

## The effect of a period of physical exercise in water on the knee osteoarthritis in old men

Y.Khanjari<sup>1</sup> (M.A) , R.Garooei (M.A)

University of Tehran, University of Kharazmi, Iran

E-mail address: ykhanjari@gmail.com

<sup>1</sup> . Corresponding – Author: Tel: 09354832941 Email: ykhanjari@gmail.com

**Keywords:** Knee osteoarthritis, Exercise in water, quality of life

**ABSTRACT. Introduction:** Aging is a stage of life that increases the risk of physical diseases, some of which are chronic and can affect different dimensions of life's quality. In addition, These days, exercising is effective in preventing chronic diseases such as osteoarthritis. The goal of the present research is to study the effect of a period of exercise in water program on the scale of knee pain, the rate of symptoms and the movement problems in daily activities, sports activities and pastime activities and the quality of old adults life.

**Materials and methods:** Fifteen old men afflicted with osteoarthritis were chosen purposely as the testees by age mean and Std  $58 \pm 6.5$ , length  $167.12 \pm 7.35$  cms, weight  $75.64 \pm 7.64$ . We used global questionnaire of the consequences of knee injuries and osteoarthritis to collect data. The testees practiced the exercise in water program in ten weeks. we analyzed the achieved data by a correlated t-test at a meaningful level. ( $p < 0.05$ ).

**Results:** Among the post-test and pre-test the symptoms scale  $p = 0.043$ , knee pain  $p = 0.024$ , movement operation in daily and pastime activities  $p = 0.018$  were recovered meaningfully after the program.

**Conclusion:** The results showed that participating in an exercise in water program on a regular basis can be considered as an effective and reliable method to decrease pain, promote the operation of knee and the old men life's quality.

### 1. INTRODUCTION

Osteoarthritis is one of the joint disorders and one of the main reasons for social, economic paralysis(1). Knee is the third organ to afflict with osteoarthritis after fingers and vertebrate and 1/3 of people aging more than 65 are facing radiologic changes in knee osteoarthritis(2). The aging process includes erosive, gradual and irrecoverable changes in body systems and this is the reason which decreases the life quality and movement operation of the old people(3). Muscular, skeletal pain is a common problem among the old and the long lasting effects of this pain is known well. Moreover, decreasing the physical activities among the old is so important.(4) The studies have shown that the rate of affliction to this disease is 60-90 percent in people aging 65 or older(5).

Furthermore, Arthritis, especially knee Arthritis occurs more in old ages and by growing old(6). Suffering from skeletal, muscular pains is one of the main reasons to be absent at work in west. These pains result in ache, losing the ability to move and a long lasting disability(7). On the other hand, in addition to the direct disease costs spent for medical care( treatment and disability), the indirect costs resulting from lack of productivity increase the financial and healthy burden of this disease(8). It's good to mention that keeping on the physical activity to self-care treatment activities is necessary for the old people afflicted with chronic diseases such as osteoarthritis and therefore; exercising regularly and strengthening the body physically can decrease the pain and the symptoms scale and promote physical operation of the patient(9). National Arthritis Department in USA suggested the patients to do exercise in water sports at 1997.(10)

Exercise in water has many advantages. Due to the water properties in producing resistance, lightening and decreasing the pressure on the patient's joints, this method of exercising will be done

with less injury and will be learned more easily(11). By strengthening the muscles around the joints and decreasing the incoming pressure, water is effective in lessening the pain and promoting the life quality of this people(12). Exercise in water is widely done in South Korea during recent years(13). Increasing physical activities is suggested as a basic solution to promote the public health of the societies and to decrease the cardiovascular diseases and diseases such as osteoarthritis and etc(6). Spector et. al(14) and Sezoeki et. al(15), explained that there is a relation between physical activities and osteoarthritis. Felson(16) and Hootman et. al(17), suggested that physical activity may be not effective, and Rogers et. al(18) and White et. al (19), stated that physical activity may prevent de-generative changes in the knee.

According to exercise in water effects on knee osteoarthritis, the studies showed that exercise in water a weak or medium effect on patient's activities and his life quality and has a very weak effect on pain scale in these patients. It seems that exercise in water has a short time effect on knee osteoarthritis in old men. However, the data achieved by the conducted studies is not enough to conclude about this subject(20). After comparing the data achieved during the two different programs exercise in water and exercise in land programs, It was explained that exercise in water has a meaningful effect on decreasing the pain and symptoms and movement status and the life quality of old men (20&21). Khanjari et. al(39), in analyzing the effect of a period of aquatic therapy exercise on the quality of life and depression in aged males suffering from chronic physical pains showed that exercise in water created a meaningful promotion in pain scale, life quality and depression. But Lund et. al(22), showed that exercise in water doesn't create a meaningful promotion in pain scale, symptoms, movement status and life quality of the people afflicted with this disease , after they compared the effect of exercise in water and exercise in land. As we conclude from the previous studies, few studies have been conducted about the subject " the effect of exercise in water on knee joint" and they show contradictory findings and this is the same in Iran. It seems that exercise in the water has short-term effects on knee osteoarthritis in older adults. By the way, studies in this area is very few for definitive conclusions (20). As the history of research suggests that limited studies about the effect of exercise in water on knee joint has been performed, it indicates contradictory findings. Such studies have not been sufficiently paid attention in Iran .

Therefore, in order to reduce the number of patients with the disease and the social and economic losses caused by it, it seems that the investigation of the possibility of developing and exacerbation of knee osteoarthritis, is necessary. So considering the results of previous studies on the positive effects of exercise on land and with emphasis on the benefits of exercise in the water that cause muscle strength and reduce the probable injuries on joints caused by exercising on land and the joy and happiness of patients during exercising in water and improvement of their spirit and self-esteem and increasing their participation in taking care of themselves, the study aimed to investigate the effect of exercise training on knee pain in water, the symptoms and problems with motor function in daily, sports activities, and quality of life of elderly patients with knee osteoarthritis .

## 2. MATERIALS AND METHODS

The nature of this study is applied and semi-experimental in pre-test and post-test research. The study population consisted of all the elderly male patients with chronic knee pain referred to the Niyayesh Health Center in Shiraz. At first the form of collecting data by which the age, weight, height, physical activity, history of illness or medication, traumatic arthritis or surgery of the knee joint was determined by holding interviews and controlled the individuals health or illness conditions and injuries.

Individuals with a history of trauma, injury, surgery or fracture of the lower limb and individuals who did not have the above mention problems but were reluctant to cooperate with the researcher, were excluded from the study. Then the subjects were examined by a specialist knee orthopaedic and radiographs were taken on each side of the front (anterior-posterior view, side view). All films were observed and examined by radiologist according to the Kellgren-Lawrence(23), and the status

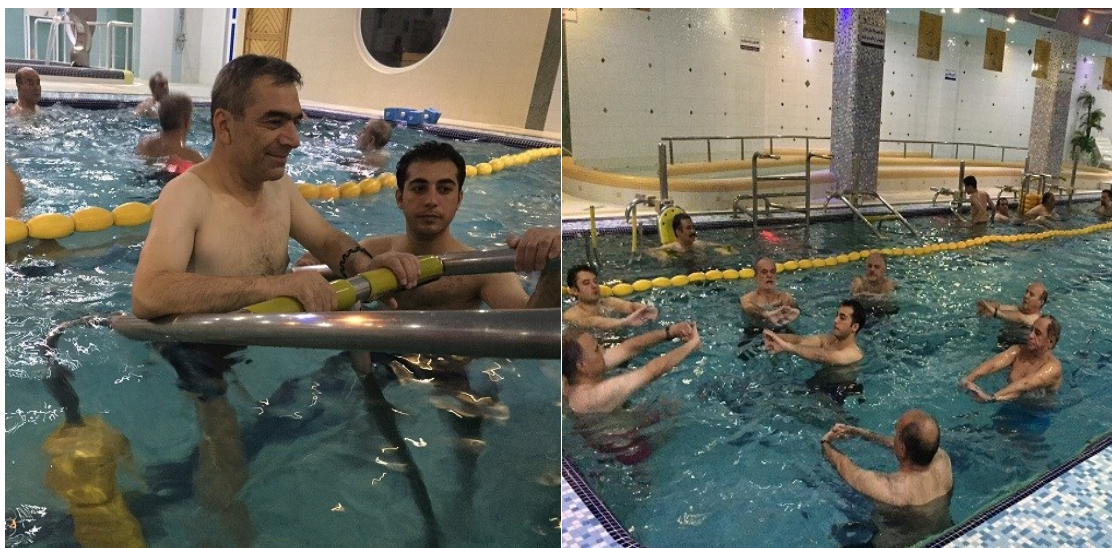
of each of the shots were reported. Then the clinical and radiological signs were evaluated by a specialist and patients with knee osteoarthritis selected in phase II and III, and patients in acute phase and level I were excluded from the study.

All the subjects were examined by a specialist in the study of osteonecrosis, diabetes, osteoporosis, rheumatoid arthritis, neuromuscular disease, history of collagen and scular disease, arthritis Psvryazy, arthritis caused by gout and Psedo gout, a long history of taking drugs affecting the musculoskeletal system and addiction. In addition, all the subjects were examined with respect to factors which affect on the lack of alignment of the lower limb that is the cause of early osteoarthritis which are not present in any of the foregoing.

Finally, because of controlling the mentioned items 15 men were purposefully selected. After the explanation of the purpose of the research to subjects, global and regional questionnaire, KOOS (Knee injury and Osteoarthritis Outcome Score) ( $p=0/76-91$ ) was determined and completed by the examiner holding an interview with subjects in order to evaluate the scale of osteoarthritis and pain intensity in knee, the symptoms, problems with motor function in daily, sport activities, and quality of life(24). Subjects were asked to answer the Likert scale of five options. Each subscale was determined separately and qualitatively and based on Visual analogue scale (VAS). Visual analogue scale is a ray which one end is zero and the other end is 100. The number 100 signified as problem status and the number 0 signified as fatal status (24). It should be noted that all participants had signed the consent for performing this study. After the initial evaluation, subjects carried out a 10-week water exercise under the supervision of a hydrotherapy instructor, at the end the final evaluation was done.

### 3. THE WATER EXERCISE PROTOCOL

The 8-week training consisted of three weekly sessions, each lasting 50 to 70 minutes progressively and increasingly with 40 to 60% of the maximum heart rate reserve. Water exercise session included of three parts warm up, main part of exercise, and cool down. Fifteen minutes of warm-up activities included walking in the water and doing stretching exercises. The main part of exercise included simple activities in the lower organs for 15 minutes and using water treatment devices in the water, including cycling, skiing and step for strengthening the muscle of the subjects. It should be noted that all the devices are embedded into the water and the subjects did exercise training on each devices for 3 to 4 minutes and then rest for one minutes. Subjects were asked to do the exercises to the severity of the pain threshold. Finally at the end of each session subjects did some stretching and flexibility activities to come back the initial status for 5 minutes.



It should be noted that the subjects had no exercise training program in the water before this research. Also use of other any type of anti-inflammation non-steroid drug and anti-pain and anti-depression drug during the research was prohibited and any kind of treatment with these drugs should not be used at least seven days before the research. This research is approved by expertise and sports medicines and orthopedic for safety in the viewpoint of physical and psychological dangerous. Researchers used Correlated T-test for statistical analyzing of data in a meaningful level  $P \leq 0.05$ . The entire of statistical analysis of this research was done by SPSS software .

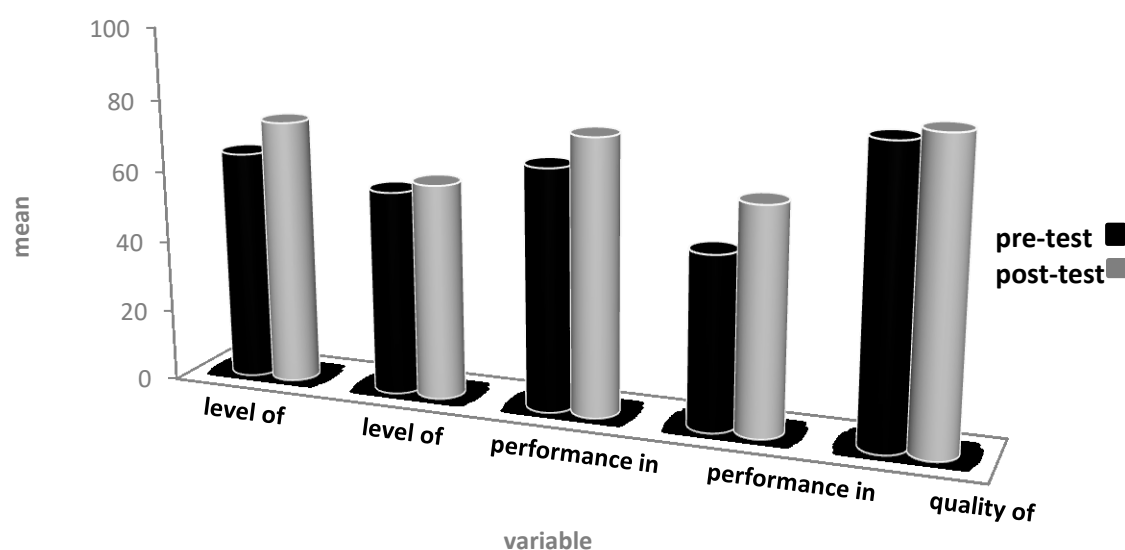
## FINDINGS

The average and standard deviation, demographic and physical characteristics of people in research is shown in table 1.

**Table 1. Mean and standard deviation of the physical qualities of the subjects**

Physical Qualities	Standard Deviation $\pm$ Mean
Age(year)	$58 \pm 6.5$
Length(centimeter)	$167.12 \pm 7.35$
Weight(km)	$75.64 \pm 7.64$

According to determined standards in questionnaire, any member of research who has the higher point, has the better situation and higher average belongs to him/her. As it is shown, the questionnaire, the mean of all variations has increased after practicing exercise protocols (graph1)



**Graph1: Total of knowledge about signs and level of pain, performance of motions in daily activities, sports, pleasure, and quality of life in before and after exercise**

The results showed that signs and level of pain, performance of motions in daily activities, sports, pleasure, and quality of life in a meaningful level in the last evaluation improved. Mean and standard deviation and also the results of dependent T-test are presented in table 2.

**Table 2. Effect of exercise in water on signs and level of pain, performance and quality of life**

variables	Standard Deviation $\pm$ Mean		Correlated t-test		
	Before	After	significance	t-value	df
Score of signs	63.35 $\pm$ 15.23	72.43 $\pm$ 11.30	0/024	-2/35	14
Score of pain	56.13 $\pm$ 6.13	61.11 $\pm$ 4.41	0/043	-2/08	14
Performance in daily activities	66.39 $\pm$ 14.08	77.33 $\pm$ 15.25	0/018	-2/94	14
Performance in sport activities	49.35 $\pm$ 15.34	64.18 $\pm$ 12.23	0/005	-3/81	14
Score of quality of life	81.25 $\pm$ 4.45	85.11 $\pm$ 3.32	0/049	-2/18	14

#### 4. DISCUSSION

The aim of doing this research is analysis of effect of one period for exercising in water on the level of knee pain, signs and performance problems of movement in daily activities, exercise, pleasure and life quality of old men. Based on findings and test of hypothesis of research of results showed that between pre-test and post-test, mean of level of signs, level of pain, movement performance in daily activities, exercise, pleasure and quality of life after doing protocols is improved.

The results showed that exercising in water as a suitable way of treatment leads to improvement of signs and severity of pain in old men who are suffering from knee osteoarthritis and by studies of Lim et al (25), in analyzing a period of exercise in water on people suffering from osteoarthritis with the BMI more than 25Kg/m<sup>2</sup>, and wang et al (20), in analyzing the influence of exercise in water and exercise on land in people suffering from knee osteoarthritis, by using Koos and Silva et al (21), in analyzing the effect of water therapy against usual treatments on land for managing patients, by using WOMAC and Bartels et al (26), questionnaire in analyzing the effect of treating exercise in treatment of patients suffering from knee osteoarthritis and Foley et al (27), in analyzing the effect of water therapy on severity of pain of patients, by using WOMAC questionnaire, and Wyatt and his colleagues (28), in analyzing influence of exercise therapy on water in people suffering from knee osteoarthritis is similar. Also the results showed that exercising in water causes improvement of movement performance in old men who are suffering from knee osteoarthritis, which is agree with studies of Lim et al (25), Wang et al (20), Silva et al (21) and Bartels et al (26).

Furthermore, the results demonstrated that exercising plan in water causes improvement of quality of life for old men suffering from knee osteoarthritis which is agree with studies of Lim et al, Wang et al, and Bartels et al. improvement of muscles performance through exercising leads to better absorbing entering powers into joints by muscles. Since unabsorbing of entering powers into joints during daily activities, exercises and pleasures causes tiny breaks in tissues underneath joints and so causes activation of peripheral skeleton making centers. This process causes the joint gristle becomes thin and joint gristles damage increases. In following, increasing bone density beneath the gristle decreases the characteristic of absorbing hits in tissues under gristle and causes increasing pain severity and decreasing knee performance and quality of life(12,29) .

Nevertheless, it is announced in some researches that exercising in water has low to middle effects on performance and quality of life and also tincture on pain severity of patients. It seems that exercising in water has short period effect on osteoarthritis of knee in old men(20) .Wang and his colleagues showed in a study that exercising in water has low to middle effect on performance and quality of life and also tincture on pain severity of elders suffering from chronic pains(20). Also in a similar research Hewood and Himnan (2007) showed that exercising in water is influential in decreasing pain and improving quality of life of elders who are suffering from chronic pains through improving muscles and decreasing the pressures entering into them(36). Kang in South Korea (2008) showed that plans for exercising in water is used for treatment of ailments of elders

like Dischopathy and osteoarthritis in recent years(37). Silva et al (2008) in a study called "comparison of the influence of a period of exercising in water and exercising on land in elders suffering from knee stoartreat " stated that exercising in water had a meaningful improvement in improving pain severity, signs, movement performance and quality of life of elders suffering from osteoarthritis(38). Khanjari et. al(2015) in analyzing the effect of a period of aquatic therapy exercise on the quality of life and depression in aged males suffering from chronic physical pains showed that exercise in water created a meaningful promotion in pain scale, life quality and depression(39).

In this study elders are suffering from ailment knee osteoarthritis and by entering to the water based on weightlessness fact in water they can continue their exercises without pain or with a very low pain which seems it is effective on increasing self-confidence. Presence of pain, unsuitable figure, worrying about injuring and more inability, highly costs of treatment, and probably other problems, is effective on quality of life of patient and his/her family. Experimental group are more confident about performance of their exercises by observing improvement in their body. Observation of better performance, encourages them to attend the next sessions of treatment.

## DEDUCTION

Results of this research demonstrated exercising in water by old men who are suffering from osteoarthritis have positive effects on improving situation and quality of their life. Also because of decreasing pressure on joints for waters quality, exercising of patients is an advantage of water sports. Thus it is worthy to say that probably exercising in water can be seen as a very useful way of exercising for improvement of pain severity, performance and quality of life of old men who are suffering from knee osteoarthritis .

## SUGGESTIONS

Current statistics illustrate that the maximum combination of country population belongs to juvenile right now, but in near futures current young people become elders, and our country will experience senility as many countries, so it is necessary to mention to these variations and subjects in next researches, and design major plans for economy, social, and culture so that needs of elders, particularly elders who are sick become seen; foundation of exercising and treatment centers for elders can be effective aids in this subject. By paying attention to advantages using water therapy including simple educating, economy, needlessness of special equipment, and results of this research, it is suggested to government to provide improvement of physical and spiritual health and following it, improvement of quality of life of elders with ailments, by providing suitable situations and environments for exercising, specially water therapy clinics for elders in order to make exercising comfortable and funny for them in these places.

## References

- [1] Pollard H, Ward G, Hoskins W, Hardy K. The effect of a manual therapy knee protocol on osteoarthritic knee pain: a randomised controlled trial. *J Can Chiropr Assoc* 2008; 52(4): 229-42.
- [2] Brenham F. Osteoarthritis in Atlanta. *Arthritis foundation* 2001; 285-9.
- [3] Heathcote G. Autonomy, health and ageing: transnational perspectives. *Health Educ Res* 2000; 15(1): 13-24.
- [4] Gaston-Johansson F, Johansson F, Johansson C. Pain in the elderly: prevalence, attitudes and assessment. *Nurs Home Med* 1996; 4(11): 325-31.
- [5] Williams MK, Spector TD. Osteoarthritis. *Medicine* 2006; 34(9): 364-8.
- [6] Sturmer T, Gunther KP, Brenner H. Obesity, overweight and patterns of osteoarthritis: the Ulm Osteoarthritis Study. *J Clin Epidemiol* 2000; 53: 307-13.



- 
- [7] Klusmann A, Gebhardt H, Nubling M, Liebers F, Quiros PE, Cordier W, et al. Individual and occupational risk factors for knee osteoarthritis: results of a case-control study in Germany. *Arthritis Res Ther* 2010; 12(3): R88.
  - [8] Wang G, Helmick C, Macera CA, Zhang P, Pratt M. Inactivity-associated medical costs among US adults with arthritis. *Arthritis Care Res* 2001; 45: 439-45.
  - [9] Black JM, Hawks JH, Keene AM. Medical surgical nursing. Sixth edition. Philadelphia: WB Saunders; 2001.
  - [10] Belza B, Topolski T, Kinne S, Patrick DL, Ramsey SD. Does adherence make a difference? Results from a community-based aquatic exercise program. *Nurs Res* 2002; 51: 285-291.
  - [11] Foley A, Halbert J, Hewitt T, Crotty M. Does hydrotherapy improve strength and physical function in patients with osteoarthritis: a randomised controlled trial comparing a gym based and a hydrotherapy based strengthening programme. *Ann Rheum Dis* 2003; 62: 1162-7.
  - [12] Hinman RS, Heywood SE, Day AR. Aquatic physical therapy for hip and knee osteoarthritis: results of a single-blind randomized controlled trial. *Phys Ther* 2007; 87: 32-43.
  - [13] Kang HS. Factors influencing aquatic exercise adherence of patients with arthritis. *J Korean Acad Fundam Nurs* 2008; 15: 350-9.
  - [14] Spector TD, Harris PA, Hart DJ, Cicuttini FM, Nandra D, Etherington J, et al. Risk of osteoarthritis associated with long-term weight-bearing sports: a radiologic survey of the hips and knees in female ex-athletes and population controls. *Arthritis Rheum* 1996; 39(6): 988-95.
  - [15] Szoek C, Dennerstein L, Guthrie J, Clark M, Cicuttini F. The relationship between prospectively assessed body weight and physical activity and prevalence of radiological knee osteoarthritis in postmenopausal women. *J Rheumatol* 2006; 33(9): 1835-40.
  - [16] Felson DT. The epidemiology of knee osteoarthritis: results from the Framingham Osteoarthritis Study. *Seminars in Arthritis Rheumatism* 1990; 20(3 Supplement 1): 42-50.
  - [17] Hootman JM, Macera CA, Helmick CG, Blair SN. Influence of physical activity-related joint stress on the risk of self reported hip/knee osteoarthritis: a new method to quantify physical activity. *Preventive Medicine* 2003; 36(5): 636-44.
  - [18] Rogers LQ, Macera CA, Hootman JM, Ainsworth BE, Blair SN. The association between joint stress from physical activity and self-reported osteoarthritis: an analysis of the Cooper Clinic data. *Osteoarthritis Cartilage* 2002; 10(8): 617-22.
  - [19] White JA, Wright V, Hudson AM. Relationships between habitual physical activity and osteoarthritis in ageing women. *Public Health* 1993; 107(6): 459-70.
  - [20] Wang TJ, Lee SC, Liang SY, Tung HH, Wu SFV, Lin YP. Comparing the efficacy of aquatic exercises and land-based exercises for patients with knee osteoarthritis. *J Clin Nurs* 2011; 20: 2609-22.
  - [21] Silva LE, Valim V, Pessanha AP, Oliveira LM, Myamoto S, Jones A & Natour J. Hydrotherapy versus conventional land-based exercise for the management of patients with osteoarthritis of the knee: a randomized clinical trial. *Phys Ther* 2008; 88: 12-21.
  - [22] Lund H, Weile U, Christensen R, Rostock B, Downey A, Bartels EM, et al. A Randomized controlled trial of aquatic and land-based exercise in patients with knee osteoarthritis. *J Rehabil Med* 2008; 40: 137-144.
  - [23] Kellgren J, Lawrence J. Radiologic assessment of osteoarthritis. *Ann Rheum Dis* 1957; 16(4): 494-501.
  - [24] Salavati M, Mazaheri M, Negahban H, Sohani SM, Ebrahimian MR, Ebrahimi I, et al. Validation of a persian-version of knee injury and osteoarthritis outcome score (KOOS) in iranians with knee injuries. *osteoarthritis and cartilage/ OARS, Osteoarthritis Research Society* 16[10], 1178-1182. 10-1-2008.
  - [25] Lim JY, Tchae E, Jang SN. Effectiveness of Aquatic Exercise for obese patients with knee osteoarthritis: A randomized controlled trial. *the American Academy of Physical Medicine and Rehabilitation* 2010; 2: 723-31.

- 
- [26] Bartels EM, Lund H, Hagen KB, Dagfinrud H, Christensen R & Danneskiold-Samsoe B. Aquatic exercise for the treatment of knee and hip osteoarthritis. *Cochrane Database of Systematic Reviews* 2007; 17: 5523.
  - [27] Foley A, Halbert J, Hewitt T & Crotty M. Does hydrotherapy improve strength and physical function in patients with osteoarthritis: a randomized controlled trial comparing a gym based and a hydrotherapy based strength programme. *Annals of the Rheumatic Diseases* 2003; 62: 1162-7.
  - [28] Wyatt FB, Milam S, Manske RC & Deere R. The effects of aquatic and traditional exercise programs on persons with knee osteoarthritis. *Journal of Strength and Conditioning Research* 2001; 15: 337-40
  - [29] Bosomworth NJ. Exercise and knee osteoarthritis: benefit or hazard? *Can Fam Physician* 2009; 55(9): 871-8.
  - [30] Usha PR, Naidu MU. Randomised, Double-Blind, Parallel, Placebo Controlled Study of Oral Glucosamine, Methylsulfonylmethane and their Combination in Osteoarthritis. *Clin Drug Investig* 2004; 24(6): 353-63.
  - [31] Ng NT, Heesch KC, Brown WJ. Efficacy of a progressive walking program and glucosamine sulphate supplementation on osteoarthritic symptoms of the hip and knee: a feasibility trial. *Arthritis Res Ther* 2010; 12(1): 25.
  - [32] Vad V, Hong HM, Zazzali M, Basrai D. Exercise recommendations in athletes with early osteoarthritis of the knee. *Sports Med* 2002; 32(11): 729-39.
  - [33] Petersen SG, Saxne T, Heinegard D, Hansen M, Holm L, Koskinen S, et al. Glucosamine but not ibuprofen alters cartilage turn over in osteoarthritis patients in response to physical training. *Osteoarthritis Cartilage* 2010; 18(1): 34-40.
  - [34] Ostojic SM, Arsic M, Prodanovic S, Vukovic J, Zlatanovic M. Glucosamine administration in athletes: effects on recovery of acute knee injury. *Res Sports Med* 2007; 15(2): 113-24.
  - [35] Hespel P, Maughan RJ, Greenhaff PL. Dietary supplements for football. *J Sports Sci* 2006; 24(7): 749-61.
  - [36] Hinman RS, Heywood SE, Day AR(2007). Aquatic physical therapy for hip and Knee osteoarthritis: results of a single-blind randomized controlled trial. *Phys Ther*; 87: 32-43.
  - [37] Kang HS(2008). Factors influencing aquatic exercise adherence of patients with arthritis. *J. Korean Acad Fundam Nurs*; 15: 350-9.
  - [38] Silva LE, Valim V, Pessanha AP, Oliveira LM, Myamoto S, Jones A & Natour J(2008). Hydrotherapy versus conventional land-based exercise for the management of patients with osteoarthritis of the knee: a randomized clinical trial. *Phys Ther*; 88: 12-21.
  - [39] Khanjari Y, et al(2015). The effect of a period of aquatic therapy exercise on the quality of life and depression in aged males suffering from chronic physical pains. *International congress on behavioral sciences*. 14 May 2015. Tehran. Iran.