

BALANCE ABILITY IMPROVEMENT OF SENIORS 65+ DURING THE SPA STAY

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Abstrakt

The study was elaborated within the project GAČR ID 17-25710S „Basic research of balance changes in seniors“. The aim of the study was to verify the feasibility of the intervention program “Life in Balance” in the conditions of a spa stay in Jupiter Bechyně Spa for seniors 65+ and to prove that the spa environment. Twenty participants (16 females, 4 males) in the age interval of 65 to 77 years old, attending comprehensive spa care, underwent the balance intervention as a part of their spa care. The following diagnostic methods were used: Medical Anamnesis, Functional anthropological examination; Tinetti Balance Assessment Tool, Short Form Health Survey (SF-36), the scale “Anamnestic Self-Assessment”. The Tinetti dynamic balance score as well as the Tinetti overall balance score of the participants improved significantly after the intervention. The intervention method “Life in Balance” can be implemented into the spa program of seniors 65+. It can influence significantly the overall balance ability. The spa environment is a very suitable place for such an intervention and it is possible to recommend the intervention program “Life in Balance” as a part of the spa medical rehabilitation care.

Keywords

Bio-psycho-social aspects of balance, Intervention „Life in Balance“, Seniors 65+, Spa.

Acknowledgement: Research was supported and funded by the Czech Science Foundation – project GAČR ID 17-25710S “Basic research of balance changes in seniors”.

INTRODUCTION

The European spa tradition is based on antique ancient traditions. Since the end of 19th century and in 20th century spa involves using of natural healing resources with a significant share of direct medical care and with a comprehensive approach to clients' medical stays. In the Czech Republic after 1989, the standard offer of spa therapeutic stays was extended to include new forms of relaxation and regeneration, which offer an individual approach with regard to the needs of seniors, when the term “senior” is defined as a person aged sixty and older, with defined pension, social security and healthcare rights (Jandová, 2009; Jandová et al 2018; EU, 2016). In the elderly, postural control generally decreases and the balance skills of seniors decline (Benzo, Novotny, Karpman, Depew, 2013; Buso, et al., 2019; Shumway-Cook & Woollacott, 2016). Disruption of the static

and dynamic balance can result in reduced physical activity in the seniors' daily life. Decreased ability to balance is also a major risk factor for falls (Bukova et al., 2019). Fear of falling can lead to anxiety and reduce the activities of seniors. Seniors are thus becoming socially isolated (Dellinger, 2017; Gilleard, Higgs, 2005). According to the survey of the Institute of Health Information and Statistics, diseases of the locomotive and nervous system are the most frequently treated problem in spa resorts and facilities in the Czech Republic (CSU, 2019).

Interventions for seniors focused on balance development in the spa environment, based on appropriate and individual selection of exercises and techniques, can significantly influence the course of spa treatment and consequently significantly affect the quality of life of seniors (Jandová et al., 2018). Undoubtedly, physical activity is the

effective middle of preventing health deterioration due to aging. Twelve-week training in male seniors restored muscle steroid levels of DHEA, free testosterone and 5 α -dihydrotestosterone, and also led to increased expression of steroidogenesis enzyme proteins. In younger participants, this training did not induce such changes (Sato and Iemitsu 2018).

One of the adequate movement activity for seniors balance support may represent yoga. Yoga exercises are slowly provided, with breathing improvement. Yoga includes effective physical and relaxation techniques for seniors used to achieve a state of inner balance and to create a feeling of well-being and freshness. Yoga exercises counterbalance muscle imbalances and ensure adequate exercise load for the musculoskeletal system. Breathing, relaxation and balance exercises establish balance of movement control, soothe the nervous system, and promote overall psycho-hygiene of elderly (Maheshwarananda, 2000; Kinser, Goehler, & Taylor, 2012; Cramer, Ward, Steel, Lauche, Dobos, et al 2016;). The authors state that regular yoga exercises can restore and maintain general endocrine functions in the human body. A study conducted with 45 untrained volunteers who were divided by in the experimental group (with exercise: n = 23, 15 males - age 42.80 \pm 7.43 years; 8 females - age 44.75 \pm 8.40 years) and control group (no exercise: n = 22, 15 males - age 41.67 \pm 7.87 years; 7 females - 45.43 \pm 7.00 years). The experimental group underwent combined yoga exercises daily in the morning time for 12 weeks while the control group continued its usual activities. After 12 weeks of yoga training, there was a significant increase in growth hormone (GH) and dehydroepiandrosterone sulfate (DHEAS) levels in both sexes compared to their baseline data, whereas no significant changes were observed in the control group. This means that physical activity can lead to the maintenance of a baseline

level of GH and DHEAS in the human body and thus healthy aging (Chatterjee, Mondal 2014; Cramer, Lauche, Langhorst, Dobos, 2013).

A hypothetical possibility represents the combination of physical activity in seniors with DHEA application. For example, this approach led to a decrease in fasting blood glucose levels in obese laboratory animals by activating the glucose metabolic signal pathway. In addition, during that the lipid metabolism in the muscles was intensified. Application of DHEA or testosterone also improves muscle protein synthesis and leads to increased muscle mass and strength in seniors and in type 2 diabetics. Increased levels of sex steroid hormones induced by DHEA applications have a number of benefits, but only in individuals with lower levels of sex steroid hormones such as the elderly, obese and type 2 diabetes patients. The combination of DHEA application and physical training then significantly it should lead to increasing of muscle sex steroid hormone levels, and to decreasing of the insulin resistance while increasing muscle mass and strength. Thus, application of DHEA in combination with exercise program may be one of the new therapeutic approaches for the treatment of obesity, type 2 diabetes and sarcopenia (Sato and Iemitsu 2018). It is possible to assume. For the development of balance in senior age, yoga exercises represent the perfect wide range of different movement situations that combine the physical and psychosocial attributes of balance, such as synchronization of movement with breathing, slowed movement sequences, and releasing the mind from fear and worry (Maheshwarananda 2000, Krejci, Kornatovska 2017, Montepare, 2019). In this context, yoga exercises can also help in psychosocial determinants of balance, such as improving concentration ability, emotional stability, ability to adapt to social change and new social situations.

OBJECTIVES, HYPOTHESES

The main objective of the presented study was to verify the feasibility of the interventional wellness program "Life in Balance" in the conditions of a spa stay in Jupiter Bechyně Spa for seniors 65+ as a part of the project "Basic research of balance changes in seniors". ID 17-25710S. Another objective was to analyze and interpret the results of the holistic balance improvement in monitored seniors during the spa rehabilitation care, and to prove that it is the spa environment and spa treatment that creates the right conditions for the realization of the balance intervention as a part of treatment.

Hypotheses

H1: After completing the intervention "Live in Balance", the overall Tinetti balance score will improve in the experimental group of seniors.

H2: After completing the intervention "Live in Balance", the mental balance score will improve in the experimental group of seniors.

METHODS

Participants

The research study included in total 20 spa clients in senior age, who completed the intervention program during their comprehensive therapeutic rehabilitation spa treatment, lasting 28 days. The research sample included 14

women and 6 men in the age interval 65 - 77 years. The mean of all participants age was 69.6, median 68.5 years old. Before the start of the program, all participants were acquainted with its course and participated voluntarily. From the view of home residence, from the 20 involved participants, two were living in senior homes, all others were living at home in a family environment. From the view of partnership, from the 20 involved participants, 11 participants were living without a partner, 9 were married.

Procedure

The research study was carried out in the Czech spa town Bechyně in the spa resort Jupiter, where the clientele mostly seniors represent (usually 80%) in the age of 65 and over. The indication groups of spa and rehabilitation care in the Jupiter spa facility are persons with the musculoskeletal and nervous system diseases (see Table 1), which, with the exception of injuries, manifest and worsen just elderly. The Jupiter Bechyně Spa provides spa and health rehabilitation care in the form of comprehensive or contributory care in the indicator groups VI and VII according the code of health insurance companies (Table 1). Accommodation of spa clients in the Jupiter spa resort is provided in single, double and triple rooms. Each room has its own bathroom with toilet and shower or bath.

Table 1 Indication groups of spa and rehabilitation care in the Jupiter spa facility

Nervous diseases (indication group VI)	
VI /1	Polyneuropathy with paretic manifestations
VI /2	Root syndromes of vertebrogenic origin
VI /3	Primary, secondary and degenerative neuromuscular diseases
VI /4	Parkinson's disease
Locomotive organs diseases (indicator group VII)	
VII/1	Rheumatoid arthritis st. I. - IV. (including juvenile arthritis)
VII/2	Ankylosing spondylitis (Bechterew's disease)
VII/3	Other seronegative spondarthritis (psoriatic arthritis, Reiter's syndrome, enteropathic arthritis), Secondary arthritis, Non-articular rheumatism
VII/4	Diffuse connective tissue disease, Osteoporosis
VII/5	Bone changes - consequence of work in compressed air - occupational disease
VII/6	Painful syndromes of tendons, tendon sheaths, bursa, sternal muscles, skeletal muscles or joints
VII/7	Coxarthrosis, gonarthrosis, arthrosis in other locations
VII/8	Arthropathy
VII/9	Chronic, vertebrogenic algic syndrome of functional origin
VII/10	Conditions after orthopedic surgery - joint replacement
VII/11	Conditions after injuries of locomotive organs and orthopedic surgeries including conditions after operations of intervertebral discs and spinal canal stenosis

Before the start of the research study, the spa physicians selected the participants eligible for participation in the research. Spa paramedics were trained to assist with intervention. At the first meeting, clients were acquainted with the content and course of the intervention. Clients completed and signed informed consent and completed anamnestic self-assessment test. In addition, Tinneti's static and dynamic balance tests were performed with them. Then they completed the SF 36 Quality of Life Questionnaire. The four week intervention was applied during the spa stay. Each week, one educational unit of 90 minutes was performed with the participants. It consisted of motivational part, physical exercises part, breathing exercises, relaxation, and concentration techniques. Physical, breathing and relaxation techniques have been adapted from yoga techniques - relaxation, mudras, concentration, meditation, asanas, pranayama - diaphragmatic breathing, full yoga breathing, Nadi Shodhana, ujjayi. Clients continued to work with this program on a daily basis, with the assistance of an assistant. The program was complemented by discussions focusing on ethics, life philosophy, reducing stressful situations, proper nutrition and a drinking regime. For each week, participants received a methodological sheet with motivation, tasks and recommendations. At the end of the intervention program, patients were again subjected to anamnestic self-assessment and Tinneti's static balance and dynamic tests. Then they absolved again SF-36 survey and discussed the course of the entire intervention program with an emphasis on feedback of participants. All investigations and educational units took place in the Jupiter Spa in the halls on the first floor. After completing the research, all the obtained data were evaluated and statistically processed, and after the results, conclusions and recommendations were determined.

Diagnostics methods:

Followed diagnostic methods were used in the investigation:

- *Medical Anamnesis*: The background of a person accumulated data concerning basic information and a medical problematic background for use in analysing of the actual health condition of senior age.
- *Functional anthropological examination*: It was created of selected classical anthropometry methods, which were non-invasive, using anthropometric instruments as anthropometer, digital personal scale, Harpenden calliper, manual dynamometer type Collin. Following parameters were examined: Body height, body weight, BMI, girth of chest across mesosternale, girth of waist, abdominal circumference, gluteal circumference, arm circumference relaxed, calf circumference maximal, biepicondylar width of humerus, biepicondylar width of femur, width of wrist, width of ankle, girth of thigh, girth of knee, girth of ankle; thickness of 7 selected skinfolds – calliper measurement type Harpenden (biceps, triceps, suprailiac, abdominal, subscapular, anterior thigh, calf medial). Body Composition Analysis using In-Body 230. The methods in the Functional anthropological examination were provided according methodological description of Bláha (2017).
- *“Tinneti's test of Balance”* (Tinneti, et al. 1990) evaluates the balance ability score of seniors and serves to evaluate the results of the intervention. Evaluates the overall balance score from the components: static balance score and gait score.
- *RAND 36 Short Form Health Survey (SF-36)*: The survey SF-36 represents widely used tool to determine the quality of life related to health in seniors, designed to research and monitor the quality of senior specific population and of

senior general population life as well. In general the questionnaire SF 36 is sensitive to all problems in areas of physical, mental and social health in aging. It consisted of 36 questions grouped into 9 categories (see Table 2). The SF-36 is a tool managed by a non-profit organization RAND Corporation (ÚZIS, 2018; Ware et al, 1993).

- *The test "Anamnestic Self-Assessment"* (Hošek 2017) was developed in frame of the project GAČR ID 17-25710S "Basic research of balance changes in seniors". We present here the new diagnostic tool in specific details as the first part of the results.

INTERVENTION

Description of the intervention program process

Week 1 - You are never alone

The aim of the first week was to realize that in life one is not alone. There is a certain anchoring in society, but main is to be in balance with self. There are various associations and associations where you can meet others. There was a discussion on this topic in the educational unit. Part of the program this week was to practice diaphragm (abdominal) breathing. This type of breathing is an important compensatory means against stress and stress. It helps to normalize blood circulation, digestion and tissue regeneration. The first exercise to achieve this is to inhale and then to exhale slowly. The diaphragm at this time pushes the abdominal organs down to the pelvic floor and creates space for maximum deployment and pump of air into the lungs. Exhaling longer than inhaling leads to the release of the whole organism.

The physical exercises of this week were based on yoga sarvahaasan in sitting on a chair including pulling arms up, turning the shoulders, practicing with fingers. At the 1st educational unit, the participants were checked and instructed

how to handle each movement correctly, in synchronisation with breathing, closed eyes, etc. They repeated themselves throughout the week.

Week 2 - Nothing is impossible

The 2nd educational unit was focused on self-acceptance. Psychological benefits of self-acceptance include mood regulation, alleviation of depression symptoms, increased positive emotions. Self-acceptance is also considered necessary for good mental health. In addition to psychological benefits, self-acceptance can also have physical benefits. The results of a 2008 study show that older women with higher levels of positive relationships with others and self-acceptance showed lower levels of glycosylated hemoglobin, a marker of glucose / insulin resistance (Ryff, 2008). The physical exercise this week was the practice of nasal breathing with internal attention to the inhalation and exhalation process, in which patients learned to use hand wisdom. Mudras act as neuromuscular stimulators. With this exercise, the patients tried to positively influence physical and mental functions and induced overall calming of the organism. Afterwards, there was an exercise for the development of deep calm breathing, brain gymnastics - practicing the fingers and toes and another balance exercise sitting on a chair.

Week 3 - Movement is life

The third educational unit concerned the necessity of a part of movement in our lives. The physical activity of a person corresponds to the quality of his life. Modern scientific knowledge shows that movement is intertwined with the psychological development and human health. It is important to realize that just as movement is part of everything around us, nature and the entire universe, it is an integral part of ourselves, a symptom of every life. Therefore, it is very important

not to underestimate the movement and to try to involve as many muscles as possible every day, including the facial, hand and foot muscles at a slow pace in the respiratory synchrony. If serious health reasons do not allow us, massage. In the educational unit there was a demonstration of hand and foot massages. In the main part of the educational unit, there was also the exercise of balance in sitting on a chair and standing behind a chair with support, repetition of exercises from previous weeks, a new breathing exercise "lion grimace" to relax the muscles in the face and relieve stress. The exercise benefits the vocal cords and diaphragm, the muscles of the face and neck, stretches the tendons on the fingers of the hands, relaxes the jaw joints, and has a preventive effect on cervical, ear and nose diseases. Cleans the tongue and improves articulation. This was followed by a vibration exercise - chanting the "OM" mantra. When this mantra is chanting, there are vibrational effects in the diaphragm, lung and brain areas, leading to positive physiological effects.

Week 4 - Enjoy life and every moment of it

The last educational unit devoted itself to realizing the joy of being. Patients painted each flower and concentrated on the inner image of the flower in the meditation section. Their task was to imagine its color, shape and smell. The aim of this exercise was to evoke an inner sense of joy and harmony. There was also an exercise to develop balance - playing flowers, which was accompanied by singing together. Exercises and breathing techniques from previous lessons were also repeated. Awareness of the state of peace, peace, freedom. At the end of the discussion there was a discussion on the length of human life and human health.

Statistics

The Wilcoxon paired test was used when the critical value was $p < 0.05$. A robust Wilcoxon pair test was used to statistically evaluate the significance of the median differences between the phases of the experiment in the Tinetti equilibrium and gait test. This is a non-parametric test. The calculation of the test is based on the paired values of two measurements on one sample: quantities X and X' (measurements before and after the experimental intervention).

RESULTS AND DISCUSSION

On the base of the data analyses the following results can be stated. The Tinetti balance score, the Tinetti dynamic score and the Tinetti summary score were clearly improved after the intervention program (see Table 2). These results verify the hypothesis H1.

The SF-36 survey results show that all patients are most restricted in physical activity and overall vitality (items 3E, 3F of SF-36). All other investigated parameters show the relation to the limitation of physical activity. Low assessment of health changes in spa patients can be attributed either to acute treatment after an injury, surgery or outbreak, or of the repeated treatment of chronic illness, which is not expected to improve the state of health compared to the previous year. Nevertheless, the results show that there has been an improvement of 1.5% in the overall perception of health after the intervention program. The greatest progress was seen in the limitations caused by emotional problems by 10.05%, physical activity limitations by 8.75% and overall mental health by 8.5% (items 9A, 9B, 9C, 9D, 9E, 9I of SF-36). Evaluation of the SF 36 questionnaire after the end of the intervention wellness program clearly shows an improvement in the perception of mental balance (items 10, 11b of SF-36; Table 2).

These results verify the hypothesis H2.

Table 2 Significant changes of parameters after the intervention (n=20; 14 females, 6 males)

Variable	Stage 1		Stage 2 - Stage 1		Difference* p-value
	Median (quartiles)	Mean ± SD	Median (quartiles)	Mean ± SD	
q3E	3 (2, 3)	2.45 (0.759)	0 (0, 0)	0.25 (0.55)	0.049
q3F	2 (1.75, 3)	2.05 (0.759)	0 (0, 1)	0.35 (0.587)	0.021
q4D	1.5 (1, 2)	1.5 (0.513)	0 (0, 0)	0.2 (0.41)	0.049
q6	2 (1, 3.25)	2.3 (1.34)	0 (0, 0)	-0.2 (0.41)	0.049
q7	3 (2, 4.25)	3.2 (1.67)	-1 (-1, 0)	-0.65 (0.745)	0.002
q9A	3.5 (3, 5)	3.55 (1.23)	0 (-0.25, 0)	-0.25 (0.444)	0.027
q9B	4 (4, 5)	4.1 (0.912)	1 (0, 1)	0.6 (0.598)	0.001
q9C	5 (5, 6)	5.3 (0.657)	0.5 (0, 1)	0.5 (0.513)	0.002
q9D	3 (2, 4)	3.15 (1.04)	0 (-1, 0)	-0.4 (0.598)	0.012
q9F	4 (4, 5)	4.45 (0.887)	0.5 (0, 1)	0.6 (0.681)	0.002
q9I	4 (3, 4)	3.6 (0.94)	1 (0, 1)	0.65 (0.745)	0.002
q10	4 (3, 5)	3.85 (1.09)	0 (0, 1)	0.3 (0.47)	0.015
q11B	2 (1.75, 3)	2.15 (0.875)	0 (0, 0)	-0.2 (0.41)	0.049
Tinetti Static					
Balance Score	13 (8.75, 16)	11.9 (5.01)	0 (0, 1.25)	0.7 (0.979)	0.005
Tinetti Dynamic	10.5 (6.75, 12)	9.15 (4.02)	0 (0, 1.25)	0.75 (1.12)	0.005
Tinetti summary	24 (15, 28)	21.1 (8.74)	1 (0, 2)	1.45 (1.76)	0.001

*The differences were evaluated using a robust paired Wilcoxon's test

Balance represents a very important indicator of quality of life for the seniors 65+. The results of the analysis showed a significant improvement in the Tinetti static balance score ($p < 0.005$), in the Tinetti dynamic balance score ($p < 0.005$) and in the Tinetti summary balance score ($p < 0.001$), see Table 2. This confirms that the spa environment is an ideal place to the intervention "Life in Balance". The great advantage of this environment is the time that patients can devote to themselves, as well as the possibility of checking the daily repetition of the intervention by the medical staff, the possibility of constant help and the necessary consultations due to their continuous presence. During each week, patients asked whether they were doing the exercises correctly, doing different exercises together in groups, not alone, so they did not have to force themselves to do the exercises. The results confirm that the right intervention based on yoga concept can positively influence the seniors balance in the bio-psycho-social context. These results are consistent with the results of studies of a similar nature (Butterfield, Schultz, Rasmussen, Proeve, 2017; Büssing, Michalsen, Khalsa, Telles et al 2012). In addition, the intervention program took place in winter, in

December, when the spa is calm, and patients spend most of their time indoors and can concentrate better.

For repetition of the exercise they had a common room where they could meet in groups and according to their narration often enjoyed a lot of fun during the exercise. Interviews with the participants show that they would like to see a similar intervention program in their home environment. Initially, they were worried about the joint exercise if they could handle it at all, but they confirmed that the concerns were unjustified. On the contrary, they often found the exercises simple and very pleasantly surprised by the positive effects they achieved in a very short time. They confirmed that they felt more relaxed during the four weeks, that they felt they were part of something important and that they enjoyed the whole intervention program. None of them felt alone during the spa treatment, they were part of a good team. If they were not happy at the first moment, they were patient and docile and at the end of the program were able to conduct the exercises themselves. During the feedback, they stated that they did not feel sad and depressed during the intervention program, which certainly correlates with collective exercise. These findings confirm the link between social

balance and overall human health, compare with Gillespie, Robertson, et al (2012), Hafström, Malmström, Terdèn, et al (2016).

Furthermore, during the intervention it was found that the physical balance of the patients improved substantially. Of course, kinesiological treatment is involved in this improvement under the supervision of experienced health care workers, especially physiotherapists, but certainly also intervention intervention. In this respect, it would be beneficial to carry out a research investigation on a much larger number of patients and to compare the results with a control sample of patients not participating in the intervention. Research would provide more accurate data on the correlation of intervention with kinesiological treatment.

Due to the continuing increased risk of falling diagnosed in five patients (3females, 2 males), they were advised to continue the intervention program after returning from spa treatment. Given the results that have shown an improvement in balance and walking after four weeks of intervention, there is a strong assumption that if they continue the program on their own, they can significantly improve their balance and walking, thus avoiding the risk of falls and injuries. Healthy and regular patient meals and a well-maintained drinking regimen have certainly contributed to the well-being and benefit of the balance intervention. Last but not least, the approach of paramedics who supported participants throughout the applied intervention.

CONCLUSIONS

The research clearly demonstrated the positive impact of the intervention on the physical and mental balance ability of the monitored seniors 65+. It has been proven that during the four-week spa rehabilitation care, appropriate intervention can enhance the treatment of patients and thus affect their overall health. From the results of the research

we can draw a clear recommendation to include the interventional wellness program "Life in Balance" as a part of the spa therapeutic rehabilitation care and thus help to increase the success of treatment and strengthen prevention of further falls, injuries and diseases.

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