Indian Journal of Nursing Sciences

International Peer Reviewed Journal

Review Article

Epsom Salt Hot Water and Plain Hot Water Application: Reduce Knee Joint Pain Updated Review

K. Samayochitha[1], B. Geetha Praveena[2]

[1]Department of Medical-Surgical Nursing, St. Joseph College of Nursing, Guntur, Andhra Pradesh, India, [2]Department of Community Health Nursing, GSL College of Nursing, GSL Medical College Campus, Rajahmundry, Andhra Pradesh, India

Abstract

It is currently estimated that adults over 60 years make up 8% of India's population, and by 2021, that number will be 137 million. India now has the second-largest aged population in the world. The small-family norm means that fewer working, younger individuals are called upon to care for an increasing number of economically unproductive, elderly persons. Applying the heat by general or local method which produce the physiological change in the body such as vasodilatation and relaxation of muscles which produce the beneficial therapeutic effect of relieving the pain**.** The Epsom salt hot water application is very effective in the treatment of joint pain. Epsom salt can act topically and immediately reduce the pain in joints. The 200 mg of Epsom salt mixed in hot water the painful joints can be bathed for 20 min. It can be used for thrice a week. It is very effective to relieve morning stiffness in joints. Epsom salt is one of the home remedies, which is rich in magnesium. This is very helpful in relieving joint pain. In this study, Epsom salt hot water application produces analgesic properties and reduces knee joint pain instantly. Here, the temperature of the water can be maintained at 125°F. The objective of the review article is the study to assess the effectiveness of Epsom salt hot water application and plain hot water application to reduce knee joint pain among old age people. Epsom salt hot water application can be used in the future for all the old age people suffering from knee joint pain for health promotion. From the study finding, it is concluded that Epsom salt hot water application is effective in reducing knee joint pain among old age people.

Key words: Epsom salt hot water, knee joint pain, old age people, plain hot water, population

Address for correspondence: B. Geetha Praveena, Department of Community Health Nursing, GSL College of Nursing, GSL Medical College Campus, Rajahmundry, Andhra Pradesh, India. E-mail: geetha.co@gmail.com

Introduction

Epsom salt hot water application intervention

Long known as a natural remedy for a number of ailments, Epsom salt has numerous health benefits as well as many beauty, household, and gardening-related uses.[1]

Access this article online	
Website:http://www.innovationalpublishers.com/Journal/ijns	e-ISSN: 2581-463X
DOI: 10.31690/ijns.2020.v05i02.003	

How to cite this article: Samayochitha K, Praveena BG. Epsom Salt Hot Water and Plain Hot Water Application: Reduce Knee Joint Pain Updated Review. Indian Journal of Nursing Sciences 2020;5(2): 139-144.

Definition

Epsom salt is also known as magnesium sulfate. It is a chemical compound made up of magnesium, sulfur, and oxygen.[2]

Purpose

Epsom salt is a pure, time tested mineral compound with many uses ranging from creating at-home spas to soothing achy muscles and reduces pain.[3]

- Epsom salt compress will be prepared by adding 30 g of Epsom salts to 1 L of boiling water (the temperature of the boiling water is 125°F as tolerated by the client) creating a hot compress by dipping a clean washcloth in the boiling water, wringing it out, applying for 20 min over the joint in which pain will present, twice a day for 10 days.[4]

60th National Sample Survey Round (2016) findings reported that the proportion of aged persons who cannot move and are confined to their bed or home ranges from

77 per 1000 in urban areas to 84 per 1000 in rural areas morbidity. It is currently estimated that adults over 60 years make up 8% of India's population, and by 2021, that number will be 137 million. India now has the second-largest aged population in the world. The small-family norm means that fewer working, younger individuals are called upon to care for an increasing number of economically unproductive, elderly persons.[5]

Srivastava committee in 2007 reported that the elderly (people above the age of 60 years) comprises 7.5% of India's total population, and making health care available and accessible to them is one of the health priorities of the country.[6]

A European Commission Euro barometer survey (2007) found that 22% of respondents reported musculoskeletal issues higher than any other health condition, in the United States, based on data from the National Health.[7]

Interview Survey, an estimated 52.5 million (22.7%) of adults have self-reported doctor-diagnosed arthritis, and 22.7 million (9.8%) have arthritis and arthritis-attributable activity limitation. It is estimated that, by the year 2030, 67 million – one in every four American adults – will have doctor-diagnosed arthritis. About 30% of adults report some form of joint pain within the prior 30 days, with the knee joint being the most common site.[8]

WHO (2005) conducted a prospective study evaluated among 100 patients above 60 years with falls a comprehensive geriatric assessment, including a detailed history of fall. Results show that the 100 patients, 68% were females. Among the causes for falls, intrinsic causes for falls were more prevalent in people >70 years. Among the medical conditions causing falls, musculoskeletal problems (72%) and visual defects (54%) were common. About 46% had three or more risk factors for falls. The conclusion shows that falls due to intrinsic causes such as joint pain and recurrent falls were common in people >70 years.[9]

Pfeil *et al*. reported that home health service, entailing home visits to detect health problems and also, a community-based health center for the aged for an educational and preventive activity will be initiated. This will be integrated with the National Rural Health Mission and an allocation made specifically for geriatric care. The Accredited Social Health Activist will be trained in geriatric care and the outpatient medical service, which serves as the base for home health service, will be enhanced. One of the aspects of home health service for the geriatrics is health education about home remedies.[10]

Brosseau *et al*. conducted a study to determine the effectiveness of thermotherapy in the treatment of osteoarthritis (OA) of the knee. The outcomes of interest were relief of pain, reduction of edema, and improvement of flexion or range of motion and function. Interventions using heat or cold therapy compared with standard treatment or placebo. The results show that three randomized controlled trials, involving 179 patients, were included in this review. In one trial, administration of 20 min of ice massage, 5 days per week, for 3 weeks. The result showed that cold packs decreased knee edema. Thermotherapy reduces pain.[11]

Applying the heat by general or local method which produce the physiological change in the body such as vasodilatation and relaxation of muscles which produce the beneficial therapeutic effect of relieving the pain. The Epsom salt hot water application is very effective in the treatment of joint pain. Epsom salt can act topically and immediately reduce the pain in joints. The 200 mg of Epsom salt mixed in hot water the painful joints can be bathed for 20 min. It can be used for thrice a week. It is very effective to relieve morning stiffness in joints.[12]

From the above review and by the researcher's own observation, the researcher found that the hot water application is very effective in relieving pain in the joints. Very few studies supporting the benefit of Epsom salt hot water application. In this study, the investigator plans to conduct the study to evaluate the effectiveness of Epsom salt hot water application and plain hot water application for joint pain.

The objective of the review article is the study to assess the effectiveness of Epsom salt hot water application and plain hot water application to reduce knee joint pain among old age people.

Nursing Implications

According to Brockopp and Hastings-Tolsma (1995), the selection of research report that focuses on implication usually includes a specific suggestion for nursing practice, education, administration, and research.[13] The findings of the study have implication in the following areas:

Operational Definitions

Effectiveness

Effectiveness is the capability of producing the desired result. In this study, effectiveness refers to the extent to which the Epsom salt hot water application will achieve the desired effect to reduce the knee joint pain as measured by 0–10 numerical pain intensity scale.

Epsom salt hot water application

Epsom salt is one of the home remedies which are rich in magnesium. This is very helpful in relieving joint pain. In this study, Epsom salt hot water application produces analgesic properties and reduces knee joint pain instantly. Here, the temperature of the water can be maintained at 125°F.

Plain hot water application

Applying the heat by local method which produce the physiological change in the body such as vasodilatation and relaxation of muscles which produce the beneficial therapeutic effect of relieving the knee joint pain. In this study, plain hot water application will reduce the knee joint pain among old age people and the temperature is maintained at 125°F.

Knee joint pain

Knee pain is refer to any aching or burning pain in the knee joint. Knee joint pain can be a symptom of numerous conditions and diseases, including knee stress, OA, injury, gout, infection, and bursitis.

Old age people

In the study, old age people refer to the people with the age group of 60 years old and above.

Studies Related to Joint Pain in Elderly

Singh *et al*. (2014), a cross-sectional study was conducted to assess the prevalence rate of knee joint pain among the elderly OA persons residing in an urban slum of Delhi using the American College of Rheumatology (ACR) clinical criteria. The prevalence of OA among the elderly is high and it affects the quality of life (QOL). Subjects were 496 elderly (>60 years). The prevalence of OA of the knee was estimated to be 41.1% (95% of confidence interval, 36.7–45.6). Female sex and age >70 years were found to be an independent risk factor for OA of the knee. Overall, individual factors of ACR criteria were both sensitive and specific in diagnosing OA of knee. In a resource-constrained setting of urban India, it can be an effective tool in the clinical diagnosis of OA of the knee.[14]

Sugiura and Demura, a study was conducted to assess the effects of mild and severe knee joint pain on activities of daily living (ADLs) in female elderly in Japan. In this study, the participants consisted of 328 elderly females. The subjects were classified into three groups: Those without knee pain, those with mild knee pain, and those with severe knee pain. Achievement rates of 40–97% for ADLs were significantly lower in the group with severe knee pain. The elderly with severe knee joint pain find it difficult to achieve many ADLs. In conclusion, it is difficult for the elderly with mild and severe knee pain to ascend and descend stairs and to sit up.[15]

Kim *et al*., a prospective cohort study was conducted to investigate the prevalence of knee pain and its influence on physical function and QOL. The sample size was 504 community residents of Chuncheon, aged >50 years. Demographic information was obtained by questionnaire, and radiographic evaluations consisted of weight-bearing semi-flexed knee anteroposterior radiographs. Self-reported QOL and function were assessed using the Western Ontario and McMaster Universities OA (WOMAC) index and short-form 12(SF-12). The prevalence of knee pain was 46.2% (32.2% in men and 58.0% in women) increased with age in women. Among the subjects with knee pain, women had worse WOMAC and SF-12 scores than men. In conclusion, the prevalence of knee pain is high (32.2% in men and 58.0% in women) in this elderly community population in Korea.[16]

Anderson pet village (2009), a study was conducted by the investigator, showed that the total number of old age people was 160 participated in the study conducted in Chennai, among them 90% reported joint pain in either one or both joints. The study design was pre-test and post-test design. This study calculated that there is more prevalence rate of knee joint pain among the elderly.[17]

Bannuru *et al*., a study was conducted to assess the effectiveness of chronic pain in the elderly, among whom it has the greatest impact. In this study, participants were 100 elderly people with knee joint pain. The results showed that the pathological findings in both conditions correlate poorly, however, with the severity of knee pain and disability.[18]

Lena *et al*., a study was conducted a cross-sectional study on geriatric problems among 231 elders in Udupi Taluk, Karnataka. The result of the study showed that the majority of them had problems such as hypertension followed by arthritis, diabetes, asthma, cataract, and anemia. Among them, 68% of the patients suffered from knee joint pain. Joint pain was found to be more common among females. The study showed that there is a high prevalence of knee joint pain among the elderly.[19]

Hill *et al*., a prevalence study was conducted regarding joint pain among the 4060 old age population in the North West region of Adelaide, South Australia. Participants were asked to report their pain, aching, or stiffness on most days in either of their joints. Overall, 17.4% of participants indicated that they had joint pain. Within the cohort, 558 (17.4%) of participants indicated that they had joint pain on most days over the past month. Of those with joint pain, 349 (62.5%) had bilateral joint pain and 209 (27.5%) had unilateral joint pain. This study concluded by saying that joint pain affected nearly one in five people in the community, was associated with age, female sex, and pain in other body regions.[20]

Men'shikova and Babyre (2008), a study was conducted among OA patients in Korea. The aim of this study was to elucidate the cause of pain in patients with the alleged diagnosis of "osteoarthritis" and to develop the relevant diagnostic algorithm. The study included 214 patients aged from 35 to 85 years with a pain level of at least 40 mm by the visual analog scale. Results of physical and X-ray examination provided indications for further studies that were performed by ultrasonographic (40.1%),

arthroscopic (52.3%), and mitochondrial replacement techniques (MRT) (64.2%) techniques. One-third of the patients were aged women with the body mass index >40.1 and stage 3 OA in whom pain was attributable to primary OA. There was excellent (98.6%) agreement between MRT diagnosis and arthroscopic data on lesioned intra-articular structures, articular cartilage, and subchondral bone. Arthroscopy revealed a traumatic and degenerative meniscal tear in 85% patients, injured anterior cruciate ligament in 8%, signs of synovitis in 52.6%, chondromalacia of the femoral condyle in 57.6%, and isolated pathology of patellofemoral articulation in 33% of the patients.[21]

Sharma *et al*., an epidemiological study was conducted on correlated joint pain in 362 old age people aged more than 65 years in the urban and rural areas of Chandigarh, India. The study revealed that the overall prevalence of joint pain among old age as 56.6% in rural areas, it was 32.6% and in urban it was 60.3%. Joint pain was more in females compared to males (70.1% vs. 41.6%). The study was concluded that there is a high prevalence rate of nee joint pain among the elderly.[22]

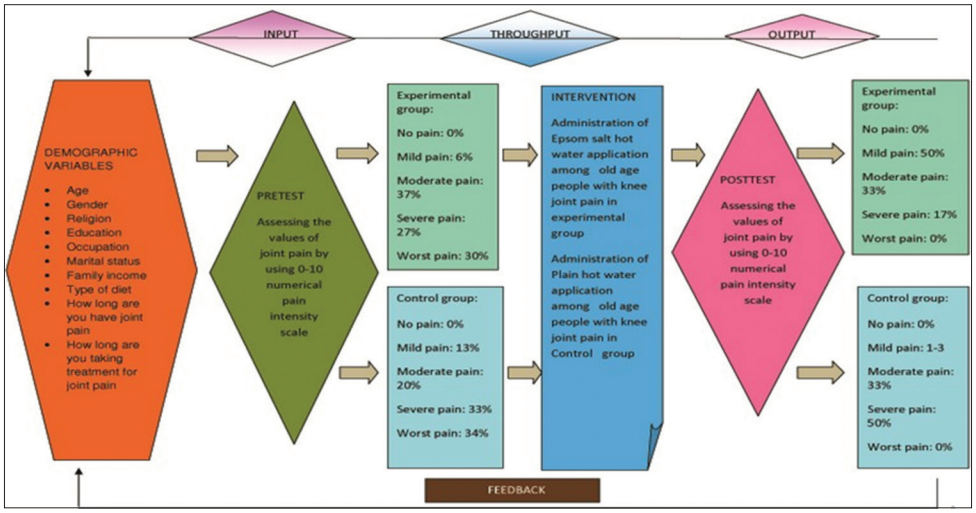
Donald and Foy (2004), a longitudinal study is conducted in the UK regarding joint pain in older people. There were 4804 subjects aged 75 years and over who accepted the offer of health screening assessments' by postal questionnaire. Subjects were recruited as a part of a randomized control trial method. The response rate to the postal questionnaire was 77%, with a mean age of 80 years. The proportion of females was 58%. The percentage of reporting any degree of pain was 83%. The prevalence of constant pain was 26% and was higher in women of 80 years and 20% of men under 85 and 24% of men over 85; 28 and 34% of women, respectively. Over 1 year, 18% acquired or had increased frequency of pain, while 14% had reduced that frequency of pain was experienced by the majority of people over 75 years. The study concluded that increasing joint pain by age.[23]

Studies Related to Plain Hot Water Application

Kaur *et al*. (2017), the study has been undertaken to study the effect of "moist heat application" on the intensity of knee joint pain among the geriatric population (≥60 years of age) residing at Dadu Majra Colony, Chandigarh. Of the total geriatric population surveyed in the present research, 48% had knee joint pain. Every 3rd individual was selected as a study sample using a systematic random sampling technique. The sample size consisted of 87 subjects that are 43 in the experimental and 44 in the control group. The intensity of knee joint pain was assessed on the 1st and 8th day of intervention among both the experimental and control group. "Moist heat" was applied at the knee joint twice a day for 7 days in the experimental group. The results show that the intensity of knee joint pain and intake of painkillers was reduced significantly in the experimental group as compared to the control group, as indicated by the Chi-square test. Hence, the use of moist heat application is recommended for home base management of knee joint pain.[24]

Missiriya (2015), an experimental study was conducted to assess the effectiveness of hot water application on knee joint pain among women at the Kuthambakkam village area and to associate between selected demographic variables with post-test scores among women with knee joint pain in the selected community area. One group pre-test and post-test design used in the study. Totally 50 women in age of 30–60 years who meet the inclusion criteria were selected by a random sampling method. In the pre-test, 285 of the women had moderate knee joint pain and in the post-tests after 2 weeks of the intervention of hot water application, 24% of the women had moderate pain and 76% women had mild pain. The study concluded that a significant reduction in pain using hot water applications.[25]

Yıldırım *et al*., a comparative study was conducted to evaluate the effect of heat application on pain in the Midwifery Department, Cumhuriyet University, Turkey. Local heat application is used as a nonpharmacological practice for the treatment of knee OA. The data were



Modified Roy's adaptation model (2019)

collected using data collection form, Western Ontario and McMaster Universities Index and SF-36. The patients with knee OA were divided into two groups (23 patients in each) as intervention and control groups, and patients in the control group were applied with the routine medication of the physician. The intervention group received a 20-min heat application every other day for four. The Western Ontario and McMaster Universities pain and Western Ontario and McMaster Universities disability scores of the patients with knee OA in control and intervention groups before and after the intervention were compared, and the differences for both scores in the change were found to be statistically significant ($P < 0.05$). It was concluded that heat application every other day decreased pain and disability of the patients with knee OA.[26]

Kirk and Kersley (2011), an experimental study was conducted to evaluate the effectiveness of heat in the physical treatment of rheumatoid arthritis at the Royal National Hospital. Hot packs were given for 20 min with temperatures approximately 45° at the beginning and at the end 41°C. Results showed that greater relief from pain and stiffness due to hot application.[27]

Lehmann *et al*. (2009), a study conducted to assess the therapeutic effect of heat on rheumatoid arthritis. Patients received heat application to the affected joint. The hot application had an effect on pain and relieving stiffness. Patients preferred heat therapy. The researcher concluded that superficial heat can be applied to chronic pain management.[28]

Wells *et al*., the study was conducted to compare the ice and heat therapy in rehabilitation of rheumatoid arthritis patients to relieve inflammation, pain, and mobility. They found that patients preferred heat therapy to hot applications (70%). The study concluded that heat therapy can be used as palliative therapy, which can be applied at home as needed to relieve pain.[29]

Chauhan and Sharma, a comparative study conducted to assess the therapeutic benefits of thermocare heat wrap combined with an education program to an education-only program on reducing pain and disability in OA clients. Forty-three clients in the US have been randomly assigned to two groups. One group received education alone; the other group received education and topical heat application 40° for 87 h. The results evaluated on days 4, 7, and 14 and it is showed a significant reduction in pain intensity, increased pain relief, and improved disability scores after treatment with heat therapy.[30]

Milne *et al*., a study was conducted in The Cochrane Library for the purpose of determining the effectiveness of heat in knee OA, and they found three randomized controlled trials involving 179 patients. In one of these studies, hot application has a significant impact on the increase of the quadriceps muscle strength (29% relative difference) for 20 min for 5 times a week, totally for 3 weeks compared with the clinical control group. This study was concluded that there is a significant improvement in hot water application to relieve knee joint pain.[31]

Studies Related to Epsom Salt Hot Water Application to Reduce Knee Joint Pain

Deshmukh and Suresh, a study is the effectiveness of the application of hot water with Epsom salt versus plain hot water on knee joint pain among geriatric women in selected urban areas. The objective of the study was to assess the level of knee joint pain among geriatric women in both the experimental groups before and after the intervention, to assess the effectiveness of interventions in both the experimental groups, and to compare the effectiveness of interventions between both the experimental groups and to determine the association between the level of knee joint pain and selected demographic variables. The majority (60%) of the geriatric women were from the age group between 65 and 70, 46.67% of them were vegetarians and having body weight between 57 and 64 kg, 63.33% of them were reported literate and suffering from pain since 4–6 years. Level of pain (19.58, 19.75) was almost same in both the experimental groups, the feelings related to pain was reported more in group 2 (15.57%), clinical outcome was almost same (15.52, 15.53) in both the groups and the level of activity was more in experimental group 1 as compared to another one. The total mean pain score of 58.67 was more in the experimental group 2. The researcher concluded that the level of pain in both groups was almost the same, but feeling related to pain was more in the group with plain hot water.[32]

Studies Related to Effectiveness of Epsom Salt Hot Water Application than Plain Hot Water Application

Benita pain is a multidimensional phenomenon. Management of pain includes pharmacological and nonpharmacological approaches. Rheumatoid arthritis is a chronic, systemic inflammatory disorder that may affect many tissues and organs but principally attacks the joints produce inflammatory synovitis that often progresses to destruction of articular cartilage and ankylosis of the joints. The researcher found that the hot water application is very effective in relieving pain in the joints. Hence, the researcher planned to conduct a study to assess the effectiveness of hot water application with Epsom salt in reducing joint pain among old age patients with rheumatoid arthritis in a selected hospital at Coimbatore. A study to evaluate the effectiveness of laughter therapy on depression among the elderly persons staying in selected old age home at Erode district, Tamil Nadu.[12]

Conclusion

The review is concluded that Epsom salt hot water application is effective in reducing knee joint pain among old age people.

References

1. Cunningham GL. Recovery of Values in Naturally Occurring Alkali Metal Sulfate Minerals. United States: Horizons Inc.; 1958.
2. Kebe EO, Charles CM, Usun OU, Gabriel UA. Comparative studies of the effect of diazepam and magnesium sulphate on motor coordination and seizures in 4-aminopyridine induced Swiss mice. Glob J Sci Front Res 2016;16:1-13.
3. Chesny HH. Magnesium compounds from ocean water. Indu Eng Chem 1936;28:383-90.
4. Amudha G. Assess the Effectiveness of Hot Water Compress with Epsom Salt Among Elderly Women with Knee Joint Pain Residing at Selected Urban Area Choolai in Chennai, Doctoral Dissertation. Tamil Nadu: College of Nursing, Madras Medical College, Chennai; 2014.
5. Barreca A, Clay K, Deschenes O, Greenstone M, Shapiro JS. Adapting to climate change: The remarkable decline in the US temperature-mortality relationship over the twentieth century. J Polit Econ 2016;124:105-59.
6. Pierpont ME, Basson CT, Benson DW Jr., Gelb BD, Giglia TM, Goldmuntz E, *et al*. Genetic basis for congenital heart defects: Current knowledge: A scientific statement from the American heart association congenital cardiac defects committee, council on cardiovascular disease in the young: Endorsed by the American academy of pediatrics. Circulation 2007;115:3015-38.
7. Blendon RJ, Schoen C, DesRoches C, Osborn R, Zapert K. Common concerns amid diverse systems: Health care experiences in five countries. Health Aff 2003;22:106-21.
8. Barbour KE, Helmick CG, Boring M, Brady TJ. Vital signs: Prevalence of doctor-diagnosed arthritis and arthritis-attributable activity limitation-United States, 2013-2015. MMWR Morb Mortal Wkly Rep 2017;66:246.
9. Extermann M, Aapro M, Bernabei R, Cohen HJ, Droz JP, Lichtman S, *et al*. Use of comprehensive geriatric assessment in older cancer patients: Recommendations from the task force on CGA of the international society of geriatric oncology (SIOG). Crit Rev Oncol Hematol 2005;55:241-52.
10. Pfeil M, Mathur A, Singh S, Morris C, Green G, Kulkarni M. Home next day: Early discharge of children following appendicectomy. J Child Health Care 2007;11:208-20.
11. Brosseau L, Wells GA, Tugwell P, Egan M, Wilson KG, Dubouloz CJ, *et al*. Ottawa panel evidence-based clinical practice guidelines for aerobic fitness exercises in the management of fibromyalgia: Part 1. Phys Ther 2008;88:857-71.
12. Benita FR. A Study to Assess the Effectiveness of Hot Water Application with Epsom Salt in Reducing Joint Pain Among Old Age Patients with Rheumatoid Arthritis in a Selected Hospital at Coimbatore, Doctoral Dissertation. Tamil Nadu: Ellen College of Nursing, Coimbatore; 2016.
13. Brockopp DY, Hastings-Tolsma MT. Fundamentals of Nursing Research. United States: Jones & Bartlett Learning; 2003.
14. Singh AK, Mani K, Krishnan A, Aggarwal PK, Gupta SK. Prevalence of osteoarthritis of knee among elderly persons in urban slums using American college of rheumatology (ACR) criteria. J Clin Diagn Res 2014;8:JC09.
15. Sugiura H, Demura S. Effects of mild and severe knee joint pain on various activities of daily living in the female elderly. Pain Res Treat 2013;2013:989508.
16. Kim IJ, Kim HA, Seo YI, Jung YO, Song YW, Jeong JY, *et al*. Prevalence of knee pain and its influence on quality of life and physical function in the Korean elderly population: A community based cross-sectional study. J Korean Med Sci 2011;26:1140-6.
17. Anderson D. Pictures of Ascent in the Fiction of Edgar Allan Poe. Berlin, Germany: Springer; 2009.
18. Bannuru RR, Natov NS, Obadan IE, Price LL, Schmid CH, McAlindon TE. Therapeutic trajectory of hyaluronic acid versus corticosteroids in the treatment of knee osteoarthritis: A systematic review and meta-analysis. Arthritis Rheum 2009;61:1704-11.
19. Lena A, Ashok K, Padma M, Kamath V, Kamath A. Health and social problems of the elderly: A cross-sectional study in Udupi Taluk, Karnataka. Indian J Community Med 2009;34:131.
20. Hill CL, Gill TK, Menz HB, Taylor AW. Prevalence and correlates of foot pain in a population-based study: The North West Adelaide health study. J Foot Ankle Res 2008;1:2.
21. Prabhakaran B. Evaluate the Effect of Hot Affusion Bath with Epsom Salt on Pain Management in Osteoarthritis of Knee, Doctoral Dissertation. Tamil Nadu Government Yoga and Naturopathy Medical College, Chennai; 2019.
22. Sharma MK, Swami HM, Bhatia V, Verma A, Bhatia SP, Kaur G. An epidemiological study of correlates of osteo-arthritis in geriatric population of UT Chandigarh. Indian J Community Med 2007;32:77.
23. Donald IP, Foy C. A longitudinal study of joint pain in older people. Rheumatology 2004;43:1256-60.
24. Kaur P, Walia I, Saini SK. Study on intensity of knee joint pain by application of moist heat' among geriatric population (> 60years of age). Nurs Midwifery Res J 2007;3:80-7.
25. Missiriya S. Effectiveness of castor oil massage with hot application on knee joint pain among women. Education 2015;25:50.
26. Yıldırım N, Ulusoy MF, Bodur H. The effect of heat application on pain, stiffness, physical function and quality of life in patients with knee osteoarthritis. J Clin Nurs 2010;19:1113-20.
27. Kirk JA, Kersley GD. Heat and cold in the physical treatment of rheumatoid arthritis of the knee: A controlled clinical trial. Rheumatology 1968;9:270-4.
28. Kestin M, Miller L, Wahlqvist M, Littlejohn G. The use of unproven remedies for rheumatoid arthritis in Australia. Med J Aust 1985;143:516-8.
29. Wells GA, Li T, Kirwan JR, Peterson J, Aletaha D, Boers M, *et al*. Assessing quality of sleep in patients with rheumatoid arthritis. J Rheumatol 2009;36:2077-86.
30. Chauhan NH, Sharma A. Effectiveness of the hot application and castor oil application in clients with joint pain-literature review. Int J Nurs Care 2017;5:70-4.
31. Milne S, Brosseau L, Welch V, Noel MJ, Davis J, Drouin H, *et al*. Continuous passive motion following total knee arthroplasty. Cochrane Database Syst Rev 2003;2:CD004260.
32. Deshmukh J, Suresh R. Effectiveness of application of hot water with Epsom salt v/s plain hot water on knee joint pain among geriatric women. Pharm Innov J 2019;8:434-41.