

Ministry of Higher

Education Univresity

Hilla University College

Department Medical Physiscs



The effect of smoking on packed cell volume (pcv)

بحث مقدم إلى:

كلية الحلة الجامعة – قسم الفيزياء الطبية

وهو جزء من متطلبات نيل درجة البكالوريوس في الفيزياء الطبية

إعداد الطلبة:

كاظم راضي حمزة قاسم صباح حمزة غيث غانم كاظم

زهراء عبد الكريم رسل كريم منصور

بأشراف: م.م. نورس بهاء

1445هـ **2024م**

بسم الله الرحمن الرحيم

(يَرْفَعِ اللَّهُ الَّذِينَ آمَنُوا مِنكُمْ وَالَّذِينَ أُوتُوا الْعِلْمَ)

دَرَجَاتٍ

صدق الله العظيم

(سورة المجادلة، الآية:١١)

الأهداء

الى الذين قاتلوا وناضلوا من اجل ان تستمر حياتنا الى من هم اكرم منا جميعا شهداء العراق .

الى التي اكثرت الدعاء كلما نطقت الى التي لولاها لما امسكت اصابعي قلما الى التي حملتني وهن على وهن امي الحبيبة .

الى من علمني ووضعني على الطريق الصحيح إلى رمز الرجولة والتضحية ابي الغالي .

الى من هم سندي وقوتي في الحياة ويهم استمد عزتي واصراري الى من هم اقرب من روحي . اخواني واخواتي .

الى من انسني في دراستي وشاركني همومي تذكاراً وتقديراً اصدقائي وزملائي

الى استاذتي م.م نورس بهاء الذي كانت نعمه السند بعد الله تعالى اسال الله ان يحفظها ويرعاها

الشكر والتقدير

كن عالما .. فإن لم تستطع فكن متعلما ، فإن لم تستطع فأحب العلماء، فإن لم تستطع فلا تبغضهم"

بعد رحلة بحث وجهد واجتهاد تكللت بإنجاز هذا البحث، نحمد الله عز وجل على نعمه التي من بها علينا فهو العلي القدير، كما لا يسعنا إلا أن اخص بالذكر اليد التي جادت بكرمها وأمدتنا بعطائها فكانت الغذاء التي أحيا بحثنا وأشرف على نموه فكل الشكر والتقدير لأستاذتنا م.م(نورس بهاء) لما قدمت لنا من جهد ونصائح ومعرفة طيلة انجاز هذا البحث فلها مني خالص الشكر والتقدير.

كما أشكر كل من ساعدني وقدم لي العون من أساتذتي الكرام، واخص منهم بالذكر أساتذة الفيزياء الطبيه التطبيقيه الذين أمدوني بتوجيهاتهم القيمة ومصادرهم الكثيرة فلهم مني كل الشكر والتقدير.

No	Subject	Page
	Abstract	VI
1.	Introduction	1
1.1	Smoking	1
1.2	Effect of smoking on pcv and Hb	2
1.3	Smoking reasons	3
1.4	Symptoms caused by smoking	5
1.5	Health effects caused by smoking	6
1.6	Ways to promote health to prevent and quit smoking	7
2.1	Material and method	9
3.1	Results and Discussion	10
	Conclusion	15
	References	16

Table

1	descriptive statistic of age	10
2	Distribution of PCV and Hb values for smokers and non-smokers with age	12
3	Evaluation Of Markers in Study Population	13

Abstract

Smoking is considered one of the most important factors that harm human health, Cigarette smoking causes significant health problems including an increase in the number and severity of respiratory illnesses, decreased physical fitness and potential effects on lung growth and function. 192 samples were studied on a group of smokers and non-smokers who were within the age group of (16-75) years. Out of 192, there were 96 Smokers and 96 non-smokers. The aim of the study is to compare the concentration of hemoglobin and packed cell volum (PCV) in the blood of smokers and non-smokers. $p \geq 0.05$ The p values indicate a very significant difference in both smokers and non-smokers, and our results showed p values for both PCV and Hb < 0.003, indicating a very significant difference compared to smokers.

Objective: To study the effect of smoking and its effects on the volume of packed cells (PCV) and hemoglobin Hb.

1.Introduction

According to World Health Organization data, approximately 5 million people die globally every year from diseases caused by smoking, and if this trend continues, this number is expected to reach 10 million by 2024.

Many studies have indicated that smoking has harmful effects on human health and represents a predisposing factor to the development of various pathological conditions and diseases[1].

1.1.Smoking

is the practice of burning tobacco and inhaling the smoke to be tasted and absorbed into the bloodstream[1]. Tobacco is made by drying leaves from tobacco plants, and it contains nicotine, which is an addictive drug[2]. When people smoke tobacco, they burn it so they can breathe it in or taste the smoke. People smoke tobacco in different ways, including cigarettes, cigars, and pipes[3]. Smoking is a hard habit to break because tobacco contains the very addictive chemical nicotine, and the body and mind quickly get used to it[4].

Smoking is the leading cause of preventable death in the United States, and it causes more than 480,000 deaths each year[5]. Smoking causes a range of devastating illnesses, including coronary artery disease, chronic obstructive pulmonary disease, cancers in every human organ system, and decreased reproductive health[6].

Smoking also affects the people around the smoker through second-hand smoke[7]. All forms of tobacco, including cigarettes, pipes, cigars, hookahs, and smokeless tobacco, are health hazards[8]

1.2.Effect of smoking on pcv and Hb

The packed cell volume (PCV) is the measure of the ratio of the volume occupied by the red cells to the volume of whole blood in a sample of capillary, venous, or arterial blood, the packed cell volume is higher in the smoking people than in non-smokers, Chronic hypoxaemia, from whatever, cause tends to cause a rise in the packed cell volume invoke hypoxaemia, resulting from lung disease induced by smoking, to explain the high values found in smokers[9].

Smoking is one of the most common causes of increased hemoglobin concentration in the blood, Carbonmonoxide binds to hemoglobin to form carboxyhemoglobin, an inactive form of hemoglobin having no oxygen carrying capacity and smokers having a higher hemoglobin level than non-smokers [10,11,12]. Hemoglobin is a protein molecule present in the red blood cells that carries oxygen from the lungs to the body's tissues and returns carbon dioxide from the body tissues to the lungs. The normal Hemoglobin level for males is 13.5 - 17.5 -grams per deciliter and for females is 12.0 - 15.5[13] ,The mean haemoglobin (Hb) concentration in men and women is higher in the smokers than in the non-smokers [14]. The mean haemoglobin levels and the carboxyhaemoglobin levels increase progressively with the number of cigarettes which are consumed per day[15]. Hemoglobin values in female smokers are much higher than non-smokers, while hemoglobin values in male smokers are slightly higher than non-smokers[16]. Hemoglobin level is associated with increased cardiovascular

mortality and chronic kidney disease (CKD) in patients with diabetes mellitus [17].

The increase of consumption of cigarette lead to a make influence on the hemoglobin and PCV concentration and There is appositive relationship between hemoglobin and PCV this may reflect the normal correlation between them since both parameters indirectly represent the Hb concentration in blood especially that all Hb in blood is contained with erythrocytes, and In Individuals who smoke frequently and continuously Hb levels increase and produces a progressive of hypoxia which result from CO bind with Hb which lead to functional anemia and this causes the impaired oxygenation of tissues and hemoglobin parameters [18,19,20].

1.3. Smoking reasons

1-Stress

Many people resort to smoking in order to relieve anxiety and stress, and to seek relaxation, even if temporarily. Although smoking can relieve stress, the nicotine in cigarettes causes addiction, as it stimulates the annoying withdrawal symptoms that the smoker feels when he stops smoking, which makes quitting smoking difficult for the smoker, so he prefers to continue smoking and not quit[21].

2-The influence of friends

Teenagers are usually exposed to pressure from their peers to smoke; They push each other towards several wrong practices just because they believe that it makes them appear more attractive and social in front of their peers, as 9 teenage smokers under the age of 18 out of 10 continue smoking after the age of majority. According to statistics from the American Cancer

Society, peer influence is not limited to teenagers only, but may also include work colleagues who push each other towards smoking to strengthen and develop their relationships[22].

3-Media influence

The media is considered one of the biggest influences on the spread of smoking. The media has portrayed the smoker in an acceptable manner over the years and in various parts of the world. Many advertisements show a large number of film actors smoking, and a study in Norway showed that the prevalence of smoking decreased by 9% when the country banned tobacco advertisements in 1975 AD. Therefore, it is the media's duty to shed light on the harms of smoking and its impact on health. And show it in an unacceptable way to reduce the number of smokers in the future[23].

4-Parental influence

Parents directly influence children; Growing up in a home where one or both parents smoke causes the child to be twice as likely to smoke in the future compared to children who live with non-smoking parents. In addition, parents who consider smoking acceptable behavior even if they are not smokers can thus push their children to smoke. This means that the commitment to raising children in a smoke-free environment is not enough, as parents must also show the extent of their rejection and society's rejection of this unhealthy habit[24].

5-Genetic factors

The genetic factor must be taken into consideration regarding people's predisposition to smoking; A study published in the journal Psychiatric Clinics of North America in 2012 showed that addiction to narcotic drugs, including nicotine, which is the active ingredient in cigarettes, could be genetic, stressing that genetic influence does not mean the transmission of

narcotic drug addiction from one generation to another. Rather, it reflects a person's ability to acquire the habit of smoking, and it is worth noting that expanding these studies can contribute to identifying the areas in which concerned authorities should focus their awareness-raising efforts to reduce the dangers of smoking addiction [25].

6-Depression

Statistics in Britain indicate that people's tendency to smoke increases if they are experiencing depression. Nicotine stimulates the release of dopamine in the brain, which is a hormone that has a role in enhancing positive feelings that are low in people with depression. Therefore, depressed people resort to smoking to raise dopamine levels, even temporarily. It is worth noting that depressed people have additional difficulties when trying to quit smoking. Where the withdrawal symptoms when quitting it are more severe than in other groups[26].

1.4. Symptoms caused by smoking

The current study used logistic regression techniques to examine the extent to which depression, anxiety, eating disorders, and nicotine dependence increase the risk of experiencing DSM-IV cravings (depressed mood, insomnia, irritability, anxiety, difficulty concentrating, and insomnia).

(decreased heart rate, increased appetite) during smoking abstinence, are retrospectively evaluated. Data presented by an ethnically diverse sample of findings suggest that variants known to be associated with smoking are risk factors for distinct and somewhat overlapping patterns of symptoms. Tobacco consumption continues to rise even as evidence regarding its danger mounts [27].

Young people smoked earlier and more heavily, while at least one occupational group showed a decline in smoking. In general, people are aware of the long-term effects of prolonged and heavy smoking, but there is a paucity of knowledge about the early effects of smoking and its associated morbidity. Most laypeople recognize lung cancer as a possible result of smoking. The causal relationship between smoking and non-specific chronic lung diseases (emphysema and/or chronic bronchitis) is less widely appreciated although there is considerable evidence for this fact. But when these changes occur is unknown. The purpose of this study was to evaluate respiratory symptoms and see if there are measurable pulmonary effects of smoking in young adults. This information may be useful in unraveling the pathogenesis of non-specific chronic lung disease. In addition, it may serve as a lever to influence the young person to reduce smoking habits, because if changes are found, it will indicate that the damage is starting early and is therefore of immediate concern to him[28]

1.5. Health effects caused by smoking

It is the health damage resulting from tobacco consumption. Epidemiological research has focused on tobacco smoking and it has been more extensively studied than any other form of tobacco consumption[29] . In the twentieth century, 100 million people died as a result of smoking, making smoking the largest cause of death in the world[30] .Smoking causes heart disease, gum disease, and lung disease and is a significant risk factor for heart attacks, strokes, chronic obstructive pulmonary disease (COPD), and cancer (especially lung, larynx, and pancreas). It also leads to diseases of the peripheral blood vessels and high blood pressure[31].

The effect depends on the number of years the smoker has smoked and the amount of tobacco. Environmental smoking has also been found to cause

health harm to inhalers of all ages[32] Cigarettes sold in developing countries tend to have a higher amount of tar and are less filtered;this increases sensitivity to tobacco-related diseases in these areas[33] Tobacco use is the largest preventable cause of death globally[34] .Nearly half of people who use tobacco die from complications of tobacco use [35]. The World Health Organization (WHO) estimates that each year tobacco causes about 6 million deaths (about 10% of all deaths) with 600,000 of these occurring in non-smokers; Due to passive smoking [36]. In the 20th century, it is estimated that tobacco killed 100 million people [37]. Likewise, the United States Centers for Disease Control and Prevention describes tobacco use as "the single most important risk to human health in developed countries and an important cause of premature death worldwide [38].

smoking is a major risk factor and causes peripheral arterial disease and high blood pressure. The effects depend on the number of years a person has smoked and on how much the person smokes. Starting smoking early in life and cigarette smoking is higher when using contraceptives and increases the risk of these diseases. Also, environmental tobacco smoke, or secondhand smoke, has shown adverse health effects on people of all ages[39]. Tobacco use is a significant factor in miscarriages among pregnant smokers, and contributes to a number of other fetal health problems such as premature birth, low birth weight, and increases by 1.4 to 3 times the chance of sudden infant death syndrome (SIDS) [40] .

1.6. Ways to promote health to prevent and quit smoking

Tobacco smoking is one of the greatest causes of mortality in the world, responsible for over 5 million deaths per annum. The prevalence of smoking is over 1 billion people, with the majority coming from low or middle income countries [41]. Yet, the incidence of smoking varies vastly between many

countries. Some countries have been able to decline the smoking and tobacco related morbidity and mortality through the introduction of health promotion initiatives and effective policies in order to combat tobacco usage. However, on the other hand, in some countries, the incidence of smoking is increasing still further [42].

With the growing body of evidence of detriment of tobacco to health, many control policies have been implemented as health promotion actions. Such methods include taxation of smoking, mass advertising campaigns in the media, peer education programs, community mobilization, motivational interviewing, health warnings on tobacco products, marketing restrictions, and banning smoking in public places. However, the review of the effectiveness of various health promotion methods used for smoking prevention and cessation is lacking. Therefore, the aim of this review is to identify and critically review the effectiveness of health promotion methods used for smoking prevention and cessation[43].

Health promotion is pivotal in the drive to reduce the growing burden of chronic disease worldwide due to tobacco and particularly smoking [44] .Comprehensive and active awareness of the population through the health promotion strategies are the primary tools for smoking prevention and cessation. Public education is an integral part of the efforts to both prevent the initiation of smoking use and encourage smoking cessation. Increased health promotion efforts about the[45].

detrimental health effects from smoking use may result in higher levels of knowledge about the harms of smoking and this in turn could increase quit intentions and subsequent quitting among users [46]. By increasing their knowledge about smoking cessation methods, health professionals can support and encourage the large majority of smokers who want to quit[47].

2.1.Material and method

The study was conducted on 192 healthy male and female volunteers, smokers and non-smokers.

Number of smokers (96),and non-smokers (96)

Collect blood by pricking the thumb with a scalpel,The capillaries are about three-quarters filled with blood .He took a drop of blood from one end of the test tube, closed the empty end of the test tube with Vatrex [48], then used a centrifuge at 13,000 rpm for 5 minutes to separate red blood cells and plasma [49]. The 12 samples are placed in numbered slots inside the small centrifuge, and the packed cell volume is calculated using a hammer. The samples are collected under sterile conditions and analyzed in the laboratory. We extract the hemoglobin value from the packed cell volume according to this equation:$\boldsymbol{HB = \frac{pcv-2}{3}}$.

Normal value Pcv%

Male 42-50

Female 37-45

Normal value HB g/L

Male 13-17

Female 12-14

3.1.Results and Discussion

A total 192 samples were collected from a group of smokers and non-smokers in Babylon province. The study was conducted on ages between 16-75 years, They were all in good health and did not suffer from diseases.

Table 1 shows that the lowest age group under the study was 16 years, while the largest age group was 75 years for smokers and non-smokers..

Table 1: descriptive statistic of age

N	Valid	192
	Missing	0
Minimum		16.00
Maximum		75.00

Cigarette smoking is a known risk factor for cardiovascular disease (CVD) [50], Cigarette smoking is associated with development and progression of numerous chronic diseases worldwide[51].Cigarette smoking is one of the 10 leading health indicators that reflect the major health concerns in the USA , During the last 20 years the amount of tar and Nicotine content delivered by cigarette made by United States has decreased more than 50% [52]. 1.3 billion people are regular smokers worldwide and every day between 8,200 and 9,900 young people start to smoke[53].

In Figure 1 the result shows the number of samples of smokers was equal to the number of samples of non-smokers, males and females, as the number of samples of male smokers was 48samples, while the number of samples of female smokers was 48 samples, while the number of samples of non-smokers was 48 samples of males and 48 samples of females.

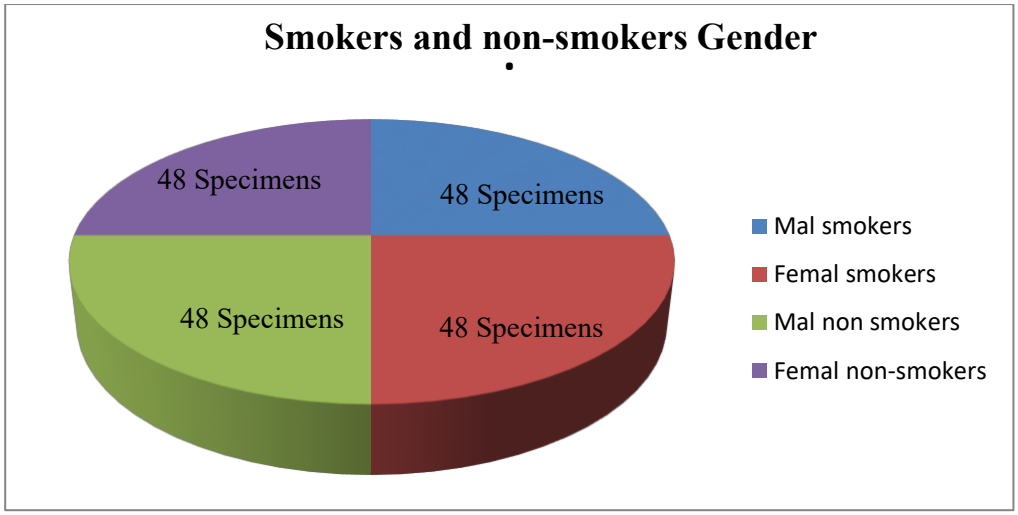

Figure 1: Distribution of smokers gender

Smoking is a major cause of coronary heart disease for both men and women and a positive correlation between tobacco use and cerebrovascular disease has been also described. In addition, cigarette smoking is the most powerful risk factor predisposing to atherosclerotic peripheral artery disease[54]. After the rapid spread of tobacco smoking before the 1950s in the United States and Northern European countries among males, the prevalence of cigarette smoking among females started to rise as well. In the 1970s, smoking prevalence among males and females began to decrease, with a stronger decline in males[55].

A 2016 study of a group of male and female smokers combined indicates that when trying to quit smoking, women have more difficulty continuing over the long term[56].

Table 2 shows that the Distribution of PCV and Hb values for smokers and non-smokers with age , Our results showed that the highest PCV and Hb values were found in the age group between 26-35 years, with a value of 56% for the PCV test and 18.0 g/dl for the Hb test. Our results indicate that this age group

had values higher than the normal values specified by the World Health Organization.

Age	16-25	26-35	36-45	46-55	56-65	66-75
*[1]PCV Maximum value	51%	56%	55%	50%	51%	47%
*[1] PCV Minimum value	24%	30%	40%	39%	39%	41%
*[2]Hb Maximum value	16.3 g/dl	18.0 g/dl	17.7 g/dl	16.0 g/dl	16.3 g/dl	15.0 g/dl
*[2]Hb Minimum value	7.3 g/dl	9.3 g/dl	12.7 g/dl	12.3 g/dl	12.3 g/dl	13.0 g/dl

Table 2: Distribution of PCV and Hb values for smokers and non-smokers with age

***[1]Male Normal Value: 42-50 % , Female Normal Value 37-45%**

***[2]Male Normal Value: 13-17 g/l Female Normal Value 12-14 g/l**

The results of our study are consistent with the study was conducted in 1971 and 2017 [25 ,26]where a positive relationship was found between cigarette consumption and packed cell volume (PCV) in both genders. In women, we also found a statistically significant relationship between 4cigarette consumption and hemoglobin concentration. In male cigarette smokers, PCV ana Hb values are higher than normal .

Table (3) represents the evaluation of blood markers, specifically packed cell volume (PVC) and Hemoglobin (Hb), in a study groups. The packed cell volume (PCV) is a measurement of the proportion of blood that is made up of cells. Hemoglobin (Hb) is the protein contained in red blood cells that is responsible for delivery of oxygen to the tissues. To ensure adequate tissue oxygenation, a sufficient hemoglobin level must be maintained. The amount of hemoglobin in whole blood is expressed in grams per deciliter (g/dl).

Table3 : Evaluation Of Markers in Study Population

Population	**N**	**Concentration of PCV %**		**Concentration of Hb g/dl**	
		Mean	**Std. Deviation**	**Mean**	**Std. Deviation**
Smokers	96	44.9716	3.3963	14.2638	1.1321
Non-smokers	96	37.2083	5.1909	11.7361	1.7303
Total	192	41.01	5.7958	13.0145	1.9698
P value (p≤0.05)		.003*		.003*	
***Highly significant difference under (p≤0.05) by one-way ANOVA**					

The group of smokers had a mean PCV concentration of 44.9716 with a standard deviation of 3.3963 . They also had a mean Hb concentration of 14.2638 with a standard deviation of 1.1321. The p-values for both PCV and Hb are < 0.003 (indicated by .003*), indicating a highly significant difference compared to the non-smokers . While the group of non-smokers had a mean PCV concentration of 37.2083 with a standard deviation of 5.1909.Their mean Hb concentration was 11.7361 with a standard deviation of 1.7303 . The p-values for both PCVand Hb are < 0.003, again indicating a highly significant difference compared to the smoker .

The results of our study are consistent with the results of our study are consistent with The study was conducted in 2017 [57]. which found that cigarette consumption affects the packed cell values (PCV) in both sexes, as well as the hemoglobin values, and leads to an increase. In women, we also found a statistically significant relationship between consumption of 4 cigarettes and hemoglobin concentration. In male cigarette smokers, PCV ana Hb values are higher than normal.

In summary, the table suggests that both PVC and Hb concentrations are significantly different between the smokers and non smokers ($p \leq 0.05$). The p-values indicate a highly significant difference in both smokers and non smokers markers in blood parameter in these two conditions .

CONCLUSION

The study found that the PCV and hemoglobin concentration were significantly higher in smokers compared to non-smokers. The increase in PCV in smokers may be due to chronic hypoxia resulting from lung disease induced by smoking. Smoking is considered a significant factor that harms human health, causing respiratory illnesses, decreased physical fitness, and potential effects on lung growth and function. The study suggests that smoking can lead to diseases of the heart, arteries, and respiratory system, as well as an increased risk of stroke and cancer. Further research with a larger population is needed to generalize these findings.

References

[1].**Hospice (2020-8-20)**, "Why Do People Smoke Cigarettes?" myallamericanhospice.com, Retrieved 2021-2-9. Edited.

" أ ب ت ^Smoking and mental health", www.mentalhealth.org.uk, Retrieved 2021-2-9. Edited.16

" ↑17.The Genetic Basis of Addictive Disorders", www.ncbi.nlm.nih.gov, Retrieved 2021-4-12. Edited.

[2]. **Pomerleau**, **C.S., Marks, J.L., & Pomerleau, OF (2000).** Who gets what symptoms? Effects of psychological cofactors and nicotine dependence on patterns of smoking withdrawal symptoms. Nicotine and Tobacco Research, 2(3), 275-280.

[3]. **Peters, J. M., & Ferris Jr, B. G. (1967).** Smoking, pulmonary function, and respiratory symptoms in a college-age group. American Review of Respiratory Disease, 95(5), 774-782.

[4]. **"Mayo report on addressing the worldwide tobacco epidemic through effective, evidence-based treatment" World Health Organization. p. 2. Retrieved January 2, 2009**. Archived copy dated August 5, 2016 on the Wayback Machine website.

[4].**World Health Organization (2008).** WHO Report on the Global Tobacco Epidemic 2008: The MPOWER Package.

[5].**Geneva: World Health Organization. p. 8. ISBN 92-4-159628-7 Archived copy on January 24, 2018** on the Wayback Machine website.

[6].**Vainio H (June 1987).** "Does passive smoking increase the risk of cancer?" Scand J Environ Health Action 13(3):193-6.

doi:10.5271/sjweh.2066 Archived 25 September 2017 on the Wayback Machine website.

[7].**World Health Organization (2008).** WHO Report on the Global Tobacco Epidemic 2008: The MPOWER Package (PDF). Geneva: World Health Organization. p. 8. ISBN 92-4-159628-7.

25.Tobacco Fact sheet N°339". May 2014. Retrieved 13 May 2015.

[8].**The top 10 causes of death". Retrieved 13 May 2015.**

[9] **Nogueira, I., Alves, A.V., Duque, A.P., Oliveira, G.M., Celente, F., Motta, I., Goretti, N.C., Leone, C.N., Junior, L.F., & Carvalho, A.C. (2022).** Smoking and cardiovascular diseases.

[10] **Dautzenberg, B. (2004).** [Tobacco-related diseases]. *La Revue du praticien, 54 17*, 1877-82 .

[11] **Arya, S.N., Rajiv, K., & Arya, S.N. (1991).** Hazards of smoking. *Journal of the Indian Medical Association, 89 4*, 98-100 .

[12] **Moore-Gillon**, **J.C., & Pearson, T.C. (1986).** Smoking, drinking, and polycythaemia. British Medical Journal (Clinical research ed.), 292, 1617 - 1618.

[13] **Catterall JR., Calverley PM., MacNee W., Warren PM., Shapiro CM., Douglas NJ. and Flenley DC. 1985**. Mechanism of transient nocturnal hypoxemia in hypoxic chronic bronchitis and emphysema 1985; J Appl Physiol. Dec; 59(6):1698-703.

[14] **Prakash, A., Grover**, **N., Tyagi, N., Misra, A., Sinha, N., & Singh, S.P. (2018)**. Blood Haemoglobin Level Comparison Between Smokers And Non-Smokers.

[15] **Smith, J.R., & Landaw, S.A. (1978).** Smokers' polycythemia. The New England journal of medicine, 298 1, 6-10 .

[16] **Sadhvi, & Suresh, V. (2020)**. Hemoglobin Levels and the Associated Factors in the Patients Visiting A University Hospital in Chennai, India. Indian Journal of Forensic Medicine & Toxicology.

[17] **Nordenberg D, Yip R, Binkin NJ. The effect of cigarette smoking on the haemoglobin levels and on the anaemia screening. JAMA.** 1990 Sep 26; 264(12): 1556-9.

[18] **Schwartz J, Weiss ST**. **Cigarette smoking and the peripheral blood laeukocyte differentials. Ann Epidemiol**. 1994 May; 4(3): 236-42.

[19] **Suleiman M**. **The haemoglobin level among the Jordanians at a 600-1025 metres altitude. RMJ.** 2008; 33(1): 72-4

[20] **New JP, Aung T**, **Baker PG, et al. The high prevalence of un-recognized anaemia in patients with diabetes and chronic kidney disease: a population-based study. Diabet Med** 2008;25:564-569

[21]**Nicotine: A Powerful Addiction Archived 05-01-2009** at the Wayback Machine.” Centers for Disease Control and Prevention

[22]**Jha, Prabhat; Peto, Richard (01/02/2014).** "Global Effects of Smoking, of Quitting, and of Taxing Tobacco". New England Journal of Medicine. 370 (1): 60–68. doi:10.1056/nejmra1308383. ISSN 0028-4793.

[23]**Rigotti NA**. **Smoking cessation in patients with respiratory disease: Existing treatments and future directions. Lancet Respir Med**. 2013;1:241–50. [PubMed] [Google Scholar]

[24]**Geneva: World Health Organization**; 2008. World Health Organization. WHO Report on the Global Tobacco Epidemic, 2008: The MPOWER Package. [Google Scholar]

[25]**Atlanta, Georgia: US Department of Health and Human Services**, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health; 2004. US Department of Health and Human Services. The health consequences of Smoking: A report of the Surgeon General. [Google Scholar]

[26]**Reddy KS, Gupta PC. New Delhi: Ministry of Health and Family Welfare, Government of India; 2004**. Tobacco control in India. [Google Scholar]

[27] **Pomerleau, C.S**., **Marks, J.L., & Pomerleau, OF (2000).** Who gets what symptoms? Effects of psychological cofactors and nicotine dependence on patterns of smoking withdrawal symptoms. Nicotine and Tobacco Research, 2(3), 275-280.

[28] **Peters, J. M**., & Ferris Jr, B. G. (1967). Smoking, pulmonary function, and respiratory symptoms in a college-age group. American Review of Respiratory Disease, 95(5), 774-782.

[29] "**Mayo report on addressing the worldwide tobacco epidemic through effective, evidence-based treatment**" **World Health Organization. p. 2. Retrieved January 2, 2009**. Archived copy dated August 5, 2016 on the Wayback Machine website.

[30]**World Health Organization (2008).** WHO Report on the Global Tobacco Epidemic 2008: The MPOWER Package.

[31].**Geneva: World Health Organization. p. 8. ISBN 92-4-159628-7 Archived copy on January 24, 2018** on the Wayback Machine website.

[32]**Vainio H (June 1987).** "Does passive smoking increase the risk of cancer?" Scand J Environ Health Action 13(3):193-6. doi:10.5271/sjweh.2066 Archived 25 September 2017 on the Wayback Machine website.
Nichter M, Cartwright E. Cartwright (1991). "Saving the Children for the Tobacco Industry". Medical Anthropology Quarterly 5(3): 236-56

[33]**World Health Organization (2008).** WHO Report on the Global Tobacco Epidemic 2008: The MPOWER Package (PDF). Geneva: World Health Organization. p. 8. ISBN 92-4-159628-7.

[34]**Jha, Prabhat**; Peto, Richard (01/02/2014). "Global Effects of Smoking, of Quitting, and of Taxing Tobacco". New England Journal of Medicine. 370 (1): 60–68. doi:10.1056/nejmra1308383. ISSN 0028-4793.

[35]**Vainio H (Jun 1987).** "Is smoking passively increasing cancer risk?" Scandinavian Journal of Work, Environment & Health. 13 (3): 193–6. doi:10.5271/sjweh.2066. PMID 3303311.

[36]**Rigotti NA. Smoking cessation in patients with respiratory disease: Existing treatments and future directions. Lancet Respir Med. 2013;1:241–50.** [PubMed] [Google Scholar]

[37]**Geneva: World Health Organization; 2008**. World Health Organization. WHO Report on the Global Tobacco Epidemic, 2008: The MPOWER Package. [Google Scholar]

[38]**Atlanta**, Georgia: US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health; 2004. US Department of Health and Human Services. The health consequences of Smoking: A report of the Surgeon General. [Google Scholar]

[39]**Reddy KS, Gupta PC. New Delhi: Ministry of Health and Family Welfare, Government of India; 2004**. Tobacco control in India. [Google Scholar]

[40]**ENGLAND J. M., WALFORD D. M. & WATERS D. A. W.** (1972) Re-assessment of the reliability of the haematocrit. Br. J. Haemal. 23, 247.

[41]**ENGLAND J. M. & DOWN M. C. (1975)** Determination of the packed cell volume using 131I-human serum albumin. Br. J. Haemal. 30, 365.

[42]**Nordenberg D, Yip R, Binkin NJ. The effect of cigarette smoking on the haemoglobin levels and on the anaemia screening. JAMA. 1990** Sep 26; 264(12): 1556-9.

[43]**Schwartz J, Weiss ST**. **Cigarette smoking and the peripheral blood laeukocyte differentials. Ann Epidemiol.Â 1994** May; 4(3): 236-42.

[44]**Haider MJ, Rauf A.** The smoking habits and their association with the total laeukocyte count among healthy men in Karachi, Pakistan. World Appl. Sci. J. 2010; 11(6): 669-73.

[45] **Erhabor, O; lsaac, I, Z; Ahmed, H.M.; Yakubu, A.; Okwesili, A.N. (2013).** The effects of cigarette smoking on some hematological indices in Sokoto, Nigeria. Br. J. Med. Health Sci,1:27-36.

[46] **Asif, M**.; **Karim, S.; Umar, Z.; Malik, A.; Ismail, T.; Chaudhary, A.; Algahtani, M. H. and Rasool, M. (2013).** Effect of cigarette smoking based on hematological parameters: comparison between males smokers and non-smokers. Turk J. Biochem.,38(1):75-80.

[47] .**Lakshmi, A.; lakshmanan, A.; Kumar G. and Saravanant. (2014).** Effect of intensity of cigarette smoking on hematological and lipid parameters. J. Clin. Diag. Res., 8(7): BC11-BC13.

[48]. **Umer Farooq**, Musadiq Idris, Nouman Sajjad, Mushtaq Hussain Lashari, Shahbaz Ahmad, Zia Ur Rehman, Haroon Rashid, Aisha Mahmood, Sajid Hameed, Investigating the potential of packed cell volume for deducing hemoglobin: Cholistani camels in perspective, PLOS ONE, 10.1371/journal.pone.0280659, 18, 5, (e0280659), (2023).

[49]. **Milman, N., & Pedersen, A. N. (2009).** Blood haemoglobin concentrations are higher in smokers and heavy alcohol consumers than in non-smokers and abstainers—should we adjust the reference range?. Annals of hematology, 88, 687-694.

[50]. **Li, G., Wang, H., Wang, K., Wang, W., Dong, F., Qian, Y., ... & Shan, G. (2017**). The association between smoking and blood pressure in men: a cross-sectional study. *BMC Public Health*, *17*(1), 1-6.

[51]. **Jena, S. K., Purohit, K. C., & Misra, A. K. (2013)**. Effect of chronic smoking on hematological parameters. *International Journal of Current Research*, *5*(2), 279-282.

[52]. **Nancy Kaufman** and Derek. Tobacco controlChallenge and prospects. Bulletin of WHO2000:78867.

[53]. **Wojtyła C,** Głuszek Ł, Biliński P, Paprzycki P, Warzocha K, Smoking during pregnancy- hematological observations in pregnant women and their newborns after delivery. Annals of Agricultural and Environmental Medicine: AAEM 2012;19:836-841

[54]. **Bolego, C., Poli, A., & Paoletti, R. (2002).** Smoking and gender. *Cardiovascular research*, *53*(3), 568-576.

[23]. Effect of smoking on Red Blood Cells Count, Hemoglobin Concentration and Red Cell indices

[55. **Mucha, L., Stephenson, J., Morandi, N., & Dirani, R. (2006)**. Meta-analysis of disease risk associated with smoking, by gender and intensity of smoking. *Gender medicine*, *3*(4), 279-291.

[56]. **Isager, H., & Hagerup, L. (1971)**. Relationship between cigarette smoking and high packed cell volume and haemoglobin levels. *Scandinavian Journal of Haematology*, *8*(4), 241-244.-

[57]. **Malenica, M., Prnjavorac, B., Bego, T., Dujic, T., Semiz, S., Skrbo, S.,& Causevic, A. (2017)**. Effect of cigarette smoking on haematological parameters in healthy population. *Medical Archives*, *71*(2), 132.