

## ORIGINAL ARTICLE- PUBLIC HEALTH

## PREVALENCE AND SEVERITY OF ANAEMIA AMONG ADOLESCENTS IN TAMIL NADU: INSIGHTS FROM A YEAR-LONG HEALTH CAMP INITIATIVE, MAY 2023 TO MARCH 2024

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**INTRODUCTION :** Anaemia is a significant global public health issue, particularly in low and middle-income countries, where nutrient deficiencies result in low haemoglobin levels. Adolescence (ages 10-19) is a crucial growth period, with 1.2 billion adolescents worldwide, many in developing nations like India, which has the largest adolescent population. According to NFHS -5 Tamil Nadu, prevalence of anaemia among adolescent girls is 52.9% and among boys is 24.6%. Our objective was to estimate the prevalence of anaemia among adolescents aged 10 to 19 years by gender, location and severity in Tamil Nadu between May 2023 and March 2024.

**METHODS :** This cross-sectional study utilized secondary data from the Directorate of Public Health and Preventive Medicine (DPPM), Tamil Nadu, based on health check-up camps held from May 2023 to March 2024 at 2,286 Primary Health Centres (PHCs) where samples were mobilised from schools and tested using gold standard tests like cell counters for haemoglobin estimation. Following Anaemia Mukth Bharat Operational Guidelines, severity of anaemia was classified as mild, moderate, or severe. Data analysis was performed using Microsoft Excel and SPSS (version 24), with protocols in place to ensure confidentiality.

**RESULTS :** The overall prevalence of anaemia among adolescents was 48.3%, with 54.4% among females and 41.0% among males. Prevalence among adolescents identified in Trichy was 84%, while in Dindigul it was 70%. In terms of classification, severe anaemia accounted for 1.6%, moderate anaemia for 44.4% and mild anaemia for 54.1% of cases.

**CONCLUSION :** The study highlights a significant prevalence of anaemia among adolescents in Tamil Nadu, particularly among females and in districts like Trichy and Dindigul. With mild and moderate cases being predominant, there is an urgent need for targeted interventions particularly for the severe anemia cases immediately. Addressing nutritional deficiencies is crucial for improving adolescent health outcomes in the region.

**KEYWORDS :** Adolescent health, Anaemia, Nutritional status

**INTRODUCTION**

Anaemia is a global public health concern, particularly in low and middle-income countries, where nutrient deficiencies lead to reduced haemoglobin levels in the blood (Hb < 12 g/dL).<sup>1,2</sup> The term "Anaemia" originates from the Greek word meaning "no blood". Anaemia is not a specific disorder, it is a condition caused by insufficient red blood cells or haemoglobin due to one or more vital nutrient deficiencies.<sup>3,4</sup> Anaemia poses serious health risks, including maternal mortality, weakened physical and cognitive capacity, increased susceptibility to infections, and poor pregnancy outcomes.<sup>8</sup>

Adolescence, defined by the World Health Organization (WHO) as the age range of 10 to 19 years for both sexes, represents a critical period of growth and development. Globally, there are 1.2 billion adolescents, with a significant portion residing in developing countries.<sup>5</sup> India has the largest adolescent population in the world, accounting for 21% of its total population.<sup>6</sup> In India, adolescent girls are particularly vulnerable to anaemia due to factors such as poor

nutrition, early marriage, and pregnancy, which exacerbate the risk of anaemia.<sup>9</sup> Ensuring adequate iron status during adolescence is critical for reducing anaemia in pregnancy and improving maternal and child health outcomes.<sup>10</sup>

National Family Health Survey (NFHS) 5, (2019-2021), reported a national prevalence of anaemia as 59% for adolescent girls and 31% for boys whereas in Tamil Nadu, the prevalence of anaemia is 52.9% in adolescent girls and 24.6% in adolescent boys which is comparatively lesser than the national prevalence.<sup>7</sup>

However, previous studies on anaemia among adolescents in Tamil Nadu have been limited in scope, often confined to specific regions or smaller populations. These studies frequently focus on adolescent girls or particular



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age subgroups, providing fragmented data on anaemia prevalence. Moreover, anaemia among adolescent boys has received limited attention in public health research and interventions. To fill these gaps, this study aimed to describe the prevalence of anaemia among adolescents (10 to 19 years), by gender, location and severity in Tamil Nadu between May 2023 and March 2024.

**METHODS**

This cross-sectional study involved secondary data analysis using information obtained from the Directorate of Public Health and Preventive Medicine (DPH&PM), Tamil Nadu collected through health check-up camps organized by 2,286 Primary Health Centres (PHCs) across the state, held from May 2023 to March 2024 in schools and colleges, and 19,15,072 adolescents were screened for anaemia. During these camps, blood samples were collected from each adolescent on-site using an aseptic venepuncture kit, including needles, syringes, and collection tubes. EDTA vacutainers were used to prevent clotting.

The samples were analysed with mobilized cell counters or the samples were mobilized to the nearby primary health centres where the cell counters were available. Key variables included age, sex, and haemoglobin (Hb) levels for adolescents aged 10 to 19 years.

We have adapted operational guidelines of “Anaemia Mukth Bharat” to classify anaemia based on severity as mild with Hb levels of 11-11.9 g/dL for females and 11-12.9 g/dL for males, moderate with Hb Levels of 8-10.9 g/dL, and severe with Hb levels of <8 g/dL.<sup>11</sup>

We analysed the data using standard statistical software like Microsoft Excel and SPSS (version 24), calculating frequencies and proportions to assess the prevalence and severity of anaemia among adolescents in Tamil Nadu. Data security protocols were followed to maintain confidentiality.

**RESULTS**

The overall prevalence of anaemia in adolescents is (n = 9,25,423) 48.3%, with 54.4% among females compared to 41.0% among males.

Figure 1 illustrates the prevalence of anaemia among adolescents across different Health Unit Districts (HUDs). The prevalence of anaemia exceeds 50% in 24 out of the 46 HUDs surveyed. Specifically, the prevalence rates are 84% in Tiruchirapalli, 70% in Dindigul, 70% in Kallakurichi, and 61% in Cuddalore districts.

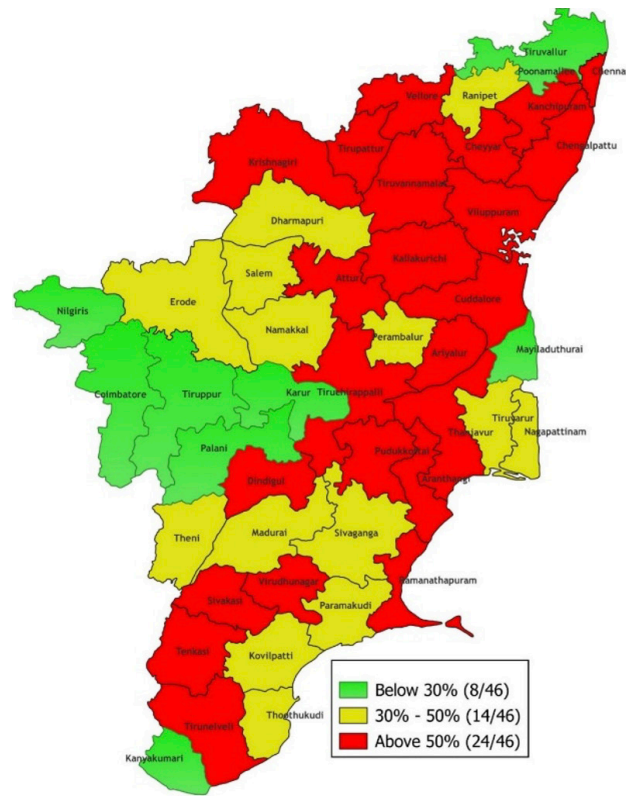


Fig 1. Figure 1 Prevalence of anaemia among adolescents by Health Unit Districts (HUD) in Tamil Nadu, May 2023-March 2024 (N=19,15,072)

Figure 2 presents prevalence of anaemia among male and female adolescents across various Health Unit Districts (HUDs). 11 out of 46 HUDs had more than 50% prevalence of anaemia among male adolescent children whereas more than 31 HUDs reported more than 50 % prevalence of anaemia among female adolescent children.

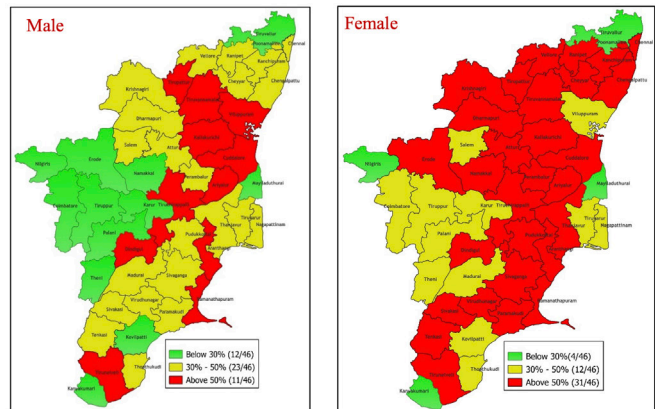


Figure 2: Distribution of Anaemia by gender and Health Unit Districts among Adolescents, Tamil Nadu, May 2023-March 2024 (N=19,15,072)

Figure 3 presents the distribution of anemia severity. Among the adolescent males with anemia, 59.1% had mild anemia, 40.2% had moderate anemia, and only 0.7% had severe anemia. Among females, the reported cases showed that 50.9% had mild anemia, 47% had moderate anemia, and only 2.1% had severe anemia.

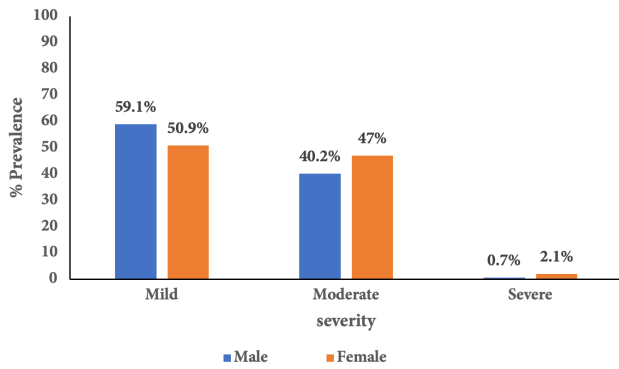


Figure 3: Prevalence of anaemia among adolescents by severity, Tamil Nadu, May 2023-March 2024 (N=19,15,072)

Figure 4 presents the prevalence of anaemia severity among adolescent males across various Health Unit Districts (HUDs), categorized into mild (11-11.9 g/dL), moderate (8-10.9 g/dL), and severe anaemia (<8 g/dL). Severe anaemia remains relatively uncommon, with only a few districts reporting rates above 1%, such as Kovilpatti (2%) and Tiruvallur (2%). Moderate anaemia was notable in several areas, with Ariyalur (66%) and Kallakurichi (54%) showing high rates. The higher percentage of mild anaemia was noted in districts like Kanyakumari (90%) and Pudukkottai (74%).

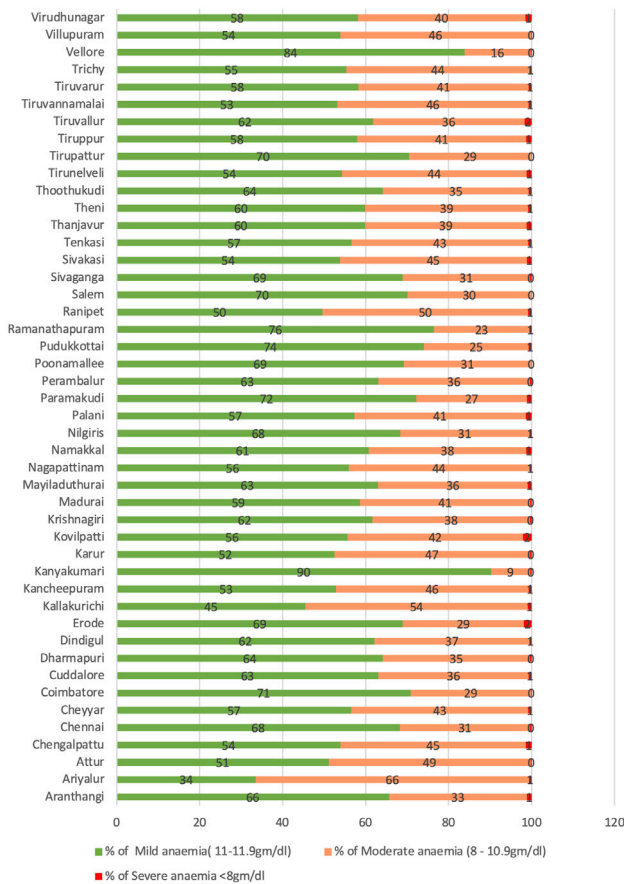


Figure 4: Prevalence of anaemia by severity among adolescent males by Health Unit Districts (HUD) in Tamil Nadu, 2023-2024 (N= 8,71,634)

Figure 5 presents the distribution of anaemia severity among adolescent females across various Health Unit Districts (HUDs), categorized into mild, moderate, and severe anaemia based on haemoglobin levels. Prevalence of severe anaemia (<8 g/dL) was comparatively lesser than moderate and mild forms, with the highest rates observed in Tiruvallur (6%) and Kovilpatti (5%), though overall, these percentages were low across the districts, with many reporting only 1-2%. Moderate anaemia was notably high, particularly in Ariyalur (71%) and Attur (62%). The prevalence of mild anaemia is higher in several districts, specifically in Cuddalore (74%) and Kanyakumari (73%) reporting the highest percentages.

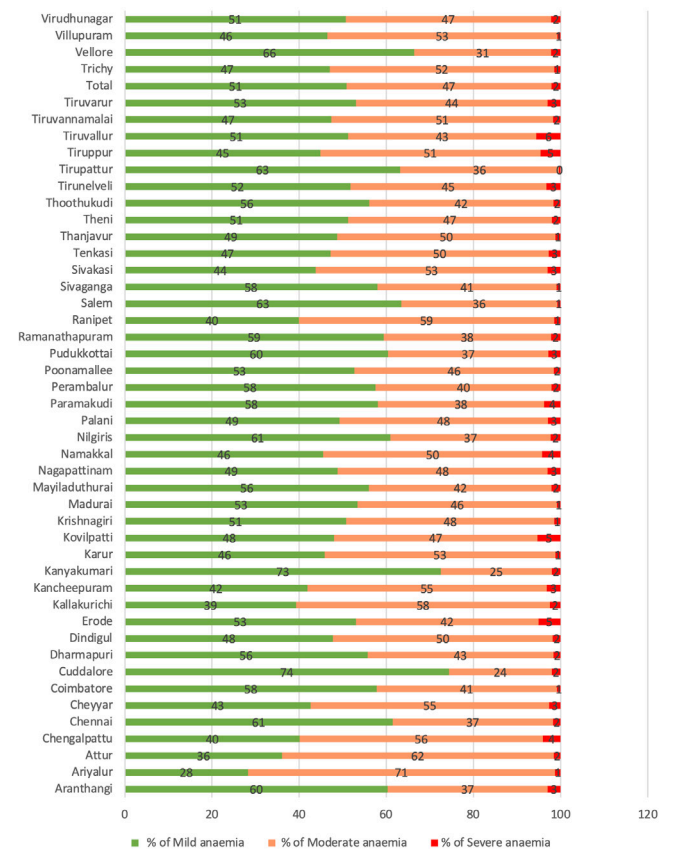


Figure 5: Prevalence of anaemia by severity among adolescent females by Health Unit District (HUD) in Tamil Nadu, 2023-2024 (N= 10,43,438)

## DISCUSSION

According to the World Health Organization (WHO), anaemia is a significant global public health issue, affecting 30% of non-pregnant women and 37% of pregnant women aged 15-49 years, with children and adolescents also at elevated risk. In Tamil Nadu, our study found a 48.3% prevalence of anaemia among adolescents, with higher rates among females (54.4%) compared to among males (41%). This prevalence is higher than the global average for developing countries, reflecting the significant burden of anaemia in this region.<sup>6</sup>

When compared to the National Family Health Survey (NFHS) 5 data (2019-2021), which reported a national prevalence of 59% for adolescent girls and 31% for boys, our findings indicate a lower overall prevalence of 48.3%. However, it is important to note that the prevalence among females in our study (54.4%) is slightly higher than Tamil Nadu-specific NFHS 5 data (52.9%) and lower than the national average (59%). Conversely, the reported prevalence among males (41%) is significantly higher than both the national average (31%) and Tamil Nadu-specific data (24.6%), suggesting a higher burden of anaemia among adolescent males in the surveyed regions.<sup>7</sup>

The WHO attributes the higher prevalence in low and middle-income countries to nutritional deficiencies, particularly iron deficiency, as well as infections like malaria and parasitic infestations. While our study did not explore the aetiology of anaemia, the high prevalence in females suggests a strong link to iron deficiency due to menstrual blood loss and inadequate dietary intake, a finding that is consistent with global data.<sup>6</sup>

Our findings align closely with previous Tamil Nadu-based studies, such as Chandrakumari et al. (2019), which reported a prevalence of 48.63% among adolescent girls, reflecting a regional consistency in anaemia rates.<sup>2</sup> However, Sunitha K (2024) reported a slightly lower prevalence of 37.2%, indicating possible geographical variations within the state.<sup>12</sup> On a national level, Singh A et al. (2021) observed a prevalence of 42% in Jharkhand, while a meta-analysis by Daniel RA et al reported a higher pooled prevalence of 65.7% across India, indicating that Tamil Nadu may have a somewhat lower overall burden of anaemia compared to other regions.<sup>13,14</sup>

Globally, our prevalence findings are comparable to studies conducted in Bangladesh, where Kundu S et al. (2023) reported a prevalence of 46.8%. This suggests that anaemia remains a persistent issue across South Asia.<sup>15</sup> However, the rates found in Tamil Nadu are still lower than those reported in high-prevalence regions, such as West Bengal, where Chakrabarty M et al. (2023) documented a significant increase in anaemia prevalence from 54.2% to 58.9% in recent years.<sup>16</sup>

Our study's gender-specific findings highlight the increased vulnerability of adolescent girls to anaemia, with a prevalence of 54.4% compared to 41% for boys. Similar research, such as Singh A et al. (2021) and Shettar D et al. (2024), corroborates these findings, emphasizing the need for gender-specific interventions.<sup>13,17</sup> Notably, our research also identified a significant prevalence of anaemia

among adolescent males (41%), showing the importance of comprehensive interventions that address anaemia in both genders.

Geographical disparities in anaemia prevalence within Tamil Nadu are evident, with Tiruchirapalli exhibiting the highest rates (87.3) among females and 80.8% among males compared to regions like Nilgiris, which had a much lower prevalence (13%). These findings highlight the necessity for localized public health interventions, especially in high-burden areas such as Trichy along with Kallakurichi, and Dindigul which also have higher prevalence.

Our study found that mild anaemia constituted the majority of cases (54.1%), followed by moderate anaemia (44.4%) and severe anaemia (1.6%). This distribution aligns with other regional studies, such as Chandra Kumari et al. (2019), which also found mild anaemia to be the most prevalent.<sup>2</sup>

The high prevalence of anaemia among adolescents in Tamil Nadu emphasizes the urgent need for targeted public health interventions. Given that most cases are classified as mild to moderate, implementing iron supplementation programs, nutritional education, and school-based health initiatives could significantly alleviate the burden of anaemia among adolescents. Furthermore, the observed gender disparity necessitates focused programs aimed at improving menstrual health management and dietary iron intake among adolescent girls.

Thus, our study emphasizes the critical need for comprehensive strategies to combat anaemia in Tamil Nadu, particularly in high-prevalence districts. Addressing the nutritional and health needs of adolescents is essential for reducing anaemia prevalence and improving overall health outcomes in this vulnerable population.

## LIMITATIONS

The data collected is specific to Tamil Nadu, which may limit the generalizability of the findings to other regions or countries, as different demographic and environmental factors could influence anaemia prevalence elsewhere.

## CONCLUSION

The study emphasizes the prevalence of anaemia among adolescents in Tamil Nadu, showing a higher rate in females than in males. Trichy has the highest prevalence, followed by Dindigul and Kallakurichi. In terms of severity, mild anaemia is more common than moderate and severe anaemia. Among males, mild anaemia is the most prevalent, while females exhibit higher rates of both moderate and



severe forms of anaemia. It highlights the need for targeted interventions in addition to Weekly Iron Folic Acid Supplementation (WIFS) and National deworming day (NDD) especially for adolescent girls and high-prevalence districts, to address this significant public health issue. Additionally, adolescent anaemia in males is also significant and must not be overlooked, as it can lead to long-term health consequences. Addressing anaemia in both genders is essential for promoting overall adolescent health. Future studies should explore the root causes of anaemia more deeply and assess the effectiveness of implemented health programs to ensure sustainable progress.

## DECLARATION OF INTEREST

The authors declare no conflict of interest

## REFERENCES

1. Kassebaum NJ, Jasrasaria R, Naghavi M, Wulf SK, Johns N, Lozano R, et al. A systematic analysis of global anemia burden from 1990 to 2010. *Blood*. 2014; 123:615–24. doi: 10.1182/blood-2013-06-508325.
2. Chandrakumari AS, Sinha P, Singaravelu S, Jaikumar S. Prevalence of anemia among adolescent girls in a rural area of Tamil Nadu, India. *J Family Med Prim Care*. 2019 Apr;8(4):1414–7. doi: 10.4103/jfmprc.jfmprc\_140\_19.
3. Ramakrishnan U. Nutritional anemias. *CRC Series in Modern Nutrition*. 2000;280.
4. Asher T, Shobana M, Abarna A, Aamina A, Bharathi B, Ponnambily Chandy. The prevalence of anemia among adolescent girls in a selected college in Kanchipuram. *Medico-Legal Update*. 2020;20(2):1-5.
5. World Health Organization. Adolescent health. Available at: [https://www.who.int/health-topics/adolescent-health#tab=tab\\_1](https://www.who.int/health-topics/adolescent-health#tab=tab_1) [Accessed 23 October 2023].
6. World Health Organization. Anaemia. Available at: [https://www.who.int/health-topics/anaemia#tab=tab\\_1](https://www.who.int/health-topics/anaemia#tab=tab_1) [Accessed 23 October 2023].
7. National Family Health Survey 5 [NFHS 5 data].
8. Nayar PD, Mehta R. Child Health. In: Gupta P, Ghai OP, editors. *Textbook of Preventive and Social Medicine*. 2nd ed. New Delhi: CBS Publishers and Distributors; 2007. p. 428–37.
9. Shobha S, Sharada D. Efficacy of twice weekly iron supplementation in anemic adolescent girls. *Indian Paediatr*. 2003;40:1186–90.
10. Kaur S, Deshmukh PR, Garg BS. Epidemiological correlates of nutritional anaemia in adolescent girls of rural Wardha. *Indian J Community Med*. 2006;31:255–8.
11. Anemia Muktbharat. Available at: <https://anemiamuktbharat.info/> [Accessed 23 October 2023].
12. Sunitha K, Muthu G, Jesuraj Arockiasamy, Maryam Jamila S, Yuvaraj J, Shantaraman K. Multiple micronutrient deficiency among adolescent girls with normal nutritional status: need for fortified nutritional support in rural settings of South Tamil Nadu, India. *Natl J Community Med*. 2024;15(2):105-11.
13. Singh A, Juneja K, Purwar N, Chauhan A, Tyagi N, Singh NP. A comparative study of prevalence of anemia and its risk factors among school-going adolescent girls in the field practice areas of medical college in Gautam Buddha Nagar district. *J Community Med Health Educ*. 2022;15(3):2455-3891. doi:10.1007/s41373-022-00432-7.
14. Daniel RA, Kalaivani M, Kant S, Gupta S. Prevalence of anaemia among adolescent girls (10–19 years) in India: a systematic review and meta-analysis. *Natl Med J India*. 2023;36:233–40. DOI: NMJI\_637\_21.
15. Kundu S, Alam SS, Mia MA-T, Hossan T, Hider P, Khalil MI, Musa KI, Islam MA. Prevalence of anemia among children and adolescents of Bangladesh: a systematic review and meta-analysis. *Int J Environ Res Public Health*. 2023;20:1786. <https://doi.org/10.3390/ijerph20031786>.
16. Chakrabarty M, Singh A, Singh S, Chowdhury S. Is the burden of anaemia among Indian adolescent women increasing? Evidence from Indian Demographic and Health Surveys (2015–21). *PLOS Glob Public Health*. 2023;3(9). <https://doi.org/10.1371/journal.pgph.0002117>.
17. Shettar D, Hiremath B, Yamakanamardi B, Totad RD. Prevalence of anaemia among adolescents in a rural area of North Karnataka. *Al Ameen J Med Sci*. 2024;17(2):177–81.