

# Innovations

## Balneotherapy on Knee Osteoarthritis among Elderly Population

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### Abstract

**Background:** Osteoarthritis is a common, chronic condition that affects older adults. Age is the greatest risk factor for Osteoarthritis. OA affects about 3.3 to 3.6% of the population globally. It causes moderate to severe disability in 43 million people, making it the 11th most debilitating disease worldwide. Estimation of the worldwide prevalence for symptomatic OA is 9.6 and 18% among men and women, respectively. OA is recorded eighth as a worldwide cause of disability especially among the women. Female sex and age  $\geq 70$  years were found to be independent risk factor for osteoarthritis knee. Osteoarthritis affects one's physical ability and that it has the potential to impair one's normal functioning. It may lead to substantial difficulties in walking and being able to get around both in the home and outdoors. **Aim:** Aim of the study was to evaluate the effectiveness of balneotherapy on knee osteoarthritis, joint pain, stiffness and physical functional ability. **Methodology:** In this study, a quantitative approach, Quasi experimental research design (pre and post-test with control group design) 70 samples were selected for the study in which 35 samples for experimental group and 35 samples for control group by Convenience sampling technique. Data was collected by using WOMAC scale (joint pain, stiffness and physical function) **Results:** The mean pretest level of osteoarthritis score was 71.00 (10.22) in the experimental group whereas, in the control group it was 66.14 (9.94) which is found to be significant ( $p=0.048$ ) at  $p<0.05$ . The mean posttest level of osteoarthritis score was 52.31 (10.24) in the experimental group whereas, in the control group it was 67.03 (7.54) which is found to be significant ( $p=0.000$ ) at  $p<0.001$ . This, infers that Balneotherapy is effective in reducing the level of osteoarthritis. **Conclusion:** From the statistical inferences, it is clearly evident that infers that the intervention, Balneotherapy was highly effective in reducing level of joint pain, stiffness and improving physical function.

**Key terms:** Effectiveness, Balneotherapy, knee osteoarthritis, elderly population

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## **Introduction:**

Aging is a universal process that began with the origination of life about 3.5 billion years ago. Accumulation of the diverse deleterious changes produced by aging throughout the cells and tissues progressively impairs function and can eventually cause death.<sup>1</sup> Older age is also characterized by the emergence of several complex health states commonly called geriatric syndromes<sup>2</sup>.

Aging population is an obvious consequence of the process of demographic transition. The developed regions of the world have already experienced its consequences, while the developing world is facing a similar scene.<sup>3</sup> Population ageing is an irreversible global trend. It is the inevitable result of the demographic transition – the trend towards longer lives and smaller families – that is taking place even in countries with relatively youthful populations<sup>4</sup>.

Burden of a disease refers to the human and economic costs that result from poor health. Arthritis is a major public health problem in our country and is one of the most common causes of disability<sup>5</sup>.

Arthritis is defined as inflammation of a joint characterized by pain, swelling, and limitation of joint movements. OA affects almost all joints, but the most commonly affected joints are the knee and hip joints. In the world, it is estimated that 10%–15% of all adults aged over 60 have some degree of OA, with prevalence higher among women than men.<sup>6</sup>

Several factors including cytokines, leptin, and mechanical forces are pathogenic factors of knee OA. In patients with knee pain attribution of pain to knee OA should be considered with caution.<sup>7</sup> The knee OA contributes to nearly 80% of the total OA burden globally. Though it would not cause mortality, it decreases the quality of life (QOL) by causing disability.<sup>8</sup>

Osteoarthritis is believed to be a disease of old age with three-fold increase in prevalence among elderly when compared to the younger counterpart. With India witnessing demographic transition leading to proportionate as well as absolute increase in number of elderly, the magnitude of osteoarthritis is bound to increase. Osteoarthritis of knee joint contributes to nearly 80% of total osteoarthritis burden<sup>9</sup> OA of the knee is a major cause of mobility impairment, particularly among females. OA was estimated to be the 10th leading cause of nonfatal burden.<sup>10</sup>

Health monitoring of the knee joints in daily life, and early OA diagnosis is challenging and draws attention to the various methods of diagnosis for this irreversible disease.<sup>11</sup> The prevalence of osteoarthritis was estimated to be 41.1%. Female sex and age  $\geq 70$  years were found to be independent risk factor for osteoarthritis knee.<sup>2</sup>

When the knee affects the joint may become unstable. Increasing the risk of falls, particularly in elderly people. Also the poor balance and flexibility and contribute to falls and broken bones. These fractures can result in significant disability and fatal complications. In most of the old age home people are not getting medical facilities, physical and recreational activities.<sup>5</sup>

Balneotherapy is the treatment of disease by bathing, usually practiced at spas. While it is considered distinct from hydrotherapy. There are some overlaps in practice and in underlying principles. balneotherapy may involve hot or coldwater massage through moving water, relaxation, or stimulation. Many mineral waters at spas are rich in particular minerals such as silica, sulfur, selenium, and radium. Medicinal clays are also widely used, which practice is known as “fangotherapy”

Balneotherapy helps to achieve the objectives of knee osteoarthritis treatment, as it relieves pain, maintains joint mobility, and delays osteoarthritis progression. At the balneotherapy center, this condition is treated with different techniques such as general individual baths with or without showers, bubbles, additional gas, jets, hydrokinesitherapy in swimming pool, use of mud packs, steams, massages, and patient health education (moderate exercise including walking, taichi, quadriceps strengthening, and isometric exercises, weight loss, use of walking stick, suitable shoes)<sup>15</sup>

Therefore, it is considered that balneotherapy (BT) could be an effective therapy for the relief of MSC pain. It is reported that BT using baths containing thermal mineral waters from natural springs or drilled wells at a temperature of at least 28 °C and with a mineral content of at least 1 g/L was superior in the long-term over tap water therapy in relieving pain and improving physical function, and is used in daily clinical practice for the management of MSC in many European countries, as well as in Turkey, Israel, and Japan.<sup>16</sup>

In medical Hydrology and physical medicine, spa therapy consists of multiple techniques based on the healing effects of water, including balneotherapy and hydrotherapy. Balneotherapy is the set of methods and practices which, based on scientific evidence.

Balneotherapy is an effective complementary approach in the management of several low-grade inflammation and stress related pathologies especially rheumatic and metabolic conditions. However, despite the demonstrated clinical and symptomatic benefits of these therapies, their role in modern medicine is still controversial, mainly because the biological mechanisms underlying these benefits have not yet been completely elucidated. In the context of pathologies, further studies are clearly necessary in order to clarify the mechanisms of effectiveness involving the stress response and consequently its interaction with the inflammatory and the researcher also personally experienced that lot of geriatric people having the problem of osteoarthritis which is highly influences the daily routine of their life.

Hence, the researcher felt that this study will help the osteoarthritis patients to reduce their joint pain, stiffness and enhance physical functional ability by use of balneotherapy technique and it will also improve their quality of life.

**Objectives:**

- To assess the existing level of osteoarthritis among experimental and control group before intervention
- To evaluate the effectiveness of balneotherapy on level of Osteoarthritis in experimental and control group
- To correlate the posttest level of joint pain, stiffness and physical functional ability in both experimental and control group
- To associate the post-test level of osteoarthritis with the selected demographic and clinical variables

**Hypotheses:**

- H<sub>1</sub>- there is a significant difference in level of Osteoarthritis, joint pain, stiffness and physical functional ability between experimental and control group
- H<sub>2</sub>-there is a significant correlation between the post test level of joint pain, stiffness and physical functional ability among experimental and control group
- H<sub>3</sub> - there is a significant association between the post-test level of Osteoarthritis with the selected demographical and clinical variables
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**Literature Review:**

**1. Pedro Cantista, Francisco Maraver**, conducted a study to identify possible health benefits (in terms of effects on dimensions of pain, functionality, emotional and social aspects, and quality of life) of a 3-week balneotherapy intervention in patients with knee osteoarthritis; to assess the clinical relevance of any benefits detected; to determine if these effects persist. Participants of this randomized controlled trial (RCT) were 120 patients randomly assigned to an experimental group (3 weeks of balneotherapy consisting of daily whirlpool baths, hydrokinesitherapy sessions, and knee shower/massages) or control group in which no form of treatment apart from their usual analgesia medication was given. Treatment benefits were assessed using the following tools: visual analogue scale (VAS) of pain, Timed Up & Go Test (TUG), WOMAC osteoarthritis questionnaire, and SF 36 health survey questionnaire. In the experimental group, these tests were conducted immediately before treatment, immediately after treatment, and at 3 months of follow-up. Patients assigned to the control group were assessed at the study start and 3 months later. Out of 60 patients in the experimental group, 45 were found to be benefit from the treatment intervention in terms of pain relief among other aspects, and also when test scores were compared to those obtained in the control group. Improvements were often clinical relevant and in most patients persisted 3 months after treatment onset.<sup>15</sup>

**2.Hiromi Matsumoto, Hiroshi Hagino, Kunihiro Hayashi, Yuki Ideno, Takashi Wada, Toru Ogata,** a study carried out to determine the effect of balneotherapy on relieving pain and stiffness and improving physical function, compared to controls, among patients with knee osteoarthritis. Studies that examined the effect of balneotherapy for treating knee osteoarthritis of a  $\geq 2$ -week duration were included. Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) scores were used as the outcome measure. A total of 102 publications were assessed according to the exclusion criteria of the study; eight clinical trial studies, which comprised a total of 359 cases and 375 controls, were included in this meta-analysis. The meta-analysis analyzed improvement in WOMAC score at the final follow-up visit, which varied from 2 to 12 months post-intervention. Our meta-analysis indicates that balneotherapy was clinically effective in relieving pain and stiffness, and improving function, as assessed by WOMAC score, compared to controls. However, there was high heterogeneity (88 to 93%). It is possible that balneotherapy may reduce pain and stiffness, and improve function, in individuals with knee osteoarthritis, although the quality of current publications contributes to the heterogeneity observed in this meta-analysis.<sup>27</sup>

**3.János Gaál, JózsefVarga, ZoltánSzekanecz, Julia Kurkó, Andrea Ficzer , Edit Bodolay et al,** completed a study to assess the effects of balneotherapy on chronic musculoskeletal pain, functional capacity, and quality of life in elderly patients with osteoarthritis of the knee or with chronic low back pain. The 81 patients in the study group underwent a 1 day course of 30 minute daily baths in mineral water. Changes were evaluated in the following parameters: pain intensity, functional capacity, quality of life, use of non-steroidal anti-inflammatory or analgesic drugs, subjective disease severity perceived by the patients, investigator-rated disease severity, and severity of pain perceived by the patients. We analyzed the results of 76 subjects as 5 did not complete the study. Compared to baseline, all monitored parameters were significantly improved by balneotherapy in both investigated groups. Moreover, the favorable effect was prolonged for 3 months after treatment. Conclusions: This study showed that balneotherapy is an effective treatment modality in elderly patients with osteoarthritis of the knee or with chronic low back pain, and its benefits last for at least 3 months after treatment.<sup>33</sup>

**4.Antonelli, M., Donelli, D. & Fioravanti, A,** completed a study to assess if balneotherapy and spa therapy can significantly improve Quality of Life (QoL) of patients with knee OA. A qualitative and quantitative syntheses were performed. Seventeen studies were considered eligible and included in the systematic review. Fourteen trials reported significant improvements in at least one QoL item after treatment. Ten studies were included in quantitative synthesis. When

comparing balneological interventions with standard treatment, results favored the former in terms of long-term overall QoL [ES = -1.03 (95% CI -1.66 to -0.40)]. When comparing balneological interventions with sham interventions, results favored the former in terms of long-term pain improvement [ES = -0.38 (95% CI -0.74 to -0.02)], while no significant difference was found when considering social function [ES = -0.16 (95% CI -0.52 to 0.19)]. In conclusion, even though limitations must be considered, evidence shows that BT and spa therapy can significantly improve QoL of patients with knee OA.<sup>43</sup>

**5.Tianwen Ma, Xiaopeng Song, Yuanqiang Ma, Hailong Hu, MSa, Hui Bai, Yue Li**, carried out a study to evaluate the effectiveness and safety of thermal mineral waters therapy for pain relief, and functional improvement, and quality of life (QoL) in patients with osteoarthritis (OA) Study inclusion criteria included assessment of the visual analog scale and Western Ontario and McMaster Universities scores and the lequesne index to evaluate the effects of thermal mineral waters on pain relief and functional improvement. Sixteen studies were included. A meta-analysis showed that thermal mineral waters therapy could significantly reduce pain as measured visual analog scale and Western Ontario and McMaster Universities assessments ( $P < .001$ ). Thermal mineral waters significantly reduced the lequesne index ( $P < .001$ ) and improved joint function. Finally, compared with a control group, European quality of life 5-dimension scale and health assessment questionnaire improved significantly in patients with OA receiving thermal mineral waters therapy ( $P < .05$ ). There is no evidence that thermal mineral waters are unsafe for treating OA. Thermal mineral waters therapy is a safe way to relieve pain, improve physical functions, and QoL in patients with OA<sup>58</sup>

**Methodology:**

**Research approach:** Quantitative research approach

**Study design:** Quasi Experimental, pretest and post-test control group design.

**Study site:** Selected old age homes, Puducherry

**Study population:** all elderly who are residing in the selected old age homes with knee osteoarthritis, Puducherry.

**Sample size:** 70

**Type of sampling:** Convenient sampling

**Study duration:** 1month

**Inclusion criteria:**

- Willing to participate in the study
- Able to understand and speak in Tamil and English
- Able to perform the daily tasks

**Exclusion Criteria:**

- Persons undergone knee surgery for last 1 year
- Persons undergone any other allopathy treatment modalities for osteoarthritis
- History of skin disorders, co-morbidities such as decompensated heart, kidney or liver, psychiatric disorders like psychosis or severe depression
- Elderly who were bed ridden

**Outcome measures:**

WOMAC Index Western Ontario and McMaster Universities Osteoarthritis Index which has 3 components such as joint pain (5items), Stiffness (2 items) and physical functional ability (17 items)

**Joint pain (5items):** includes pain during walking, pain while using staircase, pain at rest, pain while sitting, lying and standing upright

**Joint Stiffness (2items):** stiffness after first walking and later in a day

**Physical functional ability (17 items):** using stairs, rising from sitting, standing, bending, walking, getting in,/out of bed, shopping, putting on/taking off socks, rising from bed, lying in bed, getting in/ out of bath, sitting, getting on/off toilet, heavy domestic duties, light domestic duties

**Score interpretation :** Overall score interpretation

<b>Level of OA</b>	<b>Score Interpretation</b>
Mild level of osteoarthritis	01-24
Moderate level of osteoarthritis	25-48
Severe level of osteoarthritis	49-72
Extreme level of osteoarthritis	73-96

**Data collection procedure: In phase I** - The formal permission was obtained from the concerned authority of selected old age homes, Puducherry, to do data collection. Informed consent was obtained from the elderly people prior to the data collection. Before starting the data collection, the researcher collected the water from the selected old age homes for the water analysis to check whether

their area water has potency to do balneotherapy, for the presence of minerals.**In Phase II** - Then the first group members were seated comfortably and instructed to immerse their lower limbs till their knee joint in bucket which was kept ready (3.4<sup>th</sup> of bucket filled with warm tap water) in front of each one's place for 20 minutes after giving detailed instruction regarding intervention. Meanwhile the subjects were also advised to do simple flexion and extension of ankle joint in order to prevent numbness rather disturbing the intervention and the intervention was continued for another 21 days under the supervision of investigator. In control group, After the pretest the subjects were asked to follow routine care.**In Phase III** - Post test was carried out on 25th day of intervention with the same tool used for pretest and it took around 2 hours for post-test. All the subjects were co-operated well throughout the data collection period

**Statistical analysis:** Descriptive statistics includes frequency and percentage, mean and standard deviation were also used for the demographic and clinical variables. Inferential statistics includes, independent 't' test and paired 't' test to evaluate the effectiveness of intervention. Karl Pearson correlation was used to correlate the relationship between, joint pain, stiffness and physical functional ability. ANOVA test to associate the posttest level of experimental group with selected demographic variables and clinical variables.

**Result:**

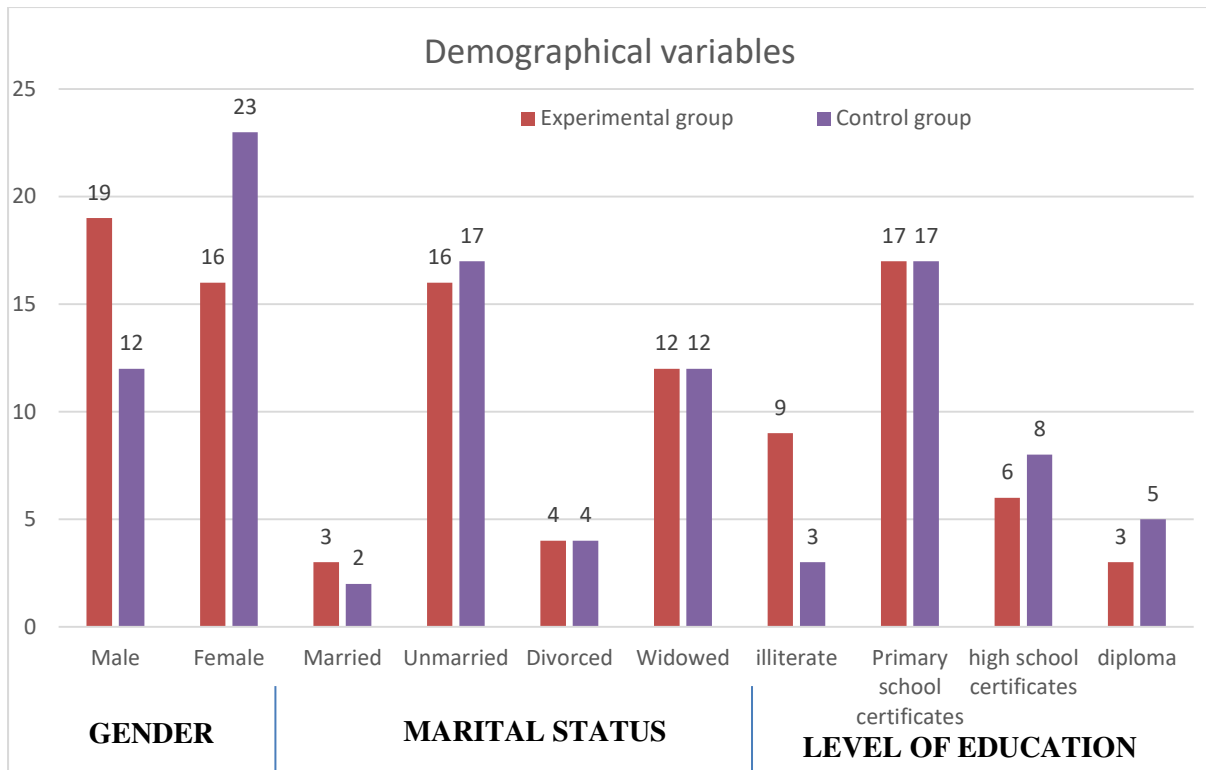
**Demographic variables distribution:**

**N = 70 (35+35)**

Age	Experimental Group (n=35)		Control Group (n=35)	
	No.	%	No.	%
60-69 years	15	42.9	15	42.9
70-79 years	13	37.1	15	42.9
80 and above	7	20.0	5	14.2

**Table 1: Age distribution among elderly in the experimental and control group**





**Figure 1: Gender, Marital status, level of education distribution among elderly in the experimental and control group**

**Table 1 and Figure 1 shows that** With respect to age of the subjects on the study, majority of the subjects 15 (42.9%) in the experimental group were 60-69 years and 15 (42.9%) were 70-79 years in control group. With respect to gender, majority of the subjects 19(54.3%) in the experimental group were male and 12 (34.3%) subjects were male in control group. 16(45.7%) were female in experimental group and majorly 23 (65.7%) subjects were female in control group. With reference to marital status, majority of them 16(45.7%) were unmarried in the experimental group and majority of them 17(48.6%) were unmarried in control group. With regards to level of education, majority of subjects 17(48.6%) had primary school education in both experimental group and control group.

**Table 2: Distribution of Clinical variables among elderly in the experimental and control group N = 70 (35+35)**

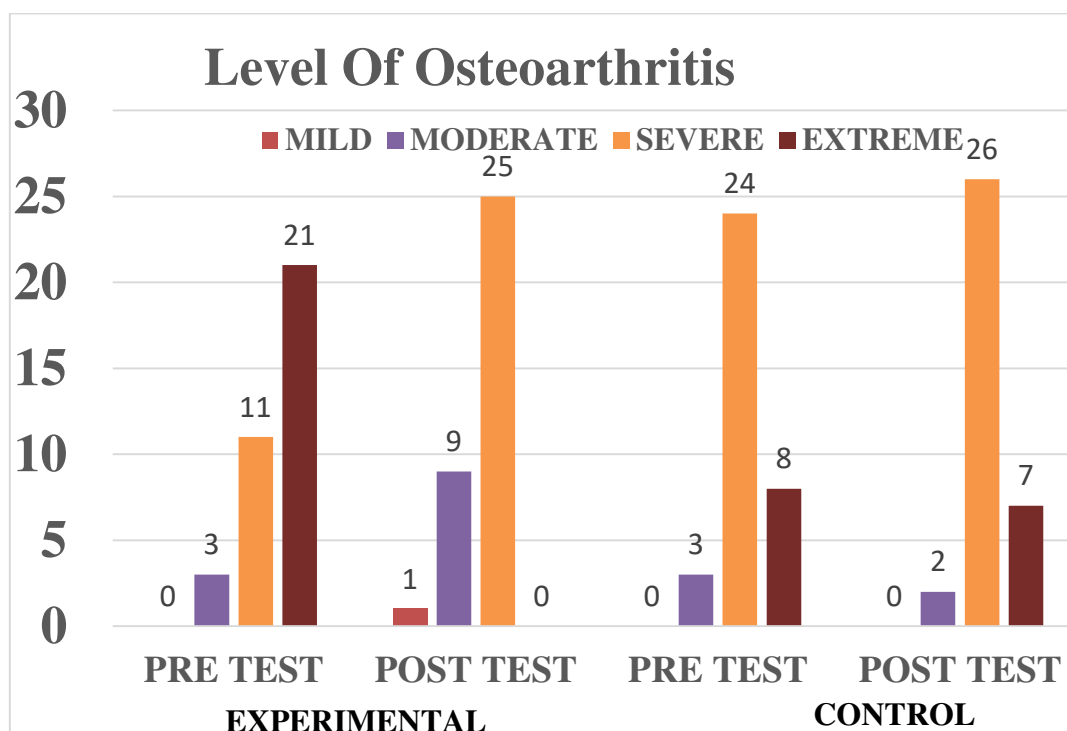
Clinical variables	Experimental group (n=35)		Control group (n=35)	
	F	%	F	%
<b>Body mass index</b>				
Obese(30 and above)	5	14.3	3	8.6
Overweight(25-29.9)	8	22.9	7	20.0
Healthy(18.5-24.9)	7	20.0	17	48.6
Lean (Less than 18)	15	42.9	8	22.9
<b>Duration of disease</b>				
Newly diagnosed	11	31.4	5	14.3
1-2 years	4	11.4	9	25.7
2-3 years	5	14.3	12	34.3
More than 3 years	15	42.9	9	25.7
<b>Co-morbidities</b>				
Nil	15	42.9	13	37.1
Diabetes	5	14.3	8	22.9
Hypertension	7	20.0	11	31.4
Any other co-morbidities	8	22.9	3	8.6
<b>Recent surgeries</b>				
Nil	30	85.7	26	74.3
Knee arthroplasty or joint reconstructive surgeries	2	5.7	7	20.0
Any other surgeries	3	8.6	2	5.7

**Table 2** depicts that Majority of subjects 15(42.9%) were lean (BMI less than 18) in experimental group and in control group majority of subjects 17(48.6%) were healthy (BMI 18.5-24.9). With regard to duration of disease, most of subjects 15(42.9%) were having osteoarthritis for more than 3 years in the experimental group. Majority of subjects 12 (34.3%) were having osteoarthritis for 2-3 years in the control group. In relation to co-morbidities, most of subjects 15(42.9%) were without any co-morbidities in experimental group, whereas, 13(37.1%) were without any co-morbidities in control group 5(14.3%) subjects were with diabetes in experimental group and 8(22.9%) were with diabetes in control group. With reference to recent surgeries, majority of subjects 30(85.7%) had not undergone any surgeries in experimental group and 26(74.3%) had not undergone any surgeries in control group. Minority of subjects 2(5.7%) were done knee arthroplasty 2(5.7%) in experimental group.

**Table3: Distribution of existing level of Osteoarthritis before the intervention in Experimental and Control Group**

Level of Osteoarthritis	Experimental group (n=35)		Control group (n=35)	
	No.	%	No.	%
Mild (01-24)	0	0.0	0	0.0
Moderate (25-48)	3	8.6	3	8.6
Severe (49-72)	11	31.4	24	68.6
Extreme (73-96)	21	60.0	8	22.9
<b>Total</b>	<b>35</b>	<b>100.0</b>	<b>35</b>	<b>100.0</b>

Table 3 reveals that in the experimental group, among 35 samples no one were having mild osteoarthritis, majority of subjects 21(60%) were in extreme level of osteoarthritis. In control group, same like Experimental group none of them had mild level of osteoarthritis, majority 24(68.6%) were in severe level of osteoarthritis.



**Figure 2:Percentage Distribution of Level of Osteoarthritis in Pre-test and post test among Elderly for Experiment and Control Group.**

**Figure 2 shows** that that in the experimental group, before the intervention none of them had mild level of osteoarthritis, most of them 21(60%) had extreme level of osteoarthritis. After the intervention, none of them had extreme level of

osteoarthritis and majority of them 25(71.4%) had severe level of osteoarthritis. In control group, before the intervention none of them had mild level of osteoarthritis and most of subjects 24(68.6) had severe level whereas, after the intervention least of them 2(5.7%) had moderate level, none of them had mild level and majority of them 26(74.3%) had severe level of osteoarthritis.

**Table 4: Mean and Standard Deviation of Joint Pain, Stiffness and level of impairment on Physical Function and Level of Osteoarthritis after the Intervention in Experimental and Control Group**

Variables	Experimental group n=35	Control Group n = 35	Independent t – test value and p - value
	Mean (SD)	Mean (SD)	
<b>Pain</b>	10.69 (2.86)	15.14 (1.77)	<b>t = 7.848, p= 0.000*** (HS)</b>
<b>Joint stiffness</b>	4.29 (1.10)	5.77 (1.06)	<b>t = 5.755, p= 0.000*** (HS)</b>
<b>Level of impairment on Physical function</b>	37.34 (7.72)	46.11 (6.76)	<b>t = 5.056, p= 0.000*** (HS)</b>
<b>Level of Osteoarthritis</b>	52.31 (10.24)	67.03 (7.54)	<b>t = 6.845, p= 0.000*** (HS)</b>

Note: \*\*\* p<0.001 level of significant, HS – highly significant, N.S. – Not Significant

**Table 4** reveals that The mean pretest level of osteoarthritis score was 49.54 (9.08) in the experimental group whereas, in the control group it was 45.40 (8.07) which is found to be significant at p<0.05 and the mean posttest level of osteoarthritis score was 52.31 (10.24) in the experimental group whereas, in the control group it was 67.03 (7.54) which is found to be significant at p<0.001

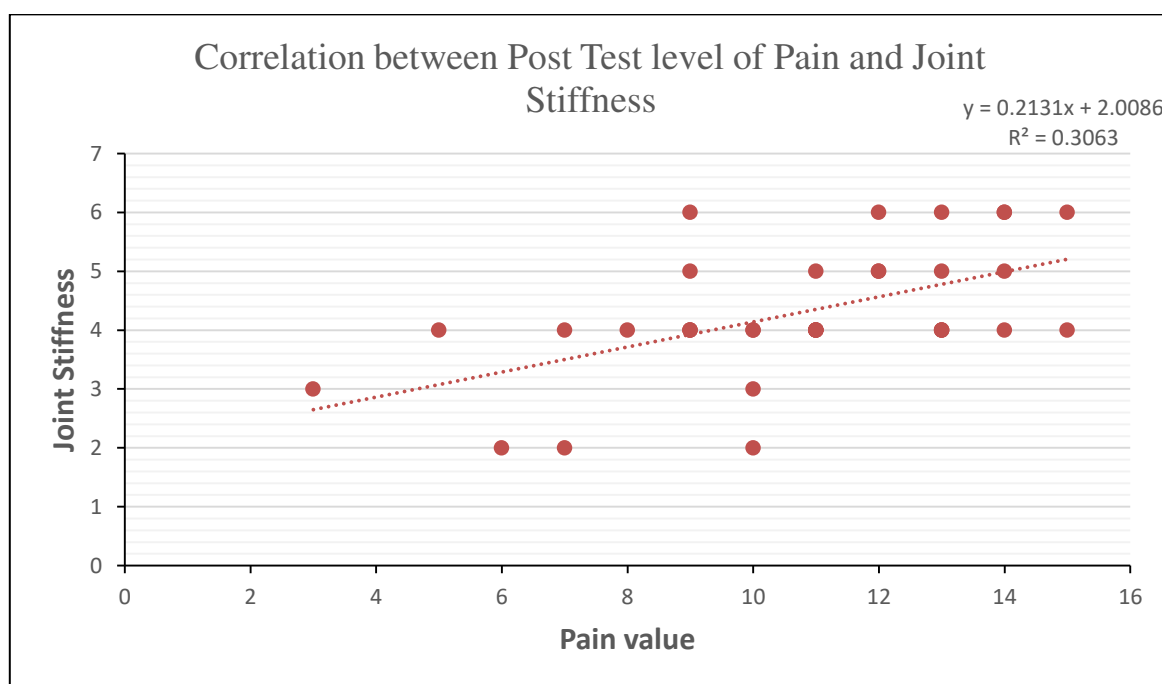
**Table 5: Effective mean of Osteoarthritis among Elderly in Experiment and Control Group after the intervention**

Variables	Experimental group n=35	Paired t – test value and p - value	Control group n = 50	Paired t – test value and p - value
	Effective Mean (SD)		Effective Mean (SD)	
<b>Pain</b>	4.89 (3.21)	<b>t = 9.015 p=0.000***</b>	0.26 (2.72)	t = 0.560 p= 0.579 (N.S)

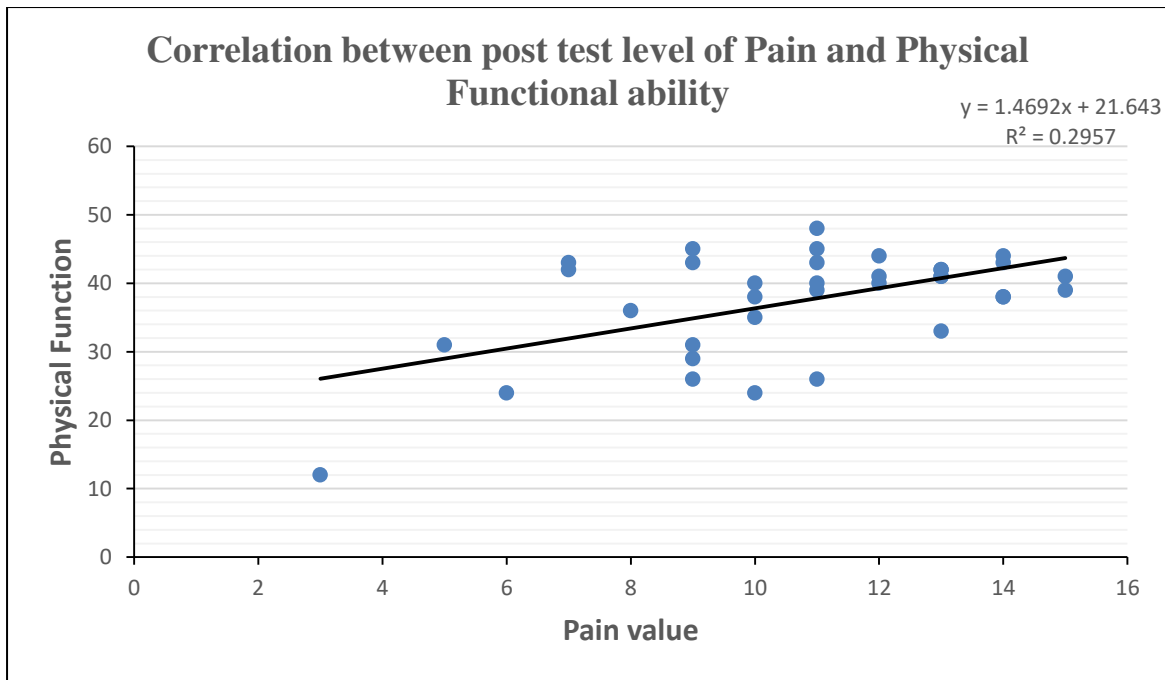
		(HS)		
<b>Joint stiffness</b>	1.63 (1.68)	<b>t = 5.729</b> <b>p=0.000***</b> <b>(HS)</b>	-0.43 (1.77)	t = 1.432 p= 0.161 (N.S)
<b>Level of impairment in Physical function</b>	12.20 (10.78)	<b>t =6.697</b> <b>p=0.000***</b> <b>(HS)</b>	-0.71 (11.11)	t =0.380 p= 0.706 (N.S)
<b>Level of Osteoarthritis</b>	18.69 (13.28)	<b>t = 8.326</b> <b>p=0.000***</b> <b>(HS)</b>	-0.90 (12.95)	t = 0.405 p= 0.688 (N.S)

Note: \*\*\* - p<0.001 level of significant, N.S. – Not Significant, HS – Highly Significant

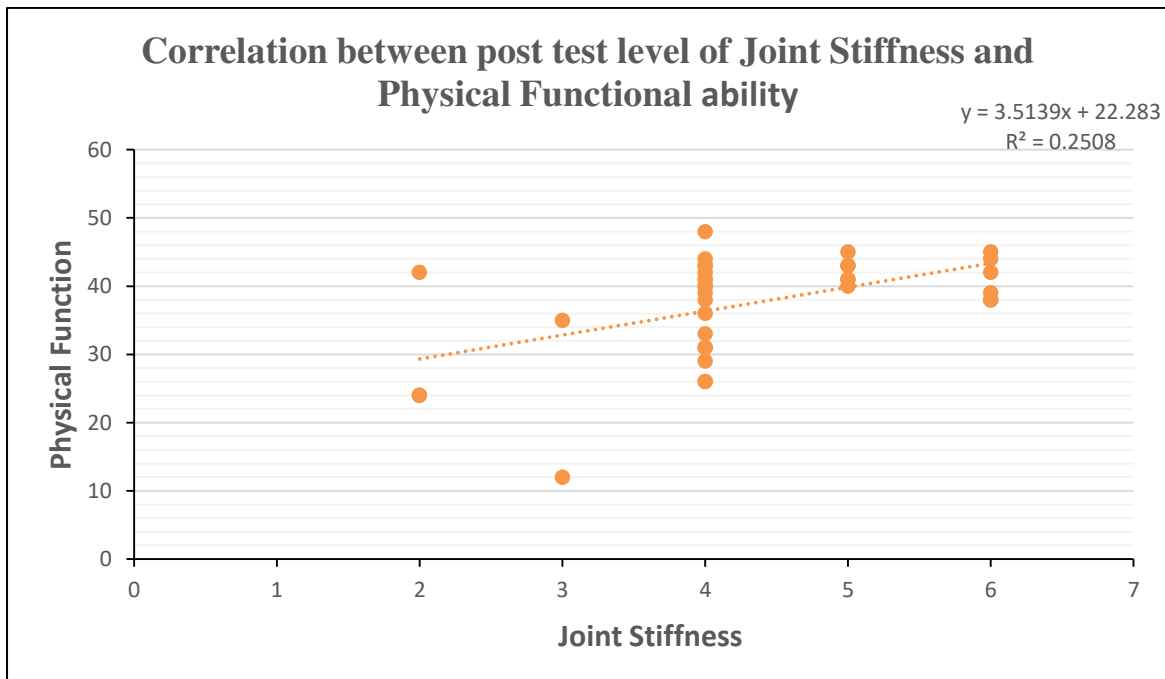
**Table 5** results that The effective mean of level of osteoarthritis, joint pain, joint stiffness and level of impairment of physical function in experimental group was 18.69(13.28), 4.89 (3.21), 1.63(1.68), 12.20 (10.78) respectively which was found to be significant for all variables at p<0.001 whereas, in control group it was found to be non-significant.



**Figure 3:Correlation between post test level of pain and stiffness among Elderly for Experimental and Control Group**



**Figure 4: Correlation between post test level of pain and physical functional ability among Elderly for Experimental and Control Group**



**Figure 5: Correlation between post test level of stiffness and physical functional ability among Elderly for Experimental and Control Group**

**Figure 3, 4, 5 reveals that** The correlation between joint pain and stiffness, stiffness and physical functional ability shows positive correlation ( $r=0.553$ ,  $r=0.544$  respectively) at  $p<0.001$  and the correlation between joint stiffness and physical functional ability also shows positive correlation ( $r=0.501$ ) but at  $p<0.01$ .

Thus, it inferred that there is positive correlation between all three variables such as the pain and stiffness, stiffness and physical functional ability, pain and physical functional ability.

**Table 6: Association between post test level of Osteoarthritis and Demographic Variables among elderly in Experimental Group**

Demographic variables	No.	Mean	SD	F and t value and p value
<b>3. Marital status</b>				
a. Married	3	52.67	6.43	<b>F = 2.857</b> <b>p = 0.050 *</b>
b. Unmarried	16	57.00	6.23	
c. Divorced	4	50.25	7.50	
d. Widowed	12	46.67	13.42	

Note: \* -  $p < 0.05$  Level of Significant, N.S. – Not Significant

**Table 7: Association between post test level of Osteoarthritis and Clinical Variables among Elderly in Control Group**

Clinical variables	No.	Mean	SD	F and t value and p value
<b>2. Duration of disease</b>				
a. newly diagnosed	5	67.80	5.49	<b>F = 2.870</b> <b>p = 0.050 *</b>
b. 1-2 years	9	61.22	10.66	
c. 2-3 years	12	69.58	4.98	
d. More than 3 years	9	69.00	5.10	

**Table 6 and 7** shows that The present study results revealed that the association between the level of osteoarthritis and the demographic variables, such as marital status only statistically significant at  $p < 0.05$  and the selected clinical variable such as duration of disease alone had shown the statistical significance with the level of osteoarthritis at  $p < 0.05$

**Discussion:**

**The first objective of the study was to assess the existing level of osteoarthritis among experimental and control group before intervention.** In the experimental group, among 35 samples, no one was having mild level of osteoarthritis, majority of the subjects 21(60%) were in extreme level of osteoarthritis. In control group, same like Experimental group none of them had mild level of osteoarthritis, majority 24(68.6%) were in severe level of osteoarthritis.

**The second objective of the study was to evaluate the effectiveness of balneotherapy on level of Osteoarthritis among elderly population in experimental group and compare to control group in selected old age homes.** In the experimental group, before the intervention none of them had mild level of osteoarthritis, most of them 21(60%) had extreme level of osteoarthritis. After the intervention, none of them had extreme level of osteoarthritis and majority of them 25(71.4%) had severe level of osteoarthritis in the experimental group. In control group, before the intervention none of them had mild level of osteoarthritis and most of subjects 24(68.6) had severe level of OA whereas, after the intervention least of them 2(5.7%) had moderate level, none of them had mild level and majority of them 26(74.3%) had severe level of osteoarthritis.

The present study was supported with the study conducted by **János Gaál, JózsefVarga, ZoltánSzekanecz, Julia Kurk, Andrea Ficzere, Bodolay and Tamás Bender** Balneotherapy in Elderly Patients: Effect on Pain from Degenerative Knee and Spine Conditions and on Quality of Life. Within-group means of total WOMAC scores reflecting changes in the functional capacity of patients were 57.42 (SD 6.9) at before intervention, 23.42 (SD 17.77) at 10-12 weeks after intervention ( $P < 0.001$ ), and 10.84 (SD 9.22) after 3 month of intervention<sup>59</sup>.**The first hypotheses H<sub>1</sub>:** from the above results proven that, there was a significance difference between the pre and post test level of Osteoarthritis, joint pain, stiffness and functional ability between experimental and control group and (H<sub>1</sub>) were accepted.

**The third objective of the study was to correlate the level of Osteoarthritis, joint pain, stiffness and physical functional ability in both experimental and control group.** The present study was supported with the study conducted by **Lina Varzaityte, RaimondasKubilius, Lolita Rapoliene, RutaBartuseviciute, ArvydasBalcius, KestutisRamanauskas et al.** to assess the effect of natural factors (mineral water and mud) on changes in the functional state of patients with knee joint OA. The study revealed results on the basis of non-parametric Spearman correlation analysis, changes of presented anthropometric parameters of subjects of all groups and categorized changes of KOOS questionnaire's data correlated between themselves after treatment and 1 month after treatment<sup>45</sup>.**Second hypotheses H<sub>2</sub>:** from the result it was clearly stated that there was a significant correlation between all three sub variables such as joint pain, joint stiffness and physical functional ability among experimental and control group

**The fourth objective of the study was to associate the post-test level of osteoarthritis, with the selected demographic and clinical variables.**In this study, ANOVA test was used to assess the association and the present study result revealed that was association between the level of osteoarthritis and the **marital status in the demographic variable alone had shown statistically significance.** Other demographicvariables had not shown statistically significance with the level of osteoarthritis joint pain, stiffness and physical



function. The present study revealed that the **selected clinical variable such as duration of disease had shown the statistical significance** with the level of osteoarthritis. Other clinical variables had not shown the statistical significance with level of osteoarthritis. The present study was supported with the study conducted by **János Gaál, József Varga, Zoltán Szekanecz, Julia Kurk, Andrea Ficzer, Edit Bodolay et al**, to assess the effects of balneotherapy on chronic musculoskeletal pain, functional capacity, and quality of life in elderly patients with osteoarthritis of the knee. Within-group means of total WOMAC scores reflecting changes in the functional capacity of patients were 57.42 (SD 6.9) at visit 1, 23.42 (SD 17.77) at visit 2 ( $P < 0.001$ ), and 10.84 (SD 9.22) at visit 3. The study shown that the association with the age, gender, marital status, duration of disease and BMI. All evaluation parameters were significantly reduced at the end of the balneotherapy cycle and remained stable for 12 weeks<sup>59</sup>.

**Third hypotheses H<sub>3</sub>**, from the result it was clearly stated that there was a significant relationship between post-test level of Osteoarthritis with the selected demographic and clinical variables in experimental and control group.

#### **Conclusion:**

The study results proved that the balneotherapy has improved the level of osteoarthritis, joint pain, stiffness and physical function among elderly people in the experimental group. So, this method of balneotherapy can be promoted by nurses in their day-to-day activities in hospital and community settings and the result of the study assisted to extend and highlight the effectiveness of balneotherapy among the elderly people on Knee osteoarthritis

#### **Clinical implications:**

- Nursing Personnel are at the best position to identify the unmet needs of Knee Osteoarthritis, especially at community area.
- Information thus obtained can be used in planning interventional strategies specific to osteoarthritis patient needs.
- Periodic training programs can be arranged among the elderly, since every Osteoarthritis elderly wish to do their daily activities by own.
- The balneotherapy can be utilized to educate the elderly people, because Balneotherapy is one of the oldest forms of therapy for patients with arthritis.

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