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Interaction Analysis of Smoking with Liver Function Tests

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ABSTRACT

Introduction: Smoking has been linked to harmful health impacts on several body organs including the cardiovascular system.

Study objectives: The primary goal of the current study is to assess how smoking models affect the level of liver enzymes.

Methods: Thirty male albino rats served as the subjects for this experimental study. We used male albino rats (Rattusratas) that were 6–8 weeks old and weighed 50–180 g. Rats were randomly allocated to one of three groups (n = 10): group 1 served as a negative control and was solely exposed to fresh air; group 2 was exposed to the most popular cigarette brands available in Jordan (red LM cigarettes) at a rate of 1 cigarette per rat per day for 30 days. Rats in group 3 were given flavored water pipes for 30 days, once a day for the entire body, after completely burning 20 g of one moassal. The smoking device was digital. LDH, AST, ALT, and liver enzymes were assessed in study groups. The collected data were examined using SPSS version 20.

Results: Both exposures to cigarette smoking and water pipe smoking resulted in a considerable rise in liver enzymes. Interesting results showed that quitting smoking restored liver enzymes to levels close to those of the control group.

Conclusion: Increased levels of liver enzymes are a sign that smoking causes liver damage, which can be reversed by quitting.

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INTRODUCTION

In underdeveloped nations, tobacco use is a widespread epidemic that is regarded as the world's first non-infectious sickness to result in avoidable fatalities. According to estimates, smoking tobacco killed more than six million people in 2010 alone[1], whereas it is anticipated that by 2030, deaths in underdeveloped countries would top a million annually[2].

Tobacco can be smoked in a variety of ways, including cigarettes, cigars, chew, pipes, and water pipes. Currently, smoking cigarettes and water pipes is seen as a stylish way to consume tobacco, especially among young and middle-aged men and women[3].

There are primarily two varieties of narghile tobacco mixtures: the flavored variety, which could be either jurak or moassal (also known as tobamel), and the unflavored variety, which is known as tumbak (or ajamy). Typically, 10 to 20 gms of tobacco are used in a water-pipe system (WPS). Muessel or maasel, which means "honeyed" in English, is made up of 70% honey or molasses and 30% tobacco (treacle). Pure, dark tobacco paste is referred to as "tumbak" or "ajami." The intermediate type known as "jurak," which is primarily of Indian origin, frequently includes fruits or oils but can also be flavorless. Apple, mango, banana, strawberry, orange, grape, mint, cappuccino, or other flavors are frequently used to flavor "Muessel." The tobacco is typically marketed in cardboard boxes or plastic jars adorned with fruit or alcohol[4].

According to estimates, there are 1300 million smokers worldwide who use different types of tobacco[5]. Additionally, smoking is regarded as the fourth significant risk factor for disease and the world's second biggest cause of death[6].

In addition to the anticipated mortality of 650 million current smokers from their addiction to smoking, studies have shown

that smoking causes the deaths of five million persons each year[7].

Epidemiological data showed regional differences in the prevalence of juvenile smoking, which is assumed to be a result of the difficulty in determining the age of adolescent smokers and the lack of adequate, trustworthy data from developing nations[8].

Around 100 million fatalities were attributed to tobacco smoke at the global level in the last century, according to estimates (Yauk, et al[9]). More than 400 chemical components, many of which are harmful and carcinogenic, are thought to be present in tobacco[10]. It is thought that nicotine, the primary molecule in cigarettes, has properties beyond those of addiction and contributes, along with other substances, to the disorders associated with smoking[11].

The liver is where nicotine is processed; it changes how oxidants and antioxidants are metabolized and boosts the generation of free radicals and reactive oxygen species (ROS), which weakens the antioxidant defense system and causes oxidative stress[12].

Study objectives

The primary goal of the current study is to assess how smoking has an impact on the level of liver enzymes.

METHODOLOGY

Experimntal Design

The 30 male albino rats used in this experiment were (females were Excluded to avoid the possible effect of hormonal changes). Male albino rats (Rattusratas), weighing 50–180 g and aged 6–8 weeks, were procured from the animal house at the University of Science and Technology and kept under ideal dietary and environmental circumstances.

Rats were randomly allocated to one of three groups (n = 10): group 1 served as a negative control and was solely exposed to fresh air; group 2 was exposed to the most popular cigarette brands available in Jordan (red LM cigarettes) at a rate of 1 cigarette per rat per day for 30 days. Rats in group 3 were given flavored water pipes for 30 days, once a day for the entire body, after completely burning 20 g of one moassal.

In order to recuperate from the negative effects of smoking cigarettes and water pipes, a further one-month period of non-exposure (cessation) to smoking was performed. Histological, immunohistochemical, and biochemical investigations were carried out after each period.

The Digital Smoking Machines

A digital smoking device with a unique smoking topography was created to expose rats to waterpipe or cigarette smoke[13]. The components of the smoking machine are as follows, as seen in (Figure 1).

Inhalation chamber made of Plexiglas (8 mm thick) with the dimensions 30 cm length × 22.5 cm width ×10.5 cm height that can host five rats rats weighting 100-150 gm. Time cotroller.Valve allowingfresh air to pass inside the inhalation chamber, vacuum pump,30% and 50% alchol traps connnected in series by rubber and glass connectors.

The Smoking Regimen

Each smoking run cycle lasted 90 seconds and included the three actions below.:

a. Continuous withdrawing of water-pipe /cigarette smoke for 30 seconds
b. Washing out of the smoke for 30 seconds,with fresh air.
c. Finally, rats were allowed to breath normalfresh air for 30 seconds.

Figure 1. Five rats placed in the digital smoking machine and exposed to the smoke of 5 cigarettes

Biochemical investigations

Selected antioxidant enzymes from the trachea, heart, lungs, and blood will have their activity measured. Blood was drawn by cardiac puncture using simple tubes and a 5cc syringe. The blood was centrifuged at 3000 rpm for 10 minutes after being allowed to clot at room temperature for 30 minutes. The serum (supernatant) was then kept at -20°C until it was needed to measure the liver enzymes and perform other biochemical testing.

The next biochemical parameters were looked at.

Lactate Dehydrogenase (LDH):

It is a stable oxidoreductase enzyme that is used to assess if

tissues and cells have been damaged and are poisonous. Pyruvate is reduced by NADH to produce lactate and NAD+, which is catalyzed by lactate dehydrogenase. The catalytic concentration is calculated from the spectrophotometrically measured rate of NADH decline[15].

Pyruvate + NADH + H + □□ lactate + NAD +

Alanine Aminotranferase (ALT)

By transferring the amino group from alanine to 2-oxoglutrate and generating pyruvate and glutamate, it catalyzes chemical processes. The LDH-coupled reaction uses the rate of decrease of NADH, which is measured by a spectrophotometer at 340 nm, to estimate the catalytic concentration[14].

$$\text{L - Alanine} + \text{2 - Oxoglutarate} \xrightarrow{\text{GPT}} \text{L - Glutamate} + \text{Pyurvate}$$

$$\text{Pyruvate} + \text{NADH} + \text{H} + \xrightarrow{\text{LDH}} \text{L - Lactate} + \text{NAD} +$$

Aspartate Aminotransferase (AST)

Oxaloacetate and glutamate are produced when aspartate aminotransferase catalyzes the transfer of the amino group from aspartate to 2-oxoglutarate. The rate at which NADH depletes via the malate dehydrogenase (MDH)-coupled process, as measured by a spectrophotometer at 340 nm, serves as the basis for the principle[15].

$$\text{L - Aspartate} + \text{2 - Oxoglutarate} \xrightarrow{\text{GOT}} \text{L - Glutamate} + \text{Oxaloacetate}$$

$$\text{Oxaloacetate} + \text{NADH} + \text{H} + \xrightarrow{\text{MDH}} \text{L - malate} + \text{NAD} +$$

Statistical analysis

Data management and analysis were performed using SPSS version 20 (Statistical Software Package for the Social Sciences). The physiological section's data is presented as means SEM for all variables. The significance of variations between the mean values of the responses from the control and experimental tissues was assessed using Student's t-test for independent samples. If the probability was less than 0.05 (P0.05), the differences were deemed significant.

RESULTS AND DISCUSSION

The Effect of Chronic Exposure to Cigarette/Water-pipe Smoking and its Recoveryon the Serum Liver Enzymes

The statistical analysis of three blood liver enzymes (ALT, AST, and LDH level) after long-term exposure to waterpipe and cigarette smoking, as well as after quitting, is displayed in tables (1-3). The reported data (represented as Mean SEM of 6 rats) are

Table 1: Effect of cigarette smoke on ALT level in albino rats

Animal groups	After exposure U/L	*P*- values	After cessation U/L	*P*-values
Control (Fresh air)	51± 3.2	1.0	51± 3.2	1.0
Cigarette	71± 2.3	0.00*	33 ± 4.2	0.01*
Water-pipe	76± 1.8	0.00*	24 ± 2.2	0.00*

* Mean significant P<0.05.

Table 2: Effect of cigarette smoke on AST level in albino rats

Animal groups	After exposure U/L	*P*- values	After cessation U/L	*P*-values
Control (Fresh air)	222 ± 7.5	1.0	222 ± 7.5	1.0
Cigarette	267 ± 12.8	0.01*	267 ± 12.8	0.01*
Water-pipe	314 ± 9.3	0.00*	264 ± 17	0.05*

* Mean significant *P*<0.05.

Table 3: Effect of cigarette smoke on LDH level in albino rats

Animal groups	After exposure U/L	*P*- values	After cessation U/L	*P*-values
Control (Fresh air)	186 ± 1.2	1.0	186± 1.2	1.0
Cigarette	502 ± 11.5	0.00*	395 ± 30	0.00*
Water-pipe	498 ± 17.4	0.00*	477 ±13	0.00*

* Mean significant *P*<0.05.

The Effects of Cigarette Smoking on Liver Enzymes

From 51 3.2 U/l in the control group to 71 2.3 U/l in the group of smokers, the levels of ALT were considerably increased (p=0.000). The level of ALT considerably decreased to 33 4.2 U/l (p=0.001) after quitting smoking. These findings corroborated earlier research in which cigarette smoking caused a considerable rise in ALT levels, indicating the liver-damaging consequences of smoking[16].

When compared to the control group, smoking increased AST levels in a significant way (p=0.01). After quitting, the level of AST drastically decreased. These results demonstrated that smoking causes the liver cells to experience negative consequences that have been observed in earlier investigations[16].

The Effects of Water-pipe Smoking on Liver Enzymes

Smoking over a water pipe significantly increased ALT levels (p=0.000). With the use of water pipes reduced, the level of ALT increased hardly (p=0.13). Its ongoing therapy following the termination of the water pipe dramatically decreased the level of ALT (0.006). Smoking a water pipe significantly raised the AST level (p=0.000). The amount of AST was dramatically reduced (p 0.05) after giving up smoking water pipes. These results suggested that smoking a water pipe causes liver oxidative damage[17]. Numerous investigations have documented the pathogenic effects of smoking on liver enzymes in general[15]. The results of this study are useful in establishing smoking's effects on the liver and other study parameters.

Smoking cigarettes and using a water pipe both significantly raised HDL levels (p=0.000). Stopping to smoke cigarettes and water pipes significantly decreased LDH levels (p=0.000).

CONCLUSION

According to the current study's findings, smoking can harm the liver by altering its enzyme composition. Quitting smoking can repair liver damage and return liver enzyme levels to normal.

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