SUMMARY & CONCLUSIONS

Osteoarthritis (OA) is a common rheumatological disorder. It is a degenerative joint disorder characterized by destruction of articular cartilage and formation of a new bone (lipping) at the joint surfaces. It is the most common form of arthritis and a leading cause of disability throughout the world (Shakoor and Loeser, 2004). Its onset is usually in older age group i.e., beyond 40 years of age. Both men and women are affected, but symptoms in women occur earlier and appear to be more severe than in men (Lawrence et al., 1998). Knee joint is the most commonly affected region of the body. Predominant feature is pain along with decrease in the range of motion. As the disease progresses, movement in the affected joint becomes increasingly limited, initially as a result of pain and muscular spasm, followed by capsular fibrosis, osteophyte formation and remodeling of bone.

Osteoarthritis has negative effect on the quality of life (Dekker et al., 1993). Patients with osteoarthritis of the weight bearing joints are less active and tend to be less fit with regard to musculoskeletal and cardiovascular status than normal controls (Minor et al., 1988; Philbin et al., 1995; Reis et al., 1995). The etiology of osteoarthritis is multifactorial with inflammatory, metabolic and mechanical factors. A number of environmental risk factors such as obesity, occupation and trauma may initiate various
pathological changes which result in degeneration of articular cartilage together with changes in subchondral bone and mild intra-articular inflammation (Altman et al., 1991). Various medical conditions are found to be associated with secondary osteoarthritis and are potential risk factors for osteoarthritis (Al-Arfaz, 2003; Hart et al., 1995; Sun et al., 2000). These medical conditions include diabetes mellitus (Silvery et al., 1994; Sturmer et al., 2001) and obesity (Bliddal and Christensen, 2006).

The estimation of biochemical parameters like fasting blood glucose and lipid profile (serum cholesterol, serum triglycerides and serum high density lipoprotein-cholesterol) becomes increasingly important for these diseases. Various studies have shown the association of osteoarthritis with elevated levels of blood glucose, serum cholesterol, serum triglycerides, serum high density lipoprotein-cholesterol and serum uric acid (Al-Arfaz, 2003; Hart et al., 1995; Punzi et al., 2003; Sturmer et al., 2001; Sun et al., 2000). Very few studies have shown the effects of treatment programmes in osteoarthritis on these biochemical parameters (Miyaguchi et al., 2003; Nagel et al., 1992; Sato et al., 2003).

The aim of present study is to see the effects of treatment programme in osteoarthritis knee patients with special reference to these biochemical parameters.
Generally the treatment programme of osteoarthritis is basically divided into three:

4. Non-pharmacological therapy
5. Pharmacological therapy
6. Surgical intervention

**1. Non-pharmacological therapy:** The treatment of osteoarthritis starts with non-pharmacological therapy. Physiotherapy plays a key role in it. The role of exercises in the treatment of osteoarthritis is now evident and widely used in physiotherapy (Chamberlain *et al.*, 1982; Eyigor, 2004; Kladny, 2005 and Sharma *et al.*, 2003). The main aims of treatment here are to reduce pain, to increase strength of quadriceps muscle, to increase range of motion and to improve functions. Various exercise programmes including isotonic exercises (Huang *et al.*, 2003), isometric exercises (Sharma *et al.*, 2003) and progressive resisted exercises (Eyigor, 2004) are believed to be useful. Also, it has been reported that dynamic exercises increase disease activity and are harmful to joint structures (Baker, 1953; Jivoff, 1975; Mills *et al.*, 1971 and Swezey, 1974). Thus, the role of aerobic exercises in particular is thought to be useful in the treatment of knee osteoarthritis (Ettinger *et al.*, 1997; Minor *et al.*, 1988) and reduction of biochemical parameters (Nagel *et al.*, 1992; Sato *et al.*, 2003). The role of aerobic exercises in osteoarthritis is not emphasized much.
There is a great need of developing a balanced and integrated exercise programme for the management of osteoarthritis along with these biochemical parameters for achieving maximum physical functions and reducing several disease related complications.

Non-pharmacological therapy also includes patients education about the disease, do’s and don’ts, personalized self care, weight reduction programmes, use of assisted devices and appropriate footwear.

2. **Pharmacological therapy:** The pharmacological therapy basically includes the use of oral analgesics and non-steroidal anti-inflammatory drugs. But the associated adverse effects of long use of analgesics and non-steroidal anti-inflammatory drugs on gastric system are also evident. In the patients with osteoarthritis of the knee where there is effusion and local signs of inflammation, the use of intra-articular corticosteroid injection is given. It is also evident that the excess use of intra-articular corticosteroid leads to further damage of the cartilage.

3. **Surgical intervention:** Patients with severe symptomatic osteoarthritis and who failed to respond to any treatment should only be treated with surgery. It includes joint lavage, osteotomy, partial or complete joint replacements. It should be the last treatment of choice.
Therefore, the primary treatment of choice is non-pharmacological therapy which is having the least side effects and maximum benefits. The present study entitled “Effects of exercise rehabilitation programme on osteoarthritis knee with special reference to biochemical changes” studies the effects of non-pharmacological therapy especially physiotherapy and exercises on various health related parameters in patients of osteoarthritis knee with special reference to their biochemical changes.

**AIMS AND OBJECTIVES:**

4. To study and compare the prevalence of various diseases like diabetes and obesity in the patients of osteoarthritis knee.

5. To study the effects of quadriceps strength, range of motion, cardiovascular fitness and functional status in osteoarthritis knee patients.

6. To study and compare the effects of exercise rehabilitation programme for the management of osteoarthritis knee with special reference to biochemical changes.

To achieve these aims a group of 200 patients of established osteoarthritis of knee ranging in age from 40-65 years were included in the study. Patients with a history of condition known to preclude exercise were excluded from the study. Such conditions include coronary heart disease, myocardial infarction, unstable
angina, chronic bronchitis, emphysema, peripheral vascular disease, thrombophlebitis, embolism, kidney failure and uncontrolled hypertension etc. The patients were explained the study protocol and written consent was taken from them before the start of study programme.

Patients were randomly divided into two groups: Group A (Experimental Control Group) and Group B (Experimental Patient Group).

**Group A: Experimental Control Group (ECG)**

100 patients (Males n= 30, Females n= 70) were included in group A, who were applied conventional physiotherapy programme for two months. The frequency of application was 5 days in a week.

**Group B: Experimental Patient Group (EPG)**

100 patients (Males n= 32, Females n= 68) were included in group B, who were applied exercise rehabilitation programme along with conventional physiotherapy programme for two months. The frequency of application was 5 days in a week.

In order to make the groups more homogeneous, they were further subdivided into males and females.

**DATA COLLECTION**

Data collection was based on thorough evaluation of the subjects and the findings were recorded in the periodic case sheet of the subjects. The findings were recorded three times during the
course of study i.e. before the start of the study programme, after one month of treatment programme and after two months of treatment programme.

The various parameters that were included in the study programme were as follows:

1. **The physical characteristics:**
   6. Age
   7. Sex
   8. Height
   9. Weight
   10. Body mass index (BMI)

2. **The clinical health status:**
   5. Pulse rate
   6. Heart rate (HR)
   7. Blood pressure (BP) systolic
   8. Blood pressure (BP) diastolic

3. **The health related fitness:**
   6. Level of Pain
   7. Range of motion of knee joint (ROM)
   8. Strength of muscles
   9. Cardiovascular fitness
   10. Functional status
4. The physiological parameters:
   3. Haemoglobin (Hb)
   4. Erythrocyte sedimentation rate (ESR)

5. The biochemical parameters:
   6. Fasting blood glucose
   7. Serum cholesterol
   8. Serum triglycerides
   9. Serum high density lipoproteins-cholesterol (HDL-c)
   10. Serum uric acid

Measurement of physical characteristics:
(a) **Height:** The height of the subjects was measured by using a stadiometer.
(b) **Weight:** Weight of the patient was measured by a weighing machine.
(c) **Body mass index:** Body mass index of the patient was calculated by the following formula:

\[
\text{BODY MASS INDEX} = \frac{\text{BODY WEIGHT (Kilograms)}}{\text{HEIGHT (Meters)}^2}
\]

Measurement of clinical health status:
(a) **Pulse rate:** Pulse rate was measured by using manual method on radial artery.
(b) **Heart rate:** Heart rate was measured by using POLAR Heart rate monitor.
(c) **Blood pressure:** Blood pressure was measured by using sphygmomanometer.

**Measurement of health related fitness:**
(a) **Level of pain:** Pain was calculated by using Visual Analog Scale (VAS).
(b) **Range of motion (ROM):** ROM was assessed by goniometric method.
(c) **Strength measurement:** Isometric strength was measured by using Back-leg-chest dynamometer. Isotonic strength was measured by using weight cuffs.
(d) **Cardiovascular fitness:** Cardiovascular fitness was assessed by using Crompton test.
(e) **Functional status:** Functional status was assessed by using the WOMAC (Western Ontario and McMaster Universities) Index of Osteoarthritis.

**Measurement of physiological parameters:**

a. **Haemoglobin:** Estimation of Haemoglobin was done by Sahli’s method.

b. **Erythrocyte sedimentation rate (ESR):** Estimation of ESR was done by Westergren method.

**Measurement of biochemical parameters:**
(a) **Fasting blood glucose:** Estimation of fasting blood glucose was done by Glucose oxidase/ Peroxidase (GOD/POD) method (Trinder, 1969).
(b) **Serum cholesterol, serum triglycerides and serum uric acid:** Estimation of Serum cholesterol, serum triglycerides and serum uric acid were done by enzymatic methods (Allain et al., 1974; Annoni et al., 1982; Ito 2000).

(c) **High density lipoprotein-cholesterol (HDL-c):** Estimation of high density lipoprotein-cholesterol was done by phosphotungstate method (Izzo et al., 1981).

**The Treatment Programme:**

Both the groups were treated for two months. Patients of experimental control group were treated with conventional physiotherapy programme and patients of Experimental Patient Group were treated both with conventional physiotherapy programme and exercise rehabilitation programme based on guidelines given by Arthritis Foundation (Gordon, 1993).

**Exercise treatment protocol for conventional physiotherapy programme:**

Conventional physiotherapy programme included application of hot packs, isometric exercises to quadriceps and hamstrings, range of motion exercises, stretching exercises, joint mobilization exercises and progressive resisted exercises.

1. **Isometric exercises for quadriceps and hamstrings:**
   
   Position of the patient was supine lying. A roll of towel was placed once below the knee and then below the heel of the
foot. Patient was asked to press the roll of towel down. A cycle of five seconds hold and five seconds rest was given with twenty repetitions in each set.

2. **Isotonic range of motion exercises:** First, the position of the patient was supine lying. Patient was asked to drag his right heel towards his right thigh as far as possible. A cycle of five seconds hold was given with twenty repetitions in each set, alternatively for each side.

Patient was asked to lie prone. Patient was asked to pull his right heel towards his posterior thigh as far as possible. A cycle of five seconds hold was given with twenty repetitions in each set, alternatively for each side.

Patient was asked to come in high sitting position. He was asked to swing his leg alternatively for 10-15 minutes.

3. **Stretching exercises:** Quadriceps stretch was applied in prone lying position. The patient was asked to lie prone and bend the knee touching the buttocks. Stretch was applied by flexing the knee further. Patient was asked to hold this position for 5-10 counts. For hamstring stretching, position of the patient was long sitting. The patient was asked to touch the toes by keeping the knees straight. The patient was asked to hold the stretch for 5-10 counts and then relax.
4. **Mobilization exercises to knee joint:** Patellar glides (medial-lateral and superior-inferior) were given before starting mobilization. Long axis traction was given to the knee joint. Anterior and posterior glides to the knee joint were given in lying and sitting position.

5. **Progressive resisted exercises:** Patients were given progressive resisted exercises by using deLorme’s Technique at the Quadriceps table. 1 repetition maximum (R.M.) was calculated first. 1 repetition maximum is the maximum weight that can be lifted by the patient once through its complete range of motion.

The patient was asked to perform:

1. Ten repetitions of one half of 10 RM
2. Ten repetitions of three forth of 10 RM
3. Ten repetitions of full 10 RM
4. 30 lifts 4 times weekly
5. Progression 10 RM once weekly

**Exercise treatment protocol for exercise rehabilitation programme:**

For exercise rehabilitation programme along with conventional physiotherapy programme, mild intensity and long duration aerobic conditioning exercises (at 60% of MHR) were applied to the whole body (including upper limbs). Treatment programme started with the application of hot packs to the knee joints.
**Aerobic conditioning exercises:** Aerobic warm up was given for 5-10 minutes. It included swinging of arms and legs (upwards, sideways, backwards and laterally). Walking was given for 5-10 minutes and cycling was given for 15-20 minutes (at 60% of MHR), 5 times a week. Aerobic exercises were followed by cool down exercises for 5-10 mins.

A thorough evaluation of the patients physical characteristics (age, weight, height & body mass index); clinical health status (pulse, heart rate, blood pressure-systolic & blood pressure-diastolic); health related fitness (pain, range of motion, strength-isometric, strength-isotonic, cardiovascular fitness & functional status); physiological parameters (haemoglobin, erythrocyte sedimentation rate) and biochemical parameters (fasting blood glucose, serum cholesterol, serum triglyceride, serum high density lipoprotein-cholesterol and serum uric acid) were done before the start of study programme, after one month of the study programme and after completion of two months of study programme.

It was not possible to control dietary habits of the patients who were at their own will to eat anything. It was the limitation of the study.

Every care was taken to control the factors like drugs. The medical history of the patients was recorded. Few patients were on oral hypoglycaemic drugs and they did not changed the drugs
throughout the course of the study. Some patients were on lipid lowering drugs like statins and fibrates and they also continued the same drugs throughout the course of the study.

The values of physical characteristics, clinical health status, health related fitness, physiological and biochemical parameters were recorded in the data sheets. Standard statistical tests were used with the help of Microsoft Excel and SPSS software.

**CONCLUSIONS**

It has been concluded that prevalence of osteoarthritis knee is more in elderly age group than in younger age group and that prevalence of osteoarthritis knee is more in females than in males. Also the prevalence of osteoarthritis knee is more in patients with diabetes mellitus and that prevalence of osteoarthritis knee is more in overweight and obese patients.

It has been concluded that

a) Weight and BMI reduced significantly after 2 months of exercise rehabilitation programme.

b) Pulse, heart rate and blood pressure reduced significantly after 2 months of exercise rehabilitation programme.

c) Pain reduced significantly whereas range of motion, strength, cardiovascular fitness and functional level improved significantly after 2 months of exercise rehabilitation programme.
d) Haemoglobin level improved significantly after 2 months of exercise rehabilitation programme whereas ESR reduced but non-significantly.

e) Fasting blood glucose, serum cholesterol, and serum triglycerides reduced significantly after 2 months of exercise rehabilitation programme whereas serum high density lipoprotein cholesterol level increased significantly, however levels of serum uric acid reduced but non-significantly.

Therefore, it is recommended that exercise rehabilitation programme which includes mild intensity aerobic exercise should be included in the treatment programme of osteoarthritis knee patients because it has beneficial effects on various health related parameters including biochemical parameters.