International Journal of Health Sciences and Research
Vol.10; Issue: 12; December 2020
Website: www.ijhsr.org
Original Research Article *ISSN: 2249-9571*

Effect of Aqua-Aerobics on Pulmonary Functions in Subjects with Knee Osteoarthritis

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ABSTRACT

Osteoarthritis (OA) is a most common type of degenerative disorder. It is a type of joint disease that results from breakdown of joint cartilage and underlying bone. Knee is the commonest joint affected in OA. Aqua-aerobics refer to the use of water that facilitates the application of established therapeutic intervention, including stretching, strengthening, joint mobilization, balance and gait training and endurance training. It is done in a vertical creating resistance and developing strength. Objective of this study is to determine the effect of aqua-aerobics on pulmonary functions in subjects with knee OA.

Methods: Ethical clearance was obtained by institutional ethical committee. Study design was experimental study. A total of 50 knee OA individuals were included in this study based on inclusion criteria. The treatment protocol was done in hydrotherapy pool, which included warm-up session (10 minutes), aerobic session (25 minutes) and cool-down session (10 minutes). Pre and post-test were done for peak expiratory flow rate (PEFR), Borg scale, respiratory rate (RR) and visual analogue scale (VAS), and the outcome measures were analysed after 4 weeks.

Results: Statistical analysis for Peak expiratory flow rate (PEFR) had significant improvement (p= 0.0001), Borg scale had significant improvement (p= 0.0001), respiratory rate had significant improvement (p= 0.0443) and visual analogue scale (VAS) had significant reduction (p= 0.0016) noted.

Conclusion: The study results concluded that aqua-aerobics was significantly effective in improving pulmonary functions in subjects with knee OA.

Keywords: knee osteoarthritis, aqua-aerobics, pulmonary functions, hydrotherapy.

INTRODUCTION

Osteoarthritis (OA) is a most common type of degenerative disorder[1]. It is a type of joint disease that results from breakdown of joint cartilage and underlying bone. It is an inflammatory joint condition[2]. The most common features are joint pain, stiffness, osteophyte formation, sclerosis, reduced joint space, joint swelling and decreased range of motion. Causes of OA are previous joint injury, abnormal joint or limb development and some inherited factors[3]. Articular cartilage has a limited tolerance for inappropriate force. It's avascular and aneural status renders it unable to repair itself. Hyaline cartilage lacks a direct blood supply, receiving nutrition through the synovial fluid released because of normal movement and joint compression[4]. 80% of persons above 45 years of age have OA in at least 1 joint. Knee is the commonest joint affected in OA. OA knee is a major cause of disability among the ageing population of the industrialized world. A major hallmark of OA is loss of cartilage[5].

Initially, OA involves only 1 or few joints, and the onset is very gradual: if

excess forces are put on the joint then it damages the cartilage, leaving a bone-on-bone situation within a joint. Articular cartilage has a limited tolerance for excess force. As we know it is avascular in nature it is unable to repair itself. Hyaline cartilage does not have a direct blood supply; it receives nutrition through synovial fluid which is released due to normal joint movement[4]. Knee pain and disability may occur in the apparent absence of radiographic OA[6]. There is moderate to strong evidence that physical workload, high intensity sporting activities and obesity are risk factors for OA[7].

Osteoarthritis is more prevalent joint disorder and is strongly associated with ageing[8]. Considering the increase in OA prevalence, the need to identify risk factors, progression, associated physical function decline and disability is a high priority[9]. The prevalence of OA knee is 27%. Subjects with OA knee complain that they spend more days in bed than others in their age[10]. Traditionally treatments include medications for pain control and some form of exercises. Bradly found that pharmacological treatments initially start with topical analgesics or NSAID's[4]. Chronic use of NSAID's in OA results in increase in blood pressure resulting in heart attack, stroke, heart failure, arrhythmias, and sudden cardiac death. Studies have shown that various forms of exercises are beneficial in managing symptoms of OA knee, among which aquatic therapy has been effective due to properties of water. Reduced pulmonary functions in these patients affect their independence in performing everyday activities. They also mentioned walking difficulty results in reduction in cardiovascular factors; these events can be prevented by managing OA[11].

Aqua-aerobics refer to the use of water that facilitates the application of established therapeutic intervention, including stretching, strengthening, joint mobilization, balance and gait training and endurance training[12]. It is done in a vertical creating resistance and developing strength. The buoyant force of water results in a significant reduction of body weight in the water which allows greater movement. This dramatically decreases compression stress on weight- bearing joints, bones and muscles. Water is the optimal environment for providing full-body resistance. The density of water is approximately 800 times that of air, which is an important factor, is contributing to the energy expenditure of aquatic exercise. Thus, the water environment allows high levels of energy expenditure with relatively little strain to the body[13]. According to previous studies pain severity, obesity, quadriceps strength, age and helplessness were the most important determinants of disability[14,15]. According to previous studies pain levels, systolic blood pressure and triglycerides were reduced after water based exercises[16,17].

METHODS

Ethical clearance was obtained from the institutional ethical committee, KIMSDU, Karad. The study included totals of 50 knee OA individuals were included in this study. Exclusion criteria included Rheumatoid arthritis, Chronic OA, Patients undergone knee surgery in past 3 years and Neurological conditions or Orthopaedic condition. The treatment protocol was done in hydrotherapy pool, which included warm-up session (10 minutes)-this included brisk walking, jogging and stretching, aerobic session (25 minutes)-this included aerobic steps which were: walking, marching on place, front toe touch, side toe touch, side stepping, side kicks, high knees, squatting, lunges and jumps, and cool-down session (10 minutes)-this included walking, jogging and stretching. Pre and post-test were done for peak expiratory flow rate (PEFR), Borg scale, respiratory rate (RR) and visual analogue scale (VAS), and the outcome measures were analysed after 4 weeks.

Intervention was given for 4 weeks, 4 days per week. Data was analysed after 4 weeks. Treatment protocol had 3 parts:- Warm up session (10 minutes)-this included brisk walking, jogging and stretching,

Aerobics session (in pool for 25 minutes)- this included aerobic steps which were: walking, marching on place, front toe touch, side toe touch, side stepping, side kicks, high knees, squatting, lunges and jumps, and Cool down session (10 minutes)-this included walking, jogging and stretching. Primary outcomes used for the results were PEFR, borg scale, respiratory rate and VAS.

Statistical analysis

The data was analysed manually and by using the statistics software's INSTAT so as to verify the results derived. Data of all outcome measures was measured as pre training and post training values. Arithmetic mean and standard deviation was calculated for each outcome measures. Arithmetic mean was derived from adding all together and dividing the total number of values. Within the group comparison was done by applying 'Wilcoxon rank sum test' to pre and post training values of same group for all outcome measures.

RESULTS

Age distribution

The age distribution in this study included was 11 and 14 male and female respectively of 45- 55 years of age group and 10 and 15 male and female respectively of 55- 65 years of age group.

Table 1: age distribution

Age	Male	Female
45-55	11	14
55-65	10	15

Gender distribution

The gender distribution in the study included 21 male and 29 females.

Table 2: gender distribution

Gender	Male	Female
Number	21	29

Peak expiratory flow rate

In this study there was extremely significant difference in PEFR values.

Table 3: Peak expiratory flow rate

Values	PRE	POST
PEFR	263.2	268.4

Borg scale

In this study there was extremely significant difference in Borg scale values.

Table 4: Borg scale

Values	PRE	POST
borg scale	15.34	14.96

Respiratory rate

In this study there was significant difference in respiratory rate.

Table 5: respiratory rate

Values	PRE	POST
respiratory rate	14.98	15.06

Visual analogue scale

In this study there was significant difference in VAS values.

Table 6: visual analogue scale

Values	PRE	POST
VAS	4.08	3.86

DISCUSSION

Patients with OA knee typically have reduced physical activity compared with the general population. Besides the primary complaints it is also found that PEFR level in these subjects is also reduced. A reduced PEFR level in these patients affects their everyday activities. Often these secondary complaints are not addressed.

Traditionally treatments include medications for pain control and some form of exercises. Bradly found that pharmacological treatments initially start with topical analgesics or NSAID's. Chronic use of NSAID's in OA results in increase in blood pressure resulting in heart attack, stroke, heart failure, arrhythmias, and sudden cardiac death. It is necessary to maintain good health in these subjects to reduce pain and disability and prevent further complications.

In 2017, Kendzerska et. al. in a study comprising 18,490 patients with 10% hip OA, 15.3% OA knee and 16.34% hand OA found that 31.9% cardiovascular events occurred in approximately 13.4 years in these patients, especially in the OA knee group. They also mentioned that the walking difficulty in OA knee severely increased the risk of a cardiovascular event.

Many cardiovascular events could be prevented by managing OA, with an increase in the cardiovascular capacity and mobility.

Objectives of my study were to determine the effect of aqua-aerobics on pulmonary functions in subjects with OA knee.

This study was conducted on 50 subjects with OA knee. Prior consent was taken. Treatment was given for 4 weeks, 4 times a week for 45 mins. The outcome measures for this study were peak expiratory flow rate, Borg scale, respiratory rate and visual analogue scale. Treatment was given in therapeutic pool; the session was divided into 3 parts warm up, aerobic and cool down session.

The result of this study showed there was significant improvement in pulmonary functions and pain perception after 4 weeks intervention. Within the group comparison was done by applying 'Wilcoxon rank sum test' to pre and post training values of same group for all outcome measures. Peak expiratory flow rate had significant improvement (p= 0.0001), Borg scale had significant improvement (p= 0.0001), respiratory rate had significant improvement (p= 0.0443) and visual analogue scale had significant reduction (p= 0.0016) noted in subjects undergoing aqua-aerobics to improve pulmonary functions with OA knee. Therefore, result of this present study showed that aqua-aerobics improved pulmonary functions in subjects with OA knee.

CONCLUSION

On the basis of the results of our study, it was concluded that aqua-aerobics was significantly effective in improving pulmonary functions in subjects with knee osteoarthritis.

ACKNOWLEDGEMENT

We would like to acknowledge the guidance and support of Vishva Bhuva from faculty of physiotherapy.

Conflict Of Interest

The authors of this study do not have any conflicts of interest.

Source of Funding

This project was self funded by the authors.

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How to cite this article: Bhosale AD, Sagar JH. Effect of aqua-aerobics on pulmonary functions in subjects with knee osteoarthritis. Int J Health Sci Res. 2020; 10(12):37-41.

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