Medical Technology Journal of Applied Science (MTJAS)

Volume 2, Issue 1, 2026, Page No: 20 - 26
Website: https://mtjas.com.ly/index.php/mtjas/index

The Effect of Smoking on the Thyroid Gland Tissue, an Experiment Study on Thyroid Gland Tissues on Bulbs Mice

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Received: January 14, 2026	Accepted: February, 01, 2026	Published: February,02, 2026

Abstract:

Background: To investigate the harmful effects of cigarette smoking on thyroid tissue, focusing on both the functional and structural impacts. By examining data from human participants and utilizing an experimental model with bulb mice. Despite existing studies indicating a potential link between cigarette smoking and thyroid dysfunction, there remains a lack of comprehensive understanding regarding the specific harmful effects of smoking on thyroid tissue. **Objectives:** The primary aim of this study was to investigate the harmful effects of cigarette smoking on thyroid tissue. To investigate the histological effects of smoking on thyroid tissue. to analyze the relationship between the collected participant data (demographics, smoking habits) and the histological and hormonal findings in bulb mice. To raise awareness of smoking's impact on endocrine health. **Methods:** The methodology was designed to assess both the functional and structural impacts of smoking on the thyroid gland. Participant Data Collection To inform the experimental design, data were collected from 100 participants using a structured questionnaire analyzed using spas experimental design. **Results:** The results of this study showed that all the people participating in the sample were between 18 and 67 years old. A large group of 34 individuals indicated that they consume between 11 and 20 cigarettes per day. The results were regarding the preferred times for smoking; most individuals agreed on all times. The preferred brand for most individuals was Oris with a percentage of 90%. The results showed that smoking has an effect on the functional activity of the thyroid gland in the bulbs mice. The result of the control group was a normal follicular structure with a healthy colloid content, which indicates that the thyroid gland is functioning properly. The results of the experimental group were the presence of significant histological changes and the appearance of mild to moderate follicles with a decrease in the size and number of thyroid follicles and is exposed to pressure and damage as a result of cigarette smoke. **Conclusion:** A significant adverse effects cigarette smoking has been shown to have detrimental effects on thyroid health, impacting both its structure, function and histological changes. The study revealed notable histological alterations in the thyroid tissue of bulb mice exposed to cigarette smoke, including follicular atrophy, decreased colloid content, and increased inflammatory cell infiltration. The hormonal analysis indicated decreased levels of thyroid hormones (T3 and T4) and elevated thyroid-stimulating hormone (TSH) levels, suggesting impaired thyroid function due to smoking. The findings highlight the need for increased awareness of the risks associated with smoking, particularly concerning endocrine health and thyroid dysfunction.

Keywords: Cigarette Smoking, Thyroid Gland Tissues, Bulb Mice**,** Thyroid Hormones (T3 And T4) And Thyroid-Stimulating Hormone (TSH).

Introduction

The thyroid gland is a small gland about 5 cm long and produces the main hormones important in regulating the metabolism and metabolic processes of the body and the functions of organs (Tallini, G *et al*., 2018) and (Khan, Y *et al*., 2019). Therefore, when a problem or disorder occurs in the function of the thyroid gland, a malfunction occurs in all body functions as a result. Smoking is one of the factors that affect the functions of the thyroid gland (Bartalena, L *et al*., 1995) and (McDermott, M. T. (2019). The harms of smoking have become known to everyone, as it is one of the important serious factors in the occurrence of several diseases, including atherosclerosis, obstructive pulmonary diseases, some cancers, and other diseases. As for the relationship

between smoking and thyroid diseases (Kim, S *et al*., 2019). Studies have shown that smoking plays an important role in the emergence of immune-mediated thyroid diseases. It is one of the most common gland diseases, as it attacks thyroid cells with antibodies secreted by the body's immune system. It leads either to the destruction of these cells or to the stimulation cells (Pontikides, N *et al*., 2002) and (Mohácsik, P *et al*., 2018). For this reason, we want to conduct a study on the effect of smoking on thyroid tissue. The T3 hormone "triiodothyronine" affects many physiological processes in the human body, including growth and representation, in addition to regulating body temperature and heart rate, the production of triiodo thyronine represents only 20% of the percentage of thyroid hormones (Hajioun, B *et al*., 2014) and (Sawicka-Gutaj, N *et al*., 2014). Thyroid hormones act as fat hormones by entering directly into the cytoplasm to bind to their receptor her own. Where they cause DNA to be synthesized to obtain m-RNA Necessary to stimulate the synthesis of the enzymes needed to complete the function of hormones related to energy generation. Thyroid hormone regulates a wide range of genes after activated by the prohormone (Vliet, G. V. (2003) and (Gereben, B *et al*., 2008). The thyroid hormones have three major effects: 1. Metabolic effect. 2. Stimulation of growth and development in children. 3. Effect on various body functions (Wass, J *et al*., 2011) and (Almomani, A *et al*., 2022). Smoking defined as a chemical toxicity it contains many toxic materials the most famous nicotine carbon monoxide and thiocyanate, which is able to cause detrimental effects either of acute or chronic type on different structure of the body (Wiersinga, W. M. (2013)). Nicotine affects many body systems as a result of it is rapid spread in these systems like cardiovascular system, respiratory system and glands target organs (Bertelsen, J *et al*., 1994) and (Utiger, R. D. (1998)). The smoke contains over7000 chemical many of which are toxic and harmful. These harmful substances enter the bloodstream through the lungs and are transport to various oragns, affecting multiple systems. Nicotine and other chemicals increase heart rate and blood pressure. Which increasing risk of heart attacks and strokes. and heightens the risk of lung cancer (Buras, A *et al*., 2014). The immune system is also compromised, with smoking reducing the effectiveness of immune responses and increasing susceptibility to infections and chronic inflammation. causing wrinkles, a sallow complexion, and slow wound healing. The cumulative damage from these mechanisms underscores the severe and widespread impact of smoking on the body (Filis, P *et al*., 2018). The primary aim of this study was to investigate the harmful effects of cigarette smoking on thyroid tissue. To investigate the histological effects of smoking on thyroid tissue. To analyze the relationship between the collected participant data (demographics, smoking habits) and the histological and hormonal findings in bulb mice. To raise awareness of smoking's impact on endocrine health.

Material and methods

This study aimed to investigate the harmful effects of cigarette smoking on thyroid tissue by conducting an experimental analysis using bulb mice. The methodology was designed to assess both the functional and structural impacts of smoking on the thyroid gland.

Place of Study

This experiment was conducted at the Higher Institute for Medical Sciences and Technology, Abu Salim, where we targeted the institute’s laboratory to conduct the experiment completely. The tissue samples were then sent to the laboratory for tissue and cell analysis Histopathology laboratory in Tripoli (AlNoran laboratory).

Tools And Devices

Animal weighing scale (electronic scale), Cages for breeding mice, food for mice, medical gloves, masks, medical alcohol, Dissection tools, Capillary tube, test tubes.

Materials

smoking, Paraffin wax, Formalin, hematoxylin Eisen staining, bulbs mice.

Study population

Participant Data Collection To inform the experimental design, data were collected from 100 participants using a structured questionnaire analyzed using spas experimental design. A total of 12 male bulb mice, with weights ranging from 24g to 30g, were divided into four groups, each containing three mice. The mice were housed in plastic boxes equipped with ventilation holes and side openings for the manual introduction of cigarette smoke via hand pumps. 1. Control Group: The control group consisted of three male mice that were maintained in isolation from the other groups. These mice were provided with water and their standard feed, ensuring they were not exposed to any cigarette smoke. 2. Experimental Groups: The first, second, third groups were

subjected to controlled exposure to cigarette smoke. The exposure protocol for the second group involved manually pumping cigarette smoke into their plastic boxes for 40 minutes, with one cigarette introduced every 10 minutes, followed by a 20-minute interval of fresh air. This process was repeated five times daily for a duration of 10 days. Following the exposure period, blood samples were collected for biochemical analysis, and the mice were subsequently euthanized for anatomical examination to extract the thyroid glands. The same exposure protocol was applied to the third and fourth experimental groups, with the duration of exposure extended to 20 days for the third group and 30 days for the fourth group. The control group was also euthanized at the end of this period for comparative analysis.

Time limits

This study lasted for a period of three months, starting from the end of April 2024 to June 2024 , during which data were collected.

Sample Collection and Histological Analysis

Thyroid samples were carefully excised and placed in tubes containing a preservation solution. The samples were retained for three days to ensure proper fixation before being transferred to the laboratory for histological analysis. In the laboratory, the thyroid tissues were subjected to staining with hematoxylin to facilitate microscopic examination. The samples were then analyzed under a microscope to detect any structural changes or damage to the thyroid tissues resulting from cigarette smoke exposure.

Data Collection and Analysis

The study utilized data on smoking brand preferences and daily cigarette consumption from 100 participants to inform the experimental design. The comparative analysis between the experimental and control groups aimed to elucidate the relationship between smoking and thyroid gland health, focusing on both functional and histological outcomes. The data were analyzed using statistical software SPSS version 25.

Results and discussion

Demographic characteristic of participants

Age of participants

The results of the study regarding the age and smoking initiation are as follows. The average age of the participants was 36.37 years, with a standard deviation (SD) of 13.06 years. The ages ranged from a minimum of 18 years to a maximum of 67 years. Participants reported starting smoking at an average age of 18.33 years, with a standard deviation (SD) of 3.54 years. The age at which participants began smoking varied, with a minimum age of 12 years and a maximum age of 30 years, as in Table 1.

Table 1: Age Distribution and Smoking Onset Among Participants.

Variable	Mean	SD	Min (years)	Max (years)
Age	36.37	13.06	18	67
Age When You Started Smoking	18.33	3.54	12	30

Daily Cigarette Consumption

Among the respondents, 2 individuals reported smoking between 1 to 5 cigarettes per day, which accounts for 2.0% of the total 22 participants. A larger group, consisting of 23 respondents, indicated that they smoke between 6 to 10 cigarettes daily, representing 23.0% of the total. The most significant portion of respondents, 34 individuals, reported consuming between 11 to 20 cigarettes per day, constituting 34.0% of the total. Additionally, 17 respondents stated they smoke between 21 to 30 cigarettes daily, making up 17.0% of the total. Finally, 24 individuals reported smoking more than 30 cigarettes a day, representing 24.0% of the total participants, as in Figure 1.

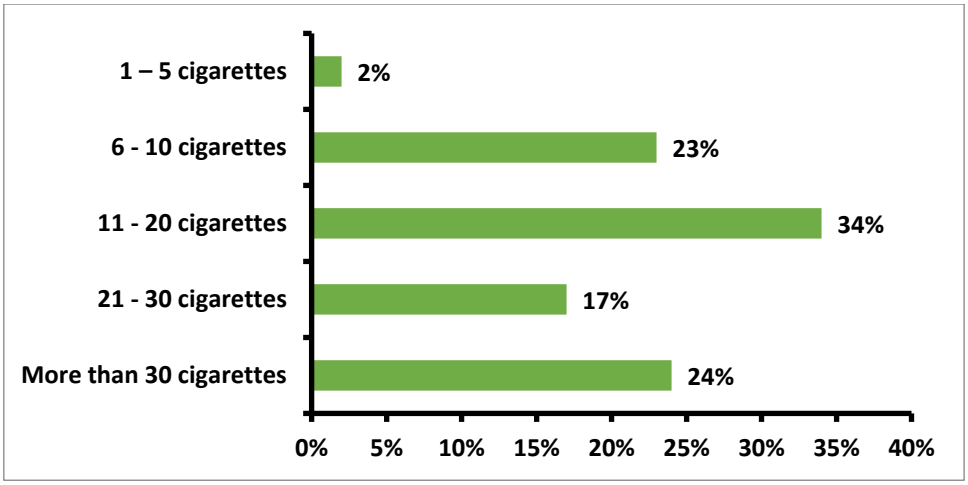

Figure 1: Daily Cigarette Consumption

Preferred Times to Smoke

The survey results regarding preferred times to smoke are summarized as follows: In the morning period, 42 respondents indicated that this is their favorite time to smoke, accounting for 42.0% of the total participants. The afternoon period was chosen by 10 respondents, representing 10.0% of the total. During the evening period, 14 individuals reported this as their preferred time to smoke, constituting 14.0% of the total. In contrast, 34 respondents favored the night period, making up 34.0% of the total. Additionally, 1 respondent indicated a preference for smoking at 5:00, which represents 1.0% of the total participants, as in Table 2.

Table 2: Preferred Times to Smoke.

Preferred Time to Smoke	Frequency	Percentage
Morning Period	42	42.0%
Afternoon Period	10	10.0%
Evening Period	14	14.0%
Night Period	34	34.0%
Total	100	100.0%

Favorite smoking brand

The survey results regarding smoking brand preferences are presented below: • Oris Cigarettes: 90 respondents, representing 90.0% of the total participants. • Other Types: 10 respondents, constituting 10.0% of the total participants, as in Figure 2.

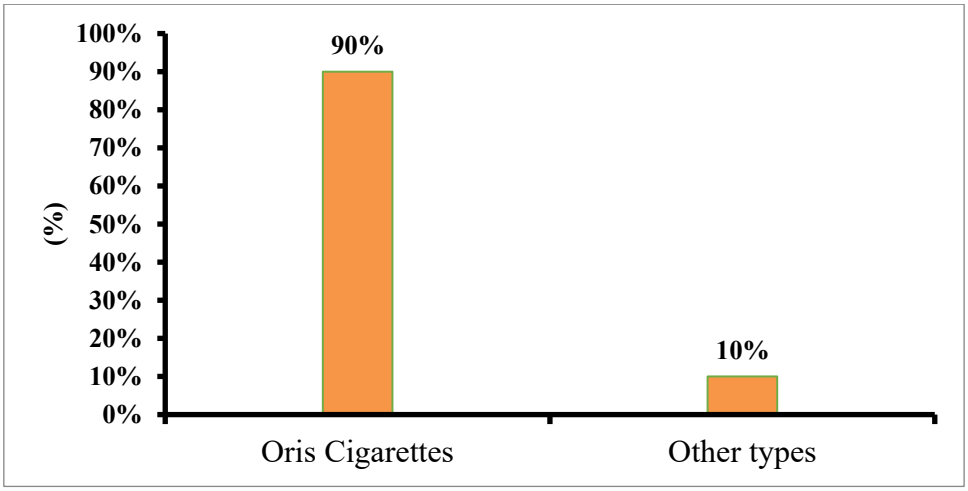

Figure 2: Distribution of Smoking Brand Choices.

Assess the Impact of Smoking on Thyroid Function

To evaluate how exposure to cigarette smoke affects the functional activity of the thyroid gland in bulb mice. 1- Control Group Histology: The control group exhibited normal follicular structure with healthy colloid content. This indicates that the thyroid gland was functioning properly, with intact follicles that are essential for hormone synthesis and storage. The presence of healthy colloid suggests adequate production and storage of thyroid hormones (T3 and T4), reflecting normal thyroid physiology. As in figure 3.

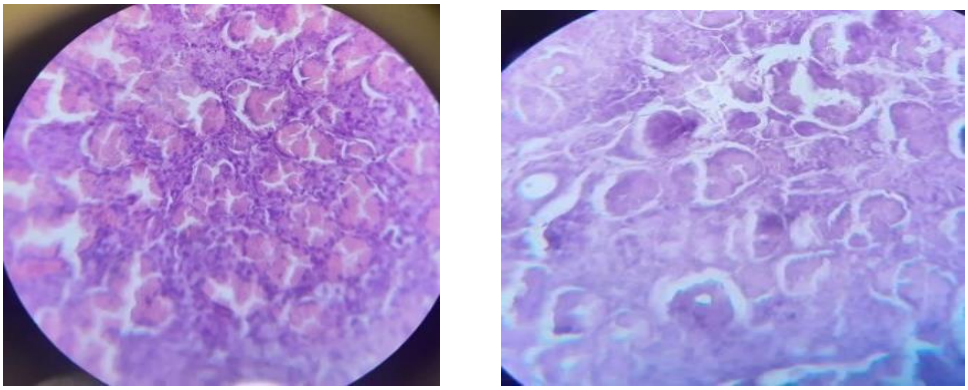

Figure 3: Represents the thyroid gland tissue in control group

Experimental first Groups Histology

The first group exhibited normal follicular structure with healthy colloid content. This indicates that the thyroid gland was functioning properly, with intact follicles that are essential for hormone synthesis and storage. The presence of healthy colloid suggests adequate production and storage of thyroid hormones (T3 and T4), reflecting normal thyroid physiology. As in figure 4.

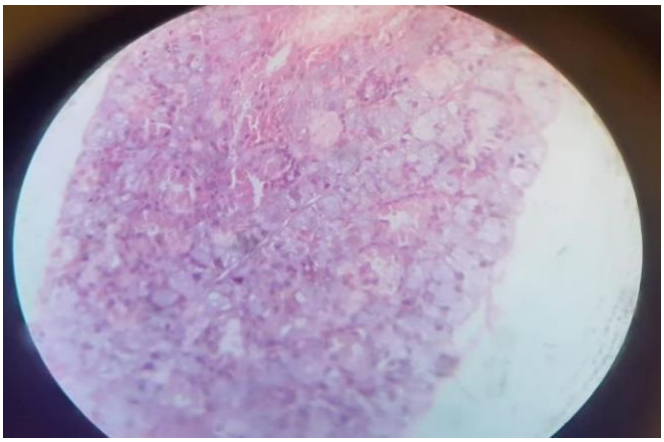

Figure 4: Represents the thyroid gland tissue in first group

Experimental Groups Second and third Histology

In contrast, the experimental groups included three mice for each of the two groups displayed significant histological changes, which include: mild to moderate follicular *atrophy*. The presence of follicular atrophy indicates a reduction in the size and number of thyroid follicles. This suggests that the thyroid gland is undergoing stress or damage, likely due to the toxic effects of cigarette smoke. Follicular atrophy can lead to decreased hormone production, contributing to the observed reductions in T3 and T4 levels. Decreased colloid content. The reduction in colloid content within the follicles signifies impaired hormone synthesis and storage. Colloid is essential for the production of thyroid hormones, and its depletion indicates that the thyroid gland is not functioning optimally. This finding aligns with the decreased levels of T3 and T4 observed in the experimental groups. As in figure 5.

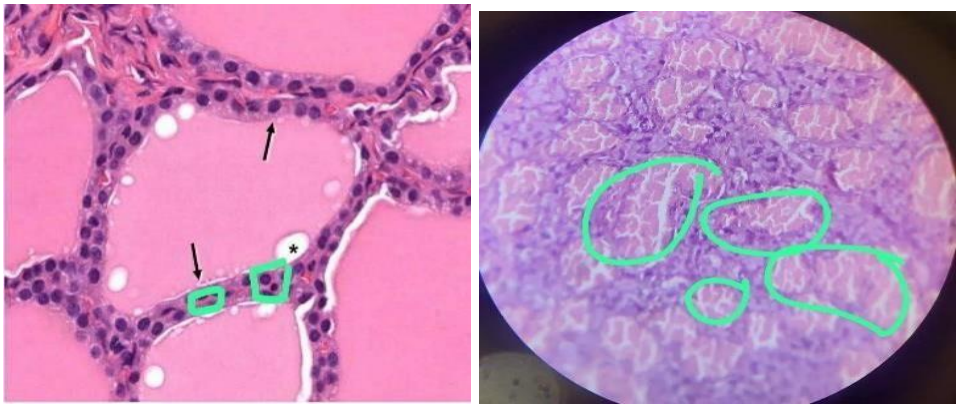

Figure 5: Represents the thyroid gland tissue in second and third group

The results of the study showed regarding the age and smoking initiation the minimum age of smokers was 18 years, i.e. standard score of 13.6, while the maximum age was 67 years. As for the age at which smoking began, the results of the study showed that the minimum age was 12 years, while the maximum age was 30 years. The results of the study also showed regarding the number of cigarettes consumed per day by individuals: between 1-5 cigarettes per day was 2 people, representing 2.0% of the totals, and between 6-10 cigarettes per day, 23 people were representing 23.0% of the totals, while the bulk of people smoked between 11- 20 cigarettes per day. This represents 34.0% of the total participants in these samples. While the number of people who smoke more than 30 cigarettes per day was 24 people, which represents 24.0 of the totals. As for the preferred times for smoking among the people participating in the sample, the results showed that the morning period is the preferred period for people to smoke, and it was a percentage of 42% out of the total participants. As for the preferred brand of smoking among the participants in the sample, the results showed that Oris cigarettes had the highest percentage, as it was a percentage of 90% out of A total of 10% participants were other types. In this study, we conducted an applied study to study the effect of smoking on thyroid tissue. Through this study, we reached the following results: The control group that was not exposed to complete inhalation of smoke, which was dissected and then examined the thyroid tissue of this group under the microscope, showed that the follicular thyroid cells natural with a healthy colloidal content, meaning that the thyroid gland is working properly. The three mice of the first group had cells that were exposed to inhaling whole smoke and were dissected and then the thyroid 30 tissue was examined under a microscope. Normal follicular cells with healthy colloid content, meaning the thyroid gland is functioning properly. As for the three mice for each of the second and third experimental groups, they were exposed to complete inhalation of smoke and were dissected and then the thyroid tissue was examined under the microscope for these groups. The results showed that exposure to cigarette smoke leads to significant structural alterations in the thyroid gland. Potentially leading to dysfunction and impaired hormone production. Where decreased T3 and T4 levels were observed alongside elevated TSH levels. The results were one of the aims of the study that we wanted to achieve investigate the harmful effects of cigarette smoking on thyroid tissue. the first study was address relationship between the tobacco smoking and thyroid function, the aim of this study was to explore how tobacco consumption effect thyroid hormone level. this study was conducted on population-based sample, the Result of this study was there is a decrease in the level of thyroid hormones (Åsvold, B *et al*.,2007). The study was address the effect of smoking on the thyroid gland tissues. the aim of this study was to investigate the harmful effects of cigarette smoking on thyroid tissues. This study was conducted on experiment on bulbs mice to examine thyroid gland tissue after exposing them to full smoke inhalation they were them dissected.

Conclusion

Conclusion Significant Adverse effects cigarette smoking has been shown to have detrimental effects on thyroid health, impacting both its structure and function. Histological changes the study revealed notable histological alterations in the thyroid tissue of bulb mice exposed to cigarette smoke, including follicular atrophy, decreased colloid content, and increased inflammatory cell infiltration. The hormonal analysis indicated decreased levels of thyroid hormones (T3 and T4) and elevated thyroid stimulating hormone (TSH) levels, suggesting impaired

thyroid function due to smoking. The findings highlight the need for increased awareness of the risks associated with smoking, particularly concerning endocrine health and thyroid dysfunction.

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