studies suggest that physical activity may enhance or slow the decline of psychomotor functions by influencing neuroplasticity, cognitive efficiency, and motor control (Colcombe & Kramer, 2003; Voelcker-Rehage et al., 2011). Therefore, analyzing the association between physical activity levels and psychomotor abilities provides valuable insights into potential protective mechanisms that support mobility and functional autonomy in aging female populations.

Results obtained with the Test2Drive system can be directly compared with findings generated using other psychomotor assessment tools commonly applied in gerontology. Test2Drive evaluates fundamental components of psychomotor performance—simple and choice reaction time, hand–eye coordination, and spatial anticipation—which correspond to the domains measured in computerized systems such as the Vienna Test System and CANTAB (Tarnowski, 2016). Unlike manual assessments, it enables a more precise separation of reaction time from movement time, which is crucial in older adults who often present concurrent cognitive and motor slowing. Its brief procedures and user-friendly interface make it suitable for field studies while maintaining comparability with standard gerontological instruments. The consistency of our findings with previously reported results supports the measurement validity of Test2Drive for assessing psychomotor functioning in older populations.

Thanks to the multifaceted approach to physical activity in older people in connection with psychomotor abilities, this research may contribute to further in-depth scientific analyses of selected determinants of quality of life for seniors to maintain their fitness and physical activity and independence. The study posed the following research question: What is the relationship between psychomotor abilities and both self-reported and objectively measured physical activity levels among women aged 65 years and older?

The aim of the study was therefore to assess the relationship between psychomotor abilities (simple reaction time, choice reaction time, and hand-eye coordination and anticipation) and the declared (PASE) and actual (accelerometer-tested) physical activity levels among women over 65 years of age.

Material and Methods

Subjects

The study was conducted on a group of 30 Polish women aged ≥ 65 years (x=70.87±6.07) living in the Podkarpacie region (70% of the respondents reside in urban areas and 30% come from rural areas). Among the study population, 50% of the women had a tertiary education and about 33% of the respondents declared that they lived alone. In addition, the vast majority of women were not in employment (approximately 87%). See Table 1 for detailed data. The research was conducted in September 2022. Each participant was in generally good health, reporting no musculoskeletal or cognitive complaints. The ethics protocol was approved by the Bioethics Committee at the University of Rzeszow, Approval No. 19/03/2020. All the subjects signed a written informed consent form before participating in the study.

Body composition was assessed using The Tanita Body Composition Analyzer type DC 430 S MA. Parameters including body mass (kg), MM (muscle mass) (kg), BM (bone mass) (kg), FAT (fat mass) (%, kg), FFM (fat free mass) (kg), TBW (total body water) (%, kg), and visceral fat were analysed. Body height was measured using a Seca 217 stadiometer and the BMI was calculated (Kyle et al., 2004).

Table 1. Subjects background

	n (%)
Education	
basic	5 (16,6)
vocational	5 (16,6)
secondary	5 (16,6)
higher	15 (50)
Current occupation	
yes	4 (13.33)
no	26 (86.66)
Household composition	
alone	10 (33.3)
with someone	20 (66.6)
Marital status	
married	16 (53.33)
not married	14 (46.66)
Material situation	
very good	1 (3.33)
good	18 (60)
average	10 (33.3)
bad	1 (3.33)
Living situation	
rural	9 (30)
urban	21 (70)

Psychomotor Abilities

The Test2Drive computer system (ALTA, Siemianowice Slaskie, Poland) was used to evaluate psychomotor abilities. Using Test2Drive, the following parameters were assessed: simple reaction time (SIRT), choice reaction time (CHORT), hand-eye coordination (HECOR) and spatial anticipation (SPANT). They were tests during which reaction (RT) and movement time (MT) were assessed. The subjects performed each test in a standing position and with the dominant hand, with a touchscreen display laid flat on a table. Before the actual test was performed, each woman was given detailed instructions on each test. This was followed by the exercise phase as guided the instructions in Test2Drive, after which the proper test began. A board showing circular boxes was presented to the subject on the touchscreen display. At the bottom of each displayed screen was a rectangular resting box labelled "START". The subjects' task was to respond as quickly as possible to the stimuli in all four tests. Each test took approximately three minutes to complete. In the SIRT, HECOR and SPANT test, 20 stimuli were displayed, with the stimulus exposure time of 3 seconds. The stimuli were presented at time intervals changing every 1s; 1.5s or 2s. The subject's task was to respond as quickly as possible to the stimuli that appeared on the display.

The study included the following tests:

- SIRT – this test was aimed to assess the speed of the reaction and its stability. The displayed stimulus was visual: in the top row of the screen, the central, bright red box occasionally lit up, changing the colour to fiery red. The required reaction was to move the finger from the START resting field to the reaction field highlighted in blue, and then quickly return the finger to the START resting field.
- CHORT – this test was aimed to assess the speed and adequacy of the response in a complex situation. The displayed stimulus was visual: from time to time, different patterns comprising vertical, horizontal and diagonal lines appeared in the boxes in the top row of the screen. Horizontal and vertical patterns were stimuli that required a response, a diagonal pattern was a neutral stimulus that did not require a response. For the response-required stimuli, the subject was to move the finger from the START resting field to the highlighted response field as quickly as possible. For the neutral pattern, the task was to refrain from reacting and keep the finger on the START resting field. In the CHORT test, 24 stimuli were displayed, including 16 critical stimuli (8 stimuli with a horizontal pattern and 8 stimuli with a vertical pattern), along with 8 neutral stimuli (diagonal pattern).
- HECOR – this test was aimed to assess eye-hand coordination. The displayed stimulus was visual: in the top row of the screen, one of the bright red boxes occasionally lit up, changing the colour to fiery red. The required reaction was to move the finger from the START resting field to the corresponding reaction field, located exactly below the displayed stimulus.
- SPANT – this test was aimed to assess visual-motor coordination but compared to the HECOR test (analogous to the Piórkowski apparatus) the task was much more complex and taxing on cognitive processing. The blue reaction boxes were displayed visible in the centre of the board on screen. For the SPANT test, there was a double stimulus – from time to time, two of the bright red boxes at the periphery of the board (at the top and to the right or left) lit up simultaneously, turning bright red. The required reaction was to move the finger from the START resting field to the reaction box located exactly at the intersection of the row and column indicated by the fiery-red boxes, followed by the fastest possible return to the start resting field (Core 2023).

Physical Activity (Accelerometer)

The GT3X accelerometer (Actigraph, Pensacola, Florida, USA) was worn by the participants on an elastic belt over the right hip for a duration of seven days, ensuring usage during waking hours and removing the device only for activities involving water, such as swimming or bathing. The recorded accelerometer data were transferred to a PC workstation using the ActiLife 6.0 software. Data processing followed standardized procedures, where raw movement signals detected along the vertical axis were aggregated into 60-second epoch intervals. The ActiGraph wGT3X-BT, a compact and lightweight device with adjustable sampling frequencies between 30 and 100Hz, increasing in 10Hz increments. For this study, the device was set to record data at an 80Hz sampling rate. During an in-person session, participants received instructions to place the accelerometer on the iliac crest, aligned with the anterior axillary line of the right hip, and secure it using the provided elastic belt. A day was considered valid if the device was worn for at least 600 minutes, and participants meeting the criterion of three or more valid days were included in the analysis, in accordance with established methods for assessing habitual physical activity (Davis et al., 2011; Harris et al., 2008; Hart et al., 2011). To categorize daily activity, cut-off thresholds were applied: sedentary behavior was defined as periods with fewer than 100 counts per minute, light physical activity (LPA) ranged between 100 and 2019 counts per minute, while moderate-to-vigorous physical activity (MVPA) was classified as exceeding 2019 counts per minute, following the methodology outlined in prior research (Troiano et al., 2008).

Physical Activity Scale for the Elderly (PASE)

The PASE is a 12-item scale that assesses the level of physical activity over the past seven days in three life spheres: leisure time, household and work-related activities. The following leisure time activities were rated by the respondents based on weekly frequency and daily duration: walking outside; light, moderate and strenuous activities; and muscle strengthening. In terms of any activities bound to a household activities, the respondents were asked about: housework that is light and/or heavy, repairs around the house, work in the garden (such as mowing the lawn or outdoor gardening), and caring for others. When analysing paid or volunteer work-related activities, the number of hours per week and the type of work performed was asked. Each activity was scored by multiplying the activity frequency value by the weight given according to the score. After the calculations, a total PASE score (the sum of all activities) and partial scores for each sphere of life were obtained: leisure time activities, household activities and work-related activities. The activity partial scoring for actions related to these activities was calculated by totalling the activities corresponding to each sphere of life. For greater reliability, the PASE questionnaire survey was administered by an investigator (Washburn et al., 1993).

Statistical Analysis

The study calculated basic statistical measures: arithmetic mean, standard deviation, coefficient of variation, and the minimum and maximum value. The strength and direction of the relationship between the two groups was calculated using the Pearson correlation coefficient.

In addition, a determination coefficient was calculated according to the formula $R^2 = (r)^2$, where r is the value of the correlation coefficient. The distribution of the variables was assessed using the Shapiro–Wilk test; all variables were consistent with a normal distribution, allowing the use of Pearson's correlation. All statistical calculations were performed using R Statistical Software (v4.3.3) at a significance level of $\alpha = 0.05$

Results

Table 2 lists the somatic parameters, body composition, psychomotor abilities, as well as the declared (PASE) and actual (accelerometers) physical activity levels of the female subjects. The mean body height of the study population was 161.73cm±5.06 and the mean body weight was 72.74kg±12.19. The BMI (27.84) indicated that the women surveyed were overweight, but the actual body fat content was within the normal range (31.88%). In addition, the body composition analysis revealed that the MM was 46.66kg±8.40; the FFM was 49.07kg±8.88 and the BM was 3.15kg±3.59. The visceral fat index was 10.23±3.37, with TBW 44.68%.

Analysing the individual psychomotor abilities, it was noted that the SIRT performed best, where the female subjects achieved the shortest RT (458.87ms±106.32) as well as MT (365.43ms±123.66) compared to the other tests. The longest RT was recorded for CHORT (751.73ms±266.78). Also in the SPANT, RT was more than 700 ms.

The mean PASE score was 192.27±60.47. It was also noted that household activities accounted for approximately 60% of the total PASE score, with leisure time activities of around 38%. With the majority of these women no longer in employment at the time of the study, the percentage of work-related activities in the overall PASE score was low.

Accelerometer data indicated that the moderate level of physical activity of the women surveyed averaged around 160 min/week. In the case of vigorous physical activity, the situation was markedly different, as only about 2 min per week of physical activity for women was qualified as 'intensive'. In addition, it was noted that the subjects' average step count was around 6392 per day, which means more than 44.500 steps per week.

In the study, sleep efficiency averaged 95.4 per cent and sleep duration averaged 410 minutes; both were within normal values (Li et al., 2022). For people over 65, sleep efficiency should be above 85% and sleep duration should average 420 minutes.

By analysing the relationship between the psychomotor abilities and the declared level of physical activity (PASE) (Table 3), it was found that only SIRT RT was significantly correlated with the total PASE score ($r=-0.42$; $p=0.026$) and household activities ($r=-0.45$, $p=0.016$). The determination coefficient for household activities exceeded 20%, while the total PASE score was approximately 18%. In case of the actual measurement of physical activity (accelerometer) (Table 3) more significant relationships were found: CHORT RT was correlated with sedentary time ($r=0.039$, $p=0.040$), LIGHT ($r=-0.40$, $p=0.035$) and step counts ($r=0.42$, $p=0.026$); SPANT RT was significantly correlated with LIGHT and step counts ($r=0.38$, $p=0.046$). The strongest predictor of CHORT RT was steps ($R^2=17.6\%$). See Tables 3 and 4 for detailed data.

Table 2. Group characteristics

	x	sd	v	min	max
Somatic parameters					
body height [cm]	161.73	5.06	3.13	152.00	173.00
body mass [kg]	72.74	12.19	16.76	51.90	98.10
BMI	27.84	4.61	16.55	21.00	39.80
Fat [%]	31.88	10.61	33.29	3.00	47.50
Fat [kg]	23.67	9.96	42.08	1.80	46.60
FFM [kg]	49.07	8.88	18.10	34.40	75.50
MM [kg]	46.66	8.40	18.01	32.60	71.80
TBW [kg]	32.61	4.59	14.08	25.40	45.00
TBW [%]	44.68	4.66	10.42	38.00	53.80
BM [kg]	2.49	0.42	16.89	1.80	3.70
Visceral fat	10.23	3.27	31.92	3.00	17.00
Psychomotor abilities					
SIRT RT [ms]	458.87	106.32	23.19	302.00	691.00
SIRT MT [ms]	365.43	123.66	33.84	187.00	709.00
CHORT RT [ms]	751.73	266.78	35.49	0.00	990.00
CHORT MT [ms]	380.20	196.02	51.56	0.00	819.00
HECOR RT [ms]	509.97	133.10	26.10	0.00	719.00
HECOR MT [ms]	413.10	127.87	30.95	0.00	686.00
SPANT RT [ms]	709.57	225.89	31.84	0.00	980.00
SPANT MT [ms]	465.93	186.70	40.07	0.00	873.00
Physical activity (PASE)					
Leisure time activities	72.86	50.65	69.52	5.50	197.99
Household activities	114.73	46.46	40.85	0.00	171.00
Work-related activities	4.68	13.06	278.88	0.00	53.97
Total PASE score	192.27	60.47	32.40	73.78	302.13
Physical activity (accelerometer measurement)					
SPA [min]	1280.52/day 8663.6/week	1181.24	92.25	805.00	7503.00
LPA [min]	315.52/day 2208.6/week	113.35	35.92	150.43	590.57
MPA [min]	22.86/day 160.02/week	21.94	96.01	0.86	86.43
VPA [min]	0.30/day 2.1/week	0.70	234.07	0	2.00
MVPA	21.71/day 151.9/week	20.18	92.94	0.75	75.88
step counts	6391.18/day 44738.2/week	2941.49	46.02	2411.43	12549.70
Average Efficiency [%]	95.40	1.73	1.82	91.44	98.57
Average Total Sleep Time [min]	410.22	86.57	21.20	221.27	593.71

x – mean; sd – standard deviation; v – variation; min – minimum; max – maximum

Table 3. Correlation between psychomotor abilities and the declared level of physical activity (PASE)

	SIRT		CHORT		HECOR		SPANT	
	RT	MT	RT	MT	RT	MT	RT	MT
Leisure	ns	ns	ns	ns	ns	ns	ns	ns
Household	-0.45* R^2=20.2%	ns	ns	ns	ns	ns	ns	ns
Work-related	ns	ns	ns	ns	ns	ns	ns	ns
Total PASE score	-0.42* R^2=17.6%	ns	ns	ns	ns	ns	ns	ns

*Statistical significance at $\alpha \leq 0.05$;
ns – not statistically significant

Table 4. Correlation between psychomotor abilities and the actual measurements of physical activity (accelerometer measurement)

	SIRT		CHORT		HECOR		SPANT	
	RT	MT	RT	MT	RT	MT	RT	MT
SPA	ns	ns	-0.39* R^2=15.2%	ns	ns	ns	ns	ns
LPA	ns	ns	0.40* R^2=16%	0.40* R^2=16%	ns	ns	0.38* R^2=14.4%	ns
MPA	ns	ns	ns	ns	ns	ns	ns	ns
VPA	ns	ns	ns	ns	ns	ns	ns	ns
MVPA	ns	ns	ns	ns	ns	ns	ns	ns
STEPS	ns	ns	0.42* R^2=17.6%	ns	ns	ns	0.38* R^2=14.4%	ns
Average Efficiency	ns	ns	ns	ns	ns	ns	ns	ns
Average Total Sleep Time	ns	ns	ns	ns	ns	ns	ns	ns

*Statistical significance at $\alpha \leq 0.05$
ns – not statistically significant

Discussion

The aim of the study was to assess the relationship between selected psychomotor abilities (SIRT, CHORT, HECOR, SPANT) and the declared and actual levels of physical activity among women over 65 years of age. For the PASE, the results show a significant negative relationship between SIRT RT and household activities and the total PASE score. In contrast, analysing the actual level of physical activity (accelerometery) revealed a significantly positive relationship between CHORT and SPANT RT vs. step counts and LPA. A significant negative correlation with CHORT RT was found for SPA.

For older people, the WHO recommends at least 150 min MPA (Moderate Physical Activity) or 75 min VPA (Vigorous Physical Activity) per week (WHO, 2010; 2021). According to this study, women had approximately 160 min of MPA per week, so they met the recommendations. In terms of step counts, at least 7.000 steps/day is recommended for older people (Hsueh et al., 2021; Tudor-Locke et al., 2011). The accelerometer data revealed that the women surveyed made more than 6.300 steps a week. This value deviates slightly from the recommendations. The number of 7000–8000 steps may provide better health benefits later in life, including those related to depression and all-cause mortality (Lee et al., 2019; Tudor-Locke et al., 2011) and 7000 steps per day is also comparable to the physical activity guidelines (Chen et al., 2019; Hsueh et al., 2021).

For LPA there are no recommended levels. However, many authors emphasise that increasing LPA may contribute to improved cardiometabolic outcomes (Buman et al., 2015). LPA has also been found to have a beneficial association with diastolic blood pressure (Buman et al., 2010). Other studies, such us in US older adults, show that LPA is associated with lower depression levels (Buman et al., 2010). In Hart et al. (2011), participants engaged in an average of 12.0–15.7 min.day of MVPA whereas in this study, it was 21.7 min. A recent meta-analysis showed a maximum reduction in risk of all-cause mortality for 24 min of MVPA a day (Sagelv et al., 2019).

Although the study group met the WHO recommendations for MPA, this did not translate into higher levels of psychomotor ability. The research by these authors shows that MVPA, MPA and VPA are not significant for psychomotor abilities. In contrast, it was found that CHORT (RT and MT) and SPANT (RT) time increases with higher levels of LPA and number of steps, with a consequent deterioration in the speed of these psychomotor abilities. Different conclusions were reached by Johnson et al. investigating the relationship between LPA and cognitive ability among older adults (Johnson et al., 2016). In this study, higher levels of LPA were associated with higher levels of cognitive function. It was therefore concluded that exercise is a good neuroprotective measure. The results from Rosano et al. (2010) also tend towards similar conclusions. A group of individuals with higher LPA levels simultaneously showed higher brain activation in areas important for processing speed (Rosano et al., 2010). Better associations of LPA — in contrast to MVPA — with cognitive function were also shown by Gothe (2021).

Current physical activity recommendations for older people also revolve around reducing SPA (Sedentary Physical Activity). These authors' analysis, however, showed that as SPA increases, reaction time decreases for CHORT RT (improvement in reaction speed). Fanning et al. completed a study on a group of older people to assess self-regulatory and executive functioning effects by substituting SPA for LPA, MVPA and sleep. The analysis revealed that replacing SPA with sleep was associated with significantly faster reaction times in some of the more difficult tasks. In contrast, the replacement of SPA by LPA and MVPA had no significant effects (Fanning et al., 2017).

For the declared physical activity score using the PASE questionnaire, the study revealed that the higher the total PASE sore and the more physical activities related to housework, the significantly faster the reaction time, SIRT (RT), was for the simplest task.

Conclusions

The results of the present study indicate the presence of moderate associations between physical activity levels and selected components of psychomotor performance in older women. For the PASE, the findings demonstrated a significant negative relationship between SIRT RT and both household activities and the total PASE score, suggesting that greater engagement in physically demanding housework may be associated with faster reaction speed in the simplest psychomotor task. In contrast, an analysis of objectively measured physical activity using accelerometers revealed significant positive associations between step counts and LPA with CHORT and SPANT reaction times (RT) – indicating slower psychomotor responses – while a significant negative correlation was observed between SPA and CHORT RT, pointing to improved reaction speed with reduced sedentary behavior.

However, these associations do not allow for causal inference. Although previous studies have shown that MVPA, MPA, and VPA are not strong determinants of psychomotor abilities in older women (≥65 years), the present results suggest that both higher sedentary behavior and lower levels of low-intensity activity may co-occur with less favorable values of specific psychomotor parameters. Still, some contradictory patterns emerged – for instance, increased SPA was linked to decreased CHORT RT (better reaction speed), whereas higher LPA and a greater number of steps corresponded with longer RT and MT values in CHORT and SPANT tasks, indicating deterioration in the speed of these psychomotor abilities.

Taken together, these findings imply that the magnitude and direction of associations between activity behaviors and psychomotor performance remain unclear and may vary depending on the type and measurement method of physical activity. Therefore, longitudinal and interventional research is needed to determine whether modifying sedentary time and specific intensities of physical activity can exert a meaningful impact on psychomotor functioning in aging populations.

The study is limited by a small sample size, a single-sex cohort, and its cross-sectional design. The analysis did not account for possible factors that may influence both physical activity levels and psychomotor abilities, including chronic health conditions, medication use, educational attainment, socioeconomic status, cognitive engagement, or participation in social activities.

Contributions from Individual Authors

KS, RG, JH, KM, DK designed the research, developed the project concept research plan. KM developed the data collection plan and provided study oversight of the trial in the field. KS, RG, JH, KM analysed the data, wrote the paper and had responsibility for the final content. All authors read and approved the final manuscript.

Ethics Statement

The ethics protocol was approved by the Bioethics Committee at the University of Rzeszow, Approval No. 19/03/2020. All the subjects signed a written informed consent form before participating in the study.

Data Availability Statement

The data presented in this study are available from the corresponding author upon reasonable request.

Financial Disclosure

No funding was received for this study.

Conflict of Interest

The authors have no conflict of interest to declare.

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