Evaluation of Knowledge among Adolescents toward Polycythemia

[1]Ishraq J. Hasan, [2]Raya Najim Rasool

[1]Department of Physiology, College of Medicine, University of Misan, Misan, Iraq.

ishraq.mcm@uomisan.edu.iq

ORCID: 0000-0003-0283-5071

[2]Department of Physiology, College of Medicine, University of Misan, Misan, Iraq.

rayaaltimimy@gmail.com

ORCID: 0009-0008-9591-7204

Abstract

This study aims to shed light on adolescents' awareness of polycythemia vera, a rare blood disorder characterized by an increased red blood cell count above normal. It was noted during the study that there is a clear lack of research examining adolescents' health awareness of such diseases, despite their importance as clinical conditions. To address this, we conducted a cross-sectional descriptive study of 300 adolescents in Maysan Governorate, Iraq. The research sample was segmented into three different age categories (10-13 years, 14-17 years, and 18-21 years). A reliable and undeniable questionnaire was developed for assessing adolescents' understanding of a certain disease, which includes identifying the related information sources, its cause, the symptomatology, and the prevention techniques.

As the participants aged, the results demonstrated an increase in overall awareness of health, especially in terms of polycythemia vera. Older age groups demonstrated greater awareness and understanding of the disease, its causes, symptoms, and prevention methods compared to early adolescents. The study also demonstrated the extent to which adolescents relied on non-institutional sources such as family, peers, and the internet for information, rather than schools or formal health radio programs. The close relationship was revealed in the search for causes of illness based on adolescents' perceptions of lifestyle factors such as unhealthy eating, smoking, and excessive alcohol consumption. Teens considered headaches, high blood pressure, and nosebleeds to be the most common symptoms. Preventive measures mentioned by study participants were clearly diverse, with the older group focusing on exercise, healthy eating, cupping therapy, and medical consultations.

Key words: Polycythemia, Adolescence, Health Awareness.

Introduction

Polycythemia refers to a condition where an individual has an increased concentration of red blood cells within the blood [1]. This can thicken the blood beyond its normal viscosity, which can lead to serious health complications. Comprehending the scope of this condition is crucial for obtaining the correct diagnosis and treatment tailored to the case [2,3].

There are a couple of main types. One is called polycythemia vera, which is a rare blood disorder due to a genetic mutation. This condition results in the bone marrow producing an excessive amount of red blood cells. The other type is secondary polycythemia, which occurs due to be a result of

something else in the body [4]. It can be low oxygen levels, certain tumors that can stimulate the bone marrow to produce more red blood cells, certain medications, and, in rare cases, using steroids or testosterone [5]. There is also another type of secondary polycythemia called relative polycythemia which is another type of secondary polycythemia [6].

Finding out what causes polycythemia is very different depending on the type. In some cases, it can be genetic, such as the JAK2 mutation associated with polycythemia vera. Other cases stem from a lack of oxygen, which can be caused by lung problems, smoking, or living at high altitudes [7]. Problems with the kidneys can also contribute, as they sometimes overproduce EPO. Even taking testosterone, steroids, or being dehydrated can make it seem like one has a surplus of red blood cells [8].

As with any medical concern, polycythemia will first begin with a consultation. Blood tests, a complete blood count, tests for the JAK2 mutation, and EPO tests will be done. In some cases, the patient's oxygen levels or lung function will be measured. In addition, some patients will receive abdominal ultrasounds or CT scans to clarify the situation [9,10].

Addressing polycythemia wholly depends on the type you have and what is causing it. For polycythemia vera, the treatment is usually scheduled blood draws to reduce hematocrit. Low-dose aspirin and other low-key medications like hydroxyurea can be given if the condition is more advanced. Occasionally, they prescribe interferon-alpha or JAK2 inhibitors ruxolitinib [11].

When it comes to secondary polycythemia, the goal is to treat the root cause. That could mean oxygen therapy for lung problems, or maybe surgery if there's a tumor involved. They also try to steer clear of anything that might be pushing red blood cell production too high. For relative polycythemia, the focus is usually on staying well hydrated to help balance your blood volume. Lifestyle changes can make a difference too, like cutting back on stress or quitting smoking if that's part of the picture [12].

Most teenagers probably haven't heard much about rare diseases like polycythemia. It's not really something that comes up in everyday conversation or even in most school lessons. Unless you or someone close to you has dealt with it, it's easy to go through high school without ever learning what it is. Some people might pick up bits of information from health classes or their own experiences, but for the most part, it just isn't on our radar.

This study is trying to figure out how much teenagers actually know about polycythemia-stuff like what causes it, what the symptoms are, and what might happen if it's not treated. It's kind of important because if they don't know much, it's hard to help them recognize when something might be wrong. A lot of times, things like feeling tired or dizzy or having headaches get brushed off as no big deal. But those could be signs of something more serious, and not realizing that means people might wait too long to get help. That's why it matters to understand what teens know-and what they don't.

When it comes to secondary polycythemia, the goal is to treat the root cause. That could mean oxygen therapy for lung problems, or maybe surgery if there's a tumor involved. They also try to steer clear of anything that might be pushing red blood cell production too high.
For relative polycythemia, the focus is usually on staying well hydrated to help balance the blood volume. Lifestyle changes can make a difference, too, like cutting back on stress or quitting smoking if that's part of the picture.

Aim of the study

The aim of the current study is to see the percentage of teenagers in Maysan Governorate who know about polycythemia. Things like what causes it, what the symptoms are, and how to prevent it. The idea is to figure out where the gaps in their knowledge

might be, so we can suggest ways to help them learn more.

Methodology

Study Design

We looked at a group of 300 teenagers for this study. They came from different age ranges, and we picked them at random. We split them into three groups based on how old they were—early teens from 10 to 13, middle teens from 14 to 17, and older teens from 18 to 21. This way of grouping follows what the World Health Organization suggests [13].

Ethical Approval

We got the necessary approvals from the Maysan Education Directorate, the College of Medicine, and each school that took part. All the students and their parents gave their consent to participate.

Data Collection Tool

We used a structured questionnaire that the students filled out themselves. It asked about basic background information and what they knew about polycythemia—things like causes, symptoms, ways to prevent it, and where they got their information. The questions were based on earlier research and were checked by experts to make sure they were clear and accurate.

Results

Table 1 shows that the study sample was evenly distributed among the three age groups: 10-13 years, 14-17 years, and 18-21 years in terms of both age and gender. As a result, the percentages of males and females were equal in all groups.

The results of Figure 1 revealed that there is a clear relationship between the age of the survey participants and their knowledge about polycythemia disease. The results of the figure illustrate that the lowest level of knowledge, 35.3%, was in the youngest age group (10-13 years). Then the percentage rose to 43.3% in the middle age group (14-17 years), until it reached 83.3% in the oldest age group (18-21 years). The results of the causes were a similar pattern for all three groups, starting at 2% in the youngest group and increasing gradually till reaching 70% in the oldest one. The same is true for the results of knowing the symptoms of the disease. Figure 1 appeared different regarding the knowledge of prevention; the results were almost the same in the two youngest groups, while the older group revealed a clear rise in the awareness about the prevention of the disease, as the percentage reached 66%.

Figure 2 displays the sources of information that study participants used to learn about polycythemia. The results revealed that family/friends and the internet were the loudest percentages in the most common sources of knowledge about the disease, with the percentages representing 38% for each. The second most common source was the school at 21%, and the last source was the media (including television, radio, and newspapers) at only 3% of the total percentage.

Polycythemia Vera: Causes in Adolescents and Their Results. As identified in the results section, unhealthy eating stands out as the most prominent, especially in older adolescents aged 18 to 21, where it was recorded to account for almost 29% of the cases. Figure 3 is much higher than the percentages seen in the younger and middle-aged groups, which were 7% and 2% respectively. Smoking as a cause also ranked second in the older age groups, accounting for 11% of cases. Alcohol was further identified as another significant cause, predominantly for the 18 to 21 year age group, receiving little recognition in the other age groups. Among the other causes that were mentioned little more than the 7% mark were carbon monoxide poisoning, genetic factors, excessive use of dietary supplements, liver disease, and certain chronic illnesses, which in the aggregate were responsible for less than 7% of the cases.

Figure 4 illustrates the observed symptoms of polycythemia vera for three age groups (10-13, 14-17, and 18-21). Results for the younger group showed a general decline in awareness, with symptoms such as headache, high blood pressure, and fatigue accounting for 3.9% each. Fever, however, decreased to only 2%. No other symptoms were reported. Results for the middle-aged group showed greater diversity, with headache accounting for 9.4% and dizziness accounting for 7.5%, in addition to other symptoms at lower rates, such as fatigue (2.5%), nosebleeds (1.9%), and stroke and fever (1.3% each). Meanwhile, the older group (18-21) demonstrated greater awareness and a greater variety of potential symptoms, including headaches, which accounted for 26.7% of the total, followed by high blood pressure (8.9%). The percentages for nosebleeds and fever were equal, at 11.1%. Less prominent symptoms included fatigue, dizziness, and stroke, with rates of 4.4%, 2.2%, and 2.2%, respectively.

Figure 5 displays participants' opinions on preventive measures for polycythemia. In the 10-13-year-old group, focus was on eating a healthy diet and getting enough sleep, each at 31.4%. The 14-17-year-old group showed more diversity, with healthy eating at the top (8.2%), followed by blood donation (6.3%) and cupping (5%). Exercising and abstaining from smoking each accounted for only 4.4%. Seeing a doctor was the lowest at 0.6%. The results for the 18-21 year old age group were more varied, with exercise as the top preventive measure (23.3%), followed by healthy eating and cupping at 16.7% each, then lower percentages for abstaining from both (5.6%), and finally, getting enough sleep (3.3%).

Table 1: Age Groups and Gender

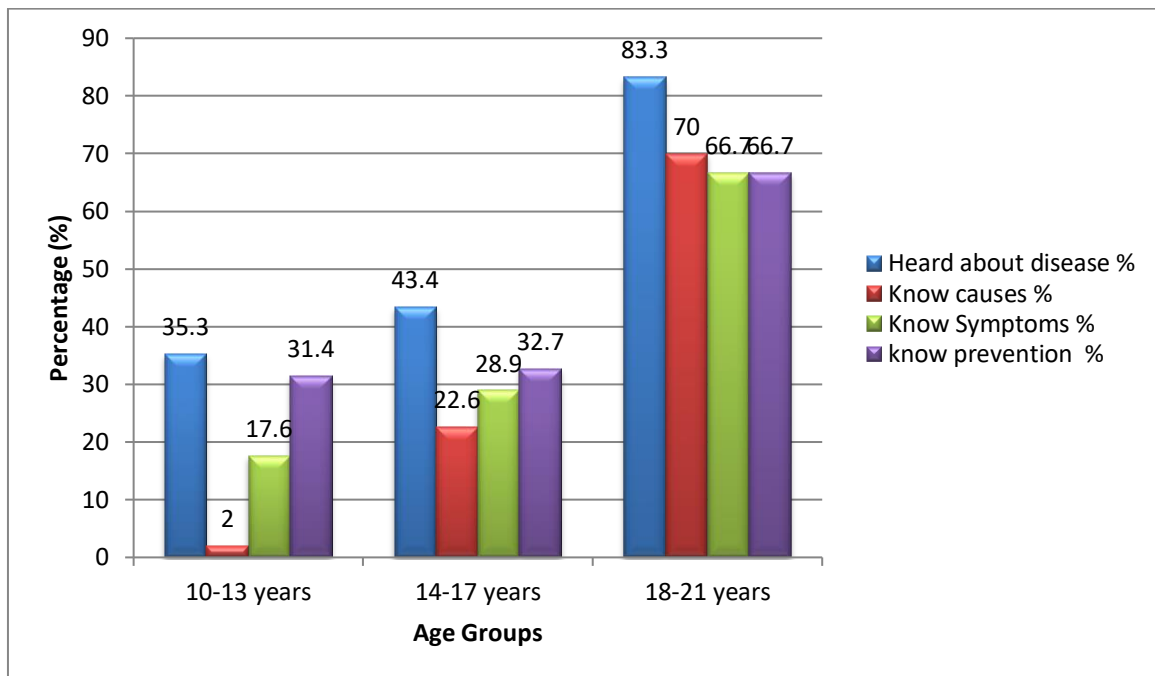| Age group	Gender	NO.	Percentage %
10-13 years	Male	50	16.7%
	Female	50	16.7%
14-17 years	Male	50	16.7%
	Female	50	16.7%
18-21 years	Male	50	16.7%
	Female	50	16.7%

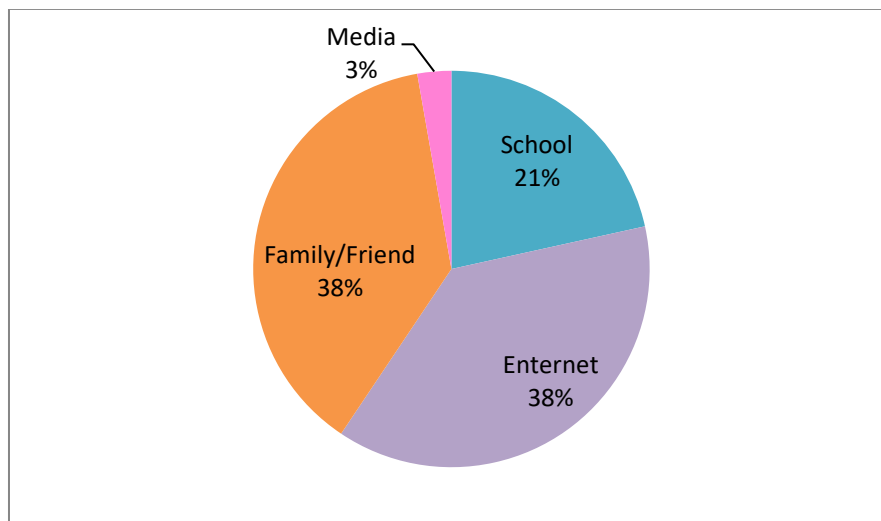**Figure 1: Level of Knowledge about Polycythemia by Age Group**

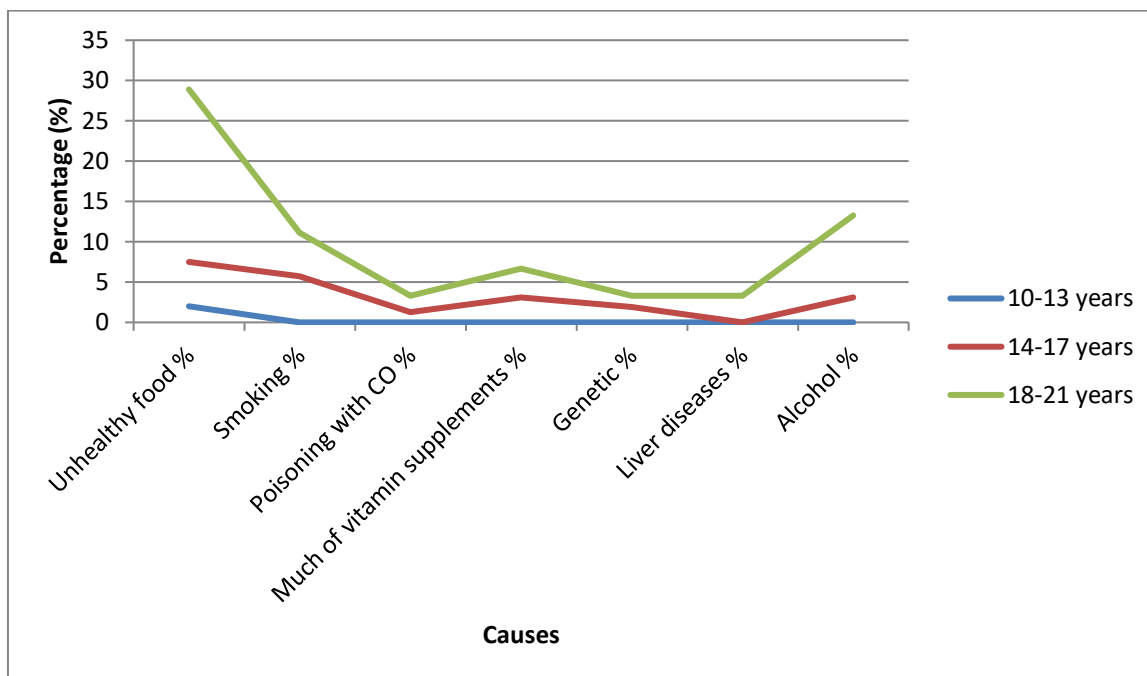**Figure 2: Sources of Information about Polycythemia by Age Group**
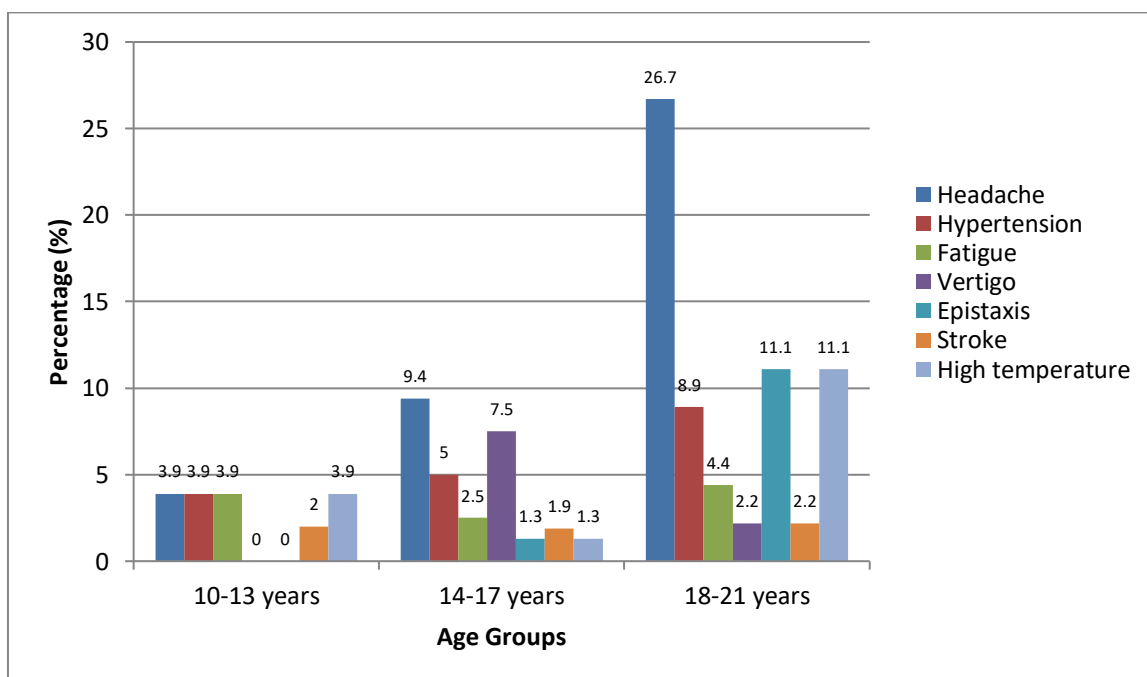
Figure 3 - Predicted Causes of Disease

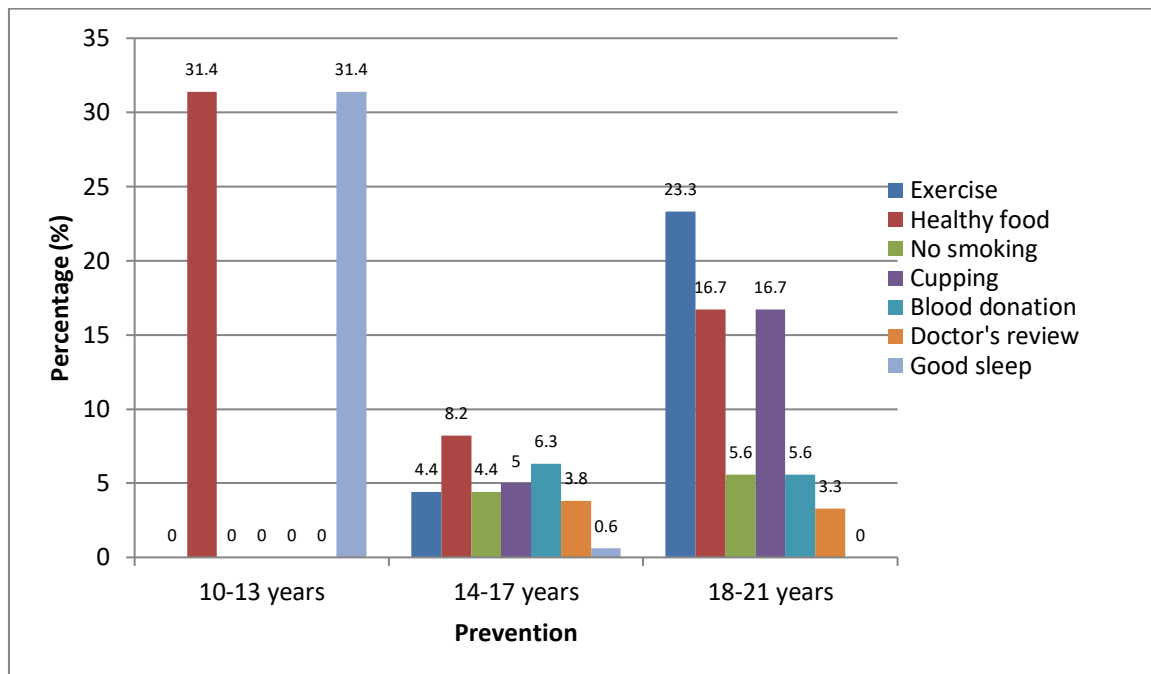**Figure 4 - Perceived Symptoms of Polycythemia by Age Group**

Figure 5 - Perceived Prevention of Polycythemia by Age Group

Discussion

The current study illuminates adolescents' awareness of polycythemia vera and their understanding of the seriousness of the disease, including its causes, symptoms, and prevention methods, across different age groups. Significant gaps were identified between groups in early adolescence, characterized by a general lack of health awareness, particularly regarding polycythemia vera, and the older group of adolescents, who exhibited greater awareness and knowledge of information about the disease.

The results of Figure 1 demonstrate a direct relationship between general health awareness and age among the study groups. The younger age group showed a clear lack of knowledge about health information, especially polycythemia, compared to the clear improvement in health awareness among the older age group, whether in disease awareness, symptoms, causes, or prevention. This result is similar to the findings presented in the study by Khanal *et al*. (2023), which showed an improvement in health awareness among adolescents aged 15 and older. It was also conducted by 16 researchers. The

health awareness of adolescents in general, and even those in advanced schools, is substandard, especially for rare blood diseases [14].

The results obtained from Figure 2 refer to adolescents' clear reliance on family, friends, and the internet, which are regarded as non-institutional sources, to obtain information about polycythemia disease, in comparison with formal Education School ranked third among sources of information about the aforementioned disease, and the media ranked last. Therefore, we emphasize the need to strengthen the institutional role in disseminating health information, as it is considered more reliable and represents the official body responsible for providing cognitive awareness to adolescents. This was confirmed by studies by Eghbal *et al*. (2023) and Caliston (2025), which demonstrated the significant role of digital tools in spreading health awareness, such as mobile phone applications and online e-health platforms, in addition to the dominance of communication with family and peers in spreading health awareness [15,16]. Benavides *et al*. (2021) highlighted that digital tools may begin to spread

public awareness among the general public, especially children. Therefore, we recommend integrating such electronic applications into school health curricula, which are considered formal from the outset, to provide reliable information to all [17]. Alharbi *et al*. (2017) also recommended health education throughout the country, as well as promoting awareness of blood diseases[18]. The results in Figure 3 indicate a low primary prevalence of polycythemia vera among younger individuals surveyed, particularly focusing on unhealthy eating habits. A significant portion of these individuals did not mention the condition, likely due to a lack of awareness in this age group. In contrast, older age groups, specifically those aged 18-21, exhibit a wide range of risk factors for the disease. Lifestyle choices are the primary factors, followed by diet, smoking, and excessive alcohol consumption. Additionally, the inadequate release of essential nutrients, such as macro-vitamins, plays a role, to a lesser extent.

The development of awareness about the disease and its causes in the older age group may be caused by the natural maturation process in adolescence and exposure to external influences, or due to the progression of age. It is necessary to provide comprehensive health care for adolescents, especially in formal institutions, to address this issue effectively. Adolescents should be equipped with important information earlier to prevent future health complications. Figure 5 highlights a clear development in health knowledge. The middle-aged groups (14-17 years) and 18-21 years reported greater diversity in identifying the onset of polycythemia. This was especially evident among the older age group, who reported symptoms such as a runny nose, stroke, fever, and high blood pressure. The focus was on all age groups. The younger age group (13-18 years) did not report symptoms compared to the older age group. Furthermore, the diversity of symptoms among participants is actually due to their greater health awareness and knowledge from the environment and influences in general, whether from family, peers, or scientific

organizations such as schools. This was indicated by the study, which was designed by Ibrahim (2020), with a specific focus on delivering accurate information to adolescents, especially before the puberty period [19]. Figure 5 shows that preventive measures focused on by adolescents in the older age group (8-21 years) were more diverse and objective. Exercise was the primary focus, along with healthy eating and some old health habits such as cupping. The result also appeared to be lower rates of blood donations and fewer visits to the doctor. This approach was also evident in the middle group (14-17 years), but at lower rates, with slight differences, as the focus was primarily on healthy eating. This trend was also seen in the younger group (10-13 years), indicating a deficit in the younger age groups. The results in align with the variables related to health knowledge, susceptibility, and benefits, which primarily influence behaviors that increase with age [20].

Limitations and Strengths of the Study
Limitations

Despite the valuable elements achieved through this study, there are some limitations that we would like to address:

1. Sample size and generalizability: The results obtained from the limited sample in the current study may not apply to all youth, considering the diverse environments and healthcare systems in which they reside.

2. Data reliability: The study collected reliable data on adolescents' symptom reports. This allowed for an exploration of older participants' perceptions, which could impact their ability to recall or evaluate symptoms compared to younger individuals who may lack the necessary awareness and knowledge.

3. Social factors: Social factors, such as family awareness, socioeconomic status, and access to medical care, may influence adolescents' understanding of the disease, its symptoms, and preventive measures.

Strengths of the Study

1. Novelty: This research addresses a rarely studied phenomenon-adolescent health awareness of polycythemia-filling a critical gap in the literature.
2. Methodological rigor: The study used a balanced sample across age groups and genders, enhancing the reliability of comparisons.
3. Public health significance: By highlighting adolescents' reliance on non-institutional sources and their misconceptions, the study underscores urgent needs for policy and educational interventions.
4. Relevance: The results provide a foundation for designing age-appropriate health literacy programs, aligning with current global health priorities for adolescents.

Conclusion

The results of this study show a significant decrease in awareness of polycythemia among adolescents. This is evident despite the variation in information gathered from the three different age groups of participants, and the challenges some faced in completing all questionnaire items, especially in the younger age group. This finding underscores the cognitive gap in health knowledge. Therefore, early educational interventions are crucial to address this evident need. The significance, originality, and impact of the study on both health and educational realms make it a valuable and intriguing contribution.

Recommendations

It is recommended that health education on hematology be included in school curricula to provide adolescents with the necessary information about rare diseases. Digital health platforms and smartphone applications should also be utilized, as they are appealing to adolescents, to promote health awareness. It is essential to use guidelines and checklists tailored for adolescents to inform them about the disease and its symptoms early on, reducing the risk of late diagnosis. Finally,

collaboration between families, schools, and healthcare providers is crucial to establishing a systematic approach to health education for adolescents.

References

1. Grenier JMP, El Nemer W, De Grandis M. Red Blood Cell Contribution to Thrombosis in Polycythemia Vera and Essential Thrombocythemia. Int J Mol Sci. 2024 Jan 24;25(3):1417. doi: 10.3390/ijms25031417. PMID: 38338695; PMCID: PMC10855956.
2. Tefferi A, Vannucchi AM, Barbui T. Polycythemia vera: historical oversights, diagnostic details, and therapeutic views. Leukemia. 2021 Dec;35(12):3339-3351. doi: 10.1038/s41375-021-01401-3. Epub 2021 Sep 3. PMID: 34480106; PMCID: PMC8632660.
3. AL-ALI, Z., Mohammed, H., Owais, M., Abdel Reda, A., Globe, M. Study of some hematological and biochemical parameters in patients with polycythemia vera. *Journal of Medical and Life Science*, 2024; 6(2): 264-268. doi: 10.21608/jmals.2024.363972
4. Harrison CN, Barbui T, Bose P, Kiladjian JJ, Mascarenhas J, McMullin MF, Mesa R, Vannucchi AM. Polycythaemia vera. Nat Rev Dis Primers. 2025 Apr 17;11(1):26. doi: 10.1038/s41572-025-00608-3. PMID: 40246933.
5. Babakhanlou R, Verstovsek S, Pemmaraju N, Rojas-Hernandez CM. Secondary erythrocytosis. Expert Rev Hematol. 2023 Apr;16(4):245-251. doi: 10.1080/17474086.2023.2192475. Epub 2023 Mar 23. PMID: 36927204.
6. Lee MW, Yeon SH, Ryu H, Song IC, Lee HJ, Yun HJ, Kim SY, Lee JE, Shin KS, Jo DY. Volumetric Splenomegaly in Patients With Polycythemia Vera. J Korean Med Sci. 2022 Mar 21;37(11):e87.

doi: 10.3346/jkms.2022.37.e87. PMID: 35315598; PMCID: PMC8938613.

7. Regimbeau M, Mary R, Hermetet F, Girodon F. Genetic Background of Polycythemia Vera. Genes (Basel). 2022 Apr 2;13(4):637. doi: 10.3390/genes13040637. PMID: 35456443; PMCID: PMC9027017.

8. Tefferi A, Vannucchi AM, Barbui T. Polycythemia vera: historical oversights, diagnostic details, and therapeutic views. Leukemia. 2021 Dec;35(12):3339-3351. doi: 10.1038/s41375-021-01401-3. Epub 2021 Sep 3. PMID: 34480106; PMCID: PMC8632660.

9. How J, Hobbs G. Management Issues and Controversies in Low-Risk Patients with Essential Thrombocythemia and Polycythemia Vera. Curr Hematol Malig Rep. 2021 Oct;16(5):473-482. doi: 10.1007/s11899-021-00649-x. Epub 2021 Sep 3. PMID: 34478054.

10. Ahmed, R., Osman, I. Hematological parameters in Myeloproliferative neoplasms in Sudanese patients. *Journal of Bioscience and Applied Research*, 2024; 10(3): 530-535. doi: 10.21608/jbaar.2024.380714

11. Fox S, Griffin L, Robinson Harris D. Polycythemia Vera: Rapid Evidence Review. Am Fam Physician. 2021 Jun 1;103(11):680-687. PMID: 34060791.

12. Filkina OM, Kocherova OY, Malyshkina AI, Vorobyeva EA, Dolotova NV. [The awareness and attitude of adolescents concerning healthy life-style]. Probl Sotsialnoi Gig Zdravookhranenniiai Istor Med. 2022 Jan;30(1):33-38. Russian. doi: 10.32687/0869-866X-2022-30-1-33-38. PMID: 35157377.

13. World Health Organization (WHO). (2022). Adolescent health. https://www.who.int/news-room/fact-sheets/detail/adolescents-health-risks-and-solutions

14. Khanal SP, Budhathoki CB, Okan O. Improving adolescent health literacy through school-based health literacy intervention: a mixed-method study protocol. BMC Public Health. 2023 Feb 28;23(1):407. doi: 10.1186/s12889-023-15316-4. PMID: 36855125; PMCID: PMC9973246.

15. Eghbal SB, Kenari ZA, Ashouri A, Rouhani-Tonekaboni N, Kasmaei P, Mehrabian F, Karimy M, Rezaei F, Fattahi E. The effectiveness of educational program based on health belief model on promotion of puberty health concepts among teen girls: a cross-sectional study in north of Iran. BMC Womens Health. 2023 May 8;23(1):239. doi: 10.1186/s12905-023-02391-3. PMID: 37158853; PMCID: PMC10165794.

16. Caliston, N. (2025). Evaluating the Effectiveness of Mobile Game-Based Learning for Raising Adolescent Health Awareness: The Case of "AHlam Na 2.0". IJOEM Indonesian Journal of E-Learning and Multimedia, 4(1), 11–20. https://doi.org/10.58723/ijoem.v4i1.349.

17. Benavides C, Benítez-Andrades JA, Marqués-Sánchez P, Arias N. eHealth Intervention to Improve Health Habits in the Adolescent Population: Mixed Methods Study. JMIR Mhealth Uhealth. 2021 Feb 18;9(2):e20217. doi: 10.2196/20217. PMID: 33599616; PMCID: PMC7932840.

18. Alharbi HA, Almutairi AF, Alhelih EM, Alshehry AS. The Learning Preferences among Nursing Students in the King Saud University in Saudi Arabia: A Cross-Sectional Survey. Nurs Res Pract. 2017;2017:3090387. doi: 10.1155/2017/3090387. Epub 2017 May 23. PMID: 28630767; PMCID: PMC5463154.

19. Ibrahim Ibrahim Rizk, H. (2020). School health services in Egypt: Critical analysis. Children and Youth Services Review. https://doi.org/10.1016/J.CHILDYOUTH.2020.105609.

20. Wood WA, Lee SJ. Malignant hematologic diseases in adolescents and young adults. Blood. 2011 Jun 2;117(22):5803-15. doi: 10.1182/blood-2010-12-283093. Epub 2011 Mar 11. PMID: 21398581.