INTERNASIONAL CONFERENCE ON
MULTIDISCIPLINARY APPROACHES IN HEALTH SCIENCE
VOLUME 2 , ISSN 3032-4408 (Online)
https://ejournal.poltekkes-denpasar.ac.id/index.php/icmahs

The Differences In Blood Hemoglobin Levels Based On Smoking Frequency Among Active Smokers In Banjar Blangsinga Saba Village Blahbatuh District Gianyar Regency

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Article history
Posted : 2024-12-12
Reviewed : 2024-10-29
Received : 2024-10-03

ABSTRACT

Background. Cigarette smoke from active smokers will cause an increase in carbon monoxide levels in the body. These high levels of carbon monoxide can affect the binding of haemoglobin with oxygen, the binding intensity of haemoglobin with oxygen. This can cause abnormal haemoglobin levels in the blood. The purpose of this study was to determine the difference in blood haemoglobin levels based on smoking frequency in active smokers. Methods. This type of research is analytic observational with cross sectional design. The research was conducted in Banjar Blangsinga in March 2024. The population studied was active smokers, with a sample size of 45 respondents, with purposive sampling technique. Examination of haemoglobin levels using venous blood samples, cyanmethemoglobin method with Photometer Microlab 300. Data analysis using One-Way Anova Test. The results. Of the 45 respondents, most active smokers were between 19-59 years old (adults), with a total of 41 people (91.1%). Each category of smokers, namely light, moderate, and heavy, had the same number of respondents, namely 15 people (33.33%). The majority, 27 respondents (60%), had smoked for >10 years, which was the highest number. A total of 37 respondents (82.2%) had normal haemoglobin levels and 8 respondents (17.8%) had high haemoglobin levels. The highest haemoglobin level of 19.5 g/dL was found in the heavy smoker category. One-Way Anova test analysis obtained a significant value of 0.000 <0.05. The conclusion. There are differences in blood haemoglobin levels based on smoking frequency in active smokers.

Keywords: Active Smokers, Haemoglobin Levels.

Introduction

The habit of smoking is found in almost every community in Indonesia. The prevalence of smoking in the age group of 10-18 years in Indonesia has increased from 7.2% in 2013 to 9.1% in 2018. According to Riskesdas data (2018), the prevalence of smoking in men aged 15 years and over has increased from 2007 (65.5%), to 2013 (66%), to 2016 (68.1%), to 2018 (62.9%) (Rikesdas 2018).

Cigarette smoke inhaled, both by active and passive smokers, will cause an increase in carbon monoxide levels in the body. High levels of carbon monoxide can affect the bonding of

haemoglobin with oxygen. This can cause abnormalities in haemoglobin levels in the blood (Pratiwi, Anggria & Rachman, 2021).

Haemoglobin is a protein that is high in iron, and has an affinity for oxygen. When haemoglobin and oxygen combine in red blood cells, it is known as oxyhemoglobin. The main role of haemoglobin is to transport oxygen from the lungs to all body tissues and carry carbon monoxide from all cells back to the lungs to be removed from the body (Rahmawati, 2022).

Increased levels of carbon monoxide in the body affect the ability of haemoglobin to bind with oxygen, which is due to the different affinity of haemoglobin for oxygen and carbon monoxide. Naturally, this will impact the level of haemoglobin in the smoker's blood (Gunadi, Mewo, & Tiho 2016). Elevated haemoglobin levels are called polycythaemia. Polycythaemia, also known as erythrocytosis, refers to an increase in the number of red blood cells in the bloodstream. Complications in venous polycythaemia such as stroke, heart attack, itching, skin problems, and pain and stiffness in the joints or muscles (Cahyanur & Rinaldi, 2019).

Based on the findings in Sayekti's (2020) research documented in her journal entitled 'The Effect of Smoking on Haemoglobin Levels,' it can be stated that 20% of active smokers have high haemoglobin levels, while 33.33% of passive smokers have increased haemoglobin levels.

Abnormal haemoglobin levels in smokers are caused by the presence of carbon monoxide gas in cigarettes, which can produce clinical symptoms such as dizziness, headache, nausea, difficulty breathing, cardiovascular disorders, increased risk of heart attack, and even potentially death (Melda, 2014).

According to the Bali Province Riskesdas Report 2018, the smoking rate in Bali has increased from 22.4% in 2013 to 23.47% in 2018. Based on a preliminary study conducted by the author in Banjar Blangsinga, Gianyar Regency, the results showed that of the 10 people studied, eight of them were heavy smokers, and nine of them had never had their haemoglobin levels checked. Based on the authors' overall observation, eight out of ten individuals who completed the questionnaire reported experiencing frequent dizziness and feeling tired easily, which is one of the factors related to high haemoglobin levels.

High haemoglobin indicates an increase in oxygen-carrying proteins in the bloodstream. It can be caused by an increase in the number of red blood cells as well as an increase in the concentration of haemoglobin in the red blood cells. This can lead to complications such as stroke, heart attack, itching, skin problems, and pain and stiffness in the joints or muscles (Cahyanur, & Rinaldi, 2019).

Based on this background, research will be conducted on the relationship of blood haemoglobin levels based on smoking frequency in active smokers in Banjar Blangsinga, Saba Village, Blahbatuh District, Gianyar Regency.

This study aims to determine the differences in blood haemoglobin levels based on smoking frequency in active smokers in Banjar Blangsinga, Saba Village, Blahbatuh District, Gianyar Regency.

Research Method

This study is a correlation study using the type of research that is analityc observational with cross sectional design. Sampling was conducted in Banjar Blangsinga in March 2024 and the examination of haemoglobin levels using the cyanmeth method was carried out at the Hematology Laboratory of the Denpasar Polytechnic.

This study used 45 samples with the sampling technique used, namely purposive

sampling with the inclusion criteria of respondents who were active smokers, residing in Banjar Blangsinga, and willing to become respondents. Active smokers were interviewed regarding the number of cigarettes consumed per day with a questionnaire and then examined blood haemoglobin levels using the cyanmeth method. The results were categorised and analysed using One Way Anova statistical test.

Results and Discussions

In this study, primary data were obtained through questionnaires to determine the characteristics of respondents and examination of haemoglobin levels of active smokers using the cyanmethemoglobin method. Interviews with 45 active smoker respondents revealed the characteristics of the subjects presented in Table 1 to Table 3. The results of the haemoglobin level examination are shown in Table 4, while the haemoglobin level data based on smoking frequency is processed and presented in Table 5

A. Characteristics of Respondent Mothers

1) The Characteristic of Research Subjects

Table 1. The Characteristics of Research Subjects Based on Age

Number.	Age (Years)	Frequency (n)	Percentage (%)
1.	19-59 (Adults)	41	91,1
2.	> 60 (Elderly)	4	8,9
	Total	45	100

Based on the data in Table 1, it shows that the age range of most active smokers is 19-59 years old (adults), totalling 41 people (91.1%).

Respondents were divided into two age categories: 19-59 years old (adults) and >60 years old (elderly). Of the 45 respondents, the majority of active smokers were aged 19-59 years, namely 41 people (91.1%). This study is in line with the findings of Alam, Oktiani, and Sarifah (2022) who noted the highest prevalence of smokers at the age of 25-55 years (95.8%) and the lowest at the age of 56-64 years (4.1%). This is because this age is the productive period. In general, smoking prevalence is lower in older age, because as people get older, interest in quitting smoking for health reasons tends to increase (Wikansari, Kertia, & Dewi, 2017).

2) The Characteristics of Research Subjects Based on Frequency of Smoking

Table 2. The Characteristics of Research Subjects Based on Frequency of Smoking

Number	Smoking Frequency	Frequency (n)	Percentage (%)
1.	< 10 Cigarettes per day (Light Smokers)	15	33,33
2.	11-20 Cigarettes per day (Moderate Smokers)	15	33,33
3.	> 20 Cigarettes per day (Heavy Smokers)	15	33,33
	Total	45	100

Based on the data in Table 2, out of a total of 45 respondents, each group category has 15 respondents (33.33%) with light smokers (< 10 cigarettes per day), moderate smokers (11-20 cigarettes per day), and heavy smokers (> 20 cigarettes per day).

In this study, each smoking frequency category consisted of 15 respondents (33.33%), with light smokers (< 10 cigarettes/day), moderate smokers (11-20 cigarettes/day), and heavy smokers (> 20 cigarettes/day). According to Amelia, Nasrul, and Basyar (2016), cigarette consumption is influenced by the addictive nature of nicotine, which encourages smokers to consume dozens to tens of cigarettes per day. The duration of carbon monoxide exposure and the number of cigarettes consumed affect haemoglobin levels. Chronic exposure to carbon monoxide can cause tissue hypoxia and stimulate the body to increase erythropoetin production, which ultimately increases the number of erythrocytes and causes polycythaemia (Amelia, Nasrul, and Basyar, 2016).

3) The Characteristics of Research Subjects Based on Length of Smoking

Table 3. The Characteristics of Research Subjects Based on Length of Smoking

Number.	Length of Smoking	Frequency (n)	Percentage (%)
1.	< 10 years	18	40
2.	> 10 years	27	60
	Total	45	100

Based on the data in Table 3, a total of 45 respondents showed that 27 respondents (60%) were in the category of smoking duration > 10 years, which is the largest number.

Based on the results of the study, the data showed that out of 45 respondents, 27 respondents (60%) were in the category of smoking > 10 years, which was the largest number compared to respondents with the category of smoking < 10 years, which amounted to 18 respondents (40%). This finding is in accordance with research conducted by Nabillah (2022), which shows that the majority of respondents, as many as 26 out of 36 (72.2%), are included in the category who have smoked for more than 10 years.

One of the substances contained in cigarettes is nicotine, which has addictive properties, thus causing dependence on smokers. Smokers feel the psychological effects of pleasure and happiness from smoking. This sudden cessation of smoking can cause stress for smokers and nicotine addicts. This has encouraged some individuals to continue smoking for several years (Amelia, Nasrul, and Basyar, 2016).

B. The Blood Haemoglobin Levels Based on Active Smokers

Table 4. The Blood Haemoglobin Levels Based on Active Smokers

Number	Haemoglobin Level	Frequency (n)	Percentage (%)

1.	Normal (13-18 g/dL)	37	82,2
2.	High (>18 g/dL)	8	17,8
	Total	45	100

Based on Table 4, the distribution of active smokers based on haemoglobin levels was 37 respondents (82.2%) had normal haemoglobin levels (13-18 g/dL) while 8 respondents (17.8%) had high haemoglobin levels (>18 g/dL).

In this study, haemoglobin levels were checked using the Cyanmethemoglobin method as it is recognised as the 'gold standard' in measuring haemoglobin levels. The total number of respondents involved was 45 respondents in Banjar Blangsinga, 37 respondents had normal haemoglobin levels (13-18 g/dL), and 8 respondents had high haemoglobin levels (>18 g/dL). The results of this study are in line with research by Wibowo (2017) with the results of 30 respondents, having normal haemoglobin levels as many as 21 people (70%) with a mean haemoglobin level of 16.02% and respondents with high haemoglobin levels were 9 people (30%) with a mean haemoglobin level of 17.89 g/dL.

Elevated haemoglobin levels are called polycythaemia. Polycythaemia, also known as erythrocytosis, refers to an increase in the number of red blood cells in the bloodstream. It can have several impacts related to blood circulation, oxygenation, and general health, namely hypertension (Sipahutar, Nompo, & Arvia, 2019). There are complications in polycythaemia such as stroke, heart attack, itching, skin problems, and pain and stiffness in the joints or muscles (Cahyanur & Rinaldi, 2019). Smokers who have high haemoglobin levels should reduce and stop smoking.

C. The Haemoglobin Levels Based on Smoking Frequency

Table 5. The Haemoglobin Levels Based on Smoking Frequency

Number	Smoker Group	Haemoglobin Levels (g/dL)						Total	
		Low		Normal		High			
		n	%	n	%	n	%	n	%
1.	Light Smokers	0	0	15	33,33	0	0	15	33,33
2.	Moderate Smokers	0	0	15	33,33	0	0	15	33,33
3.	Heavy Smokers	0	0	7	15,56	8	17,77	15	33,33
	Total	0		37		8		45	100

Based on Table 5, it shows that the majority of respondents who have normal haemoglobin levels are in the light smoker and moderate smoker groups, each consisting of 15 respondents (33.33%). Meanwhile, the number of respondents with high haemoglobin levels was 8 people (17.77%) in the heavy smoker group.

Based on the results of the study, it shows that the majority of respondents who have normal haemoglobin levels are light smokers and moderate smokers, each

consisting of 15 respondents (33.33%). Meanwhile, the number of respondents with high haemoglobin levels was 8 people (17.77%) in the heavy smoker group.

Normality test results were conducted using the Shapiro-Wilk test, which showed Sig> 0.05. This indicates that the data from the examination of haemoglobin levels are normally distributed, so proceed with the One Way Anova statistical test. The results of the data analysis test using the One-way Anova test obtained a p-value of 0.000 or smaller than alpha 5% ($p < 0.05$). Thus, the One Way Anova test shows that there is a significant difference in haemoglobin levels between the light smoker group, the medium smoker group, and the heavy smoker group. After knowing the results of the One Way Anova test, then proceed to find out which groups have significant differences with the Post Hoc Games-Howell test. The results of the Games-Howell Post Hoc test showed that there was a significant difference in the mean amount of haemoglobin levels in all treatment groups.

This study is in line with research conducted by Mariani and Kartini (2018), which found a significant relationship between smoking rates and haemoglobin levels. Another study conducted by Septiani (2022) also showed a significant relationship between smoking frequency and haemoglobin levels. Cigarette smoke contains around 4000 harmful chemical compounds such as carbon monoxide, carbon dioxide, phenol, ammonia, formaldehyde, pyrene, nitrosamines, nicotine, and tar that can harm the human body. In addition, cigarette smoke also contains various oxidants and free radicals that can damage lipids, proteins, DNA, carbohydrates, and various other biomolecules. Smoking is one of the risk factors for various heart diseases, hypertension, inflammation, stroke, blood clotting disorders, and also respiratory diseases.

D. Test Analysis

1. Normality Test

Table 6. Saphiro Wilk Test Data Normality Test

Haemoglobin Levels Smoking Frequency	Significant Value (95% confidence degree, α = 0.05)
Light Smokers	0,106
Moderate Smokers	0,650
Heavy Smokers	0,999

In Table 6, the normality test was performed using the Shapiro-Wilk test, which showed Sig > 0.05. This indicates that the data of haemoglobin level is normally distributed.

2. One Way Anova Test

The results of the data analysis test using the One-way Anova Test (One-way Anova) obtained a p-value of 0.000 or smaller than alpha 5% ($p < 0.05$). Thus the test decision is to reject H0, namely there is a significant difference in haemoglobin levels between the light smoker group, the medium smoker group, and the heavy smoker group.

Post Hoc Test

Before conducting the Post Hoc test, a homogeneity test was conducted. In the homogeneity test, the results showed p < 0.05, which means that the data was not homogeneously distributed, so it was continued with the Games-Howell Post Hoc test.

Post Hoc Games-Howell test was conducted to determine which groups had significant differences. The results of the Post Hoc Games Howell test can be seen in the following table.

Table 7. The Results of Games-Howell Post Hoc Test

Smokers Group	Sig. (95% confidence level, α = 0.05)
Light Smokers and Moderate Smokers	0,000
Moderate Smokers and Heavy Smokers	0,000
Light Smokers and Heavy Smokers	0,000

The results of the Games-Howell Post Hoc test in Table 7. show that there is a significant difference in the mean number of haemoglobin levels (p < 0.05) in all treatment groups.

Conclusions

Characteristics of respondents based on the age range of the most active smokers are age 19-59 years (adults) totalling 41 people (91.1%). In each group category there were 15 respondents (33.33%) with a smoking frequency of < 10 cigarettes per day (light smokers), 11-20 cigarettes per day (moderate smokers), and > 20 cigarettes per day (heavy smokers). Characteristics based on smoking duration showed that 27 respondents (60%) were in the category of smoking duration > 10 years, which was the largest number. Haemoglobin levels in active smokers showed that 37 respondents (82.2%) had normal haemoglobin levels and 8 respondents (17.8%) had high haemoglobin levels. Based on the results of the One-Way Anova test, it can be concluded that there are differences in blood haemoglobin levels based on smoking frequency in active smokers in Banjar Blangsinga, Saba Village, Blahbatuh District, Gianyar Regency.

Conflict of Interest

The authors declare that there are no conflicts of interest, financial, professional or personal, that could influence the results and interpretation of this study. All data and findings presented have been obtained and analysed objectively in the interest of scientific development.

Acknowledgment

Thank to the head of Denpasar Health Polytechnic for the facilities provided so that this research can be carried out properly. Thanks are also expressed to the supervisors for their guidance, input, and valuable suggestions that have been given during the research process and writing of this paper.

REFERENCES

Alam, N., Oktiani, B. W., dan Sarifah, N. (2022). Pengaruh Jenis, Lama, Dan Jumlah Rokok Yang Dikonsumsi Terhadap Nilai Indeks Smoker's Melanosis Perokok Dewasa. Dentin, 6(3).

Amelia, R., Nasrul, E., dan Basyar, M. (2016). Hubungan Derajat Merokok Berdasarkan Indeks Brinkman dengan Kadar Hemoglobin. Jurnal Kesehatan Andalas, 5(3), 619–624. https://doi.org/10.25077/jka.v5i3.587.

Cahyanur, R., dan Rinaldi, I. (2019). Pendekatan Klinis Polisitemia. Jurnal Penyakit Dalam

Indonesia, 6(3), pp. 156-161. https://doi.org/10.7454/jpdi.v6i3.349.

Gunadi, V.I.R, Mewo, Y, dan Tiho M. (2016). Gambaran Kadar Hemoglobin Pada Pekerja Bangunan, Jurnal e-Biomedik (eBm),4(2), Fakultas Kedokteran Universitas Sam Ratulangi Manado. https://doi.org/10.35790/ebm.4.2.2016.14604.

Kementerian Kesehatan Republik Indonesia. (2018). Hasil Utama Riskesdas 2018.

Kementerian Kesehatan Republik Indonesia. (2018). Laporan Provinsi Bali Rikesdas 2018

Mariani, K. R. dan Kartini, K. (2018) 'Derajat Merokok Berhubungan dengan Kadar Hemoglobin pada Pria Usia 30-40 Tahun'. Jurnal Biomedika dan Kesehatan, 1: 85-92. https://doi.org/10.18051/JBiomedKes.2018.v1.85-92.

Melda. (2014). Prevalensi Smoker's Melanosis Pada Kalangan Petani. Skripsi. Makassar: Fakultas Kedokteran Gigi Universitas Hasanuddin.

Nabilahh,P. (2022). Gambaran Kadar Hemoglobin Pada Perokok Aktif di RT 02 Dusun Wanasari Desa Dauh Puri Kaja Kecamatan Denpasar Utara. Poltekkes Kemenkes Denpasar. Diakses dari http://repository.poltekkes-denpasar.ac.id

Pratiwi, P., Anggria, N., & Rachman, I. (2021). Tingginya Kadar Karboksihemoglobin (COHb), Hemoglobin (Hb), dan Hematokrit pada Montir Bengkel Motor di Kota Makassar. HIGIENE: Jurnal Kesehatan Lingkungan, 7(1), 11-16.

Rahmawati, H. (2022). 'Perbedaan Kadar Hemoglobin Pada Perokok Aktif Dan Perokok Pasif Di Desa Cicadas Kecamatan Gunung Putri Kabupaten Bogor' (Doctoral dissertation, Universitas Binawan).

Sayekti, S. (2020) 'Pengaruh Merokok Terhadap Kadar Hemoglobin (Studi Di Desa Candi Mulyo Kecamatan Jombang)'. Jurnal Insan Cendekia, 7(2).

Septiani, R. (2022) 'Hubungan Lama Merokok dan Frekuensi Merokok dengan Kadar Hemoglobin (Hb) Pada Perokok Aktif'. Babul Ilmi Jurnal Ilmiah Multi Science Kesehatan, 14(1). https://doi.org/10.36729/bi.v14i1.809.

Sipahutar, B. M., Nompo, R. S., & Arvia, A. (2019). Perbedaan Kadar Hemoglobin (Hb) Sebelum dan Setelah Hemodialisa Pada Penderita Hipertensi di RSUD Jayapura. DINAMIS, 16(2), 55-63

Wibowo, D. V., Pangemanan, D. H., dan Polii, H. (2017). Hubungan Merokok dengan Kadar Hemoglobin dan Trombosit pada Perokok Dewasa. J eBiomedik. 5(2).

Wikansari N, Kertia N, Dewi FST. Determinan Perilaku Berhenti Merokok pada Penderita Hipertensi di Kabupaten Sleman. BKM Journal of Comunity Medicine and Public Health. 2017; 33(3): 135-140.