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THE EFFECTS OF PASSIVE AND ACTIVE SMOKING ON BRACHIAL AND RADIAL BLOOD PRESSURE AND SOME OTHER PHYSICAL FACTORS IN HEALTHY YOUNG ADULTS

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ABSTRACT:
Tobacco smoke is enormously harmful to human health, there's no safe way to smoke. The primary objective of this study is to analyze the role of tobacco smoke compounds and their ability to damage the cardiovascular system and, in particular, to interfere with blood pressure (Brachial and radial pressure), heart rate and partly on the percentage blood Oxygen saturation. A new device has been manufactured which is unique for measuring the level of smoke, to obtained privies readings, the device had fixed to the first reference level and starting up from it.
The effect of smoking has been studied on (26) male passive (26) active smoker volunteer, (14) female passive and (14) female active smoker participants. The results have been showed that the blood pressure and heart rate has been increased with increasing the number of cigarettes in both genders for passive and active smokers. However, this effect for male was more pronounced comparing with females for passive and active smokers. In the case of oxygen saturation concentration percentage, for males the change of oxygen concentration percentage was not stable. In other words, it was fluctuated with the number of cigarettes. But for females the oxygen concentration was decreased but not too much. This means that this effect was not pronounced. this study found that the most pronounced effect has been shown by male's comparison to females for both passive and active smokers.
As well as in nonsmoker's males, the relation between heart rate and smoke level is inversely proportional. While in male and female smokers and female nonsmokers the relation is proportional. In all cases the relation between the smoke level and time of smoking is inversely proportional.
Finally, males& females are affected differently by tobacco use; the sensitivities to smoke for males are higher than in females for passive and active smokers in both brachial and radial blood pressure measurement.

Keywords: Passive and Active Smoking, Brachial, radial Blood pressure, Physical Factors, Young Adults.

1. INTRODUCTION

There is no specific history for smoking according to the known resources, but many books and references determined an approximate history of the smoking to 5000-3000BC.by ancient Americans [1]. Tobacco was primarily used for healing, medical reasons by the natives and for enjoyment [2].
Cigarette smoke is a complex mixture of over 4000 chemicals [3]. These chemicals are presented as: gases, such as carbon monoxide, hydrogen cyanide, nitrogen oxides. Liquid vapors, such as formaldehyde, methane, benzene, ammonia, acetone. Part of tiny solid particles, such as phenols, nicotine, and naphthalene [4, 5]. Thirty metals have been detected in tobacco smoke, as well as radioactive compounds such as polonium 210 and potassium 40 [4].
Once inhaled into the lungs, many of these chemicals pass through the lungs walls into the blood stream, and are distributed through the body [5].
There are several previous studies on the same topic done in different countries. Jensen and Frederiksberg found that cigarette smoking increases heart rate, arterial blood pressure, and plasma catecholamine levels. In healthy subjects, the increase in heart rate occurs in the absence of peripheral vasoconstriction [6]. Manfred S. Green and his freands studied cigarette smoking related to ambulatory blood pressure and heart rate. They found that in younger subjects, both resting and ambulatory blood pressures are lower in smokers than in nonsmokers. However, the reduced differences in the ambulatory compared with the resting measures suggest that the lower resting blood pressures in smokers may be at least partly dependent on posture at the time of measurement or could reflect a certain rebound effect following temporary cessation of smoking [7]. Eric T. Moolchan with some researcher found blood pressure, heart rate, and exhaled carbon monoxide concentrations were measured before and after smoking. Additionally, mean puff volume (ml), puff duration (sec) and maximal puff velocity (ml/sec) during smoking were also determined. No significant ethnic differences were observed in either smoking topography or acute cardiovascular response to smoking [8]. Mikail with his team Founds that passive smoking has a remarkable acute effect on heart rate and blood pressure in healthy young females. Besides carboxy hemoglobin level is closely correlated with the systolic blood pressure and moderately correlated with heart rate and diastolic blood pressure measurements as shown previously [9]. George Papathanassiou with his team found that smoking affects the resting and exercise heart rate (HR) responses in both male and female young smokers. Smokers had elevated HR rest, a slower HR increase during exercise, impaired ability to reach their age-predicted HR max, and female smokers had an attenuated HR decline during the recovery [10].
The aim of this study is to analyze the role of tobacco smoke compounds and their effects on cardiovascular system and, in particular, to interfere with blood pressure (Brachial and radial pressure), heart rate and partly on the percentage blood Oxygen

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saturation. through this study a new device has been manufactured which is unique for measuring the level of smoke, to obtained privies readings, the device had fixed to the first reference level and starting up from it.

2. MATERIAL AND METHODS

2.1 Instrumentation:

Several instrumentations have been used in this study.

2.1.1. Brachial blood pressure: A sphygmomanometer blood pressure meter is a device used to measure brachial blood pressure.

2.1.2. Radial blood pressure measurement device BC32device is used to measure the blood pressure from the wrist position. It cannot be used on the arm position.

2.1.3. Oxygen saturation %&pulse rate measurement device: Pulse oximeter of type MD300C26 is used to measure the pulse rate and of oxygen saturation% by connecting it to the pointer finger.

2.1.4. Volt craft CO-50 – air quality measuring device: CO-50 measures temperature and air humidity inside the room plus the CO2 rates, and gives an alarm when the set threshold exceeded. Co-50 has light features for quick indication alarm.

2.1.5. Manufacturing device for measuring smoke level (voltage) inside the laboratory: This device was originally manufactured and calibrated for measuring the level of smoke at the beginning, during and after the experiment and converted to voltage level as shown in figure (1), in order to avoid any mistake in readings and it was fixed to the first reference point and starting up from it. The equivalent circuit for the device is shown in figure (2).

Figure 1. Smoke level measuring device in Volte unite

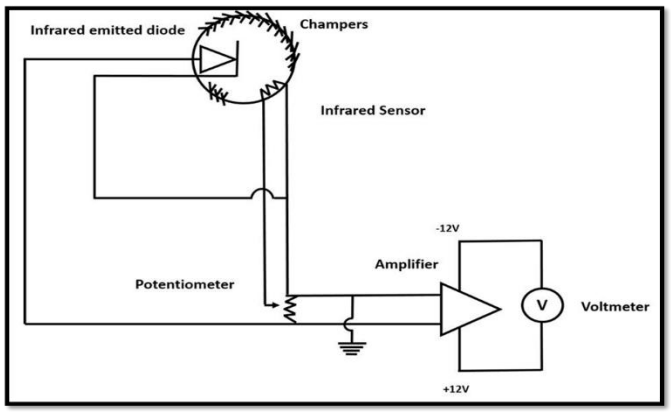

Figure 2. Circuit diagram of Smoke level measuring device in Volte unite

2.2. Subjects under test:

This project is deals with passive and active smokers for both genders (males and females). A special questionnaire form has been prepared for the volunteers who include volunteer's personal information and any complains of previous diseases which may interfere with the test required in the study. A special controlled ventilated laboratory at university of Zakho was used in this study. Subjects are reunited for the test 80 in total which are divided into two groups according to gender 52 males and 28 females, both sample groups were healthy (no respiratory and cardiovascular diseases). Each group consist of 50% smokers (active) and 50% none smokers (passive)**.** The age of the subjects ranged between (23- 33) years old.

The occupations of the subject differ from one to the other. Some of the males worked as governmental employees and others as daily workers at the University of Zakho. As for the females, nearly all they have been working in the smokers Café's in Zakho. The smoking rate of the subject is different from one to the other. Some of them smoked more than of 20 cigarettes per day, while others are smoking 10 – 15 cigarettes a day.

The Subjects were selected on the basis that they have no problems of physiological disorders and blood pressure. Each subject is seated on a comfortable chair; the device is connected to the correct position. The chamber used for collecting sample data consists of (W283 x L28 x H263) cm. it is totally closed and isolated chamber. Each reading consists of 2 samples: active and passive smokers. They sit down in a distance of (15) cm between them, the distance between the sample position and the smoke detector sensor is (110 cm), which lies above the sample. The volt craft lies on (80 cm) in front of the samples position.

The first measurements were taken prior to smoking, then they started smoking for 15 minutes (0-15 -30-45-60 minutes) as shown in figure (3)

Figure 3. The subject under test

3. METHODS AND TECHNIQUES OF DATA COLLECTION

3.1. Blood pressure and heart rate

The data collected for the smoke stimulators for a period time of 15 minutes have been selected before the effect of a certain smoke stimulator when a subject is in a complete stability relax and in a comfortable condition as shown in figure (3). In the same way, the blood pressure was recorded every 15 minutes through one hour (15, 30, 45, and 60 minutes) after the subject has been exposed to certain smoke for each passive smokers and active smokers in both genders.

3.2. Measuring of oxygen saturation percentage in blood

The data of oxygen that have been collected for the smoking stimulator is done by the same techniques followed in sections (3.1). Oxygen saturation% is measured by a pulse oximeter, a device placed on the finger that uses light absorption to indicate the level of saturated hemoglobin.

3.3 Measuring smoke level in the laboratory

As seen in figure (3), when there is no smoke in the champers the infrared detector cannot give a signal. When there is an amount of smoke in the chamber the infrared light will distort or reflect from the smoke. The incident on the infrared sensor will give a signal to the amplifier then to the voltmeter. Of course, if smoke increased, the readings of the voltmeter will be increased as well.

4. RESULTS AND DISCUSSION

The data of the mean brachial and radial blood pressure with standard deviations (±SD) have been drown (4 to 11) respectively.

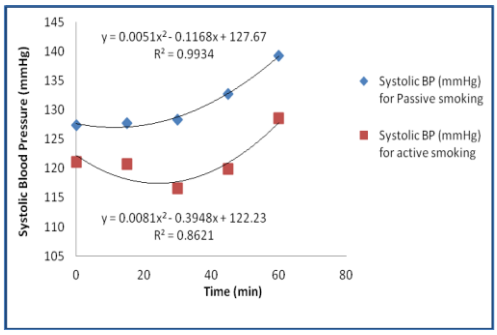

Figure 4. Relation between brachial systolic blood pressure and time for a female passive and active smoker.

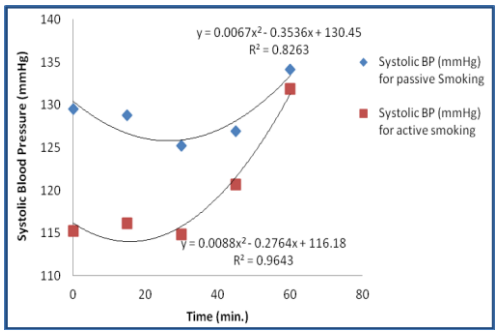

Figure 5. Relation between radial systolic blood pressure and time for a female of passive and active smoker.

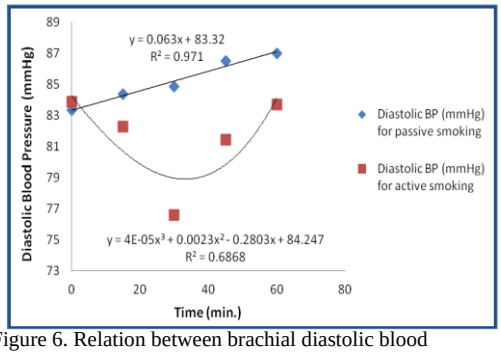

Figure 6. Relation between brachial diastolic blood pressure and time for a female passive and active smoker.

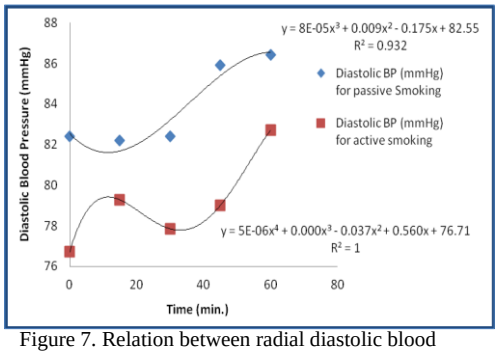

Figure 7. Relation between radial diastolic blood pressure and time for a female of passive and active smoker.

In figure (4), blood pressure rise appears in the systolic brachial BP, maximum which occurs at last period times (60 min). The same is shown in figure (5), (6) and (7). In these figures, it appears that the sensitivity of females to smoke is always increased with increasing the number of smoked cigarettes with the time of smoking.

The addictive effects of smoking on the blood pressure are only partly known, but it is likely that hemodynamic effect of tobacco smoking may contribute to the habituation. It has since long been known that blood pressure increases during smoking. These effects are specifically associated with nicotine while the other components which are more than a thousand have been isolated which they seem to be of minor importance. The rise in blood pressure is due to an increase in both cardiac output and total peripheral vascular resistance.

The fitting equations and correlation coefficient (R2) for brachial systolic BP in female passive and active smoker are Y=0.005x2-0.116x+127.6, R2= 0.993 and Y=0.008x2-0.394x+122.2, R2=0.862 respectively, as shown in figure (4).

But when the data recorded from radial systolic BP in female passive and active smokers, the fitting equations are respectively Y= 0.006x2-0.353x+130.4 with R2 =0.826, and Y = 0.008x2-0.276x+116.1 with R2=0.964, as shown in figure (5).

The relations between the brachial diastolic blood pressure (mmHg) and time (min.) for female passive and active smoker are polynomial in females of the polynomial fitting equation relation Y= 0.063x+83.32with R2 =0.971, and Y = 4E-05x3+0.002x2-0.280x+84.24 with R2= 0.686 respectively as shown in figure (6). The radial diastolic blood pressure (mmHg) and time (minute) for female passive and active smokers are also linear of fitting equation Y= 8E-05x3+0.009x2-0.175x+82.55with R2 =0.932, and Y = 5E-06x4+0.000x3-0.037x2+0.560x+76.71with R2=1 respectively, as shown in figure (7).

It is a paradox that while smoking acutely increases blood pressure; a slightly decrease of blood pressure level has been found among smokers (active smokers) than nonsmokers (passive smokers). Because blood pressure may increase after the cessation of smoking

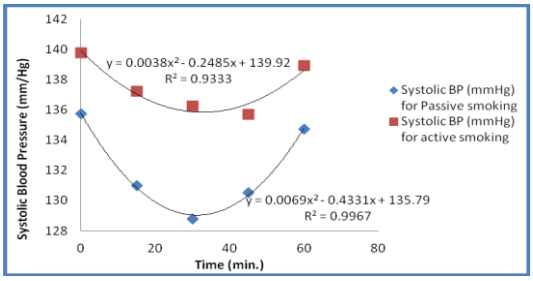

Figure 8. Relation between the brachial systolic blood pressure and time for male passive and active smokers

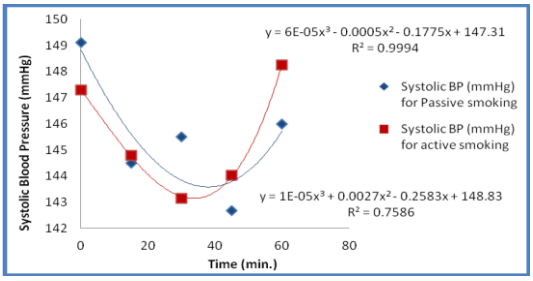

Figure 9. Relation between the radial systolic blood pressure and time for male passive and active smoker.

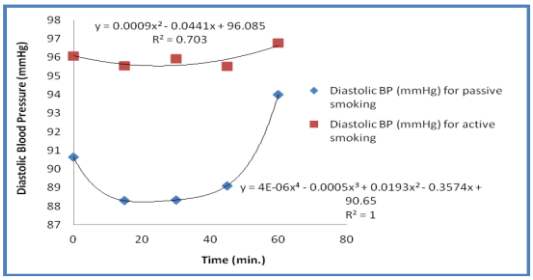

Figure 10. Relation between the brachial diastolic blood pressure and time for male passive and active smokers

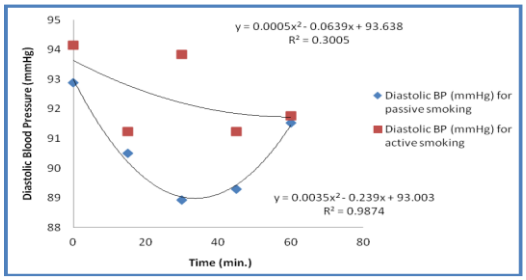

Figure 11. the relation between the radial diastolic blood pressure and time for male passive and active smokers.

In figure (8) the blood pressure rise appears in systolic brachial BP and maximum which occurs at last period times (60 min.). The fitting equations and correlation coefficient (R2) for brachial systolic BP in male passive and active smokers for male are Y = $0.003x^2$-o.248x+139.9, R2=0.933 and Y=$0.006x^2$ 0.433x+135.7, R2=0.996 respectively.

But when the data recorded from radial systolic BP in male passive and active smokers, the fitting equations are respectively Y=6E-05x3-0.000x2-0.177x+147.3 with R2 =0.999, and Y = 1E-05x3+0.002x2-0.258x+148.8 with R2=0.758, as shown in figure (9).

The relations between the brachial diastolic blood pressure (mmHg) and time (minute) for male passive and active smokers are polynomial in males of the polynomial fitting equation relation Y=0.000x2-0.044x+96.08 with R2 =0.703, and Y =4E-06x4-0.000x3+0.019x2-0.357x+90.65 with R2=1 respectively as shown in figure (10). The radial diastolic blood pressure (mmHg) and time (minute) for male passive and active smokers are also linear of fitting equation Y= $0.000x^2$-0.063x+93.63with R2 =0.300, and Y = $0.003x^2$-0.239x+93.00 with R2= 0.987 respectively, as shown in figure (11).

4.1. Heart rate, carbon dioxide (CO2), Smoke level (voltage), and oxygen saturation% (PO2), in passive and active smokers:

The mean heart rate, carbon dioxide (CO2), smoke density (here we will call voltage to represent smoke density meter), and peripheral capillary oxygen saturation% (PO2), for all volunteers and in both groups for the time periods 0, 15, 30, 45and 60 minutes have been drown in figures (12 to 21) respectively.

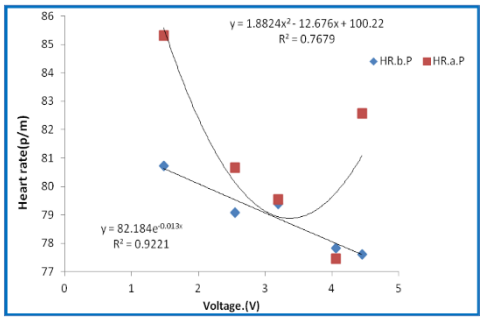

Figure 12. Relation between heart rate (pulse/minute) and voltage (volt) for a male passive smoker.

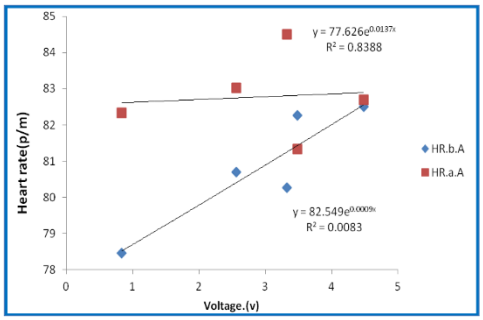

Figure13. Relation between heart rate (pulse/minute) and voltage (volt)for a male active smoker.

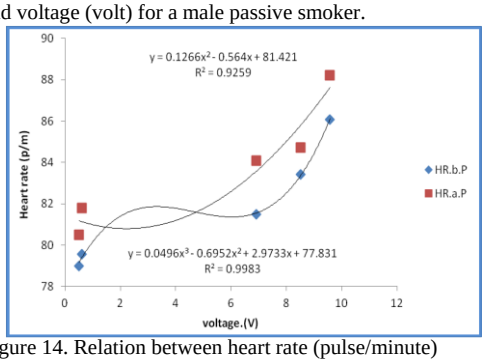

Figure 14. Relation between heart rate (pulse/minute) and voltage (volt) for a female passive smoker.

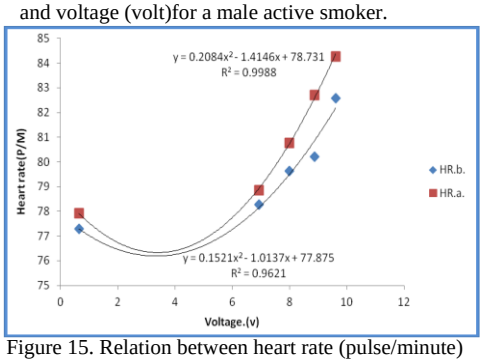

Figure 15. Relation between heart rate (pulse/minute) and voltage (volt)for a female active smoker.

In figure (12), we can clearly see that in passive smoking for male the first cigarette caused an immediate and marked increase in heart rate polynomials with the voltage, and then decreases with increasing the number of smoked cigarettes. It

means that in non-smokers the relation between the heart rate and voltage is inversely proportional. While figures (13), (14) and (15) show increase in heart rate with increasing in smoke level (voltage) .

In figure (12), the fitting equations and correlation coefficient (R^2) for heart rate in a male passive smoker are $Y = 1.882x^2 - 12.67x + 100.2$, $R^2 = 0.767$ and $Y = 82.18e^{-0.01x}$, $R^2 = 0.922$ respectively.

But when the data recorded from the heart rate in a male active smoker the fitting equations are respectively $Y = 77.62e^{0.013x}$, $R^2 = 0.838$ and $Y = 82.54e^{0.000x}$, $R^2 = 0.008$ as shown in figure (13).

However, the fitting equations and correlation coefficient (R^2) for heart rate in a female passive smoker are $Y = 0.126x^2 - 0.564x + 81.42$, $R^2 = 0.925$ and $Y = 0.049x^3 - 0.695x^2 + 2.973x + 77.83$, $R^2 = 0.998$ respectively as shown in figure (14).

While the fitting equations and correlation coefficient (R^2) for heart rate in a female active smoker are $Y = 0.208x2 - 1.414x + 78.73$, $R^2 = 0.998$ and $Y = 0.152x^2 - 1.013x + 77.87$, $R^2 = 0.962$, as shown in figure (15).

This result agrees with Jens Trap-Jensen and Frederiksberg [6].

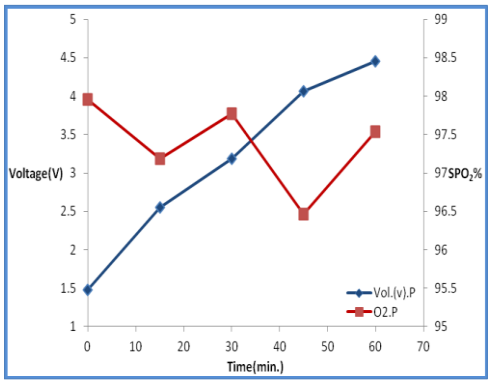

Figure 16. change of CO_2, smoke level (V) and oxygen sat. % with exposure smoking time for a male of passive smoker

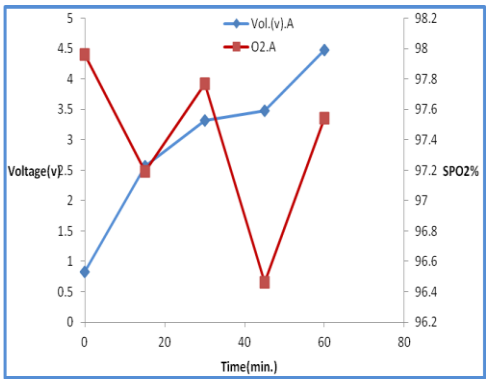

Figure17. change of CO_2, smoke level (V) and oxygen sat. % with exposure smoking time for a male of active smoker.

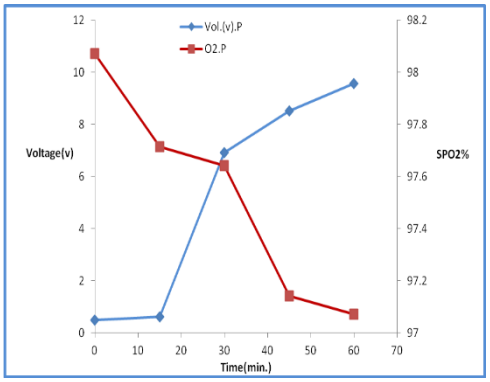

Figure 18. change of CO2, smoke level (V) and oxygen sat. % with exposure smoking time for a female passive smoker.

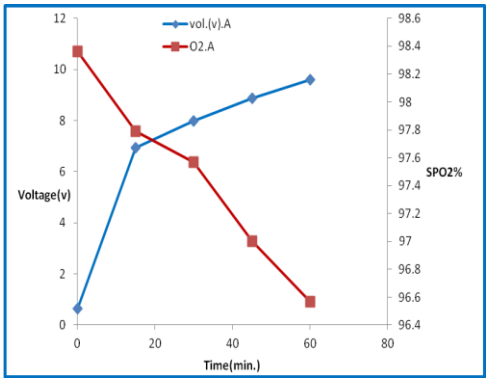

Figure19. change of CO2, smoke level (V) and oxygen sat. % with exposure smoking time for a female active smoker.

Figure (16) shows clearly that for males, peripheral capillary oxygen saturation (PO2) is not stable in another word because it is fluctuated with the time. However, the voltage is increasing significantly with the time. The behavior shown in figure (16) is the same as shown in figure (17).

If we look to the same effect in females, we can apparently observe a big difference with respect to males. That is peripheral capillary oxygen saturation (PO2) is decreased with time, while the voltage is increased with the time, which is not the case with males. This is shown in figures (18) and (19).

4.2. Comparison between males and females sensitivities to smoke in passive and active smokers:

In order to see the difference between males and females sensitivities to smoke in passive and active smokers, we make a chart for radial and brachial systolic and diastolic blood pressure for males and females and for passive and active smokers. Figure (20) shows the relation between brachial and radial systolic blood pressure with time for male and female passive smokers. The figure shows the blood pressure of males is more sensitive to the time with respect to female for the first two cigarettes then female is more sensitive for last two cigarettes in systolic blood pressure. While figures (21), (22), and (23) all show the sensitivity of male is more than that of the females. This can also be observed in the below charts.

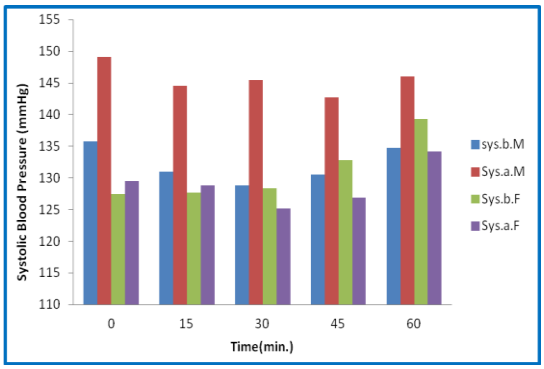

Figure 20. Relation between brachial and radial systolic blood pressure and time for male and female passive smokers.

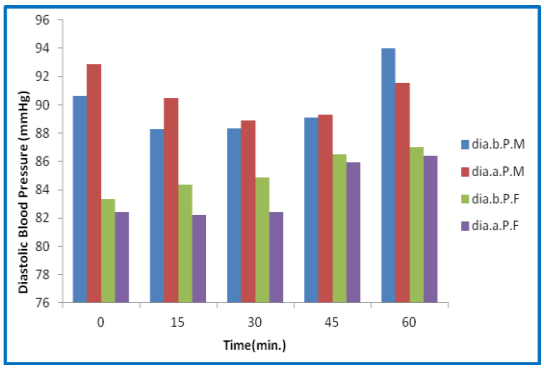

Figure 21. Relation between the brachial and radial diastolic blood pressure and time for male and female passive smokers.

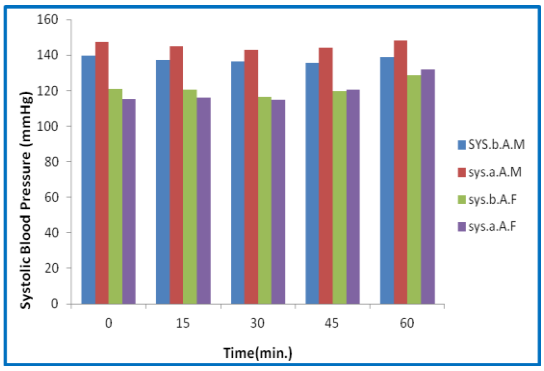

Figure 22. Relation between the brachial and radial systolic blood pressure and time for male and female active smokers.

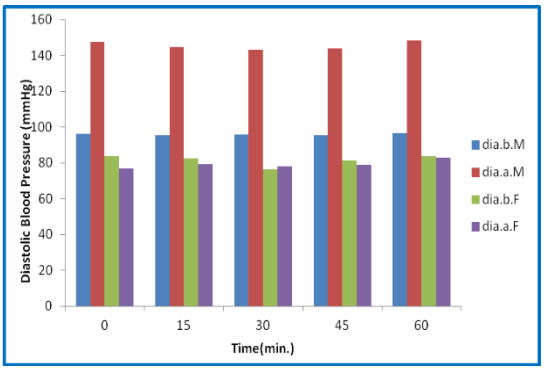

Figure 23. Relation between the brachial and radial diastolic blood pressure and time for male and female active smokers.

Both genders are relevant for tobacco control. While sex refers to the biological differences between women and men, gender refers to the array of the socially constructed roles and relationships, personality traits, attitudes, behaviors, values, relative power and influence that society ascribes to the two sexes on a differential basis. Men and women are affected differently by tobacco use, tobacco messaging, and smoking rates which differ between men and women.

Generally, the sensitivities to smoke for males are higher than for females for passive and active smokers in both brachial and radial blood pressure measurement. The reasons are:

- Men are heavier smoking than women. Male smokers consume an average of 16 cigarettes per day compared with 14 among women smokers.
- Men tend to smoke higher tar cigarettes than women.
- Men smoke more hand-rolled cigarettes than women.
- Women tend to think of cigarettes as their main source of pleasure and 48% smoke to give them confidence in social situations.

The observations that chemical chains of smoking compounds, particularly nicotine, are more strongly reactive according to their spatial shape. Provide study material on a subject not yet well investigated but potentially of positive impact. In my opinion, changing the molecular reactivity of smoking compounds towards the production of less toxic substances could open unexpected positive results for a better control of damage from smoking.

The harmful health effects of tobacco smoke adversely target the cardiovascular system and there is also evidence that death rates are uniformly higher among smokers than among non-smokers in both sexes and whatever the age at the death.

CONCLUSION

Throughout this study the effects of smoking on blood pressure, heart rate, and oxygen saturation% in both genders for active and passive smokers are presented experimentally. The conclusions that have been arrived throughout the study are as:

1. Blood pressure is increased with increasing the number of cigarettes.
2. A lower change in blood pressure levels has been found among smokers (active smoking) than nonsmokers (passive smoking).
3. The most pronounced effect has been shown by male's comparison to females for both passive and active smokers.
4. In nonsmoker's males, the relation between heart rate and voltage is inversely proportional. While in male and female smokers and female nonsmokers the relation is proportional.
5. Regarding to the oxygen saturation %(PO2), it has been found that in males the effect of smoking on PO2 is fluctuated and not stable with the number of cigarettes. However, in females the PO2 is inversely with the number of smoked cigarettes, although this effect was not very large.
6. In all cases the relation between the smoke level and time of smoking is inversely proportional.
7. Males& females are affected differently by tobacco use; the sensitivities to smoke for males are higher than in females for passive and active smokers in both brachial and radial blood pressure measurement.

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