INTRODUCTION

Exercise plays an important role to improve the performance of sportspersons. Exercise increases endurance and muscular strength of sports persons, causes faster recovery of muscle damage. There are three major types of exercises. Aerobic exercise is done at a pace that allows an adequate supply of oxygen to reach the muscles. This type of exercise includes walking and long distance running. It quickens the heart for sustained periods which make the cardiovascular and respiratory systems more efficient. Anaerobic exercise involves intense or explosive spurts of strenuous activity that leave the player gasping for breath. This type of exercise can be done only for a minute or two at a time. It includes weight lifting and sprinting full speed for 100 meters. Limited amount of glycogen stored in the muscles is rapidly depleted with this type of exercise, resulting in intense muscle fatigue. Anaerobic exercise helps to build up muscle mass and develops speed, strength and power. Third type of exercise is skill development exercise which improves flexibility, balance, and coordination. Examples of this type of exercises are yoga, tennis and golf. All types of exercises are important for improving performance of sports persons. Overall, exercise enlarges heart, increases blood stroke volume and slows the resting heart rate, which indicates good physical fitness (Leon, 1985). Endurance exercise makes the body fit to meet the requirements of intense muscular activity and related energy needs for sports activity.

During exercise due to intense muscular activity energy demand increases which lead to fast oxidative metabolism. To fulfill this demand volume of oxygen consumption increases 10-15 fold (Alessio, 1993). Mainly oxygen undergoes a tetravalent reduction to water and proceeds in the mitochondria with cytochrome oxidase as the final catalyst. This reduction is coupled to phosphorylation of ADP to ATP. This pathway has been calculated to account for 95 to 98% of the total oxygen consumption. Rest 2-5% of the oxygen consumed by cells is reduced through a univalent pathway in which highly reactive oxygen species are produced (Ernster, 1986). These reactive oxygen species are responsible for unwanted and harmful oxidative reactions such as lipid peroxidation and cause oxidative stress. Emerging data show that the players are under oxidative stress
Exercise induced oxidative stress leads to impairment of membrane function, cellular swelling and tissue inflammation (Hicks and Gebicki, 1978). Another harmful effect of intensive exercise is the damage to DNA. Halliwell (1996) observed that reactive oxygen species production leads to oxidative damage to DNA and contribute to the development of cancer.

To combat the deleterious effects of exercise our body has natural antioxidant system. This system consists of antioxidant molecules and enzymes. Antioxidant molecules are both lipid and water soluble molecules. Antioxidants like vitamin E, ubiquinol and beta-carotene are lipid soluble, while, vitamin C and reduced glutathione are water soluble. Vitamin E is major lipid soluble antioxidant in cell membranes. It protects against lipid peroxidation by interacting directly with a variety of oxygen radicals, including singlet oxygen, lipid peroxide products and superoxide radicals (Niki et al., 1988). Vitamin C can interact with the tocopherol radical to regenerate reduced tocopherol (Schweinzer and Goldenberg 1992). Levels of these antioxidant molecules have been reported to be higher in players than the sedentary subjects (Aguilo et al., 2005 and Cases et al., 2006). After exercise, the levels of vitamin C and E have been reported to increase. After running for 30 minutes at 80% VO\textsubscript{2}\text{max}, the levels of vitamin E and C in players were higher as compared to their pre exercise levels (Goldfarb et al., 2007). Antioxidant enzymes includes superoxide dismutase, glutathione peroxidase and catalase. Superoxide dismutase dismutates superoxide anion to hydrogen peroxide. Thus superoxide dismutase scavenges the superoxide anions. There is some evidence that superoxide dismutase protects LDL-C from oxidation (Heinecke et al., 1986). Decomposition of hydrogen peroxide to water is catalyzed by another enzyme, catalase. Players have higher superoxide dismutase and catalase activities (Miyazaki et al., 2001 and Asghar et al., 2007).

Oxidative stress contributes significantly to coronary artery disease pathogenesis (Sorescu and Griendling, 2002). Superoxide anions react with nitric oxide to form peroxynitrite, a potent oxidant involved in the process of atherosclerosis (White et al., 1994). Oxidation of LDL is a key event in the process of atherosclerosis (Steinberg et al., 1989). The risk of coronary artery disease is evaluated from lipid profile of the subjects.
Raised serum levels of total cholesterol, triglycerides, LDL cholesterol and VLDL cholesterol have been associated with increased risk of coronary artery disease (Stampfer et al., 1991, Talmud et al., 2002) while HDL cholesterol levels have an inverse relation to this disease (Lien et al., 1996). Positive effects of exercise on lipid metabolism has been reported by some workers (Park et al., 2003, Mena et al., 1991, Gordon et al., 1998). However no such data is available for the Indian players.

There is some evidence that vitamin E and C supplementation in diet of players improved the levels of antioxidant molecules. Vitamin supplementation for 3 weeks decreased the malondialdehyde concentration in players participating in extreme running competition that consisted of six long races in the desert (Machefer et al., 2007). Thus an improvement in the antioxidant system of the players can be made and oxidative stress can be reduced by vitamin E and C supplementation in their diet.

To the best of our knowledge, no systematic study on influence of exercise on oxidative stress, susceptibility to coronary artery disease and the effect of antioxidant supplementation has been done so far in Indian elite cyclists and athletes. The present study was conducted with the aim to investigate:

- The oxidative stress in Indian elite cyclists and athletes.
- Effect of endurance exercise on lipid profile of elite cyclists and athletes.
- Effect of vitamin E and C supplementation on antioxidant system of elite cyclists and athletes.