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ALTERATION IN TOTAL ANTIOXIDANT CAPACITY AND ANTIOXIDANT VITAMINS IN RESPONSE TO EXERCISE OF KNEE IN ARTHRITIC PATIENTS

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ABSTRACT

Osteoarthritis is a chronic escalating degenerative joint disorder characterized by mechanical malformations affecting degradation of joints, including articular cartilage and subchondral bone.

Exercise is related with oxidative stress and tissue breakdown therefore, the aim of this article is a presentation of current knowledge of the modification in the amount of antioxidant vitamins.

The total antioxidant capacity was also observed as a result of exercise in patients with knee osteoarthritis. Fifteen patients with knee osteoarthritis were enrolled in the study. One of the groups remained untreated and was called Group "A", was considered as control. Group "B" was the experimental group treated with Exercises only. Total antioxidant capacity (TAC) and antioxidants Vitamins (Vitamin C and Vitamin E) levels in plasma were determined before and after, following three months of exercise. It was observed that exercise had no effect on total antioxidant capacity, Vitamin C, and Vitamin E, levels in plasma. The total antioxidant capacity levels, increase up to 4.37% when exercise is given to the osteoarthritis patients. Whereas Vitamin E concentration increased by 10.91% and Vitamin C content by 4.72% when given to the osteoarthritis patients. These level of total antioxidant capacity and Vitamin C remained statistically non significant, but Vitamin E concentration shows significant improvement.

The result of our study suggested that exercises did not affect the serum total antioxidant capacity, Vitamin C, levels when given to the osteoarthritis patients and Vitamin E level slightly increase, and it might be due to the frequency, intensity, and duration of the exercise or the gender and the variation in the severity of symptoms.

Key-words: Antioxidant capacity, knee osteoarthritis, oxidative stress, synovial fluid, vitamin E

INTRODUCTION

Osteoarthritis is a degenerative joint disease. Symptoms may include joint pain, tenderness, stiffness, locking, and sometimes an effusion and impairments. The knee is the part of the body mainly put on by osteoarthritis. It is marked by the developing damage of articular cartilage, joint space narrowing, osteophytes, subchondral sclerosis and synovitis (Mandelbaum and Waddell, 2005). Osteoarthritis continues to charge a considerable health and monetary load on community, particularly amongst the aged.

The origination and development of a disease remain unclear, but these have been connected with numerous risk factors for instance aging, obesity, and traumatic injuries (Pelletier *et al*., 2001). However, biochemical features have by currently been recognized to play a significant part in Osteoarthritis development (Kraus 1997). Growing facts suggests that oxidative stress is one of the foremost contributing factors in the pathogenesis of OA .These free radicals are counterbalanced by antioxidant enzymes for example catalase, superoxide dismutase, glutathione peroxidase, and numerous non-enzymatic antioxidants, together with vitamins A, E and C, glutathione, ubiquinone, and flavonoids (Vivek and Surendra, 2006). Reactive Oxygen Species are produced normally in the human body and are eliminated by cellular antioxidant defense mechanism. The first and foremost produced radical is usually, superoxide radical (O_2–); which may be changed in to further dangerous substances like hydroxyl radicals (OH–) and hydrogen peroxide (H_2O_2). This reactive oxygen can cause tissues damage.

Exercise can create an inconsistency among Reactive oxygen species and antioxidants, which is attributed to as oxidative stress (Cao *et al*., 1993) .Total antioxidant capacity is an indicator of oxidative stress. A number of researches have used this method to reveal the raise in oxidative stress following exercise (Ginsburg *et al*., 2001); (Santos-Silva *et al*., 2001). However, plasma total antioxidant capacity did not escalate in return to an exercise (Alessio *et al*., 1997).

Decreased activity of antioxidant enzymes and depletion of total antioxidant capacity may increase the susceptibility of osteoarthritis patients to oxidative injury .In the light of these facts a significant correlation,

between total antioxidant capacity and clinical characteristics of osteoarthritis patients exists which, suggests that the measurement of total antioxidant capacity of osteoarthritis patients can be a marker of disease control. Therefore, the assessment of Total Antioxidant Capacity (TAC) in present study is of particular interest.

MATERIAL AND METHODS

From January 2009 to August 2009, patients with knee osteoarthritis were recruited to participate in the study which was sanctioned by the Ethics Committee of the Baqai Medical University. The patients with Osteoarthritis were determined by the standards of the American Rheumatism Association. Patients who had been getting corticosteroid agents, D-penicillamine for at least three months prior to the consultation were disqualified from this research. On the other hand, patients who had been getting usual amounts of non-steroidal anti-inflammatory drugs (NSAIDs) were not disqualified. All the patients with Osteoarthritis had been using NSAID treatment. Patients with rheumatoid arthritis or secondary osteoarthritis (such as post-traumatic, post-infection osteoarthritis), concomitant knee or adjacent area infection, allergy to viscoelastic medication (injection), post-steroid injection, post-knee arthroplasty, immune-compromised patient. Severe knee pain (from any cause in addition to primary knee osteoarthritis), and poor medical condition were also excluded. All subjects volunteered for the trial. The control Group "A" of healthy subjects consisted of 15 individuals (6 Males, 9 Females; mean age: 52.5 years; range: 40-65 years. Group "B" was the experimental group treated with exercises. The subjects performed exercises for three months. Their blood samples were taken before and after the treatment sessions. The patients of this group consisted of 15 individuals (6 Males, 9 Females).The mean age was 55.5 years; ranging from49-62 years of age. All of the materials (glass and plastic) used for the blood samples were carefully washed with a warm solution of nitric acid (20% v/v) for 48 hours and washed thrice with deionized water.

Disinfectant solution was used for cleaning all containers and glassware in which the plasma and synovial samples were placed. The blood samples had been obtained before and after treatment, by using 10cc disposable syringe. Ten ml (10ml) of blood was drawn from a large vein using disposable syringe. This was centrifuged to separate serum for estimations of Superoxide Dismutase, Total Antioxidant Capacity, and vitamins i.e. Ascorbic acid (Vitamin C) and Tocopherol (Vitamin E).

Estimation of Total Antioxidant Capacity was carried out by FRAP (Ferric reducing ability of plasma) Assay (Iris Benzie and Strain, 1996). Estimation of serum Ascorbic acid was done by means of 2, 4-dinitro phenyl hydrazine technique (Natelson, 1988) & interpret as μmol/L, estimation of serum tocopherol through Baker and Frank (1988) and expressed as μmol/L.

STATISTICAL ANALYSIS

Data are described as mean ± standard error of the mean (SEM). Statistical impact was evaluated by analysis of variance (ANOVA), when applicable; the unpaired student t test was used. The significance measure was set at $P < 0.05$.

RESULTS AND OBSERVATIONS

Mean calculated age of osteoarthritis patients ranged (40-65 years) & that of control was also of similar range. More than half of the samples were females 9 & 6 were males in osteoarthritis group. Control group consist of 8 females & 7 males. The mean ± SEM of total antioxidant capacity (TAC), Vitamin C and Vitamin E are reported in Table 1

It was observed that exercise had no effect on Total Antioxidant Capacity, Vitamin C, but on Vitamin E, levels there is improvement in plasma. The total antioxidant capacity levels, when exercises given to the osteoarthritis patients increase up to 4.37%. The exercise increased the Vitamin E concentration by 10.91% and Vitamin C content by 4.72% when given to the osteoarthritic patients. These levels remained statistically non significant.

DISCUSSION

The present study had several limitations. This report was derived from our initial observation, which had low number of patients with severe or mild to moderate severity of knee osteoarthritis. These limited numbers of patients may not be able to reveal considerable variations in parameters. A further constraint of this study might be due to the variation in frequency, intensity and duration of the exercise. Nevertheless, it was believed that the findings of present study might suggest new treatment, vis-à-vis frequency, intensity and duration of the exercise.

Table 1. Comparison of TAC, vitamin C and E level before and after exercise in osteoarthritic patients

EXERCISE GROUP	MEAN ± SEM		**SIGNIFICANCE**
	PRE TREATMENT	POST TREATMENT	P>0.05=Non Significant P<0.05=Significant
TAC (µml/L)	1611.12 ±42.66	1684.81 ±40.93	P>0.05
VITAMIN C (µmol/L)	49.6 ±1.072	52.06 ±1.017	P>0.05
VITAMIN E (µmol/L)	25.06 ±0.581	28.13 ±0.772	P<0.05

In the current study different antioxidants level were compared with control group and osteoarthritic patients, treated with exercises. The assessment of Total Antioxidant Capacity (TAC) in our study is of particular consideration .Our treated Group of the patients exhibited 1611.12 µml /L of TAC serum level (Table 1). When it is compared after exercise it revealed that the Total Antioxidant Capacity (TAC) level in the blood increased by 4.37% in the group that was treated by exercises. This result defines that exercises did not affect the serum TAC levels when given to the osteoarthritis patients. Our study is inline have with the result of other and their studies explain that exercises have no effect on Total Antioxidant Capacity (TAC) (Jackson *et al*., 2010).

It has been reported that Total Antioxidant Capacity (TAC) could be taken back to normal or increased by exercises while treating osteoarthritis (Di Massimo *et al*., 2004; Franzoni *et al*., 2005; Schneider *et al*., 2005).

When reviewing the result of Vitamin C, of the patients before treatment exhibited 49.6 µmol/L of serum level. When it is compared after exercises it reveals that Vitamin C level in the blood increased by 4.72 % (Table 1). The exercise has no effect on Vitamin C levels (Viguie *et al*., 1993) .Several researchers have reported that Vitamin C was increased by exercise (Robertson *et al*., 1991; Sumida *et al*., 1989).

However some workers have reported results that are contrast to our results, i.e. decrease in Vitamin C level after exercise (Camus *et al*., 1994).

Some workers have reported that exercise usually produces a transitory · raise in circulating ascorbic acid in the hours after exercise, however a fall below pre exercise levels happens in the days following extended exercise (Peake, 2003).

The osteoarthritic group, Group of the patients before exercises exhibited 25.06 µmol/L of Vitamin E serum level. When it is compared to after experiencing exercises it reveals that Vitamin E level in the blood only increased by 10.91 % in the group that was treated by exercises (Table 1). Several researchers have reported that Vitamin E increased by exercise (Viguie *et al*., 1993; Robertson *et al*., 1991).

Some workers reported different outcomes from our mentioned results that decrease in Vitamin E level occurred after exercise in skeletal muscles (Bowles *et al*., 1991; Reznick *et al*., 1992). There is evidence representing that Vitamin C and E have a physiological relationship. Vitamin C deficiency leads to reduction of Vitamin E in guinea pigs found association between Vitamin C deficiency and reduced Vitamin E levels in rats (Hruba *et al*., 1982; Bendich *et al*., 1984; Tanaka *et al*., 1997).

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