Original article:

Study of effects of smoking on teenage college going girls

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ABSTRACT

Introduction: Smoking habit is injurious to health for both the sexes all age group, especially teenage smoking habit in girls affects female reproductive mechanism

Aims and objective: To evaluate the etiopathogenesis of damages caused by smoking in teenage girls by estimating antioxidant stress and antioxidants

Methods: The study was conducted by taking 30 each teenage girls and normal subjects of same gender; estimated Melondialdehyde (MDA) as indicative of oxidative stress and Vit-C, Vit-E and glutathione as antioxidants

Results: 'ANOVA' was used for statistical analysis. The MDA, Vit-C, Vit-E and glutathione levels were very highly significant ($P<0.001$) when compare to normal subjects

Conclusion: The values of MDA are significantly increased and values of Vit-C, Vit-E and glutathione are decreased in smoking groups. Estimation of above parameters are relative for the assessment for the etiopathogenesis of damages caused in smoking group. This also aid in early diagnosis and assessment of severity of the disease process

Key words : Teenage girls, smoking, MDA, Vit-C, Vit-E and glutathione .

INTRODUCTION:

Each year a great amount of money are being wasted in smoking, although it is quite obvious that smoking habit is dangerous and injurious to heath but still a large number of people especially teenagers are attracting and getting involved in smoking habit day by day. Between the age group of 14 to 18 years, a person is most likely to attract towards the smoking habit and become an addict for the rest of his or her life. Young females are particularly susceptible to marketing tactics of tobacco companies, which promote smoking as a means to slimness, emancipation and sexual allure. There is now very little difference between males and females in terms of cigarette smoking and use of other tobacco products.[1]Cigarette smoking, alcohol use, and recreational drug use have been implicated in the pathogenesis of perturbed female reproductive mechanisms, leading to increased times to conception and infertility [2].

Tobacco is the single largest cause of death and disability worldwide.[3] Globally everyday about 80,000-1,00,000 youth initiate smoking, most of them are from developing countries [4]. About one-fifth of all worldwide deaths attributed to tobacco occur in India [5]. It was estimated in 1999-2001 that 5500 adolescents start tobacco use every day in India joining the 4 million under 15 children who already use it regularly [6,7]. 1000 teenagers who smoke today, 500 will eventually die of tobacco related diseases, 250 in their middle age and 250 in their old age.[8]Non-communicable diseases are rapidly increasing inmany developing countries, largely due to demographic and lifestyle changes .Globally, many of the risk factors for heart disease, diabetes, cancer and pulmonary diseases are due to lifestyle and can be prevented. Among risk factors for non-communicable

diseases, tobacco is enemy number one. [9,10] Smokers are extracting approximately 1–2 mg of nicotine per cigarette, suggesting that smokers absorb more thanhalf of the inhaled nicotine.[2] Nicotine from tobacco smoke is absorbed quickly (in seconds) throughout the body on initial dosing and then is eliminated with a half-life of 2–3 hours[2]. Nicotine minimum and myosamineiminium are the chief metabolites produced by oxidation of nicotine. The reduction potentials of these metabolites seem to permit in vivo ET and resultant OS. In a healthy body, reactive oxygen species (ROS) and antioxidants remain in balance. When the balance is disrupted towards an overabundance of ROS, oxidative stress (OS) occurs. Reactive oxygen species are prominent and potentially toxic intermediates, which are commonly involved in OS, OH* modifies purines and pyrimidines, causing DNA strand breaks and DNA damage. Apoptosis results from overproduction of ROS, inhibition of ETC, decreased antioxidant defences, and apoptosis-activating proteins, amongst others. OS influences the entire reproductive lifespan of a woman ,affect multiple physiological processes from oocyte maturation to fertilization, embryo development and pregnancy. It has been suggested that OS modulates the age-related decline in fertility.

Smoking on females have an increased risk for hip fracture , increased risk for peptic ulcers, Crohn's disease , also for age-related macular degeneration, cataract, compared with women who do not smoker and influence menstrual function by increasing the risks for dysmenorrhoea, secondary amenorrhea and menstrual irregularity. Women who smoke have increased risks for conception delay, ectopic pregnancy and spontaneous abortion. Pregnancy related problems (miscarriage, low birth weight, perinatal mortality and Sudden Infant Death Syndrome (SIDS). linked to decreased pregnancy rates and increased time to conception .Reactive oxygen and nitrogen species can negatively affect Endothelial dysfunction, recurrent pregnancy loss, preeclampsia, IUGR, and preterm labour. embryo implantation and may influence the development of reproductive disorders such as endometriosis and preeclampsia. placental ischemia/hypoxia.[11,12,13]

Hence, we took the study to estimate levels of oxidative stress as [MDA] and antioxidants [Vit C, Vit E and glutathione] for the probable etipathogenesis of hazards of effects of smoking in teenage girls.

MATERIAL AND METHODS:

The study was conducted among two groups of 30 each smoking teenage girls in college canteens of Raichur city and normal subjects. They were smoking “wills” and “kings” cigarettes 3-4 per day. The study was conducted between July 01 to December 31 of 2017.

Exclusion criteria:

1. Irregular menstrual cycle
2. Thyroid disorders
3. Tuberculosis
4. Type 1 Diabetes mellitus
5. Leprosy
6. Chronic Granuloumotous disorder
7. Not willing

Inclusion criteria:

1)Dysmenorrhoea

2)Irregular periods

3)Not conceived even after maariage

4)Oligomenorrhoea

5)White discharge per vagina

6)Heavy bleeding during periods

To all test and control subjects 5ml of venous blood was drawn and subjected to following investigations

1. MDA was estimated by spectrophotometric method[14]
2. Glutathione was estimated by modified manual method[15]
3. Vit – C was estimated by spectrophotometric method[16]
4. Vit – E was estimated by manual simple method[17]

RESULTS:

The results obtained were tabulated as follows, Anova software is used for statistical analysis.

PARAMETERS	NON SMOKERS n=30	SMOKERS n=30
MDA (n.mol/g of Hb)	8.20±0.18	12.45±0.50
GLUTATHIONE (mg/g of Hb)	17.90±0.25	12.02±0.11
VIT. C (mg/dl)	5.95±0.12	4.05±0.82
VIT.E (μ mol/L)	6.92±0.02	5.12±0.12

[P value < 0.001 very highly significant.]

All the parameters were in favour of increase with p-value very highly significant when compared to test controls or non smokers.

DISCUSSION:

This smoking habit may enhance oxidative stress not only through the production of reactive oxygen radicals in smoke but also through weakening of the antioxidant defence systems. Thus increased levels of serum MDA and decreased level of glutathione, vitamin C and vitamin E are seen these may be important in determining the oxidant/antioxidant imbalance in smoker teenage girls compared to non smoking teenage girls. Oxidative stress occurs when the production of ROS exceeds levels of antioxidants and can have damaging effects on both male and female health, specially reproductive abilities when the matter of teenage girls come. The stability of reproductive cells and tissues is dependent on balanced concentrations of antioxidants and oxidants. Varied levels of ROS can have both positive and negative impacts on female reproduction. At physiologically appropriate levels, they are involved in cell signalling processes. The excess production of free radicals and subsequent induction of OS, however, have long been known to significantly affect reproductive functions. During ovulation, ROS are produced within the follicles, however, the excessive production of ROS may increase the risk for poor oocyte quality since oxidative stimulation promotes oocyte maturation and wall rupture within the follicle . Women with 30% degenerate oocytes demonstrate significantly increased intrafollicular 8-OHdG, indicating DNA damage by OS.[1,2]

Damage induced by ROS can occur through the modulation of cytokine expression and pro-inflammatory substrates via activation of redox-sensitive transcription factors AP-1, p53, and NF-kappa B. The increase of pro-inflammatory cytokines interleukin (IL) 1-beta and tumor necrosis factor (TNF)- alpha activates the

apoptotic cascade, causing cell death. Conversely, the antioxidants vitamin C and E, and sulfalazine can prevent this damage by inhibiting the activation of NF-kappa B16.Deleterious attacks from excess ROS may ultimately end in cell death and necrosis.[2,7,9,11]

In women it plays a role during pregnancy and normal parturition and in initiation of preterm labor. Numerous studies have shown that OS plays a role in the pathophysiology of infertility and assisted fertility. There is some evidence of its role in endometriosis. There is growing literature on the effects of OS in female reproduction with involvement in the pathophysiology of preeclampsia, hydatidiform mole, free radical-induced birth defects and other situations such as abortions, preterm labour and preeclampsia and gestational diabetes.

MDA is one of the most frequently used indicators of lipid peroxidation, a potential biomarker for oxidative stress. Daily smokers had a slightly higher average concentration of P-MDA than non-smokers and P-MDA correlated with daily exposure to cigarette smoke. One of the prominent risk factors for increased lipid peroxidation is smoking. Because of the presence of free radicals in cigarette smoke increases in P-MDA may occur .it was found a significant correlation between P-MDA and the number of hours of exposure to cigarette smoke as Cigarette smoke is known to increase production of oxygen free radicals by polymorphonuclear leukocytes and to decrease activities of some free radical scavengers.[18]Strategies to overcome oxidative stress and enhance fertility, both natural and assisted are delineated. Trials investigating combination intervention strategy of vitamin E and vitamin C supplementation in preventing preeclampsia are highlighted. GSH (glutathione) metabolism is one of the most essential antioxidative defence mechanism present both in tissue and blood.The glutathione (GSH) family of enzymes includes GPx, GST, and GSH reductase. GPx uses the reduced form of GSH as an H+ donor to degrade peroxides. Depletion of GSH results in DNA damage and increased H2O2 concentrations; as such, GSH is an essential antioxidant.

During the reduction of H2O2 to H2Oand O2, GSH is oxidized to GSSG by GPx. Glutathione reductase participates in the reverse reaction, and utilizes the transfer of a donor proton from NADPH to GSSG, thus, recycling GSH.[13,23]

Glutathione (GSH) is a peptide found in most forms of aerobic life as it is made in the cytosol from cysteine, glutamate, and glycine; it is a major nonenzymatic antioxidant found in oocytes and embryos. Its antioxidant properties stem from the thiol group of its cysteine component, which is a reducing agent that allows it to be reversibly oxidized and reduced to its stable form. [13] Its levels are regulated through its formation de-novo, which is catalysed by the enzymes γ-glutamylcysteinesynthetase and glutathione synthetase.Glutathione is present in the oocyte and tubal fluid and has a role in improving the development of the zygote beyond the 2-cell block to the morula or the blastocyst stage.[11,13,19]

Incells, GSH plays multipleroles, which include the maintenance of cells in a reducedstate and formation of conjugates with some hazardous endogenous and xenobiotic compounds.Follicular ROS promotes apoptosis, whereas GSH counterbalance this action in the growing follicle.[20,21]

Vitamin E (α-tocopherol) is a lipid soluble vitamin with antioxidant activity. It reacts with lipid radicals produced during lipid peroxidation. This reaction produces oxidized α-tocopheroxyl radicals that can be transformed back to the active reduced form by reacting with other antioxidants like ascorbate, retinol, or ubiquinol.Hence it protect proteins and lipid in biological membranes from oxidative damage.[13,18,20,22]

Vitamin C (ascorbic acid) is a known redox catalystthat can reduce and neutralize ROS. Vitamin C is a chain breaking antioxidant that stops the propagation of the peroxidative process. Vitamin C also helps recycle

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oxidized vitamin E and glutathione. Its reduced form is maintained through reactions with GSH and can be catalysed by protein disulfide isomerase and glutaredoxins.[13,18,22,24]

In female reproduction,each month, a cohort of oocytes begin to grow and developing the ovary, but meiosis I which occur in one of them develops as the dominant oocyte. This process is targeted byan increase in ROS, the progression of meiosis II is promoted by antioxidants The peritoneal fluid of women with endometriosis contains low concentrations of the antioxidants ascorbic acid and GPx, vitamin E antioxidant limit the proliferation of endometriotic cells, by inhibiting activation of NF-kappa B. Studies have shown decreased levels of OS markers in people who consume antioxidant rich diets or take antioxidant supplements.[11,19]

Results from Valavanidis A et al [22] positively correlated MDA concentrations with levels of necotine-- a marker of tobacco smoke exposure-- in maternal smokers; additionally, a decreased antioxidant supply was also observed in smokers. Tiboni et al [24] found a sequestration ofintrafollicular tobacco metabolites relating to cigarette smoke exposure. They also reported an additional association of cigarette smoke exposure to markedly increased follicular lipid peroxidation with parallel reduction of local antioxidant capacity. Similar findings were also observed in those who exposed to passive smoke.

Furthermore, Biri et al [25] reported that higher levels of MDA and xanthine oxidase and lower levels of antioxidant concentrations in the plasma, placenta, and umbilical cords in patients with IUGR compared to controls.

Hence, we concluded that increased OS and decreased antioxidant system is the main role in etiopathogenesis of female reproductive disorders due to smoking and supplementation of above mentioned antioxidants along with proper treatment will definitely improves the quality of female health.

SUMMARY AND CONCLUSION:

Oxidative stress is the result of overproduction of ROS in relation to antioxidant defence levels. Smoking is associated with oxidative stress and increased risks of many chronic diseases that both shorten life and impair its quality. Low concentrations of several micronutrients, especially the antioxidants vitamin C, vitamin E, and glutathione are associated with smoking, inflammatory changes increase turnover of these micronutrients so that blood concentrations are still lower in smokers than non-smokers Yet we have some deep rooted causes and driving factors that attract a large number teens to play with their health.

In teenage girls smoke induced oxidative stress may renders physiological processes of female reproduction, can contribute to several diseased states affecting female reproduction and these effects have been reported to improve with the aid of antioxidants like Vit C ,Vit E Glutathione, and diets rich in these antioxidants thus could minimize the associated risk for health hazard of smoking.

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