



International Journal of Advance Research in Community Health Nursing

E-ISSN: 2664-1666

P-ISSN: 2664-1658

www.communitynursing.net

IJARCHN 2023; 5(2): 05-11

Received: 05-04-2023

Accepted: 11-05-2023

Dr. Deepika R Kumar

Director Principal, Rayat
Bahra College of Nursing,
Mohali, Punjab, India

Shalika Sandal

Nursing Tutor, Rayat Bahra
College of Nursing, Mohali,
Punjab, India

Madhvi Sharma

B.Sc. Nursing 4th Year, Rayat
Bahra College of Nursing,
Mohali, Punjab, India

Navneet Kaur,

B.Sc. Nursing 4th Year, Rayat
Bahra College of Nursing,
Mohali, Punjab, India

Navjot Kaur,

B.Sc. Nursing 4th Year, Rayat
Bahra College of Nursing,
Mohali, Punjab, India

Pawan Kumar,

B.Sc. Nursing 4th Year, Rayat
Bahra College of Nursing,
Mohali, Punjab, India

Payal Verma,

B.Sc. Nursing 4th Year, Rayat
Bahra College of Nursing,
Mohali, Punjab, India

Parneet Kaur,

B.Sc. Nursing 4th Year, Rayat
Bahra College of Nursing,
Mohali, Punjab, India

Yash Kumar

B.Sc. Nursing 4th Year, Rayat
Bahra College of Nursing,
Mohali, Punjab, India

Corresponding Author:

Shalika Sandal

Nursing Tutor, Rayat Bahra
College of Nursing, Mohali,
Punjab, India

A quasi-experimental study to assess the effectiveness of Epsom salt with hot water application on joint pain among the elderly people of selected villages at district Mohali, Punjab

**Dr. Deepika R Kumar, Shalika Sandal, Madhvi Sharma, Navneet Kaur,
Navjot Kaur, Pawan Kumar, Payal Verma, Parneet Kaur and Yash
Kumar**

DOI: <https://doi.org/10.33545/26641658.2023.v5.i2a.140>

Abstract

Background: Pain is an unpleasant sensory and emotional experience. Pain is just like a sensory annoying perception that a person feels in his life. Joint pain causes great discomfort which commonly felt in hands, feet, legs, knees or spine. The non-pharmacological treatment includes exercises, various yoga poses, positioning, massaging, acupuncture, deep breathing, meditation, relaxation therapies and hot water application. The most effective therapy for joint pain is application of hot water with Epsom salt.

Aim of the study: To assess the effectiveness of Epsom salt with hot water application on joint pain among the elderly people of selected villages at district Mohali, Punjab.

Material and Method: A quantitative research approach and quasi-experimental research design was used to conduct the study. Total 60 samples were selected and allocated in experimental and control group by using purposive sampling technique. Visual analogous scale was used for data collection and analysis was done by using descriptive and inferential statistics.

Result: The study findings revealed that in experimental group mean score and standard deviation was 4.60 ± 1.714 . In control group mean score and standard deviation was 5.20 ± 2.483 . The paired t-test was used in the analysis and p value was 0.016 which is statistically significant. Hence, Epsom salt therapy with hot water application is found to be effective.

Conclusion: This study concluded that hot water application with Epsom salt was effective in reducing joint pain. This emphasis on the need to use non pharmacological method of pain management. Hence, Epsom salt therapy with hot water application is found to be effective.

Keywords: Joint paint, Epsom salt, hot water application, elderly people (50-65 years), visual analogous scale

Introduction

Aging is a natural process of living organisms ^[1]. Commonest health problem among elderly population is a musculoskeletal pain based on the health surveys undertaken in both developed and developing countries ^[2]. Knee and low back pain are the most frequent complaints among the elderly population ^[3]. Knee joint pain is more common among elderly than back pain ^[4].

Aging is not just a consequence of wear and tear but a mechanism of the body cells. Aging is a natural process of living organisms. At the biological level, ageing result from the impact of cellular damage over time. This ultimately leads to a gradual decrease in physical and mental ability of a person, a growing risk of various diseases. Aging is directly proportional to increase in health problems involving all organs of the body ^[5].

Joint pain also called as Arthralgia rises from any joint of the body including cartilages, bone, ligaments, tendons or any other muscles that are present in our body. Joint pain causes great discomfort which commonly felt in hands, feet, legs, knees or spine. Pain may be constant or it can be come and go. Sometimes the severity of joint pain causes stiffness and tenderness and the pain of joint feels achy or sore and sometimes burning sensation also.

This pain may affect person's ability to do daily activities of life. Severe joint pain causes immobility of the person and decrease the quality of life. Treatment should also be focus on pain as well as affected daily functions [6].

In up to 85% of people with joint pain, despite a thorough medical examination, no specific cause of pain can be identified. WHO in 2016 has estimated that 40% of people over the age of 50 years suffers from musculoskeletal disorders and osteoarthritis is the 2nd most common cause of knee joint pain among elderly people with the prevalence of 22% to 39% in India. Joint pain is caused in 9.6% men and 18% in women at the age of 50 years or above. Joint pain is caused in 9.6% men and 18% in women at the age of 50 years or above [7].

Epsom salt is a chemical compound made up of magnesium, sulfur and oxygen which when placed in water, it breaks into magnesium and sulfate. When Epsom salt is soaked both magnesium and sulfate get absorbed into the body through the skin. It may help to relax muscles, reduce swelling and pain from arthritis and relieve pain from fibromyalgia and various causes and it is considered as a very useful home remedy for reducing joint pain among old age people. Natural relief from joint pain can be achieved by staying active, managing weight, and making changes to the diet are a few natural ways to ease arthritis pain. Some alternative therapies could also help by improving flexibility or relieving stiffness and swelling [8].

Need of the study

According to population census 2011, there are nearly 104 million elderly persons (age 60 years or above in India, 53 million females and 51 million males) according to report of technical group on population projection for India and states 2011-2036, there are nearly 138 million elderly persons in India in 2021 (67 million males and 71 million females) and is further expected to increase by around 56 million elderly persons in 2031 [9].

The first priority of the country is to make proper health care availability. Joint diseases affects millions of people throughout the world causing pain, immobility and disability. Most of population don't get enough nutrients that usually affects their nerve, muscle and enzyme functioning and ultimately contributes to pain and inflammation that affect one's joints [10].

Epsom salt is a magnesium sulfate mineral, has been found to alleviate pain. Additionally, soaking in an Epsom salt and compression of hot water application with Epsom salt helps to pull toxins from the body, which improves the healing process of inflamed joints. Many old age people are suffering from knee joint pain, which effects their motion and all day-to-day life activities. Epsom salt contains many beneficiary elements that helps to reduce joint pin among old age people by using hot water compressions of it [11].

The topical application and therapy is best suitable for them. That's why Epsom salt application can be chosen as remedy for the elderly patients as it is easily available at home and does not cause any side effects to the person. We are using Epsom salt with hot water application because we want to assess its effectiveness with hot water which is expected to be as higher as compared to be used separately [12].

Problem statement

A Quasi-experimental study to assess the effectiveness of Epsom salt with hot water application on joint pain among the elderly people of selected villages at District Mohali, Punjab.

Objectives of the Study

- To assess the level of joint pain with visual analogous scale among elderly people in experimental group.
- To assess the level of joint pain with visual analogous scale among elderly people in control group.
- To implement procedure of Epsom salt with hot water application in experimental group.
- To assess the effectiveness of Epsom salt on joint pain by comparing pain score in experimental and control group.
- To find out the association of pretest pain score with selected demographic variables.
- To disseminate the findings.

Operational definitions

Effectiveness: It refers to the reduction in the level of joint pain score in visual analogous scale after the application of Epsom Salt with hot water.

Joint Pain: It is defined as an unpleasant sensation felt in one or more joints due to inflammation, infection or any other deficiency.

Epsom salt: It is a white colored salt that is used as a natural home remedy with hot water for reduction in level of joint pain.

Hypothesis of the study

- **H₁:** There was significant difference between mean pre and post-test pain score in experimental group.
- **H₂:** There was significant association between pre-test pain score with selected demographic variables.

Methodology

Research approach

In the view of the problem a Quantitative research approach was chosen for the present study in order to evaluate the effectiveness of Epsom salt with hot water application on joint pain among the elderly people of selected villages at District Mohali, Punjab.

Research design

A quasi-experimental research design was considered to be appropriate for the present study to assess the effectiveness of Epsom salt with hot water among elderly people of selected villages at District Mohali, Punjab.

Research setting

The present study was conducted in selected villages of district Mohali, Punjab.

Population

Target Population: The target population of the study was "Elderly people (50-65 Years) of selected Villages of Mohali, Punjab."

Accessible Population: In present study accessible population was "Elderly people who fulfill inclusion and exclusion criteria."

Sample, sample size and sampling technique

Sample: The sample of the study was "Elderly people of selected villages of Mohali, Punjab."

Sample size: In present study sample size was 60 elderly people. 30 people in experimental group and 30 people in control group.

Sampling Technique: In present study samples were selected by “Purposive Sampling Technique”

Sampling criteria

Inclusion criteria

1. Elderly people who were willing to participate in the study.
2. Elderly people who were having knee joint pain.
3. Elderly people who were available at the time of data collection.

Exclusion Criteria

1. Hypersensitivity for skin reactions.
2. Elderly people with complications like neuropathies, vascular compromise and systemic lupus erythematosus.
3. Chronically ill patients

Research Variables

Independent variable: Epsom salt compress with hot water application

Dependent variable: Joint pain

Selection of tool

The tool is formulated according to the need of the study and consists of:

Section A: Socio Demographic Variables

Section B: Visual analogous scale

Section C: Procedure of applying Epsom salt with hot water application

Section A: Socio-Demographic Variables

This section consists of information about demographic variables such as age, gender, type of diet, occupation, lifestyle, income, BMI, education, duration of pain and history of arthritis/genetics.

Section B: Visual analogous scale

The data was collected through Visual analogous scale. It consists of 10 cm line, with anchors at either end. One end marked “no pain” and other end is marked “unbearable pain”, selects the face that is consistent with current level of patient’s pain.

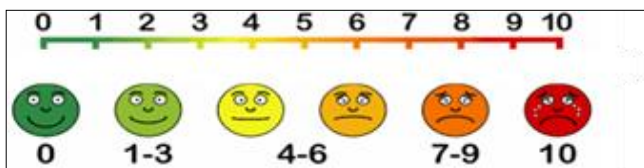


Fig 1: Visual Analogous scale

Criterion Measured

Interpretation of scores of Visual analogous scale.

Score 0 = No pain

Score 1-3 = Mild Pain

Score 4-6 = Moderate pain

Score 7-9 = Severe pain

Score 10 = Worst pain possible

Section C: Procedure of applying Epsom salt with hot water application

This part consists of applying Epsom salt with hot water application among elderly people.

Description about intervention

As the study participants were elderly people age group 50-65 years who were having joint pain. Written informed consent was taken from the elderly people. Researchers first introduced themselves to the study subjects and assured that their response would be kept confidential and used only for study purpose.

1. Select the study samples according to purposive sampling technique and allocate into experimental and control group.
2. Assess the level of joint pain with visual analogous scale and record the pain score.
3. Take 30 gram of Epsom salt and add 1 litre of boiling water creating hot compress by dipping a clean wash cloth in hot water for 15 min.
4. Wringing it out and apply for 15 min. over the joint in which pain is present. Use once a day for one week.
5. Reassess the level of joint pain with visual analogous scale and record the pain score.
6. The researcher then recorded the data (Demographic data was collected by interview schedule and researcher’s assisted approach)
7. At the end researcher compared the level of pain between both experimental and control group using statistical analysis.

Validity of tool

In order to measure the content validity. Research supervisor was consulted regarding content and language of the tool. The changes were made as per guidance of experts after discussion with research supervisor, the tool was finalized.

Reliability of tool

It is the degree of consistency or dependability with which an instrument measures the attributes. Reliability of tool was calculated by Split Half method and Karl Pearson method. Reliability of tool of the present study was established by using descriptive and inferential statistics. The tool was found to be reliable, valid, feasible and practicable and this tool is a standardized tool for pain assessment.

Ethical Considerations

- Written permission was taken from the Director Principal of Rayat Bahra College of Nursing, Mohali.
- Written permission was taken from the Sarpanch of village Daunmajra and Saharaun.
- An informed written consent was taken from each sample.
- Confidentiality and Anonymity of the subjects was maintained throughout the study.

Pilot study

The pilot study was conducted to find out the practicality of the study. It was conducted on 10% of total sample size in concerned village i.e., Daunmajra village of District Mohali Kharar. It was found that tool was feasible and reliable.

Plan for data analysis

Data analysis and interpretation was found on the basic of the objective of the study. The analysis was done using descriptive and inferential statistics. Descriptive statistics was frequency, mean standard deviation and inferential statistics was used paired T test. It was being presented in the forms of tables, charts, diagrams and graphs.

Description of sociodemographic characteristics**Table 1:** Frequency and Percentile distribution of Subjects as per their Socio-demographic variables N=60

S. No.	Variables	Categories	Experimental Group (n=30)		Control Group (n=30)	
			F	%	f	%
1.	Age	50-55 Years	8	27%	6	20%
		56-60 Years	13	43%	17	57%
		61-65 Years	9	30%	7	23%
2.	Gender	Male	14	46.67%	19	63%
		Female	16	53.33%	11	37%
		Others	0	0%	0	0%
3.	Diet	Vegetarian	11	37%	12	40%
		Non-Vegetarian	19	63%	18	60%
		Mixed	0	0%	0	0%
4.	Occupation	Private job	3	10%	3	10%
		Labour	9	30%	16	53%
		Government job	7	23%	8	27%
		Others	11	37%	3	10%
5.	Lifestyle	Sedentary	15	50%	11	37%
		Active	15	50%	19	63%
6.	Income	Below Rs 10,000	15	50%	4	13%
		Rs 10,000 – Rs 30,000	8	27%	18	60%
		Above Rs 30,000	7	23%	8	27%
7.	BMI	Underweight	5	16.67%	2	6.67%
		Normal	18	60%	20	66.66%
		Overweight	7	23.33%	6	20%
		Obese	0	0%	2	6.67%
8.	Education	Primary	2	7%	1	3%
		No formal education	20	67%	17	57%
		Secondary	8	27%	9	30%
		Graduated	0	0%	3	10%
9.	Duration of pain	1-3 months	2	6.67%	3	10%
		3-6 months	15	50%	19	63.34%
		6 months-1 year	11	36.66%	7	23.33%
		Above 1 Year	2	6.67%	1	3.33%
10.	Hereditary	Yes	1	3%	3	10%
		No	29	97%	27	90%
11.	Previous Treatment	Allopathic	6	20%	5	17%
		Ayurvedic	8	27%	6	20%
		Homeopathic	8	27%	12	40%
		No treatment	8	27%	7	23%

Table 2: Findings related to comparison of pain score between experimental and control group by using Paired t-test. N=60

Groups	N	Pain Score				Df	T	p value
		Pre-test		Post-test				
		Mean	SD	Mean	SD			
Experimental Group	n=30	5.77	2.285	4.60	1.714	29	2.550	0.016*
Control Group	n=30	4.700	1.985	5.20	2.483	29	0.961	0.344

Maximum = 10 Minimum = 0, * denotes significant result at p value <0.05.

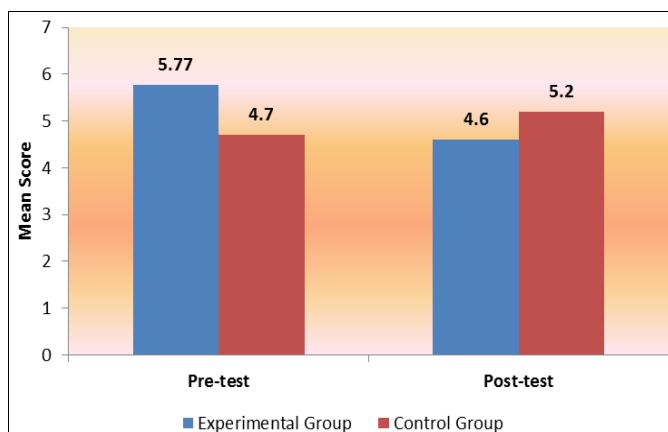
**Fig 2:** Reveals the comparison of pain score between experimental and control group

Table-2 and figure.2 reveals the comparison between the Experimental and Control Groups with Paired t-test of Pain Score.

In experimental group pre-test pain score and standard deviation were 5.77 ± 2.285 whereas post-test pain score and standard deviation for Post-test experimental group was 4.60 ± 1.714 . t value was found 2.550 which was significant at 0.05 level of significance that means there was significant difference in the Pre-test and Post-test pain score of experimental group.

In control group pre-test pain score and standard deviation was 4.70 ± 1.985 whereas post-test pain score and standard deviation for Post-test control group were 5.20 ± 2.483 . t value was found 0.961 which was non-significant which means there was no significant difference in the Pre-test and Post-test pain score of control group.

Table 3: Association of Sociodemographic variables with pre-test pain score in Experimental group N=60

Variables	Categories	Worst Pain Possible	Severe	Moderate	Mild Pain	No Pain	Chi test	df	p Value
Age	50-55 Years	0	5	2	3	0	9.539	3	0.022*
	56-60 Years	1	3	5	5	0			
	61-65 Years	0	3	1	2	0			
Gender	Male	0	1	5	0	0	5.087	3	0.166
	Female	1	10	8	5	0			
	Others	0	0	0	0	0			
Diet	Vegetarian	2	4	6	2	0	10.255	3	0.016*
	Non- vegetarian	1	5	7	3	0			
	Mixed	0	0	0	0	0			
Occupation	Private job	0	0	2	1	0	6.603	9	0.678
	Labour	0	2	5	2	0			
	Government job	0	4	2	1	0			
	Others	1	5	4	1	0			
Lifestyle	Sedentary	2	10	3	2	0	11.738	2	0.002*
	Active	3	1	8	1	0			
Income	Below Rs 10,000	1	5	7	2	0	3.073	6	0.800
	Rs 10,000 – 30,000	0	2	4	2	0			
	Above Rs 30,000	0	4	2	1	0			
BMI	Underweight	1	1	1	0	0	9.750	4	0.044*
	Normal	2	6	8	5	0			
	Overweight	1	3	1	1	0			
	Obese	0	0	0	0	0			
Education	Primary	0	1	1	0	0	2.773	6	0.837
	No formal education	1	6	10	3	0			
	Secondary	0	4	2	2	0			
	Graduated	0	0	0	0	0			
Duration of Pain	1-3 months	1	2	1	0	0	10.309	4	0.035*
	3-6 months	0	3	8	5	0			
	6 months-1 Year	2	4	2	2	0			
	Above 1 Year	0	1	0	0	0			
Hereditary	Yes	0	0	1	0	0	1.353	3	0.717
	No	1	11	12	5	0			
Previous Treatment	Allopathic	1	3	1	1	0	8.262	9	0.508
	Ayurvedic	0	4	3	1	0			
	Homeopathic	0	3	4	1	0			
	No treatment	0	1	5	2	0			

* Denotes significant result at p value <0.05

Table 4: Association of Sociodemographic variables with pretest pain score in Control group N=60

Variables	Categories	Worst Pain Possible	Severe	Moderate Pain	Mild Pain	No Pain	Chi Test	df	p Value
Age	50-55 Years	0	2	4	1	0	12.156	3	0.006*
	56-60 Years	0	3	8	5	0			
	61-65 Years	0	2	3	2	0			
Gender	Male	0	2	10	7	0	3.333	2	0.189
	Female	0	3	7	1	0			
	Others	0	0	0	0	0			
Diet	Vegetarian	0	3	5	4	0	10.940	3	0.012*
	Non- vegetarian	0	5	9	4	0			
	Mixed	0	0	0	0	0			
Occupation	Private job	0	1	1	1	0	8.818	6	0.184
	Labour	0	4	6	6	0			
	Government job	0	0	7	1	0			
	Others	0	0	3	0	0			
Lifestyle	Sedentary	0	0	10	1	0	8.501	2	0.014*
	Active	0	5	7	7	0			
Income	Below Rs 10,000	0	1	2	1	0	4.588	4	0.332
	Rs 10,000 -30,000	0	4	8	6	0			
	Above Rs 30,000	0	0	7	1	0			
BMI	Underweight	0	1	1	0	0	11.365	4	0.022
	Normal	0	6	10	5	0			
	Overweight	0	0	5	1	0			
	Obese	0	0	1	0	0			
Education	Primary	0	0	0	1	0	8.410	6	0.210
	No formal Edu.	0	4	7	6	0			
	Secondary	0	1	7	1	0			

	Graduated	0	0	3	0	0			
Duration of Pain	1-3 months	0	2	0	3	0	10.316	4	0.354*
	3-6 months	0	3	9	6	0			
	6 months-1 Year	0	0	5	0	0			
	Above 1 Year	0	0	2	0	0			
Hereditary	Yes	0	0	2	1	0	0.670	2	0.715
	No	0	5	15	7	0			
Previous Treatment	Allopathic	0	1	4	0	0	3.420	6	0.755
	Ayurvedic	0	1	4	1	0			
	Homeopathic	0	2	6	4	0			
	No treatment	0	1	3	3	0			

* Denotes significant result at p value<0.05

Discussion

Discussion in reference to effectiveness of Epsom salt with hot water application on joint pain

The present study depicts that there was reduction in the level of pain during receiving Epsom salt compression. The present study results revealed that (10%) had no pain, (18%) had mild pain, (22%) had moderate pain while receiving Epsom salt compression. It was concluded that hot water application with Epsom salt is effective. These findings were supported by S. Shilpa Parag, D. Basvant (2018) ^[13] in which pain was measured with numerical rating scale. The t-test showed significant improvement of joint pain in the first group after the intervention ($p<0.05$). Consistent findings were supported by R. Ranjini *et al* (2021) ^[14] conducted a study randomized controlled trial study using visual analog scale. The result of the study showed that warm Epsom salt may reduce pain, stiffness and improves quality of life. The findings were also supported by S.Anuradha *et al* (2021) ^[15] conducted an experimental study among elderly with ortho-arthritis. This study concluded that standard deviation was 0.57 and 53% reduction in pain level as compared to the control group. The findings were also supported by M. Khevna Rameshbhai *et al* (2021) ^[16] conducted a quasi-experimental study. Conclusion of this study that the mean differences between pre and post interventional pain was found statically significant in experimental group. So, the hypothesis H_1 is accepted. A study by Bhawna, Anney *et al* (2019) ^[17] showed that mean pre-test pain score 4.50 and in post-test mean pain score 2.70 so the mean difference was 1.8 ± 1.349 . On computing paired test the value of t (7.307) was significant at 0.05 level of significance.

Conclusion

This study concluded that there was significant reduction in level of joint pain after applying Epsom salt with hot water application among elderly people. As per the significance of the result of this study it was concluded that this therapy is effective for reducing joint pain among elderly and it is also helpful for creating awareness among community people regarding non- pharmacological treatment of joint pain.

Recommendation

Based on the present study findings following recommendations were made

- The study can be conducted on a larger sample to generalize the findings.
- Comparison can be done to evaluate the effectiveness of other nursing interventions such as hydrotherapy and ice application

Acknowledgement

First and foremost, we would like to thank Lord Almighty for his abundant blessings that he showed on us for

accomplishing this task.

Our research project has never been successful without the coordinated efforts of all members involved. The satisfaction and pleasure that accompanies the successful completion of any task would be incomplete without the mention of the people whom admit possible.

We want to express our indelible thanks to all those who have inspired us and rendered their valuable support to us for completing this study.

We express our sincere heartiest gratitude to Prof. (Dr.) Deepika R. Kumar, Director Principal, Rayat Bahra College of Nursing, Mohali, Punjab. It is a great privilege to have benefitted from her excellent teaching skills, sagacious guidance, help keen interest and encouragement all through our research period.

We would like to thank our guide Ms. Shalika Sandal, Nursing Tutor, Rayat Bahra College of Nursing, Mohali, Punjab for her guidance, critical suggestions and support from the beginning till the end for the completion of this work.

We would also like to thank our teachers who have contributed their valuable suggestions. Grateful acknowledgement is extended to all experts invalidating the tool. We own our deepest affection to our parents for their boundless prayers, moral support and constant encouragement during the course of the study.

We would like to conclude with lots of appreciation for all those who have directly or indirectly helped in the successful completion of the thesis.

References

1. Harman D. The aging process. Proceedings of the National Academy of Sciences. 1981 Nov;78(11):7124-8
2. Bergman S. Public health perspective—how to improve the musculoskeletal health of the population. Best Practice & Research Clinical Rheumatology. 2007;21(1):191-204.
3. Inoue R, Ishibashi Y, Tsuda E, Yamamoto Y, Matsuzaka M, Takahashi I, *et al*. Knee osteoarthritis, knee joint pain and aging in relation to increasing serum hyaluronan level in the Japanese population. Osteoarthritis and cartilage. 2011;19(1):51-7.
4. Tortora GJ. Principles of human anatomy. HarperCollins College; c1995.
5. Szilard L. on the nature of the aging process. Proceedings of the National Academy of sciences. 1959;45(1):30-45.
6. Schaible HG, Richter F, Ebersberger A, Boettger MK, Vanegas H, Natyra G, *et al*. Joint pain. Experimental brain research. 2009;196:153-62.
7. Dureja GP, Jain PN, Shetty N, Mandal SP, Prabhoo R, Joshi M, *et al*. Prevalence of chronic pain impact on daily life, and treatment practices in India. Pain practice. 2014;14(2):E51-62.
8. Sankar L. Effectiveness of Epsom salt with hot water

- application on knee joint pain among elderly in a selected rural area at puducherry. Pondicherry Journal of nursing (PJN). 2019;12(2):42-5.
9. Mathis DT, Hirshchmann MT. Why do knees after total knee knee arthroplasty fail in different parts of the world? Journal of orthopaedics. 2021;23:52-9.
 10. Sharma SP. Ageing in India Demographic Background and analysis based on census materials.
 11. Jackson EM, Omura JD, Boring MA, Odom EL, Foster AL, Olivari BS, *et al.* Prevalence and Characteristics of Arthritis Among Caregivers-17 States 2017 and 2019. Morbidity and Mortality Weekly Report. 2022;71(44):1389-95.
 12. Kharbanda JS, Yadav SK, Soni V, Kumar A. Modeling of heat transfer and fluid flow in Epsom salt ($MgSO_4 \cdot 7H_2O$) dissociation for thermochemical energy storage. Journal of Energy Storage. 2020;31:101712.
 13. Shilpa S, Parag D. Basvant -conducted a study to assess the Effectiveness of Application of Warm Compress with Epsom Salt to Reduce Knee Joint Pain among Women. International Journal of Science and Research. (IJSR). 2018;7(5):319-322.
 14. Rajasekharan R, Dinesh S, Shetty P. Effect of Warm Epsom Salt Pack over Knee Osteoarthritis-A Randomized Controlled Trial. Journal of Complementary and Alternative Medical Research. 2021;16(3):7-15.
 15. Anuradha S, Anusha AR, Umamaheswari K, Priyanka A, Sreelatha B. Effect of Epsom Salt with Hot Water Compress on Knee Joint Pain among Elderly with Osteoarthritis at Arunodaya Vrudhashram, Nagaiahgaripalli, Near Tirupathi, Andhra Pradesh, India. International Journal of Orthopedic Nursing. 2021;7(1):1-6.
 16. Macwan KR, Savaliya PK. Effectiveness of Foot Exercise and Epsom Salt Water on Reduction of Foot Oedema among Antenatal Mothers. Journal of Clinical & Diagnostic Research; c2021, 15(5).
 17. Prabhakaran B. Evaluate the Effect of Hot Affusion Bath with Epsom Salt on Pain Management in Osteoarthritis of Knee (Doctoral dissertation, Government Yoga and Naturopathy Medical College, Chennai).