Association between Blood Pressure and Smoking
"Evaluating the Role Age and Smoking Duration"

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الملخص:

تقديم: تشير التقديرات إلى أن ارتفاع ضغط الدم يؤثر على حوالي 40٪ من البالغين فوق سن 25 عامًا على مستوى العالم. في حين أن العديد من عوامل الخطر لارتفاع ضغط الدم معروفة جيدًا ، فإن هذا ليس هو الحال مع التدخين. الأدبيات المنشورة ذات الصلة غير متجانسة، مع ندرة البيانات المحلية ذات الصلة.

الأهداف: دراسة العلاقة بين التدخين ومستويات ضغط الدم وتقدير آثار العمر ومدة التدخين على هذه العلاقة.

طرق البحث: أجريت دراسة مقطعية على 40 عينة ملائمة من اشخاص تتراوح أعمارهم بين 20–60 عامًا من الطلاب وأعضاء هيئة التدريس بالمعهد العالي للعلوم والتكنولوجيا تيجي لهذه الدراسة، تضم 20 مدخن و 20 غير مدخن. كان المدخنون يستهلكون بانتظام 10–20 سيجارة في اليوم لمدة 3 سنوات على الأقل، وتم فحص ضغط الدم الانقباضي (SBP) وضغط الدم الانبساطي (DBP) وضغط النبض (PP) باستخدام جهاز قياس ضغط الدم الرقمي. وتم جمع بيانات العمر والوزن عن طريق استبيان منظم.

النتائج: بشكل عام، ارتبط كل من مستويات ضغط الدم الانقباضي والانبساطي بشكل كبير مع تدخين السجائر في مجموعة الدراسة من المدخنين وغير المدخنين (p = 0.025 و p = 0.048 على التوالي) حيث وجد أنها أعلى لدى المدخنين عنها لدى غير المدخنين. أيضًا، بعد قياس العلاقة بين الطبقات القائمة على العمر ومدة التدخين، ظلت مستويات ضغط الدم الانقباضي والانبساطي مرتبطة بشكل كبير بالتدخين في المرضى الذين تقل أعمارهم عن 30 عامً.

الاستنتاجات: أظهرت نتائج الدراسة ارتباطًا معنويًا للتدخين الإيجابي بمستويات ضغط الدم الانقباضي والانبساطي المرتفعة، على الرغم من أنه بعد التقسيم الطبقي للعمر ومدة التدخين، استمرت هذه العلاقة فقط في المرضى الذين تقل أعمارهم عن 30 عامًا.

Abstract

Background: Hypertension is estimated to affect about 40% of adults above 25 years of age globally. While many of the risk factors of hypertension are well known, such is not the case with smoking. Pertinent published literature is heterogeneous, with a dearth of relevant local data. **Objectives:** was to study the relationship between smoking and blood pressure levels and to assess the effects of age and smoking duration on such a relationship.

Methods: A cross-sectional study was carried out on a total of 40 conveniently sampled. having age's between 20-60 years from the students and staff members of Higher Institute of Science and Technology Tiji were selected for this study. Comprising 20 smokers and 20 non-smokers. The smokers were regularly consuming 10-20 cigarettes per day for at least 3 years.Systolic blood pressure (SBP), diastolic blood pressure (DBP), and pulse pressure (PP) were examined using digital blood pressure measuring device. and The age, wieght data was collected by means of a structured questionnaire.

Results: Overall, both the systolic and diastolic blood pressure levels were significantly associated with smoking of cigarette ($p=0.025$ and $p=0.048$ respectively) where they were found to be higher in smokers than in non-smokers. Also, after Relationship Measurement between the age and smoke duration based stratifications; both the systolic and diastolic blood pressure levels were still significantly associated with smoking.

Conclusions: The study results showed a significant association of positive smoking with higher mean systolic and diastolic blood pressure levels, though after stratifying for age and smoke duration, this relationship persisted only in patients who were male, were <30 Years old.

Keywords: Cigarette smoking, Blood pressure levels, Systolic blood pressure (SBP), Diastolic blood pressure (DBP), Age, Hypertension duration.

Introduction

Hypertension, also known as (high blood pressure), was defined as systolic blood pressure (SBP) of at least 140 mmHg, or diastolic blood pressure (DBP) of at least 90 mmHg, Hypertension was the leading risk factor for global disease burden and accounting for 9.4 million deaths in 2010 (Lim et al, 2010). According to World Health Organization, hypertension is known to increases the risk of various medical conditions such as heart attack, stroke, kidney failure and blindness and is estimated to affect about 40% of adults above 25 years of age and results in 7.5 million deaths annually (WHO, 2013).

The worldwide prevalence of hypertension is estimated and that it consistently increases with age worldwide. Cigarette smoking and hypertension are the two most important long-term risk factors for atherosclerosis, coronary artery disease, acute myocardial infarction and sudden death (Kearney et al, 2005). The acute effect of cigarette smoking is a temporary increase in heart rate and blood pressure with an increase in epinephrine and norepinephrine production due to activation of the sympathetic system (Cryer et al, 1976).

Of the over 4,000 toxic substances identified in cigarette smoking, there is evidence that mainly two, specifically nicotine and carbon monoxide, exert toxic effects on the heart and blood vessels. Both these compounds show their harmful properties by different mechanisms. Nicotine damages cardiovascular system acutely by stereoisomer and receptor binding mechanisms. The first (Dong et al, 1991).

Hypertension has been commonly and is still considered one of the major coronary risk factors, which is often associated with others, including cigarette smoking. In addition, there is evidence that hypertension is one of the most frequent diseases and a leading cause of morbidity and mortality since it is able to cause a large variety of cardiovascular and cerebrovascular complications

(Hughes et al, 1993). Some of these events are strongly associated with cigarette smoke, while others show to be related to the disease that high values in blood pressure can determine.

While many of the risk factors of high blood pressure are well known, such is not the case with smoking. Published literature exploring the association of smoking with hypertension is heterogeneous, and the debate is ongoing with no consensus achieved as of now (Primatesta et al, 2001). However, the relationship between smoking and blood pressure are not univocal, with some studies showing a positive and others an inverse association (Halperin et al, 2008).

Given the importance of smoking of cigarette, Blood Pressure (BP), and their interaction in the determination of cardiovascular risk, we investigated blood pressure (BP) levels among smokers and nonsmokers with evaluating the role age and smoking duration.

Materials and Methods

Participants.

A total of 40 volunteer male subjects, smokers(20) (study group) and nonsmokers(20) (control group); The smokers with the history of smoking for at least three years having age's between 20-60 years from the students and staff members of Higher Institute of Science and Technology Tiji were selected for this study. age, height, weight, and blood pressure were measured.

- Healthy participants were selected (for the purposes of this study, those not previously diagnosed with hypertension).

-Each eligible participant was instructed not to take any stimulant before blood pressure measurement (e.g., coffee and tea) for at least one hour.

Table 1. The frequencies of smokers, non smokers.

Subject	Frequency	Percent%
Smokers	20	50%
Non- smokers	20	50%
Total	40	100%

Blood pressure measured

- Systolic and diastolic blood pressures (BP) were measured twice at 5 min intervals from the left arm after at least 15 min of rest.
- BP values were obtained by the using Digital blood pressure monitor.
- The means of the two measurements were recorded as mean systolic and diastolic blood pressure.

* Pulse pressure (PP) was calculated as the difference between SBP and DBP.

Statistical Analysis

The results were analyzed by the Student's unpaired t test to compare each smoking group with the non-smoking group. All results were analyzed by using Minitab (Version 17), < 0.05 considered as significant level and results were displayed as tables. variables were defined as mean ± standard deviation (SD) and categorical variables were defined as percentages. Independent-Samples T test and analysis of variance (ANOVA) were used for parametric variables at comparison of means and Chi square test in the comparison of levels. We reported our data using mean difference and 95% confidence interval (CI), and we used a P-value threshold of 0.05.

Results

A total of 40 participants were included in this study with the mean age in this study was 42.90 ± 11.77 in group Non Smokers, while was 35.40 ± 10.71 in the group smokers. The mean weight in this study was 78.3 ± 11.3 in group Non Smokers, while was 74.3 ± 30.3 in the group smokers, so the value was (p=0.153 and p=0.700 respectively). (Table 1).

Table 1: Comparison of anthropometric data between smokers and non-smokers.

Parameters	Group (A), Non Smokers (n=20) (mean ± SD)	Group (B), Smokers (n=20) (mean ± SD)	P value
Age (years)	**42.90 ± 11.77**	**35.40 ± 10.71**	**0.153**
Weight (Kg)	**78.3 ± 11.3**	**74.3 ± 30.3**	**0.700**

Smoking Period (years)	**0.00**	**13.50 ± 6.11**	

Table 1, 2 shows age (years), weight (kg), Pulse pressure, PP (mmHg) and heart rate (HR)in nonsmokers, smokers, comparisons showed no significant differences in indices (all P > 0.05).

The study results revealed that while analyzing overall both the systolic and diastolic blood pressure levels were associated with smoking (p=0.025 and p=0.048 respectively) where both these blood pressure levels were found to be higher in smokers than in non-smokers (138.6±12.0 mmHg vs. 123.1±15.6 mmHg and 87.60±9.44 mmHg vs. 87.40±9.90mmHg respectively) (Table 2) (Fig. 1. 2. 3).

Table 2: Comparison of blood pressure levels among smokers and non-smokers (overall).

Characteristics	Non-smokers (mean ± SD)	Smokers (mean ± SD)	T-Value	P-value
Systolic SBP (mmHg)	**123.1 ± 15.6**	**138.6 ± 12.0**	**2.48**	**0.025**
Diastolic DBP (mmHg)	**78.40 ± 9.90**	**87.60 ± 9.44**	**2.13**	**0.048**
Pulse pressure, PP	**44.7 ± 11.4**	**51.00 ± 9.13**	**1.22**	**0.239**
heart rate (HR)	**78.8 ± 11.8**	**83.6 ± 12.7**	**0.87**	**0.394**

SBP: Systolic blood pressure (mmHg), DBP: Diastolic blood pressure (mmHg), PP: Pulse pressure; HR: heart rate, SD: Standard deviation

Data were expressed in mean ± SD form. P<0.05 was considered to be significant.

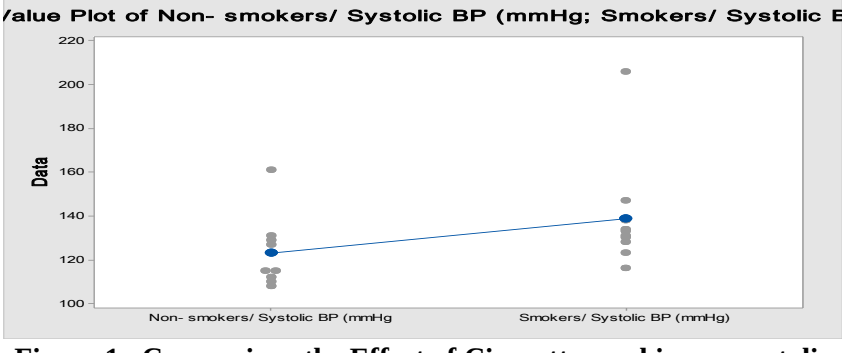

Figure 1. Comparison the Effect of Cigarette smoking on systolic Blood pressure between smokers and nonsmokers.

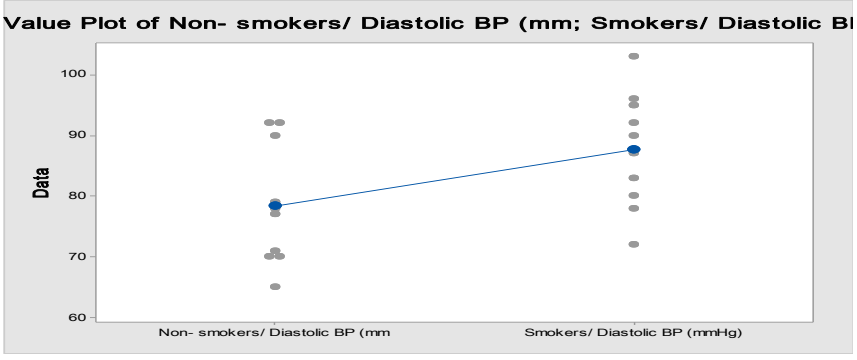

Figure 2. Comparison the Effect of Cigarette smoking on diastolic Blood pressure between smokers and nonsmokers.

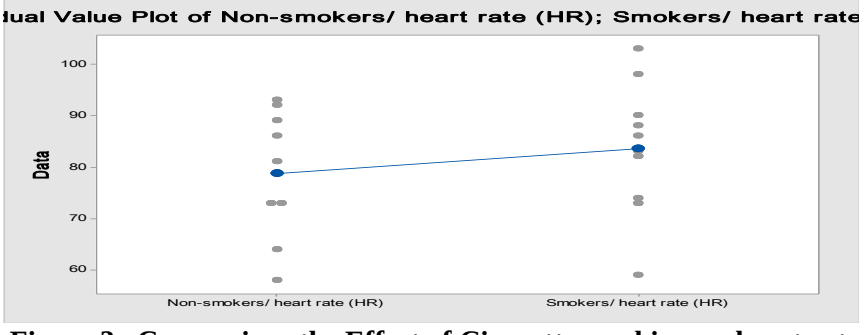

Figure 3. Comparison the Effect of Cigarette smoking on heart rate between smokers and nonsmokers.

Table 3 shows the distribution of smokers and non smokers into two categories on the basis of severity of blood pressure. Out of 20 smokers, 8 had normal blood pressure which accounts only 40% smokers, 12 were hypertensive which accounts 60% of smokers. While in non smokers, Out of 20 nonsmokers, 18 had normal blood pressure which accounts 90% non smokers, 2 were hypertensive which accounts only 10% of non smokers.

Table 3: Classification of blood pressure of smokers

Variables	Non smokers		Smokers	
	Number	Number	Number	percent (%)
Normal	**18**	**90 %**	**8**	**40 %**
Hypertension	**2**	**10 %**	**12**	**60 %**

Hypertension (> 140/90 mm Hg).

Furthermore, among < 30 years old participants the systolic blood pressure levels were significantly associated with smoking (p=0.003) where systolic blood pressure levels were found to be higher in smokers than in non-smokers (137.00 ± 6.83 mmHg vs. 114.50 ± 3.59 mmHg respectively). While no significant differences were found between of the diastolic blood pressure levels (p=0.087) where diastolic blood pressure levels were in smokers and non-smokers (84.8±10.7mmHg vs. 76.25±3.59mmHg respectively). (Table 4).

Table 4: Comparison of blood pressure levels among smokers and non-smokers (<30 Years old).

Characteristics	Non-smokers (mean ± SD)	Smokers (mean ± SD)	T-Value	P-value
Systolic SBP (mmHg)	114.50 ± 6.35	137.00 ± 6.83	4.82	0.003
Diastolic DBP (mmHg)	76.25 ± 3.59	84.8 ± 10.7	1.51	0.087

Moreover, among >30 years old participants neither of the systolic or diastolic blood pressure levels were significantly associated with smoking (p=0.054 and p=0.111 respectively). Where systolic blood pressure levels were in smokers and non-smokers (139.67±9.87mmHg vs. 128.83±7.05mmHg respectively), and where diastolic blood pressure levels were in smokers and non-smokers (89.50±4.59mmHg vs. 79.8±12.8mmHg respectively). (Table 5).

Table 5: Comparison of blood pressure levels among smokers and non-smokers (>30 Years old).

Characteristics	**Non-smokers (mean ± SD)**	**Smokers (mean ± SD)**	**T-Value**	**P-value**
Systolic SBP (mmHg)	**128.83 ± 7.05**	**139.67 ± 9.87**	**2.19**	**0.054**
Diastolic DBP (mmHg)	**79.8 ± 12.8**	**89.50 ± 4.59**	**1.75**	**0.111**

Furthermore, when Comparison of blood pressure levels among smokers participants both the systolic and diastolic blood pressure levels were non significantly associated with smoking (<30 Years old p=0.75 and >30 Years old p=0.46). Where systolic blood pressure levels were in smokers < 30 years old and >30 years old (137.00±6.83mmHg vs. 139.7±15.1mmHg respectively), and where diastolic blood pressure levels were in smokers < 30 years and >30 years old (84.8±10.7mmHg vs. 89.50±9.01mmHg respectively). (Table 6).

Table 6: Comparison of blood pressure levels among smokers (<30 Years old) and (>30 Years old).

Characteristics	Smokers (<30 Years old) (mean ± SD)	Smokers (>30 Years old) (mean ± SD)	T-Value	P-value
Systolic SBP (mmHg)	137.00 ± 6.83	139.7 ± 15.1	0.33	0.753
Diastolic DBP (mmHg)	84.8 ± 10.7	89.50 ± 9.01	0.76	0.469

Furthermore, among participants with >10 years from smoking duration both the systolic and diastolic blood pressure levels were significantly associated with smoking (p=0.038 and p=0.042 respectively)where both these blood pressure levels were found to be higher in smokers have smoke duration > 10 years than in smokers with smoke duration ≤10 years (143.00 ± 7.35 mmHg vs. 134.20 ± 3.03 mmHg and 90.80 ± 3.70 mmHg vs. 84.40 ± 4.62 mmHg respectively) (Table 7).

Table 7: Comparison of blood pressure levels among smokers (≤10 years and > 10 years smokers duration).

Characteristics	Smokers ≤10 years (mean ± SD)	Smokers > 10 years (mean ± SD)	T-Value	P-value
Systolic SBP (mmHg)	134.20 ± 3.03	143.00 ± 7.35	2.46	0.038
Diastolic DBP (mmHg)	84.40 ± 4.62	90.80 ± 3.70	2.42	0.042

Discussion

The present analysis attempts to evaluate the correlations between blood pressure level, cigarette smoking and to assess the effects of age and smoking duration on such a relationship.

The study results revealed that while analyzing overall both the systolic and diastolic blood pressure levels were significantly associated with smoking where they were found to be higher in smokers than in non-smokers ($p= 0.025$ and $p= 0.048$ respectively). The levels of systolic and diastolic blood pressure in smokers and non-smokers were (138.6 ± 12.0 mmHg vs. 123.1 ± 15.6 mmHg and 87.60 ± 9.44 mmHg vs. 87.40 ± 9.90 mmHg respectively). Also, we found that most nonsmokers (90%) had normal blood pressure, while 40% smokers had normal blood pressure, 60% smokers had hypertension.

Although many studies have been performed, the effect of cigarette smoking on blood pressure and development of hypertension is still unclear (Narkiewicz et al, 2005). Other studies showed a finding consistent with our study, which is an increase in systolic and diastolic blood pressure as:

Study Jena and Purohit, 2017 reported that systolic and diastolic blood pressure (SBP, DBP) and blood pressure (PP) of smokers were more than nonsmokers.

In a study involving 12,417 in which only males participated, Halimi et al, 2002 showed that smoking increased the risk of systolic hypertension in cases aged 60 and over that continued to smoke. Yin et al, 2012 reported high systolic and diastolic blood pressure and prevalence of hypertension in smokers compared to non-smokers in a study of 1780 sample. Also, Dochi et al, 2009 reported a positive association of smoking with lood pressure in a cohort including 8251 male Japanese workers in a steel company. Which is consistent with the results of this study.

In study Aronow et al, 1971, the researchers in their study demonstrated the effect of cigarette smoking on blood pressure. They reported that there is increase in systolic as well as diastolic blood pressure along with heart rate (HR) after cigarette smoking.

Mahmud et al, 2003., examining the acute and chronic effect of smoking in young healthy subjects, observed that smokers had

higher central systolic blood pressure (SBP) and lower in pulse pressure (PP) amplification. Acutely, smoking leads to an increase in both heart rate and blood pressure through a mechanism involving sympathetic nervous system stimulation (Grassi et al, 1994). However, it has been suggested that after the first few puffs of smoke, blood pressure increases abruptly and only returns to pre smoking levels after 1–2 hours (Hansen et al, 1994).

Also, after age and smoking duration based stratifications; both the systolic and diastolic blood pressure levels were still significantly associated with smoke in men were < 30 years old, where they were found to be higher in smokers than in non-smokers.

In this study, the mean value for pulse pressure was higher in smokers higher pulse pressure was observed in smokers than non-smokers, but the increase is not significant (p= 0.239).

There are also a limited number of studies reporting that cigarette smoking has no effect on blood pressure. as, Primatesta et a,. 2001 observed no difference in systolic and diastolic blood pressures between smokers, ex-smokers and non-smokers. Also, we have not found any epidemiological study reporting the associations between smoking amount and PP in adults. The Irbid-TRY study conducted in male adole scent showed that smoking cigarettes predicted lower SBP, DBP, MAP and PP (Alomari and Al-Sheyab, 2016).

Furthermore, In this study Heart rate: In smokers heart rate was slightly increased but not significant were (p= 0.39), Where heart rate were in smokers and non-smokers (83.6±12.7 vs. 78.8±11.8mmHg respectively). Similar findings were also found by Roberto et al, 1996. Heart rate measured by ambulatory monitoring is higher throughout the day when smokers are smoking compared with when not smoking.

In addition, this is first study which demonstrated the relationship between smoking and the indices blood pressure among men in study area. Therefore, other studies are needed to further understand the chronic effect of smoking on blood pressure. Furthermore, sample size was relatively small, and

further studies need to examine the association between smoking and blood pressure in larger sample.

In conclusion:

despite many studies performed, our Study have shown that the effect of cigarette smoking increases high blood pressure in the study sample. However, Further research is needed on the subject. Also, the study findings clearly point out towards potential effects of the age and smoking duration on a relationship between the smoke and hypertension .

On the other hand, these findings could prove useful in identifying and establishing a high risk profile of hypertensive patients, in the context of their smoking habits, for assessment of risk and prioritization of its management in such patients

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