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Study of plasma levels of Malondialdehyde as an oxidative stress marker" so it comes as marker in smokers & non-smokers.

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ABSTRACT

Background : Smoking is a complex and profound neurochemical and behavior disorder influenced by social, environmental, psychologic, and biologic factors. Cigarette smoking is one of the most extensively used potentially hazardous social habits throughout the world. Smoking induces oxidative stress & can be measured by increased plasma Malondialdehyde. So the aim of the study is to evaluate & compare the status of oxidative stress by estimation of Malondialdehyde (MDA) levels in smokers. Methodology: This was a prospective study and controls were selected from the workers in the medical college and hospital in the age group of 25 to 50 years of males. Assay for Malondialdehyde in Plasma by Esterbauer & Steinberg method .Results: Malondialdehyde levels were significantly higher in smokers than in non-smoker group. Conclusion : Elevated plasma levels of Malondialdehyde indicate increase in the level of production of oxygen free radicals, suggesting their possible role in atherogenesis, leading to Coronary Heart Disease. Therefore, quitting smoking represents an irreplaceable preventive strategy against tobacco- induced oxidative stress

KEYWORDS

Introduction:

Smoking is a complex and profound neurochemical and behavior disorder influenced by social, environmental, psychologic, and biologic factors.[1,2] Smoking has a particularly large impact in the developing world & accounts for 1.17 million deaths per year. The first Global Adult Tobacco Survey of 2010 reports that currently 34.6% of adults (47.9% males & 20.3% females) in India are users of tobacco products. [3,4]

According to WHO approximately one third of world population older than 15 years, are consuming tobacco.[5] Cigarette smoking is one of the most extensively used potentially hazardous social habits throughout the world but more extensively prevalent in South East Asia.[5]

Today tobacco consumption has been established as a number one preventable cause of death and disease worldwide .Tobacco use has become widespread in many societies for religious, medicinal and recreational purposes.[6]

Addicted smokers regulate their nicotine intake by adjusting the frequency and intensity of their tobacco use, both to obtain the desired psychoactive effect and also to avoid withdrawal.[7] Along with nicotine other toxic and carcinogenic compounds are inhaled, deposited in the airway and alveoli and absorbed into the body and hence the use of tobacco as cigarettes is more hazardous.

Nicotine in the particulate phase in fresh smoke volatilizes into the gaseous phase as the smoke ages and is a major vapor phase constituent in environmental tobacco smoke. Biologic markers of extent of smoke inhalation includes carbon monoxide bound to hemoglobin in the blood, nicotine, cotinine in the blood, saliva and urine, hydrogen cyanide in the blood, saliva and urine, globin adducts of nitrogen oxides, ethylene and tobacco specific nitrosamines etc [8,9,10]

Smoking has long been being associated with an increased risk on developing several chronic diseases including the atherosclerosis, which is believed to be initiated by lipid peroxidation. The chronic smoking which is defined as more than 10 years which creates more free radicals in human system by which all of the major classes of biomolecules may be attacked by the free radicals; but lipids are probably the most susceptible.[11,12,13]

Smoking may enhance oxidative stress not only through the production of reactive oxygen radicals but also through the weakening of the antioxidant defense system. Cigarette smoke contains numerous radicals and radical generating compounds[14]; the action these oxidative agents and other mutagens present in cigarette smoke are accompanied by DNA damage, mutations in oncogene's activation and tumor suppressor gene inactivation.

Smoking has long been associated with an increased risk of developing several chronic diseases including atherogenesis. The process of atherogenesis is believed to be initiated by lipid peroxidation. Smokers are prone to oxidation from the inhalation of large number of gas-phase and other radicals giving rise to increased oxidative damage.[15]

Smokers have indeed been shown to have higher levels of lipid peroxidation compared with non-smokers, as measured by increased plasma Malondialdehyde[16] The increased levels of MDA due to lipid peroxidation is known to be a crucial step in the pathogenesis of large number of pathological states like lung cancer, asthma, diabetes mellitus, coronary heart disease,& oral cancer.[17]

Smoking enhances oxidative stress not only through the production of ROS in cigarette tar and smoke but also through weakening of the antioxidant defense systems.[18]

These effects singly and in combination, lead to the injuries and diseases caused by smoking. After years of denial by the tobacco industry [19], it is now being recognized that environmental tobacco smoke is risk factor for cardiovascular disease, cancer, and pulmonary diseases, maladies that were previously attributed only to the long-term effects of active smoking.

The clinical and epidemiological studies have shown that malnutrition and sedentary life style, emotional stress and tobacco smoking which are the factors contribute to the increased free radical changes which is the cause for many diseases.[20] As a part of treatment one have to give up the habit of smoking, then only the medical treatment will be effective in the smokers. So the aim of the study is to evaluate & compare the status of oxidative stress by estimation of Malondialdehyde (MDA) levels in smokers .

Methodology :

The present study was conducted at Vinayaka Mission's Medical College & Hospital, Karaikal . This was a prospective study and controls were selected from the workers in the medical college and hospital in the age group of 25 to 50 years of males. The cases were selected from the outpatient department of medicine and surgery. The subjects were male subjects aged between 25-50 years, non-smokers and smokers. Subjects with history of Diabetes mellitus, Hypertention, Hepatic disorders,Renal disorders, On medications like beta blockers, steroids & multi- vitamins were excluded from the study

After recording and receiving the completed questionnaire, the controls and cases were selected. Under aseptic precautions the venous blood samples were collected from the subjects, after getting their consent. Each participant gave an informed consent and this study was approved by the Ethical committee of Vinayaka Mission's Medical College, Karaikal. After the addition of EDTA anticoagulant, the samples were centrifuged at the rate 3000 rpm for 30 minutes and their plasma was separated for the study of estimation of Malondialdehyde

Assay for Malondialdehyde in Plasma by Esterbauer & Steinberg method .This method is based on the fact of condensation of lipid peroxides with 1-methyl-2 phenyl indole(MPI) under acidic conditions, resulting in the formation of chromophore. To determine specifically lipid peroxides in serum or plasma they are precipitated along with serum or plasma proteins to remove water soluble MPI reactive substance. The lipid peroxide level is expressed in terms of MDA, which is unstable. Reference value of MDA in adults is < 4 µmol/L .Statistical analysis was done using appropriate statistical tests & p value was calculated.

Results :

Table 1: Comparison of MDA in smoker and non-smoker group

Parameters	Smoker (n=30)		Non-smoker (n=30)		Z Value	P Value
	Mean	SD	Mean	SD		
MDA(umol/l)	5.56	1.23	2.89	0.59	10.69	<0.0001

Table 1 shows that MDA levels were significantly higher in smokers than in non-smoker group

DISCUSSION

Chronic smoking leads to oxidative challenge and leads to formation of many deleterious substances including free radicals [21], among which plasma Malondialdehyde(MDA), is a commonly used biomarker of lipid peroxidation.[22] Kushdeep Singh Arora et al in 75 patients reported a mean MDA value of 4.78 +/- 0.91 µmol/l in smokers, and 3.54 +/- 0.82 µmol/l in non-smokers.[23]

In the present study , the mean Malondialdehyde level measured in smokers were significantly higher in smokers than in non-smoker group. Aparna et al reported that the mean MDA levels in patients(n=25) with metabolic syndrome as 3.44 +/- 0.47 µmol/l, so they are at risk of developing metabolic syndrome, for which smoking is an important risk factor. [24] Khan et al found mean MDA levels in cases of newly diagnosed Lung cancer, who are smokers as 3.8 +/- 2.5 nmol/ml (nmol/ml = µmol/l), hence cases in present study can be at high risk of developing Lung cancer.[25] Shilpa HD et al 2013 reported mean value of MDA, as raised, in acute myocardial infarction patients on the day of hospital admission.[26]Mudassir et al concluded that elevated serum levels of Malondialdehyde indicate increase in the level of production of oxygen free radicals, suggesting their possible role in atherogenesis, leading to Coronary Heart Disease.[27]

Nicotine has been demonstrated to increase plasma levels of norepinephrine and epinephrine. This increase in catecholamines is followed by an increase in heart rate and blood pressure as well as other changes attributed to increased adrenergic activity following cigarette smoking.

The results of present study demonstrate that smoking significantly increases MDA levels and decreases J. Lykkesfeldt et al shows that poor antioxidant status is only partly responsible for the increased level of MDA found in smokers in general.[28] Therefore, quitting smoking represents an irreplaceable preventive strategy against tobacco- induced oxidative stress.

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