MANUAL REACTION SPEED AND MANUAL DEXTERITY IN ELDERLY PEOPLE: A COMPARATIVE STUDY BETWEEN ELDERLY PRACTITIONERS AND NON-PRACTITIONERS OF PHYSICAL ACTIVITY

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Abstract

The human being, as years go by, transforms and loses their normal movement abilities, like too quickly react and objects manipulate. Most of the epidemiological evidence argues that when a subject adopts an active lifestyle through physical activity (PA), this minimizes the effects of the aging process and improves their capabilities. To assess the influence of PA in manual reaction speed (MRS) and manual dexterity (MD) we applied The Nelson Hand Reaction Test and The Minnesota Manual Dexterity Test (the placing and turning tests), respectively. The sample consisted of 40 volunteers (between 67 and 85 years old) residents in two elderly institutions of the Porto city and they were divided into 2 groups, one by practitioners of PA and the other by non-practitioners (with 20 subjects respectively). This study had these conclusions: 1/Concerning to manual reaction speed (MRS): (i) there are statistically significant differences between practitioners and non-practitioners of PA, as well as between genders, and between males-practitioners and males non-practitioners of PA; (ii) between female practitioners and female non-practitioners of PA there weren't any significant differences; 2/ Concerning to the manual dexterity (MD) it was verified that: (i) either in placing or in turning tests, there are statistically significant differences between practitioners and non-practitioners of PA, and equally there are differences between practitioners and non-practitioners of PA in each gender; (ii) between genders, in the placing test, they observed differences with statistical significance, but in the turning test these differences were only verified in the third and fourth issues, and in the average of four issues.

Key words*: elderly, reaction speed, manual dexterity, proprioceptive sensibility, physical activity*

Introduction

Over the last years, the percentage of elderly people has significantly increased in the developed countries, being the number of subjects over 80 years old the highest growth segment of the elderly population (Puggaard, 1999). This increase, comparatively to total population, is due to the decline in birth rate and mortality and the improvement of life's expectancy at birth (Costa, 2007). Born, grow, mature and aging are characteristics of all living humans, being the aging an integral and natural part of life. How we age and experience this process depends not only of our genetic constitution, but also of what we do in the life (Heikkinen, 2003). According to the same author, aging is common to all members of a species; it is progressive and includes mechanisms that affect our ability to perform various functions. Knowing the existence of different concepts of aging, they all share the idea that is common to all living beings, where exist loss of functionality, an increase in susceptibility and incidence of diseases with the probability of death (Heikkinen, 2003; Mota, Figueiredo & Duarte, 2004). The successive growth of the elderly population in contemporary societies, it became an urgent matter of research to aim the ways to maintain and improve the functional ability these people, helping them to maintain their independence in the community and acquire a quality of life with more accuracy (Heikkinen, 2003). This quality of life will be always related to the health, the ability to perform the normal tasks and the feelings of well-being and satisfaction (Spirduso, 1995). The evolution of the hand in humans reached a high development in the various functional and creative capabilities, particularly with the opposition of the thumb which was directly related to the development of Central Nervous System (CNS). This progress has improved the grasp and the hand control, leading the human species to expansion and becoming the most dominant of the world (Carmeli et al., 2003). According to Barreiros (1999, 2001), with age, the Nervous System (NS) works more slowly and the response of the muscle is late and ineffective. These facts are due to the combination of the effects of aging of muscular and nervous nature, justifying the slowing of elderly people. However, today the problem is to know the causes: what is due to natural biological causes, common to all members of the same

species, or what is due to the use reduction's activity with the inherent degenerative pathological processes, or the negative effects of sedentary life or the environment's effect of physical and chemical agents. The ability to detect small movements at the joints is narrowing, particularly with the decrease in the efficiency of proprioreceptors. Note that the reaction time slows gradually, especially in subjects with low levels of activity (Barreiros, 1999, 2001; Francis & Spirduso, 2000; Godinho, 1999). Summarizing, the time needed to perform a movement increases in the elderly, which could be caused by inactivity and biological decline in sensory, perceptual, cognitive and motor functions. Many authors emphasize the importance of a constant involvement in the activities of day-to-day and to keep standards of living assets in order to prevent the harmful effects of aging (Barreiros, 1999, 2001; Godinho, 1999).

Methods

Subjects and variable

The sample of this study consisted of 40 volunteers elderly adults residents in two elderly institutions (Oporto city), with 67 to 85 years old. The sample was divided into 2 groups, formed by practitioners of physical activity the group one and non-practitioners the other group (each other with 20 subjects). Of the 40 subjects, 22 are female (10 practitioners and 12 non-practitioners) and 18 are male (10 practitioners and 8 non-practitioners). Instrumentarium: - The Nelson Hand Reaction Test (NHRT). For the assessment of the manual reaction speed was selected the NHRT. The aim of this test is to measure the reaction speed of the dominant hand of elderly people in response to a visual stimulus. - The Minnesota Manual Dexterity Test (MMDT). For the assessment of manual dexterity, we selected the MMDT. The MMDT includes two batteries: the Placing Test and the Turning Test. The MMDT is a standardized test, often administered for assessment: The ability to move small objects to various distances; The manual dexterity; From the simple but rapid eye coordination / hand; To diagnose problems of hand coordination.

Statistical Procedures

For statistical analysis of the variables we used the Statistical Package for the Social Sciences (SPSS) version 16.0. To analyse the results we use the Descriptive Statistics, which enabled us to calculate the mean, standard deviation, the percentage, the maximum and minimum values. Also, we use the Inferential Statistics to compare the 2 groups in both tests. To compare the data between each group (type of practice and gender) we use the Student t-test for independent measures. For the analysis between subjects in each group we use the Mann-Whitney nonparametric test. The level of significance for the rejection of the null hypothesis in all statistical tests was set at $p \leq 0.05$.

Results

(Legend: PY = practitioners, PN = non-practitioners. M = male, F = female, Att = attempt)

Manual Reaction Speed (MRS)

Table 1 - Comparison between practitioners and non-practitioners of PA in NHRT. Values in seconds (s). Maximum and minimum, mean, standard deviation (sd), t and p.

	PY N=20	PN N=20	t	p
Max.	0,30	0,33		
Min.	0,17	0,20		
Mean	0,22	0,25		
sd	0,03	0,03	-3,53	0,001

Table 2 - Comparison between genders in NHRT. Values in seconds (s). Maximum and minimum, mean, standard deviation (sd), t, p.

	M N=18	F N=22	t	p
Max.	0,32	0,33		
Min.	0,17	0,18		
Mean	0,22	0,24		
sd	0,03	0,03	2,46	0,019

Table 3 - Comparison between male practitioners and not practitioners of PA in NHRT. Values in seconds (s). Maximum and minimum, mean, standard deviation (sd), z, p.

	PY N=10	PN N=8	z	p
Max.	0,24	0,32		
Min.	0,17	0,20		
Mean	0,20	0,24		
sd	0,02	0,03	-3,42	0,001

Table 4 - Comparison between female practitioners and on-practitioners of PA in NHRT. Values in seconds (s). Maximum and minimum, mean, standard deviation (sd), z, p.

	PY N=10	PN N=12	z	p
Max.	0,30	0,33		
Min.	0,18	0,21		
Mean	0,23	0,25		
sd	0,04	0,03	-0,86	0,391

Table 5 - Comparison between practitioners and non-practitioners of PA in the Placing Test. Values in seconds. Mean, standard deviation (sd), t, p.

	PY (N=20)	PN (N=20)	t	p
1. att	103,68±10,93	120,51±10,06	-5,07	0,000
2. att	102,66±10,92	114,48±13,68	-3,02	0,005
3. att	101,16±12,06	114,52±12,82	-3,39	0,002
4. att	100,69±10,39	113,92±13,16	-3,53	0,001
Mean	102,05±10,39	115,86±12,43	-3,72	0,001

Table 6 - Comparison between genders in the Placing Test. Values in seconds (s). Mean, standard deviation (sd), t and p.

	M (N=18)	F (N=22)	t	p
1. att	122,35±09,39	103,71±9,97	-6,08	0,000
2. att	121,02±09,04	98,38±5,99	-9,49	0,000
3. att	120,02±09,95	97,87±7,36	-8,09	0,000
4. att	118,93±10,24	97,78±6,48	-7,94	0,000
Mean	120,58±09,54	99,44±7,44	-7,88	0,000

Table 7 - Comparison between male practitioners and not practitioners of PA in the Placing Test. Values in seconds (s), mean, standard deviation, z and p.

	PY (N=10)	PN (N=8)	z	p
1. att	114,27±1,54	132,46±1,08	-3,56	0,000
2. att	113,25±1,41	130,74±1,36	-3,56	0,000
3. att	112,25±5,78	129,74±1,75	-3,55	0,000
4. att	110,44±3,99	129,55±1,64	-3,55	0,000
Mean	112,55±2,99	130,62±1,44	-3,55	0,000

Table 8 - Comparison between female practitioners and non-practitioners of PA in the Placing Test. Values in seconds (s), mean, standard deviation (sd), z and p.

	PY (N=10)	PN (N=12)	z	p
1. att	93,10±1,00	112,55±1,10	-3,96	0,000
2. att	92,08±0,89	103,63±1,28	-3,96	0,000
3. att	90,07±0,84	104,37±1,25	-3,96	0,000
4. att	90,93±0,65	103,50±1,20	-3,96	0,000
Mean	91,55±0,83	106,02±1,17	-3,96	0,000

Table 9 - Comparison between practitioners and non-practitioners of PA in the Turning Test. Values in seconds (s). Mean, standard deviation (sd), t and p.

	PY (N=20)	PN (N=20)	t	p
1. att	108,69±6,94	133,62±3,24	-14,56	0,000
2. att	107,29±6,34	130,71±3,11	-14,84	0,000
3. att	107,23±7,16	128,70±4,23	-11,54	0,000
4. att	105,87±7,60	126,49±5,11	-10,08	0,000
Mean	107,27±3,99	129,88±3,89	-12,62	0,000

Manual dexterity (MD)

As we see in Table 1 the maximum and minimum values reached in MRS were far lower in practitioners. In general, the elderly practitioners of PA showed lower average results (0,217 ± 0,034), compared to elderly non-practitioners of PA (0,249 ± 0,026).

Table 10 - Comparison between genders in the Turning Test. Values in seconds (s), mean, standard deviation (sd), t and p.

	M (N=18)	F (N=22)	t	p
1. att	124,94±11,19	118,06±15,01	-1,61	0,115
2. att	122,51±10,67	116,12±13,96	-1,60	0,119
3. att	122,56±9,89	114,21±13,03	-2,24	0,031
4. att	121,58±9,84	111,76±12,43	-2,72	0,010
Mean	122,90±10,39	115,04±13,60	-2,02	0,051

Table 11 - Comparison between male practitioners and non-practitioners of PA in the Turning Test. Values in seconds (s), mean, standard deviation (sd), z and p.

	PY (N=10)	PN (N=8)	z	p
1. att	115,33±1,64	136,96±1,88	-3,56	0,000
2. att	113,34±1,54	133,98±1,79	-3,55	0,000
3. att	114,10±1,59	133,14±2,04	-3,55	0,000
4. att	113,16±1,52	132,10±2,08	-3,56	0,000
Mean	113,98±1,57	134,04±1,91	-3,55	0,000

Table 12 - Comparison between female practitioners and non-practitioners of PA in the Turning Test. Values in seconds (s), mean, standard deviation (sd), z and p.

	PY (N=10)	PN (N=12)	z	p
1. att	102,05±0,99	131,39±1,53	-3,96	0,000
2. att	101,23±0,97	128,53±1,32	-3,96	0,000
3. att	100,37±0,96	125,74±2,08	-3,96	0,000
4. att	98,57±1,12	122,75±2,05	-3,96	0,000
Mean	100,56±1,00	127,10±1,60	-3,96	0,000

We also found that the differences between averages of both groups are statistically significant (p = 0,001). So, we can say that older practitioners of PA have improved MRS. When comparing the genders (Table 2) we see that the maximum and minimum values of males were much lower in relation to females. Given the average results, the male subjects showed lower results (0,220 ± 0,030), when compared with the female subjects (0,243 ± 0,034), i.e., the elderly males are faster than the elderly females. The results indicate the existence of significant differences between genders (p = 0,019). By the analysis of Table 3, we can infer that the group of practitioners succeeded better average results (0,201 ± 0,018), compared to the group of non-practitioners (0,244 ± 0,025), i.e., the elderly practitioners of PA were faster than the elderly not-practitioners of PA. We can see that there are significant differences between male practitioners and not practitioners of PA (p = 0,001). As for the female subjects (Table 4) the older practitioners of PA showed better maximum and minimum results than the group of elderly non-practitioners of PA. As regards the average values, we see that the older practitioners of PA achieved better results (0,233 ± 0,039), when compared with the

older non-practitioners of PA (0,252 ± 0,026), i.e., the older practitioners of PA obtained better MRS results than the older non-practitioners of PA. Despite these results, there are no significant differences (p = 0,391). So, we can't say that female practitioners of PA have better MRS than non-practitioners of the same gender.

- Placing Test: Analyzing the results contained in Table 5, when comparing the practitioners of PA with non-practitioners, we found that the values of MD showed statistically significant differences (p <0.05) in all attempts. Regarding to the sequence of issues, the values of MD of practitioners improves on average 1 second (s) between attempts; being the first to the last, the results indicate improvements in the order of 3s. In respect of non-practitioners it is noted that from the first to the second attempt, the value of MD improves about 6s, and between other issues the improvements are, respectively, 4 and 60 hundredths (hs) of second. According to the results, it is possible to observe the existence of a large difference in the performance between the two groups: in the first attempt less 16s and 83hs, in the second less 11s and 82hs, in the third less 13s and 36hs, in the fourth attempt less 13s and 23hs, and finally, in the average of all attempts less 13s and 81hs. Of all the attempts the last is where subjects have better results, i.e., their performance improves in each attempt. When comparing the two genders (Table 6), we can observe that the values of MD show significant differences in all attempts (p <0.05). The elderly females have a uniformity of values of MD, i.e., they were faster in all attempts compared to the opposite gender. In the first trial we found that the female subjects showed a better performance (103,71 ± 9,97) compared to males (122,35 ± 9,39), therefore, less 18s and 64hs. In the second trial found that those females showed a better performance (98,38 ± 5,99) compared to males (121,02 ± 9,04), therefore less 22s and 64hs. In the third attempt we can see that the female subjects exhibited faster performance (97,87 ± 7,36) compared to males (120,02 ± 9,95), therefore, less 22s and 15hs. In the fourth attempt the female subjects showed faster performance (97,78 ± 6,48) compared to males (118,93 ± 10,24), therefore, less 21s and 15hs. Finally, in the average of four attempts we found that older females have faster performance (99,44 ± 7,44) compared with older males (120,58 ± 9,54), therefore, less 21s and 14hs.
- Through the analysis of Table 7, when compared male practitioners with male non-practitioners, we see that the values of MD show significant differences (p = 0,000) in all trials. We see uniformity in the results, having male practitioners of PA obtained higher performance compared to non-practitioners of the same gender. We verify that male practitioners of PA showed faster performance than the non-practitioners. In the first attempt less 18s and 19hs, in the second and third attempts less 17s and 49hs, in the fourth attempt less 19s and 11hs and in the average of four attempts less 18s and 7hs. By the results displayed in Table 8, when comparing female practitioners and non-practitioners of PA, we see that the values of MD showed statistically significant differences (p <0.05) in all trials. We see a congruence of values of MD, having the female practitioners of PA proved superior performance compared with non-practitioners of the same gender. In the first attempt less 19s and 45hs, in the second attempt less 11s and 55hs, in the third attempt less 14s and 30hs, in the fourth attempt less 12s and 57hs and in the average of four attempts less 14s and 47hs.

Turning Test

Through the analysis of Table 9, when comparing the practitioners and non-practitioners of PA, we can see that the values of MD differ with statistical significance (p = 0,000) in all attempts. You can also see a substantial difference in performance between the two groups: in the first attempt less 24s and 93hs, in the second attempt less 23s and 42hs, in the third attempt less 21s and 47hs, in the fourth attempt less 20s and 62hs and, finally, in the average of four attempts less 22s and 61hs. We can see that the fourth attempt for both groups is the best of all tests. Note that in the group of practitioners of PA, from the first to the last attempt, we see a decrease in execution time of 2, 82 s. In the group of non-practitioners of PA, the difference is 7, 13 s. For the analysis of Table 10, when comparing the two genders, we don't find statistically significant differences in the values of MD. Only in the third and fourth attempts, we can observe differences with statistical significance when compared the genders. We are also aware that females display better performances than the opposite gender. The females showed in the first attempt less 6s and 88hs, in the second attempt less 6s and 39hs, in the third attempt less 8s and 35hs, in the fourth attempt less 9s and 82hs and, finally, in the average of four attempts less 7s and 86hs. Overall the values of MD in males ranging from first to last attempt at about 2, 04s. Already, in females this variation is about 3, 02 s. For the analysis of Table 11, when comparing the two males groups (practitioners and non-practitioners), we can see that the values of MD showed significant statistically differences (p = 0,000), in all attempts. We found that male practitioners of PA exhibited higher

performance than non-practitioners of the same gender, in all attempts. So, in the first attempt we have less 21s and 63hs, in the second attempt less 20s and 64hs, in the third attempt less 19s and 4hs, in the fourth attempt less 18s and 94hs and, finally, in the average of four attempts less 20s and 6hs. In the results presented on Table 12, when comparing women practitioner and non-practitioner of PA, we found that the values of MD show statistically significant differences in all attempts. We found that female practitioners of PA showed better results than non-practitioners of the same gender. So, in the first attempt we have less 29s and 34hs, in the second attempt less 27s and 30hs, in the third attempt less 25s and 37hs, in the fourth attempt less 24s and 18hs and, finally, in the average of four attempts less 26s and 54hs.

Discussion and conclusion

This study presents a research on the manual reaction speed and manual dexterity in elderly people (practitioners and non-practitioners of physical activity). The results support, in almost its entirety, the hypothesis that physical activity improves the levels of manual reaction speed and manual dexterity in elderly subjects. Regarding to the manual reaction speed, only female practitioners of physical activity didn't showed significant improvements in its performance. Regarding to the manual dexterity, only when we compare the elderly subjects between genders in the placing test, we were unable to observe significant differences. However, overall the study, the results showed that physical activity improved the rates of manual reaction speed and manual dexterity in the elderly.

Manual Reaction Speed

Practice: Given the results, there were significant statistically differences (p = 0,001) among the elderly practitioners of PA and the elderly not-practitioners of PA at the MRS. These results are similar to various studies, such as Era, Jokela and Heikkinen (1986) that, using a sample of 75 elderly practitioners and non-practitioners of PA in three locations of northern Europe, concluded that reaction speed has more favourable value in physically active subjects. In this sense go the results obtained by Carneiro (2005), which conducted a study in order to investigate the simple reaction time and anticipation-coincidence time, in preferred and not preferred hands of elderly practitioners and non-practitioners of physical exercise.

The sample was made up of 86 elderly patients with mean age of 73.7 ± 7.4 years, of which 42 were males (72.1 ± 7.3 years) and 44 females (75.1 ± 7, 3 years). For the evaluation of simple reaction time, the author applied the Multi-Choice Reaction Time Apparatus, 63014th model. Of the results obtained, the author concluded that the practitioners of physical exercise show higher performance of simple reaction speed, with both hands, comparing to non-practitioners of physical exercise. On the other hand, we also found different results of our study. Azevedo (2005) conducted a study to compare the visuo-motor memory and MRS in the elderly population, practitioners and non-practitioners of PA in the past five years. The sample was made up of 46 elderly people of both genders, aged between 65 and 93 years, being divided in two groups: one group of PA practitioner in the past 5 years and the other group non-practitioner of PA in the past 5 years. To assess the MRS, the author used the NHRT. Regarding the type of practice, she concluded that the differences found between averages of both groups were not statistically significant. However, overall, the elderly practitioners of PA in the past five years showed below average performance (212 ± 41.1), compared to elderly non-practitioners of PA in the same period of time (219 ± 45.8). In turn, Binder, Brown, Craft, Schechtman and Birge (1994), after confronted a group of elderly subjects with a low/medium intensity program of PA, for eight weeks, verified that they were unable to find improvements in psychomotor speed . However, they added that these results didn't surprise them, because its protocol of PA not emphasizes the strengthening of the upper extremities and didn't provide a sufficient intensity and duration to allow changes in the performance of reaction speed. Gender: In relation to our study, there are significant differences between genders in MRS, regardless of the type of practice. When we assess practitioners and non-practitioners of PA for each gender, we find that only males show statistically significant differences (p = 0,001). However, in females, when compared the older practitioners and non-practitioners of PA, we observed that the differences are not significant (p = 0391). In Carneiro's study (2005), to assess the simple reaction time in preferred hand and no preferred hand of elderly practitioners and non-practitioners of PA, the author concluded that the men obtained better results, i.e., less simple reaction time, either with the preferred hand or not preferred hand, when compared with females. However, the differences between genders were not statistically significant. Medell and Alexander (2000) also found that active older females have lower values of reaction speed than those more sedentary. On the other hand, in the study of Kauranen and Vanharanta (1996), the authors included in their research some aspects of motor performance, such as reaction time, movement speed, manual and pedal

coordination, using the Human Performance Measurement. Participated in the study 200 subjects (100 males and 100 females) aged between 21 and 70 years old. The authors observed the absence of statistically significant differences between genders.

Manual Dexterity

Practice: By the results obtained in this study, we can say that there are differences with statistical significance ($p < 0.05$) among the elderly practitioners and non-practitioners of PA. Our results converge on the same line of several previous studies. Mesquita (2002) conducted a study with 113 elderly over 65 years, 49 practitioners of PA and 64 non-practitioners of PA, which aim was the multidimensional assessment of elderly people (manual preference and proficiency). Millán (2002) in an elderly institution, conducted a program of regular PA with 42 subjects (35 women and 7 men), where the average age was 66 years. Okuma et al. (1994) compared 38 adult men, between 39 and 63 years, being practitioners of PA, undergoing 3 years of training to develop specific neuro-motor variables, including MD. In these three studies, it was possible to prove that practitioners of regular PA obtained better results in all functional areas, including the MD. Claiming to assess the effect of a training program in the manual function, Ranganathan et al. (2001) performed an experimental study in 28 elderly people, divided into experimental and control groups, 65 and 79 years old. The training program during a period of 8 weeks, with bi-daily sessions of 10 minutes, 6 days a week and included movements of digital dexterity. The experimental group and control group were evaluated through various tests. One was the Pegboard Test which measured the coordination of eye-hand movements required to perform manual tasks requiring speed and accuracy. The authors found that the elderly group, which was submitted to 8 weeks of training, improved their MD, compared to elderly people who were not subjected to regular training. A study conducted by Pinto (2003) aimed to meet some aspects of physical fitness, the MD and proprioceptive sensibility in elderly practitioners and non-practitioners of PA. For this, she used a sample of 57 elderly people, of whom 29 were practitioners of PA and 28 were non-practitioners of PA, and applied the MMDT to assess MD. As for the total sample, the author concluded that there are significant differences between the practitioners and non-practitioners of PA, both in Placing Test and Turning Test. So, changes in MD related to age may be delayed by entering in a training program, specific exercises to hand movements that increase the capacity and manual speed in the elderly, as well as programs of manuals strength and flexibility. These potential increases may be related to changes induced by training the peripheral and CNS, and probably for the elderly will benefit from a more independent life, since many of the daily activities call for MD (Carmeli et al., 2003; Ranganathan et al., 2001). Furthermore, a study of Ferreira and Gobbi (2003) check the influence of generalized and supervised physical activities, general agility (GA) and arms agility (AA) in elderly women, as well checking if there is a relationship between these two types of agility. Participated in the research 60 women (59.7 ± 5.9 years) divided into two groups: a) trained group (TG) - Participants of a generalized program of physical activity for at least one year, 3 weekly sessions of one hour; b) not trained group (NTG) – non-practitioners of generalized and supervised physical activities. For the assessment of the GA, they applied the EUROFIT tap test discs. They founded statistically significant differences between TG and NTG in the test of GA. However, this didn't happen for the AA test. The authors concluded that the regular practice of generalized and supervised physical activities improve the levels of GA, but not the AA. Gender: In our research, when comparing genders, we find statistically significant differences in all attempts, between males and females, in the Placing Test. However, the evaluation of MD in Turning Test we don't observe these differences. There only are significant differences in the last two attempts. As the values recorded for each gender, among the elderly practitioners and non-practitioners of PA, in both tests, it's possible to see statistically significant differences in MD. Our results are supported by several studies. Heuvelen, Kempen, Ormel and Rispen (1998) conducted a study with 624 individuals, of whom 274 were male and 350 female, between 57 and 91 years old. Among various parameters of a battery of tests to assess the physical fitness, they included the assessment of MD. In this research, the authors observed that the females showed significantly higher levels of manual performance in relation to males. In a study held in elderly people aged between 60 and 89 years on the manual functionality, HackelI, Wolfe, Bang and Canfield (1992) used a test consisting of seven sub-tests, representing seven different tasks of the day activities. In all sub-tests, except one, the women had a higher manual performance. Jebsen, Taylor, Trieschmann, Trotter and Howard (1969), in order to asses the manual function, implemented seven sub-tests representative of several manual activities (write a short text, turn three cards, take up small objects and place them in a container, stacking pieces of drafts, simulating the act of

eating, moving empty and filled boxes). The sample consisted of a group of 20 to 59 years and another from 60 to 94 years, being a total of 360 subjects. The females showed a superior performance in the oldest age group in both hands. In the same line of thought we note a survey conducted by Rudisill and Toole (1993), which held a study to access the differences in performances of several motor tasks in 73 individuals, men and women aged between 50 and 79 years. The differences between men and women in these motor tasks were significant. However, they also observed that men had greater motor performance (in the balanced long jump, sit and reach) and MD compared to women, which is contrary to the results that we obtained. On the other hand, some investigations have contrary results to those found in our study. In the research of Francis and Spirduso (2000), for the evaluation of manual preference and proficiency, they used 5 tests which assess the MD, precision, speed and manual coordination, in a group of 81 dexterous subjects (40 young people: 20 males and 20 females; 41 elderly people: 21 females and 2 males). This study revealed no differences in performance between genders. Pinto (2003) conducted a study with 57 elderly subjects of both genders, 65 and 99 years old, and assessed the MD using the MMDT. The author concluded that there was no statistically significant difference between genders, although the males present levels performance slightly higher than the females. These results contradict those obtained in our study, since there are significant differences between genders in both tests, with the exception of the first two attempts of the Turning Test. Moreover, in our study the elderly female had better values of MD than the elderly male. Another study by Desrosiers, Herbert, Bravo and Rochette (1999) intended to assess the changes that occur in the upper limbs in healthy elderly residents in a community, through a longitudinal study. They evaluated the following capabilities: manual function, power, sensitivity, MD and motor coordination. The sample was made up of 264 elderly subjects (128 females and 136 males) and the authors show that no significant difference was found between genders, in the evaluation of the different capacities. Identical conclusions resulted from the study conducted by Smith et al. (1999). The sample consisted of 56 adults (between 18 and 52 years) and 38 elderly subjects (between 61 and 94 years) and the authors used the Human Motor Activities Panel to assess the MD through 4 tasks with increasing degree of difficulty. The results showed no statistically significant differences in performance levels between genders. Mesquita (2002) in its study about multidimensional assessment of elderly people (manual preference and proficiency) with a sample of 43 men and 70 women, 65 to 99 years old, in relation to manual proficiency and gender, the author found that the women presented more low values compared to the men, indicating, however, that the differences were not significant. The study of Cãmina, Arce, Real, Cancela and Romo (2001) with 804 elderly people of 65-85 years, aimed to quantify the physical abilities in the elderly. The battery of tests used beyond the assessment of strength, flexibility, endurance and balance, it also includes a test of MD. The authors reported a better manual performance in male in relation to the opposite gender. Fernandes (2004) held a study, which aimed was to investigate the relationship between the intensity of manual preference and manual proficiency of senior residents in an elderly institution, through the assessment of manual preference, manual proficiency, MD and eye-manual coordination. The sample was made up of 56 elderly (21 males and 35 females), aged 65 to 91 years. Regarding the assessment of MD, by gender and manual preference, the author concluded that there are no significant differences between genders, with preferred and non-preferred hands. However, the males had better performance, either the preferred hand (1.76 ± 0.48) or with non-preferred hand (1.86 ± 0.42) when compared with the opposite gender (1.86 ± 0.48 and 1.97 ± 0.61, respectively).

This study provides evidence of the influence of PA in the manual reaction speed and manual dexterity in elderly people, practitioner and non-practitioners of physical activity. On the manual reaction speed, our results allow us to conclude that PA improves the performance of the elderly practitioners of PA and the elderly males in detriment of the opposite gender. When comparing the two variables in the study, practice and gender, we find that only the elderly male practitioners of PA show improvements of this capacity when compared with sedentary elderly subjects of the same gender. The same can not be confirm in female, since the improvements found among the older practitioners and non-practitioners of PA were not significant. Regarding to manual dexterity we conclude that in both tests, placing and turning test, the practice of PA influences positively the performance of the elderly subjects. As for gender, only in the placing test we found significant improvement between genders, where the women have better performances comparing to males. For the turning test, only in the third and fourth attempts and the average of four attempts there were significant improvements in the manual dexterity.

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BRZINA REAKCIJE I POKRETLJIVOST RUKU KOD STARIJIH OSOBA: KOMPARATIVNA STUDIJA OSOBA KOJE SE BAVE I KOJE SE NE BAVE TJELESNIM VJEŽBANJEM

Sažetak

Ljudsko tijelo, kako vrijeme prolazi, se transformiše i gubi svoju pokretljivost, poput brzine reakcije ili manipulacije objekata. Većina epidemioloških dokaza pokazuje kada osoba prihvati aktivan stil života, to minimizira proces starenjai poboljšava mogućnosti. Da bi se ocijenili efekti fizičke aktivnosti (PA) kod brzine ruku (MRS) i pokretljivosti ruku (MD) upotrijebili smo Nelsonov test reakcije ruku i Minnesota test ručne pokretljivosti (test postavljanja i okretanja). Uzorak su činili 40 dobrovoljaca (izmedju 67 i 85 godina starosti) stanovnici dva staračka doma u gradu Porto, i bili su podijeljeni u dvije grupe, jedna grupa se bavila fizičkim aktivnostima, druga ne. Ova studija je dovela do ovih zaključaka: 1/Što se tiče brzine reakcije ruke (MRS): (i) postoje statistički značajne razlike između aktivnih i neaktivnih subjekata, kao i među spolovima, i među aktivnim i neaktivnim (ii) među ženskim aktivnim i neaktivnim subjektima nije bilo značajne razlike 2/ Što se tiče ručne pokretljivosti (MD) potvrđeno je da: (i) ili u testovima smještanja ili okretanja postoje statistički značajne razlike između aktivnih i neaktivnih, i jednako ima razlika između fizički aktivnih i neaktivnih kod oba spola; (ii) među spolovima, u testu smještanja, primjećene su razlike od statističke važnosti, ali u testu okretanja ove razlike su potvrđene kod trećeg ili četvrtog pokušaja, u prosjeku kod četvrtog pokušaja.

Ključne riječi*: stariji, brzina reakcije, manipulacija, proprioceptivna senzibilizacija, vježbanje*

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