University of Pécs, Faculty of Health Sciences

Doctoral School of Health Sciences

Quality of life of women in menopause with loss of muscle strength. Possible physiotherapy interventions
Ph.D. Theses

Márta Hock

Head of Doctoral School
Prof. Dr. József Bódis

Program Leader
Prof. Dr. József Bódis

Supervisors of Doctoral School
Prof. Dr. József Bódis
Dr. János Garai

Pécs
2015

Sarcopenia and exercise as determinants of well-being in the elderly

Successful aging, considering increased life expectancy, is largely dependent on expected quality of life, higher degree of retained mobility, and the degree of self-sufficiency. The physical functions in the old age are highly dependent on the amount and function of the skeletal muscle. Muscle loss in adulthood, approximately to 50 years of age, is moderate, approximately 0.5% a year, however with age it can start to grow, and reaching 1.0-1.4% each year (Lexell, 1988; Frontera, 2008). Muscle loss rate greater than 30% is called sarcopenia, which may be followed by muscle strength and/or muscle function reduction (Doherty, 2003).

Aims of the study

1. Our aim was to define the rate of patients with sarcopenia in the subjects participating in the aqua exercise program and in the control group.
2. To compare the body composition index of those who participated in the subaquatic program for 3 years, twice a week for 30 minutes with the body mass index of subjects in the control group.
3. To assess the handgrip of subjects and to compare it with that of people who are not engaged in regular physical activity
4. To assess the state of nutrition and cognitive functions of subjects involved in the subaquatic program and in the control group
5. To assess the effect of the aqua exercise program on physical functions in both groups

Participants

Twenty-two female postmenopausal volunteers aged 59–75 were involved in this human study. They participated in a supervised shallow-water exercise program for 30 minutes, 2 days a week, for 3 years in an indoor swimming pool of Pécs, Baranya County, Hungary. An age-matched control group was recruited in Baranya County. The examination of the participants was performed at the Department of Pathophysiology and Gerontology, the University of Pécs in 2013.

Aquatic exercise program

Water temperature was maintained at 30°C, pool depth was 120 cm. The warm-up consisted of stretching and slow-pace walking while changing the rhythm and direction in water. The main part of each session consisted of joint mobilization, low-intensity strength training. The cool-down consisted of slow-pace walking with breathing exercise, stretching and muscle relaxation.

Methods

Body weight (kg), height (cm), waist, hip, mid-arm, and calf circumferences (each in cm), were measured. Cognitive function was assessed by using the Mini Mental State Examination (MMSE) (Folstein, 1975) score, and the Mini Nutritional Assessment (MNA) (Guigoz, 1996) test was used to assess nutritional status. Activities of daily living were measured by the Barthel index (Mahoney, 1965). Physical performance was estimated by "timed get up and go" test (TGUG) (Podsiadlo, 1991).

Muscle mass was measured by bioimpedance analysis (BIA) using Bodystat Quadscan 4000. The SMI cutpoints of 5.76–6.75 kg/m^2 were adapted as class I (moderate) and <5.76 kg/m^2 were adapted as class II (severe) sarcopenia (Janssen, 2004, Cruz-Jentoft, 2010). Muscle strength was assessed by hand grip dynamometer (KERN MAP 80K1). In diagnosing sarcopenia, the criteria of the European Working Group on Sarcopenia in Older People (EWGSOP) were used (Cruz-Jentoft, 2010).

Results

Waist circumference, mean MNA and mean MMSE scores, physical performance and muscle strength were significantly better in the aquatic exercise group. No significant difference was found between the age and body weight values of the 2 groups (Table 1). One of the participants in the aquatic exercise group had class I sarcopenia. In the control group, on the other hand, 2 individuals had moderate and 2 others had severe sarcopenia. The subjects with sarcopenia had chronic joint pain as well.

Skeletal muscle mass of patients with and without chronic joint pain were also compared. Volunteers without joint pain served as a reference group. The SMI scores of those volunteers with chronic joint pain (mean rank: 7.5; sum of rank: 60) were compared with scores of the

reference group (mean rank: 13.79; sum of rank: 193) using Mann-Whitney U test, and the difference was found to be statistically significant (Z −2.184 P < 0.029).

Characteristics	Aquatic exercise (n=22)			Control (n=26)			p value
		95% CI			95% CI		
	Mean ± SE	Lower bound	Upper bound	Mean ± SE	Lower bound	Upper bound	
Age (years)	64.5 ± 0.9	62.7	66.2	65.6 ± 0.8	63.8	67.4	0.361
Weight (kg)	76.3 ± 2.4	71.2	81.3	75.7 ± 3.3	68.8	82.6	0.899
Height (cm)	161.9 ± 1.1	159.7	164.2	159.3 ±1.6	156.0	162.6	0.208
Body mass index (kg/m^2)	29.1 ± 0.9	27.2	31.1	28.4 ± 1.6	25.1	31.7	0.717
Mid-upper arm circumference(cm)	32.4 ± 0.7	30.9	33.8	31.2 ± 0.7	29.7	32.7	0.284
Calf circumference (cm)	37.6 ± 0.62	36.3	38.9	37.3 ± 0.8	35.6	38.9	0.802
Waist (cm)	98.9 ± 2.6	93.4	104.5	107.5 ± 2.8	101.7	113.4	**0.035**
Hip (cm)	112.5 ± 2.2	107.9	117.1	113.1 ±2.6	107.7	118.6	0.857
Total body fat (%)	41.5 ± 1.0	39.3	43.7	41.7 ± 1.4	38.9	44.6	0.898
SMI (SMM/height^2)	7.7 ± 0.2	7.4	8.1	8.1 ± 0.2	7.5	8.6	0.309
Maximal handgrip strength (kg)	23.8 ± 0.7	22.3	25.4	19.2 ± 1.4	16.3	22.1	**0.008**
Timed up and go test (s)	9.2± 0.9	7.7	8.6	16.4 ± 1.7	12.7	19.9	**0.001**
MMSE	28.9 ± 0.3	28.4	29.5	25.8 ± 0.8	24.0	27.5	**0.002**
MNA	28.9 ± 0.9	28.5	29.3	25.4 ± 0.6	24.2	26.6	**0.000**
Barthel index	98.4 ± 2.4	97.4	99.5	96.7 ± 1.5	93.6	99.8	0.326

SE: standard error of mean, CI: confidence interval, SMI: skeletal muscle index, SMM: skeletal muscle mass, MMSE: Mini Mental State Examination, MNA: Mini Nutritional Assessment.

Table 1 Descriptive characteristics of study participants

Discussion

Menopause is associated with a decline in muscle mass and muscle strength. Sarcopenia causes functional and eventually cognitive decline, frailty and falls with a high risk for hip fracture. Water is a safe, supportive, low risk exercise environment that may reduce the likelihood of acute injury and fear of falling while improving participation and adherence in the elderly. It is thought that the benefits of aquatic exercise are mainly attributable to the decreased effects of gravitation.

The goal of this study was to assess the possible role of long-term aquatic exercise on maintenance of normal muscle mass and muscle function in postmenopausal women. Both the prevalence of class I and class II sarcopenia within our control group was 7.7%. However, only 1 subject with class I sarcopenia (4.5%) was identified in the aquatic exercise program.

Chronic joint pain or osteoarthritis predisposes patients to decreased physical activity; therefore, they are at risk for sarcopenia. It was also confirmed by our data. The pace of loss in muscle mass and strength might be slowed by aquatic exercise in patients even with chronic joint pain. Our results may also suggest that water exercise may slow the progression of loss of the muscle mass and strength.

Examination of quality of life, sexual function and incontinence after hysterectomy

Hysterectomy is one of the most frequent type of gynecological surgical operation in both the European Union (EU) and the United States of America (USA) (Thakar, 2002; Carlson, 1993). According to a nationwide population-based cohort study in Sweden, the risk of developing stress incontinence that manifests after surgical management is the highest in the first 5 years following hysterectomy (Altman, 2007). No other previous research has found significant positive longitudinal difference either in the quality of life or in sexual functions when different modes of hysterectomy (vaginal or abdominal) were compared (Roussis, 2004).

Aims of the study

1. Our aim was to assess quality of life after the surgical intervention
2. To assess changes in sexual functions with the help of a questionnaire survey
3. To define the degree of incontinence after the surgical intervention (in the long term)

Material and methods

Three questionnaires were used for data collection: a self-compiled demographic questionnaire (1st), the Short Form (SF) 36 questionnaire (2nd) (Ware, 1995; McHorney, 1993), and a shortened combined version of the Lemack and Female Sexual Function Index (FSFI) questionnaire (3rd) (Lemack, 2000; Rosen 2000).

Results

Of the 210 women requested to fill in the questionnaires, 164 were willing to participate in the study. 21 of them were excluded either due to self-reported depression or sending in questionnaires that were not fully assessable. The total number of subjects was 143.

Demographic data

The mean age of the participants was 51.77±10.17 years, and their average BMI was 26.88±3.45 kg/m^2. The average of the postoperative period was 4.05±2.25 years. The average number of children was 1.74 children/person; most of the participants were married (59.44%) and had a college or university degree (37.6%). Prior to hysterectomy, 49 females had other surgical interventions due to gynaecological problems (34.26%). Seventeen females (11.88%) had incontinence and 21.67% were sexually inactive. The number of subjects in the different sub-groups based on the operation types is as follows: vaginal total hysterectomy group (VTH): 54 subjects (37.77%), 38 subjects (26.58%) in the abdominal subtotal hysterectomy (ASH), and 51 subjects (35.66%) in the abdominal total hysterectomy group (ATH).

Sexual function

Thirty one (21.67%) subjects out of 143 indicated that they had been sexually inactive during the preoperative period. None of them remained inactive after the surgery. Concerning the sexual function questions, there was no statistically significant difference (p>0,05) found with regard to the three different modes of surgery. From all the patients (n=143), pain interfering with sexual life was mentioned among the complaints in 68 cases (47.55%). Seventeen (11.89%) of them belonged to the ones who were sexually inactive in the preoperative period. Although no dissatisfaction was reported, minor complaints in sexual life did occur: thirty five females complained of vaginal dryness (24.47%), 34 patients mentioned lack of orgasm (23.77%), and 69 females complained of decreased libido (48.25%). None of the subjects reported or experienced complaints that would significantly inhibit or hinder their sexual life.

In the vaginal total hysterectomy group, the number of those who occasionally felt pain during sexual activity was significantly ($p = 0.047$) higher than in the other group.

Life quality

Life quality was evaluated with the SF-36 questionnaire. There was no statistically significant difference (p>0,05) found in the subgroups in their life quality.

Incontinence

Incontinence was reported in 34 cases (23.77%). Nineteen subjects (55,88%) had stress incontinence, and 15 females (44,11%) experienced urge incontinence. Six subjects (17.64%) noticed urine loss during sexual intercourse. When comparing the 3 groups, the vaginal total hysterectomy group showed a significantly increased involuntary loss of urine (p=0.023).

Discussion

The physiological background of human female sexual functioning is rather complex. The independent role of the uterus or the cervix has not been established so far beyond doubt by scientific studies (Hasson, 1993). The only one characteristic of sexual functions that was found different between the groups was the increased rate of occasional pain during intercourse in the TVH group. When findings related to life quality in general were also taken into consideration, the lowest scores of pain could be found in the vaginal total hysterectomy group. This may point to the possibility that pain during sexual intercourse might originate from the genitourinary tract. Thus, it appears that the pain is directly connected to the sexual act, hence, it may not be linked with the dysfunction of other organs. Former findings have shown that significant improve in the life quality could be observed during the first year after the surgery (Gorlero, 2008). In our case, the average time from surgery was three years longer than that of that research. The longer time interval involved, the more likely possibility is that not only the negative eliminated symptoms determined the quality of life. Apart from the negative symptoms, getting rid of their source, i.e. removal of the uterus, does not seem to be a major determinant of life quality in the long term. Some studies have shown that previous hysterectomy does not seem to be of great importance in the development of de novo incontinence (Greer, 2010; Robert, 2008). In other studies, hysterectomy for benign indications seems to increase the risk for subsequent stress urinary incontinence surgery (Kudish, 2014; Neumann, 2007). According to Lakeman et al. (2010), lower urinary tract symptoms appear to be more common following vaginal hysterectomy as compared to abdominal hysterectomy. The incidence of incontinence in the total vaginal group was also significantly higher accordance with our findings.

Operations of Prolapse

Change of Body Composition and Pelvic Floor Muscle Strength after colporrhaphy and colpoperineorrhaphy among overweight/ obese women in postmenopause

Proper support of pelvic organs is maintained by the intact and coordinated functioning of pelvic floor muscles, their innervations and the connective tissue elements (Wei, 2004).
Interventions mainly aim to reconstitute connective tissue (Grody, 2003; Richardson, 1993). Isolated insufficiency of single pelvic tissues, however, is rare. This may explain why surgical management of pelvic organ prolapse proves unsuccessful in about one third of the cases (Olsen 1997).

Aims of study

1. Our aim was to determine the rate of change in the body composition and pelvic floor muscle strength during the perioperative period in case of colporrhaphy and colpoperineorrhaphy.

2. To assess changes in the strength of pelvic floor muscle in the perioperative phase

Materials and Methods

The study involved 30 postmenopausal women who underwent anterior colporrhaphy or colpoperineorrhaphy.
At the first session, a thorough medical history was taken about the volunteers' general medical health. To assess symptoms affecting the volunteers' quality of life, we used the Menopause Rating Scale (MRS) (Schneider, 2010). During the perioperative period, body composition was monitored with HUMAN IM-SCAN Bioelectrical Impedance Analyser from Dietosystem, Milan, Italy. The following parameters were computed: Total Body Water (TBW), Extracellular Water (EW) and Intracellular water (IW), Fat Mass (FM) as well as Fat Free Mass (FFM).
Pelvic floor muscle activity was assessed with FemiScan surface EMG (Mega Electronics Ltd, Kuopio, Finland). The following parameters were measured: muscle activity, relaxing ability and the difference in activity between the left- and right sides.

Results

Demographic data of the participant are presented in Table 1. According to Eurofit tests, the patients achieved 58% less than expectable abdominal strength.

Characteristics	Age (years)	BMI (kg/m^2)	Waist (cm)	Hip (cm)	Waist-Hip Ratio	Concomitant disease					MRS (1st measurement)**	MRS (2nd measurement)**
						total*	cardiovascular *	respiratory *	diabetes *	musculoskeletal*		
Mean	59.47	30.3	98.56	111.3	0.89	4.13	21	4	4	3	12.91	12.55
SD	8.58	3.86	8.34	8.79	0.05	3.79	-	-	-	-	8.5	8.2

* counts, **scores

Table 1 Descriptive characteristic of patients

No significant difference was observed in body composition between the first and second sessions in the preoperative period. Concerning bioelectrical impedance data of the second and third sessions (i.e. immediate pre- and postoperative days), a significant difference was found in each computed parameters, except for the intracellular fluid (p=0.15). No significant changes were found between bioelectrical impedance data obtained on the 1st postoperative day and 6 weeks after the surgery. Results of FM body composition do not show a significant decrease (5.9%) between measurements. Surface EMG results show a significant improvement in the ability of the pelvic floor muscles to relax (p=0.03) in the preoperative period (1st and 2nd sessions). Although not a significant (p=0.054) but a decreasing tendency was observed in the average muscle strength on the day before and at 6 weeks after the surgery; a significant decrease of muscle strength was found on the left side (p=0.034). A significant (p=0.005) decrease was found between the average muscle strength on the first and last sessions (1 month prior to the surgery and 6 weeks after surgery) (Table 2).

Charac-teristics	1st measurement			2nd measurement			3rd measurement			4th measurement		
	Mean ± SE	95% CI		Mean ± SE	95% CI		Mean ± SE	95% CI		Mean ± SE	95% CI	
		Lower bound	Upper bound		Lower bound	Upper bound		Lower bound	Upper bound		Lower bound	Upper bound
Total body fat (%)	30.13 ± 3.1	25.03	35.23	27.92 ± 3.16	22.76	33.08	28.3 ± 3.23	23.05	33.56	28.33 ± 3.25	21.96	34.71
PFM strength (µV)	7.13 ± 0.97	5.23	9.04	6.98 ± 1.206	4.62	9.35	-	-	-	5.55 ± 0.76	3.83	7.27

Table 2 Data of Total Body Fat and Pelvic Floor Muscle (PFM) strength

Discussion

Body mass index of all our obese patients reached or exceeded the upper limit of 25 in the follow-up period, a factor that is known to contribute to postoperative relapses (Moalli, 2003). According to the waist–hip ratio, central obesity is prevalent in our sample, which is an increased risk factor for prolapse (Brown, 1999). A higher than average FM was observed already in the preoperative period, despite the fact that almost all participants (93.3%) performed regular physical activity as part of their job and /or in their free time, but it decreased by 1.8 FM % (5.97%) during the postoperative follow-up.

It is widely accepted that the levator muscle function is a determinant for not only the subjective or objective symptoms but also for relapse and for a need of a surgical intervention in pelvic floor dysfunction. The anatomical position of the levator muscle may favorably change in the postoperative period (Song, 2009; Vakili, 2005). In a current study, pelvic floor muscle activity indicators have shown poor results in the preoperative period. Lack of hormonal effect in postmenopausal women changes the tissue quality in the levator muscle and sacrouterine ligaments. Muscle activity results on the preoperative day and 6 weeks after the surgery show a significant decrease. Taking into consideration the average muscle activity of the pelvic floor as measured by the EMG, a significant, 22.15 % decreasing tendency can be seen 1 month prior to the surgery and 6 weeks after surgery.

Our results confirm that postmenopausal obese women who undergo anterior or posterior colporrhaphy need a follow-up concerning pelvic floor muscle function and suggest that physiotherapy started at the earliest possible date may aid in preserving postoperative functionality in the long run.

Conclusion

The results of the present study show that the frequency of sarcopenia is lower, and the muscle strength and physical and cognitive performance is higher in postmenopausal women regularly attending the aqua exercise program. Although it would be more advantageous to prevent loss of function and muscle mass in middle aged women than trying to regain them in an elderly age. The prevention of sarcopenia is not only more cost effective, but it promotes better life quality in the elderly as well. One of the tools in complying with this effort may be the aqua exercise program.

One of the solutions in the treatment of gynaecology diseases involving decline in muscle strength may be the surgical intervention, which is widespread in Hungary as well. Based on our study results, we may conclude that the various types of hysterectomies do not have a negative impact on life quality in the long term, but vaginal hysterectomy was more likely to affect sexual function. However, based on international research results, the development of incontinence is more frequently related to posthysterectomy conditions. After colporrhaphy or colpoperineorrhaphy, a decrease in pelvic floor muscle strength is found in patients with short follow-up. It would, therefore, be reasonable to follow-up the condition of the pelvic floor muscles in obese patients in the perioperatve phase to promote the life quality improving the effect of these procedures in the long term.

New results

1. Regular exercise is an advantage in the prevention of sarcopenia. In the water exercise group, better nutritional status, greater muscle strength, improved physical function and mental state were found.
2. The outcome of total vaginal hysterectomy in menopausal patients does not generally differ from the outcomes of other (abdominal) operating techniques in regards to their effects on quality of life. However scar tissue pain caused by total vaginal hysterectomy can have a negative outcome on sexual life, and it can increase the risk of developing incontinence.
3. Prolapse operations (colporrhapy, colpoperineorrhaphy) in postmenopausal, overweight patients, can further weaken and overload, their already weakened and overloaded pelvic floor muscle in the perioperative period, hence pelvic floor muscle training starting at the earliest in the perioperative period may be justified for these patients.

Practical implementations

1. An important task in the work of the physiotherapist is preventive work in the elderly. The results of our study may be helpful in the elaboration of a more effective preventive program for muscle exercises.
2. Our results may direct the attention to late potential sexual dysfunctions and the frequency of incontinence after hysterectomy.
3. According to our research results, it is worth following up changes in pelvic floor muscle strength in obese women in the postcolporrhaphy and postcolpoperineorrhaphy periods.

Acknowledgements

I have received a lot of help and support in carrying out my research, without this my thesis would not have been possible. I would like to express my respect and my sincere thanks to

József Bódis, (rector, University of Pécs), for his support during my research and the preparation of my doctoral thesis, for promoting honest motivation, patience and understanding, that made the defence of my social sciences-oriented doctoral thesis possible.

János Garai, (associate professor, institute of Pathophysiology and Gerontology, University of Pécs), who is always available to me in my work, gives selfless, valuable advice and effective support with untiring patience while writing articles and dissertation.

Szilvia Soós, (lecturer, Institute of Pathophysiology and Gerontology University of Pécs) for her generous help, the inspiration she gave, the advice, her always fresh thoughts, her encouragement provided during my work.

József Betlehem, (dean, Faculty of Health Sciences University of Pécs), who, with infinite patience, made it possible to continue my PhD studies and scientific work.

Endre Sulyok, (Faculty of Health Sciences, University of Pécs Doctoral School of Health Sciences) who as the head of the doctoral programme, and as secretary of the doctoral school allowed to continue to work on my PhD thesis.

Brigitta Hajnal, (Institute of Languages and Communication Faculty of Medicine, University of Pécs), who was always available to me in case of linguistic doubts.

All employees and colleagues who with their help, advice and support contributed to the preparation of my dissertation at the Faculty of Health Sciences, University of Pécs.

Loved ones, *my daughter*, my mother, my father and my friends for their support, understanding and patience, for their love is unconditional.