

Evaluation of Nicotine Deleterious Effects on Human Sperm Features

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Abstract

Background: Nicotine is a life style factor and its harmful effects on fertility and reproduction have come to be obvious but are not valued. Therefore, this research intended to estimate the nicotine influence at different concentrations on normal human sperm features in vitro. **Method:** This study included 100 semen samples of non-smoking fertile men, each sample (2 ml) was divided equally to four splits which have been treated with diverse nicotine concentrations (0 , 1,1.5 as well as 2) mg/ml and three periods of incubation were used in this study: 30, 45 and 60 minutes. **Results :** 1 mg/ml of nicotine did not effect on the sperm motility, but 1.5 and 2 mg/ml of nicotine caused a significant decline ($P \leq 0.05$) in the sperm motility as shown by an intense increase in immotile sperm and a decrease in the progressive motility as well as there was a significant difference between these two concentrations in compared to control, but all these concentrations did not effect on the concentration of the sperm and the percentage of abnormal sperm morphology in compared to control for all periods of incubation. **Conclusion :** We can conclude that nicotine causes a marked decrease in the percentage of sperm motility and progressive motility (grade A+B) and its effect appears in a manner dependents on its concentration but it has no effect on sperm concentration and abnormal sperm morphology percentage in vitro.

Keywords: Fertility, Nicotine, Sperm features.

Introduction:

Nicotine is an organic alkaloid substance, mainly extract from the leaves of the tobacco plant and unable to ionize, so nicotine can simply enters the cell membrane and causing disorder through generating free radicals and increasing oxidative stress (1), so it is a very toxic compound and declines fertility and libido (2) and identified

in both the semen and serum of smokers and its level is correlate positively with the smoking exposure dose (3), so in this research we aimed to detect the decrease in semen quality is due to the direct nicotine effect or to another substance existing in the cigarette smoking and we used *in vitro* model to imagine the possible mechanism of its effect.

Specimens and Methods:

Specimens:

This study included 100 semen specimens of non-smoking fertile men, who were referred with their pregnant partners to the reproductive Medicine Center which care for pregnant women in Babylon Hospital for Delivery and children (Iraq, Hilla)

These samples were obtained via masturbating and next liquefaction, Microscopic analysis was achieved on these samples, microscopic analysis consist of: Concentration of Sperm , Sperm Motility Percentage, Grade of Motility and Abnormal Sperm Morphology Percentage which was completed by one technician and depending on exact methods acclaimed by the World Health Organization (4)

Methods:

Each specimen (2ml) was divided equally into four sections in four tubes. Each tube contains 0.5 ml of semen and all 4 tubes were treated according to a previous study (5) ,these 4 tubes were covered with layer of sperm incubation media provided with: 0 mg /ml of nicotine (control) , 1 mg/ ml , 1.5 mg/ ml and 2 mg/ ml of nicotine. These tubes incubated at 37°C and after sperm swim up in the sperm incubation media, microscopic examination was performed at three periods of incubation 30,45 and 60 minutes.

Statistical Analysis: It was done by using SPSS software: mean, standard deviation, chi-square and One-way ANOVA. Significance considered at $P \leq 0.05$.

Results: As shown in Figure 1 (at 30 minutes of incubation period): grade D (immotile sperm) increased form 30 % in control to 72 % in 2 mg /ml treatment and 52% in 1.5 mg /ml treatment.

Grade A+B (progressive motile sperm) reduced from 58 % in control to 12 % in 2 mg /ml treatment and 28 % in 1.5 mg /ml treatment.

Figure 2 (at 45 minutes of incubation period): grade D (immotile sperm) increased form 25 % in control to 81 % in the 2 mg /ml treatment and 64 % in 1.5 mg /ml treatment.

Grade A+B (progressive motile sperm) reduced from 60 % in control to 10 % in 2 mg /ml treatment and 24 % in 1.5 mg /ml treatment.

Figure 3 (at 60 minutes of incubation period): grade D (immotile sperm) increased form 15 % in control to 90 % in 2 mg /ml treatment and 75% in 1.5 mg /ml treatment.

Grade A+B (progressive motile sperm) reduced from 68% in control to 3% in 2 mg/ml treatment and 7 % in 1.5 mg /ml treatment.

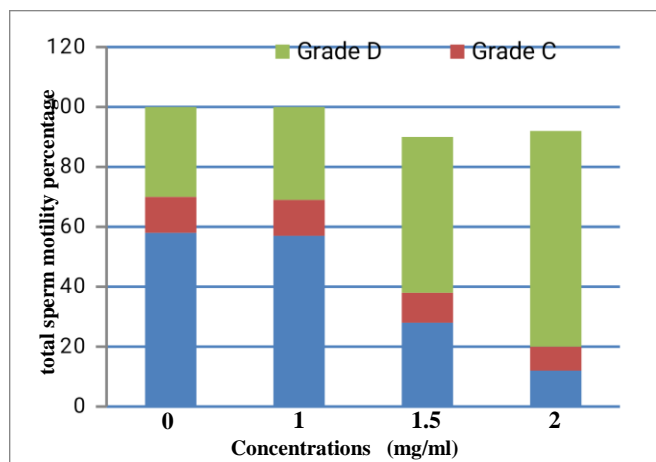


Figure (1): Sperm motility and grade of motility in all treatments of nicotine at 30 minutes of incubation period.

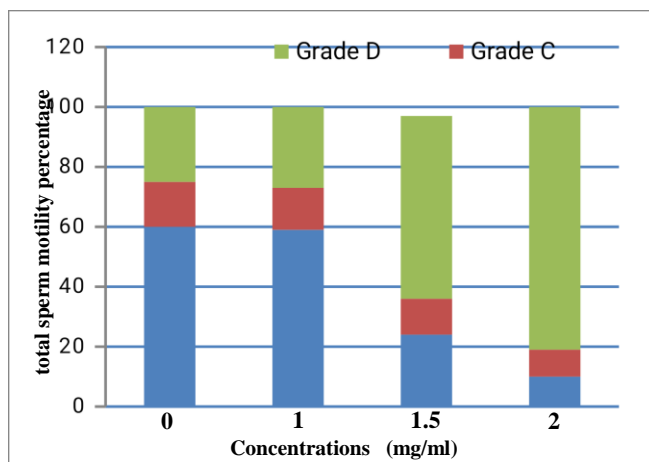


Figure (2): Sperm motility and grade of motility in all treatments of nicotine at 45 minutes of incubation period.

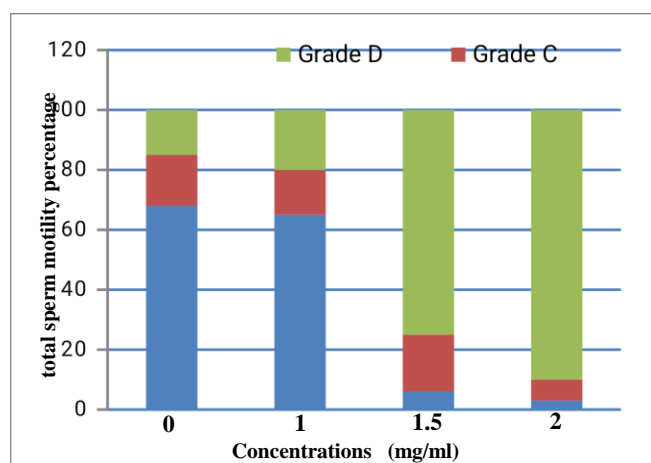


Figure (3): Sperm motility and grade of motility in all treatments of nicotine at 60 minutes of incubation period.

The result of this study did not reveal any significant difference in Sperm Concentration and Abnormal Sperm Morphology percentage among different nicotine treatments and control for all incubation periods. Figures 4,5,6,7,8 and 9.

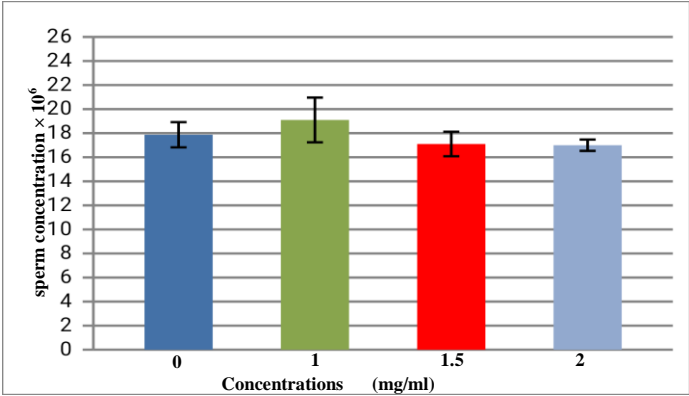


Figure (4) : Sperm concentration in all treatments of nicotine at 30 minutes of incubation period.

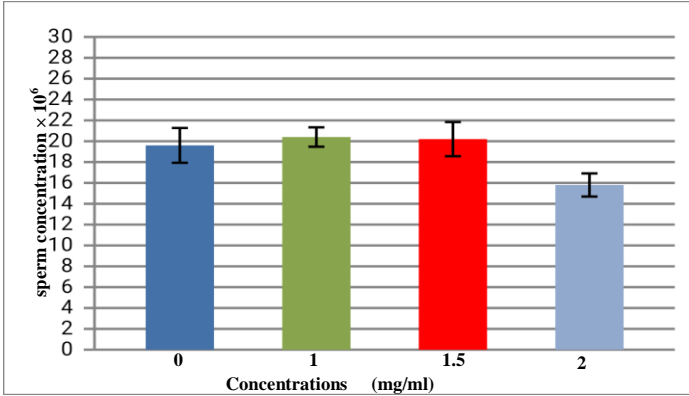


Figure (5) : Sperm concentration in all treatments of nicotine at 45 minutes of incubation period.

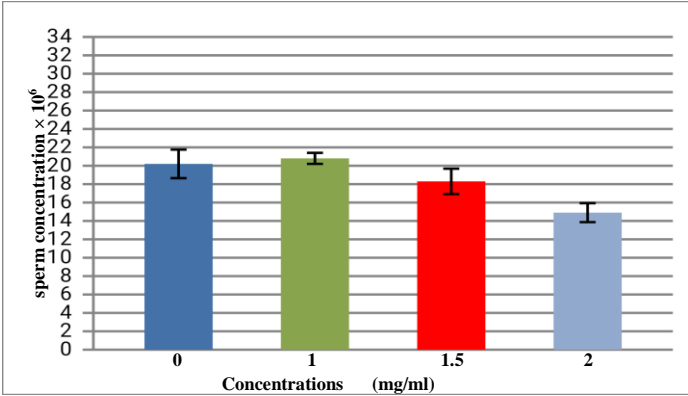


Figure (6) : Sperm concentration in all treatments of nicotine at 60 minutes of incubation period.

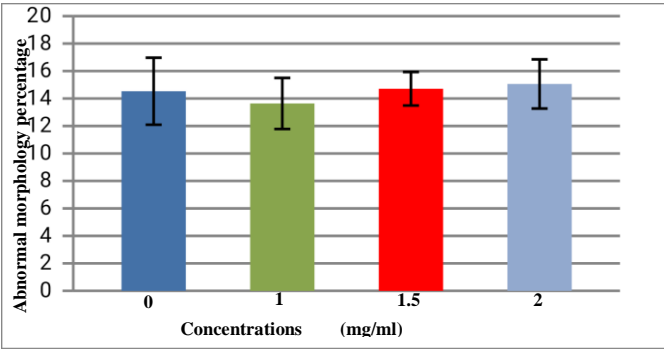


Figure (7) : Abnormal sperm morphology percentage in all treatments of nicotine at 30 minutes of incubation period.

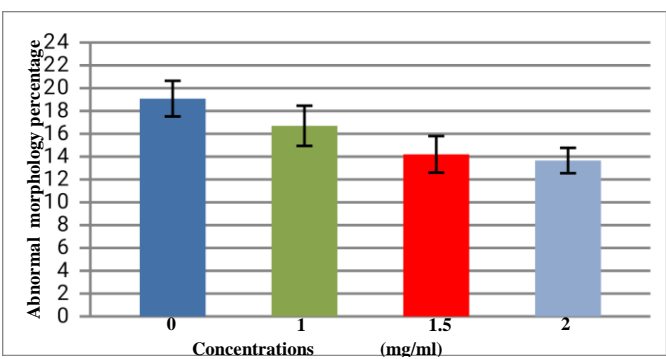


Figure (8) : Abnormal sperm morphology percentage in all treatments of nicotine at 45 minutes of incubation period.

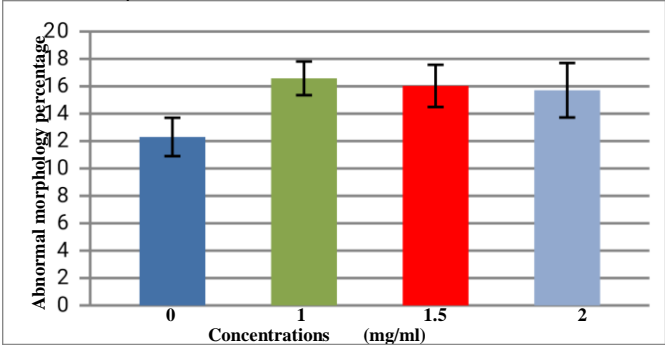


Figure (9) : Abnormal sperm morphology percentage in all treatments of nicotine at 60 minutes of incubation period.

Discussion :

The results of this study illustrate that nicotine had an adverse effect on spermatozoa motility percentage and grade of motility and this influence depends on nicotine concentration as illustrate in figures 1, 2 and 3, this result agree with several studies which have reported the influence of tobacco smoke on reducing the quality of semen via inspiring oxidative stress, damage of nucleic acid finally apoptosis of sperm cells (5-10), other study have stated that nicotine effect is due to its ability to interrupt the testicular microcirculation and reducing the number of red blood cells which can reach the testis to provide oxygen for respiration (9).

According to this *in vitro* model investigation, We may possibly can attribute the nicotine adverse influence on spermatozoa motility through its direct effect on the reliability of sperm membrane, mitochondrial membrane and impair the function of mitochondrial and consequently the motility and progressive motility of sperm with higher concentrations of nicotine.

In conclusion :the present research revealed that high concentrations of nicotine (1.5and 2mg/ ml) have deleterious effect on sperm motility percentage and progressive motility (grade A + B), but low nicotine concentration (1 mg / ml) has no effect and there is no effect on sperm concentration and abnormal sperm morphology percent in compare to control.

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