

Original Research Article

Effect of smoking on vitamin C and MDA: a cross sectional comparative study

Chandrashekar V. Kubihal, Hemalatha D. Naik*

Department of Biochemistry, Karnataka Institute of Medical Sciences, Hubli, Karnataka, India

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***Correspondence:**

Dr. Hemalatha D. Naik,

E-mail: dr_hemanaik@yahoo.com

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ABSTRACT

Background: Plasma gets exposed to the gases present in the smoke of the cigarette which leads to peroxidation. The ascorbic acid present in the body gets oxidized there is danger of derangement of lipid profile. The measure of malondialdehyde which is formed in lipid peroxidation reaction is indicative of oxidative stress. Oxidative stress seen among the smokers has been attributed to high MDA levels. Objective was to study the effect of smoking on vitamin C and MDA.

Methods: Present study was cross sectional study. Two groups of subjects were compared. Out of 100 study subjects, 25 were non smokers and were kept in one group. Remaining 75 were smokers. These two groups were compared to find out how the smoking habit affects the MDA as well as vitamin C levels among them.

Results: The levels of MDA were more in smokers compared to those who did not smoke and this difference was significant. The levels of vitamin C were less in smokers compared to those who did not smoke and this difference was significant ($p < 0.05$). It was found that the MDA levels were significantly more among all degrees of smokers. It was less in smokers with mild degree compared to smokers with heavy or moderate degree. Level of vitamin C was more in non smokers compared to smokers. Mild degree of smokers had better levels of vitamin C compared to moderate degree of smokers.

Conclusions: Smoking affects the vitamin C levels and MDA levels in the human body.

Keywords: MDA, Peroxidation effect, Smoking, Vitamin C

INTRODUCTION

Smoking is hazardous and not only it irritates others due to its smoke but also causes a lot of health problems. A Cigarette smoker not only affects himself but also is capable for affecting others those who come into the contact of his smoke. Various health problems have been reported as a result of active as well as passive smoking. There is 30% increased risk of death among passive smokers.^{1,2}

Oxidants are present in the cigarette smoke. Because of this, the free radicals are formed which are responsible "for peroxidation of the lipids in the body". Plasma also

gets exposed to the gases present in the smoke of the cigarette which leads to peroxidation. The ascorbic acid present in the body gets oxidized there is danger of derangement of lipid profile. The ascorbic acid present in the body is only one which maintains the lipids of the body. But cigarette smoke can alter lipid profile by damaging ascorbic acid.^{3,4}

Vitamin C is a strong reducing agent known to act as an anti-oxidant in vitro and in vivo. Vitamin C very effectively protects lipids in human plasma against peroxidative damage by scavenging oxygen derived free radicals. Imbalance between pro oxidants and anti oxidants within the vasculature also may be operative in

smokers since plasma levels of vitamin C are in general low compared with healthy control subjects a phenomenon that appears to reflect increased metabolism as the result of oxidant load rather than decreased food intake.⁵ The measure of malondialdehyde which is formed in lipid peroxidation reaction is indicative of oxidative stress. Oxidative stress seen among the smokers has been attributed to high MDA levels. With this background present study has been undertaken to study the levels of MDA and vitamin C and compared among smokers and non smokers.

METHODS

The study design was comparative cross sectional study. Those who smoke were in one group and those who do not were in another. This was a comparative study. These two groups were compared in terms of vitamin C levels and MDA levels. Over a period of one year from November 2000 to October 2001 it was possible to complete the present study. Ethical approval from the Institutional Ethics Committee was obtained. Participating subjects were asked to sign the informed consent form once they were explained the nature of the study.

Out of 100 study subjects, 25 were non smokers and were kept in one group. Remaining 75 were smokers and were kept in another group for analysis. This group was further sub divided into three groups of 25 each depending upon the duration and frequency of smoking. The smokers were graded as follows:

Table 1: Grading of smokers.

Grading	Number of cigarettes/day	Duration
Mild smokers	10-15	Last 5 years
Moderate smokers	16-20	Last 5-10 years
Heavy smokers	> 20	> last 10 years

Table 3: Comparison of MDA and vitamin C between non smokers and different groups of smokers.

Parameters	Non smokers (N =25)	Smokers grading			
		Mild	Moderate	Heavy	Total
MDA (n.moles/ml)	4.11±0.55	4.82±0.26	5.22±0.40	5.42±0.24	5.15±0.39
Vitamin C (mg/L)	13.9±1.45	11.4±1.6	10.3±1.2	9.2±1.0	10.35±1.44

Table 3 shows comparison of MDA and vitamin C between non smokers and different groups of smokers. It was found that the MDA levels increased as the degree of smoking increased from 4.82n.moles/ml in mild smokers; 5.22n.moles/ml in moderate smokers; 5.42n.moles in heavy smokers. The vitamin C levels decreased as the smoking severity increased from 11.4mg/L in mild

Inclusion criteria

- Age 25 years to 65 years,
- Willing to participate in the present study.

Exclusion criteria

- Age less than 25 years and more than 65 years,
- Not willing to participate.

Estimation of malondialdehyde (MDA) was done by TBA method.⁶⁻⁸ Estimation of ascorbic acid was done by 2, 4 dinitrophenylhydrazine (DNPH) methods.^{9,10}

Statistical analysis

Mean values with ±2 standard deviation was used. Students t test was calculated. If the probability value was less than 0.05, then it indicates that the difference is statistically significant.

RESULTS

Among non smokers the MDA value was 4.11n.moles/ml and the MDA value was 5.15n.moles/ml among smokers. This difference was found to be statistically significant. (p<0.05). Vitamin C value in non smokers was 13.9mg/L and vitamin C value was 10.35mg/L among the smokers. This difference was also found to be statistically significant difference (p<0.05) (Table 2).

Table 2: Comparison of MDA and vitamin C between smokers and non smokers.

Groups	MDA (n.moles/ml)	Vitamin C (mg/L)
Non Smokers (N = 25)	4.11±0.55	13.9±1.45
Smokers (N = 75)	5.15±0.39	10.35±1.44
T value	10.36	10.65
P value	<0.0001	<0.0001

smokers; 10.3ml/L in moderate smokers; to 9.2ml/L in heavy smokers.

Table 4 shows comparison of Malondialdehyde levels between non smokers and different groups of smokers. It was found that the MDA levels were significantly more among all degrees of smokers. The MDA value was lesser in mild degree of smoking compared to other

degrees of smokers. But it was comparable between the heavy and moderate smokers. In non smokers the range was 3.27-4.99. the range in mild smokers was 4.29-5.29.

the range in moderate smokers was 4.62-5.89. the range in heavy smokers was 4.99-5.96.

Table 4: Comparison of malondialdehyde levels between non smokers and different groups of smokers.

Groups (Smokers grading)	Malondialdehyde (n.moles/ml)		Group wise comparison		
	Range	Mean±SD	Mild smokers	Moderate smokers	Heavy smokers
Non smokers	3.27-4.99	4.11±0.55	P<0.01	P<0.01	P<0.01
Mild smokers	4.29-5.29	4.82±0.26	-	P<0.01	P<0.01
Moderate smokers	4.62-5.89	5.22±0.40	-	-	NS
Heavy smokers	4.99-5.96	5.42±0.24	-	-	-

One factor ANOVA (F = 56.6, P<0.01); MSR = 0.35 (P = 0.01); NS = Not significant

Table 5: Comparison of vitamin C levels between non smokers and different groups of smokers.

Groups (Smokers grading)	Vitamin C (mg/L)		Group wise comparison		
	Range	Mean±SD	Mild smokers	Moderate smokers	Heavy smokers
Non smokers	11.84-16.60	13.9±1.5	P < 0.01	P < 0.01	P < 0.01
Mild smokers	9.89-13.52	11.4±1.6	-	P < 0.05	P < 0.01
Moderate smokers	8.92-13.01	10.3±1.2	-	-	P < 0.05
Heavy smokers	8.02-11.80	9.2±1.0	-	-	-

One factor ANOVA (F = 57.7, P<0.001); MSR = 0.99 (P = 0.05); NS = Not significant

Table 5 shows comparison of vitamin C levels between non smokers and different groups of smokers. The value of vitamin C was 13.9 in non smokers compared to 11.4 in mild smokers, 10.3 in moderate smokers and 9.2 in heavy smokers. Thus as the degree of smoking increased, the vitamin C values decreased significantly (p<0.05). the range in non smokers was 11.84-16.60. the range in mild smokers was 9.89-13.52. the range in moderate smokers was 8.92-13.01. the range in heavy smokers was very less i.e. 8.02-11.80.

DISCUSSION

The multiple chemical constituents present in cigarette smock have multiple effects on different parameters. We studied and compared the MDA and vitamin C among those who smoke and those who do not and also across the degrees of smokers like mild, moderate and heavy.

The present findings are in accordance with the study of Petruzelli S et al, Rahman I and W. mac Nee, and Stringer MD et al.¹¹⁻¹³

The rise in MDA levels is due to oxidants and free radicals present in cigarette smoke which leads to lipid peroxidation. As a consequence MDA level increased.¹¹

According to Rahman I and W. mac Nee, all tissues are vulnerable to oxidative damage, but by virtue of its location, the airspace epithelium is particularly vulnerable to cigarette smoke.¹² Oxygen radicals generated close to a cell membrane oxidize the membrane phospholipids. The major site of free radical attack in on

polyunsaturated fatty acids in cell membranes, producing lipid peroxidation which generate hydroperoxides and long lived aldehydes. The end product of these reactions is malondialdehyde, ethane and pentane. This leads to rise in the levels of malondialdehyde in smokers.¹²

According to Stringer MD et al, peroxidised lipids are important in atherogenesis and its complications. They suggested that peroxidised lipids may provide an index of the severity of atherosclerosis.¹³

The mean levels of ascorbic acid in control group and in the total smokers were in the range of 13.9mg/L and 10.35mg/L respectively. Among the groups in controls, mild, moderate and heavy smokers it was in the range of 13.9mg/L, 11.4mg/L, and 10.3mg/L and 9.2mg/L respectively.

The present findings are in accordance with Kallner AB et al, Heitzer et al, Levime GN et al, Lykkesfeldt J et al.¹⁴⁻¹⁷

According to Heitzer T et al, vitamin C very effectively protects lipids in human plasma against peroxidative damage by scavenging oxygen derived free radicals.¹⁵ Because of increased oxidative stress, vitamin C levels are decreased in smokers.

According to Lykkesfeldt J et al, ascorbic acid is the only plasma antioxidant depleted by smoking per se. the high oxidant content of cigarette smoke explains the low antioxidant status and increased oxidative stress which causes endothelial damage leading to atherosclerosis.¹⁷

CONCLUSION

Thus, we concluded that smoking affects the vitamin C levels and MDA levels in the human body. There is clear dose response relationship. Hence all efforts should be made to stop the epidemic of smoking globally.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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