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SERUM TESTOSTERONE LEVEL IN NIGERIAN MARIJUANA AND CIGARETTE SMOKERS

¹Adu EM, ²Popoola OA, ³Adikema NA

1. Department of Medical Laboratory Services, Antiretroviral Therapy Centre, Central Hospital, Agbor, Nigeria
2. Genetic Research Unit, Institute for Advanced Medical Research and Training, College of Medicine, University of Ibadan, Ibadan, Nigeria
3. Department of Medical Laboratory Science, Faculty of Science, Rivers State University of Science and Technology, Port-Harcourt, Nigeria

Corresponding Author: Adu EM
Email: adumatthew10@yahoo.com

ABSTRACT

Aim: To evaluate the effects of marijuana and cigarette smoke on serum testosterone level in male marijuana and cigarette smokers.

Methods: Testosterone was estimated using enzyme immunoassay on micro plate format in 30 marijuana smokers, 15 cigarette smokers and 25 sex, age matched non-smokers as controls. Body mass index (BMI) of all subjects was also calculated.

Results: There was a significant decrease ($P < 0.05$) in testosterone level in marijuana smokers ($5.33 \pm 3.5 \text{ ng/ml}$) when compared with non-smokers ($8.5 \pm 2.4 \text{ ng/ml}$) but showed no significant difference statistically ($P > 0.05$) when compared with cigarette smokers ($5.4 \pm 1.5 \text{ ng/ml}$). A significant difference ($P < 0.05$) was observed when cigarette smokers were compared with non-smokers. The BMI of marijuana smokers was significantly higher when compared with cigarette smokers and non-smokers but no significant difference was observed between cigarette smokers and non-smokers.

Conclusion: These differences are attributed to the psychoactive chemical and pro-oxidants as well as oxidants present in marijuana and cigarette smoke which alter the hypothalamic-pituitary-gonadal integrity. We therefore recommend that stringent measures should be put in place to curb the indiscriminate use of the substances and also smoking history should be considered in the diagnosis of infertility in males.

KEY Words: Psychoactive, Oxidants, Androgen, Infertility, Immunoassay, Delta-9-tetrahydrocannabinol.

INTRODUCTION

Marijuana refers to dried leaves and flowers of *Cannabis sativa* in plants that contain the psychoactive chemical Delta-9-tetrahydrocannabinol (THC) at various levels of

concentration (Hubbard et al., 1999). There are countless street terms for marijuana. These include pot, herbs, weed, grass, moroko, stone, widow, Igbo etc. Marijuana is the most commonly used illicit drug (Porter, 1999). Cigarette smoke on the other hand is a complex mixture of

thousands of compounds containing relatively high concentration of oxidants and pro-oxidants (Alberg, 2002), which include nicotine, carbon monoxide and cadmium. The androgens are involved in sexual differentiation, spermatogenesis, anabolic metabolism, gene regulation and male pattern behavior. Testosterone is the principal and the most powerful androgen (Mayne, 1998). Other important androgens are dihydrotestosterone, androsteronediol, D-4-Androstene-3-17dione, androstanediol dehydroepiandrosterone (DHEA) and dehydroepiandrosterone sulphate (DHEAS). Early morning testosterone levels are used for measuring androgen activity in males (Badoe et al., 2000). Marijuana and other cannabinoids, act on the hypothalamic –pituitary – gonadal (HPG) integrity and affect reproductive function which results in infertility (Brown and Dobs, 2002). These effects are mediated by central cannabinoid receptors (CB1) in the hypothalamus (Murphy et al., 1998). The cannabinoid receptors have also been found in the testes (Gerard et al., 1991) and ovaries (Galiegue et al., 1995) of experimental animals, suggesting a possible direct effect of cannabinoids on the gonads. Marijuana and its active chemical components have been shown to have adverse effects on male fertility as well as nicotine which is present in cigarette smoke (Kaporr and Jones, 2005; Oyeyipo et al., 2010). These effects can manifest in form of lowered sperm count, abnormal spermatozoa shape and even functionality of the testis (Schuel, 2002). Kelodny and his co-workers (1976) reported decreased level of testosterone in male marijuana smokers while Freidrich et al., (1990) observed no significant difference in the testosterone levels of marijuana smokers and non-smokers. Due to this inconsistency coupled with the limited information on androgen status of the Nigerian male marijuana smokers and cigarette smokers, we therefore aim to assess the androgen status of Nigerian male marijuana smokers as well as cigarette smokers and by extension, establish if body mass index (BMI) has a role in androgen status of marijuana smokers as well as cigarette smokers.

MATERIALS AND METHODS

Study Population

A total of seventy (70) apparently healthy males with age range of 18-35years in Benin City, Nigeria were used for this study. These consist of 30 marijuana smokers, 15 cigarette smokers and 25 non-smokers as controls. Informed consent was obtained from all participants and smoking habit of all subjects was established by a well structured questionnaire. Ethical clearance was obtained from the Ethical Committee, Ministry of Health, Edo State. The study was in conformity with Helsinki Declaration of 2008 as amended. Venous blood samples were collected from all subjects between 7:00am-9:00am (one hour after smoking) with minimum stasis. This was allowed to clot and spun at 3000rpm for 5 minutes and the serum separated, kept frozen until required for analysis. The heights and weights of all participants were taken and the BMI calculated.

Biochemical Assay

Serum total testosterone level was determined quantitatively by standard method of Enzyme Linked Immunosorbent Assay (ELISA) on micro plate format (Gronwski and Landav-Levine, 1999). Kit was a commercially available product of Dialab, Austral and manufacturer's instruction was strictly adhered to.

Statistical Analysis

The groups mean \pm SD was calculated and significant difference between means evaluated using the unpaired student t-test. Statistical Package for Social Science (SPSS) version 16.0 software (SPSS Inc. Chicago, IL USA) for windows was used, with $P < 0.05$ considered as statistically significant.

RESULTS

The mean \pm SD and the statistical comparison of serum total testosterone level in marijuana smokers, cigarette smokers and non-smokers is as shown in Table 1. Table 2 shows the mean \pm SD of BMI in marijuana smokers, cigarette smokers and non-smokers. Figure 1 shows the mean \pm SD of serum testosterone level in marijuana smokers, cigarette smokers and non-smokers in graphical

form while Fig.2 shows the BMI in marijuana smokers, cigarette smokers and non-smokers in graphical form. The mean testosterone level of marijuana smokers was significantly decreased when compared with cigarette smokers and non-smokers. Also, when the mean of cigarette smokers was compared with non-smokers it was

observed to be significantly decreased statistically. The Body Mass Index (BMI) of marijuana smokers was significantly increased when compared with cigarette smokers and non-smokers but there was no significant difference observed between the BMI of cigarette smokers and non-smokers.

Table1: Mean ± SD of serum testosterone and statistical comparison of marijuana smokers, cigarette smokers and non-smokers.

	Serum Testosterone ng/ml	P value
Marijuana smokers (n=30)	5.33±3.5	
Cigarette smokers (n=15)	5.40± 1.5	
Non-smokers (n=25)	8.5 ± 2.4	
Marijuana vs Cigarette		P>0.05
Marijuana vs Non-smokers		P<0.05
Cigarette vs Non-smokers		P<0.05

Table2: Mean ± SD of BMI and statistical comparison of marijuana smokers, cigarette smokers and Non-smokers.

	BMI	P value
Marijuana smokers(n=30)	29.5±8.07	
Cigarette smokers (n=15)	22.8±2.05	
Non-smokers (n=25)	23.2±2.39	
Marijuana vs Cigarette		P<0.05
Marijuana vs Non-smokers		P<0.05
Cigarette vs Non-smokers		P>0.05

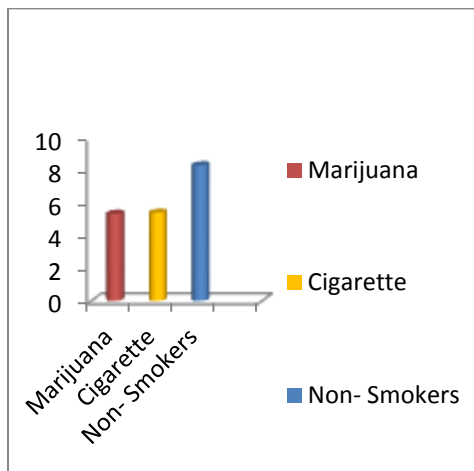


Fig. 1: Mean serum testosterone (ng/ml) level of marijuana smokers, cigarette smokers and non-smokers.

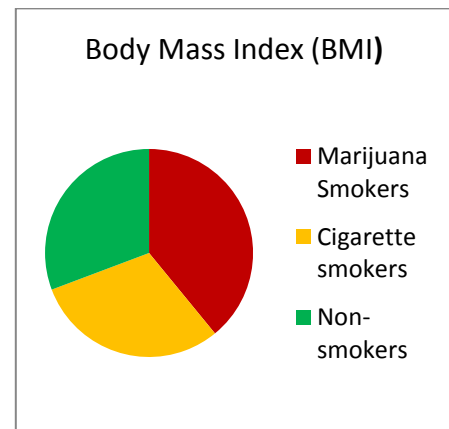


Fig. 2: Body Mass Index (BMI) of marijuana smokers, cigarette smokers and non-smokers.

DISCUSSION

Infertility in males has been a major problem in our society and this has posed serious threat to marriages in recent times. Marijuana and cigarette smoke have been found to be precursors to low sperm count, abnormal spermatozoa shape as well as functionality of the testis. Our results in this study show a statistically significant decrease in testosterone level in the mean of marijuana smokers ($5.35 \pm 3.5\text{ng/ml}$) when compared with non-smokers ($8.5 \pm 2.4\text{ng/ml}$). This is in accordance with the work of Kelodny et al., (1976) but in contrast with the work of Freidrich et al., (1990) who found no significant difference between the serum testosterone level of marijuana smokers and non-smokers. This decrease in testosterone can be attributed to inhibition of the Gonadotrophin Releasing Hormone (GnRH) pulse generator in the hypothalamus by Δ^9 -THC (Murphy et al., 1994). Our study also showed no significant difference between the means of marijuana smokers ($5.35 \pm 3.5\text{ng/ml}$) and cigarette smokers ($5.4 \pm 1.5\text{ng/ml}$) when compared ($P > 0.05$). This can be explained due to the fact that all marijuana smokers are also cigarette smokers. The mean of cigarette smokers when compared with that of non-smokers shows a significant decrease in the serum testosterone. This is in agreement with the work of previous authors (Kaporr and Jones 2005, Oyeyipo et al., 2010; Oyeyipo et al., 2011; Heidary et al., 2012). Serum testosterone decrease following cigarette smoking is due to the presence of nicotine in cigarette smoke which produces free radical and causes oxidative stress thereby altering the biological system. The BMI of marijuana smokers was significantly higher ($P < 0.05$) when compared with cigarette smokers and non-smokers. This is in agreement with the work of previous authors (Heidary et al., 2012; Nelson et al., 1994). This increase in BMI may be due to accumulation of breast tissue in men which results from increase in circulating estrogen/androgen ratio, which is a common feature with marijuana smokers (Gorter et al., 1992; Glass, 2001). On the other hand when the BMI of cigarette smokers was compared with non-smokers there was no significant difference ($P > 0.05$) observed. This is in accordance with the work of Adikema and Adu (2013). Conclusively, it has be affirmed that both marijuana and

cigarette smoking alter the reproductive endocrine organ of males which ultimately leads to low level of testosterone, an important androgen needed in spermatogenesis. This has resulted in infertility among the male folk. We therefore recommend that stringent measures should be put in place against the indiscriminate use of these substances to reduce infertility.

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