

# A silent crisis: two decades of anaemia trends among women in the Eastern Mediterranean Region (2000–2019)

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## Abstract

**Introduction:** Anaemia remains a major public health issue. This condition adversely impacts women of reproductive age, especially in low-income countries. Although there is an ongoing global effort to reduce anaemia prevalence, progress is slow and uneven. Anaemia exhibits unique patterns in the Eastern Mediterranean Region (EMR) due to this region's economic disparities and variations in access to health services. This study examined trends in anaemia prevalence among pregnant and nonpregnant women in the EMR by national income.

**Material and methods:** This retrospective cross-sectional study examined anaemia prevalence among pregnant and nonpregnant women in 21 EMR countries in the period 2000–2019 at 5-year intervals. The data on anaemia prevalence were compiled by the World Health Organization (WHO), while the World Bank provided the income classifications. Descriptive statistics were used to examine trends in prevalence and their associations with each country's income.

**Results:** Although a general decrease in anaemia prevalence was observed among both pregnant and nonpregnant women, this improvement varied by income group. Pregnant women exhibited a greater reduction than nonpregnant women (–12% vs. –10%). Low-income countries reported higher prevalence rates. The study revealed significant negative associations between national income and anaemia prevalence ( $p < 0.001$ ). While some countries demonstrated improvements, others exhibited unique or unexpected behaviours or stagnant rates.

**Conclusions:** Economic differences significantly impact trends in anaemia prevalence among women of reproductive age in the EMR. Urgent, country-targeted interventions, particularly in low-income countries, are necessary to meet the WHO's goal of reducing anaemia among women of reproductive age by 50% before 2030.

**Key words:** pregnant women, nonpregnant women, prevalence, region, national income.

## Introduction

Anaemia is widely considered a major public health problem. This condition has negative effects on health, especially among women of reproductive age (WRA) [1]. The continued prevalence of anaemia generates continual cycles of morbidity and mortality all around the world [1, 2]. The World Health Organization defines anaemia as a haemoglobin (Hb) level of less than 12.0 g/dl for nonpregnant women and less than 11.0 g/dl for pregnant women [3]. Global reports indicate that 29.9% of nonpregnant and 36.5% of pregnant women worldwide had anaemia in 2019, with low-income countries reporting the highest burden [4]. Anaemia is a multifactorial condition that has been attributed in different cases to chronic inflammation, parasitic infection, hereditary disorders, and deficiencies in iron, vitamin B<sub>12</sub>, and folate. Its prevalence remains excessively high in low- and lower-middle-income countries, exceeding 40% in women of reproductive age [5]. Iron deficiency is considered the leading cause of anaemia. However, other causes, such as infections (e.g. malaria and helminthiasis), genetic blood disorders (e.g. thalassaemia and sickle cell disease), and inadequate healthcare access, significantly increase the burden of anaemia. In addition, socio-economic disparities, limited varieties of food, and a lack of access to prenatal care can accelerate this problem. To address these factors, it is crucial to design targeted interventions to reduce anaemia prevalence and associated health risks [5].

The complications of anaemia not only degrade individual health but also impact cognitive development, quality of life, and work productivity; they can also increase maternal and neonatal risks, including premature delivery, low birth weight, and stillbirth [6–8]. Although antenatal care programmes prioritise caring for pregnant women by providing vitamin and mineral supplements as well as malaria protection drugs [9–11], nonpregnant women are not covered by these programmes. Although there is an ongoing global effort to reduce the prevalence of anaemia, progress has been slow and globally uneven globally. One notable target set by the WHO is to reduce anaemia prevalence among WRA by 50% by 2030 (following the original, failed target of 2025) [12].

The EMR is characterised by broad variation in economic status across different countries, which leads to disparities in anaemia prevalence. Many studies have examined anaemia among different populations in the EMR, noting considerable disparities in trends and prevalence. For example, researchers have reported a high burden of anaemia among pregnant women, nonpregnant women, children, and the elderly [13–17]. Other research has focused on the effects of socioeconomic fac-

tors on anaemia prevalence [18–20]. While there have thus been many studies of anaemia in the EMR, most have been limited to small sample sizes or specific subpopulations. Only a few have considered the role of national income in shaping anaemia prevalence [21].

The present study helps fill these gaps by pursuing three main objectives. First, it analyses the prevalence of anaemia among pregnant and nonpregnant women aged 15–49 years in the EMR. Second, it investigates the relationships between income and anaemia prevalence and changes throughout the period 2000–2019. Finally, it compares country-specific patterns of anaemia prevalence in pregnant and nonpregnant women.

## Material and methods

This retrospective cross-sectional study consulted WHO data representing 21 countries in the EMR from 2000 to 2019. Specifically, data on WRA were extracted and classified according to pregnancy status (pregnant vs. nonpregnant). The countries deemed to belong to the EMR were determined according to the WHO's classification, and the WHO also provided estimates of anaemia rates based on national surveys and modelling tools. Data on country incomes, in contrast, were taken from the World Bank's records for 2023. The methodology of this study is similar to that of our previous research [22].

### Variables and definitions

In this study, anaemia was defined as a haemoglobin (Hb) level of less than 120 g/dl for nonpregnant women and less than 110 g/dl for pregnant women. Country incomes were categorised into four groups according to the 2023 classification of the World Bank: low income, lower middle income, upper middle income, and high income. This classification is updated annually by the World Bank, but we used the most recent income classification (2024), following the usual conventions of global health studies.

Pregnancy status was determined in a binary fashion: Women were classified as either pregnant or not pregnant. Data were extracted for the period from 2000 to 2019 and aggregated into 5-year intervals (2000–2005, 2005–2010, 2010–2015, and 2015–2019) to assess temporally specific trends.

### Data sources

The data on anaemia prevalence that we consulted are publicly available on the WHO's website at [https://www.who.int/data/gho/data/indicators/indicator-details/GHO/anaemia-in-nonpregnant-women-prevalence-\(%\)](https://www.who.int/data/gho/data/indicators/indicator-details/GHO/anaemia-in-nonpregnant-women-prevalence-(%)) and <https://www.who.int/gho/data/estimates/gender/anaemia-prevalence-in-women>.

[who.int/data/gho/data/indicators/indicator-details/GHO/prevalence-of-anaemia-in-pregnant-women-\(-\)](http://who.int/data/gho/data/indicators/indicator-details/GHO/prevalence-of-anaemia-in-pregnant-women-(-).). The country income classification is publicly available on the World Bank's website: <https://datahelpdesk.worldbank.org/knowledge-base/articles/906519-world-bank-country-and-lending-groups>.

### Analytical phase

The first step of the analysis involved extracting data on anaemia prevalence in the two study groups (pregnant and nonpregnant women) from the WHO's website and data on national incomes from the World Bank's website. The data on anaemia prevalence were then correlated with the information on country income. The relative and absolute changes in anaemia prevalence as well as annual reductions were calculated for the study period at 5-year intervals. We then compared the trends in anaemia prevalence among pregnant and nonpregnant women.

### Ethical considerations

The study was performed according to the principles of the Declaration of Helsinki. This study used publicly available, anonymous data and thus did not require formal ethical approval.

### Statistical analysis

To conduct the statistical analysis, we used IBM SPSS v28, Microsoft Excel, and Graph Pad Prism for Windows (version 5.0, San Diego, CA; [www.graphpad.com](http://www.graphpad.com), SCR\_002798). Descriptive statistics, including means and standard deviations for continuous variables and frequencies with percentages for categorical variables, are used to summarise the data. We tested the assumption of normality of variances using the Shapiro-Wilk test and visual inspection of a histogram. The data did not follow a normal distribution, so a nonparametric Mann-Whitney *U* test was used for comparisons. The Kruskal-Wallis test and analysis of variance were used to analyse the associations between anaemia prevalence and income category. Statistical significance was set at  $p < 0.05$ . These statistical methods were selected to match the distribution of the data, thereby ensuring an appropriate analysis.

## Results

### Anaemia prevalence: trends for the period 2000–2019

Our analysis revealed notable trends and shifts in the prevalence of anaemia among pregnant and nonpregnant women aged 15–49 years in 21 EMR countries between 2000 and 2019. The

prevalence of anaemia in both pregnant and nonpregnant women decreased overall throughout the study period. In pregnant women, the average prevalence decreased from 37.6% in 2000 to 33.0% in 2019. This decline marks an absolute change of -4.6 points and a 12% relative reduction. The mean prevalence among nonpregnant women decreased from 36.7% in 2000 to 33.1% in 2019. This marks an absolute change of -3.6 points and a 10% relative drop (Table I).

Reductions in anaemia throughout the EMR have not been consistent over the past two decades. The greatest decline in prevalence among pregnant and nonpregnant women occurred between 2000 and 2010. The prevalence of anaemia decreased only slightly over the second decade (Table I). Although there were reductions in both study groups, the change among nonpregnant women was consistently higher than that in pregnant women (-12% vs. -10%). Furthermore, anaemia prevalence was consistently higher in low-income countries (Figure 1) than in high-income countries (Figure 2).

### Prevalence of anaemia by national income

The greatest anaemia burden was reported by low-income countries. In 2000, the mean prevalence of anaemia among both pregnant and nonpregnant women exceeded 45%. By 2019, the prevalence had decreased by 9% in pregnant women and 5% in nonpregnant women (Table I). Conversely, countries with higher incomes reported a lower anaemic burden. In 2000, the average prevalence was 31.8% in pregnant women and 32.1% in nonpregnant women. By 2019, the prevalence had decreased by 13% in both pregnant and nonpregnant women (Table I).

Upper-middle-income countries reported varying rates of improvement (Figure 3). From 2000 to 2019, Iraq reported -23% and -28% changes for pregnant (Table II) and nonpregnant women, respectively (Table III). In the same income group, Libya reported a -9% relative change in pregnant women (Table II) and a -8% relative change in nonpregnant women (Table III). Lower-middle-income countries exhibited a variety of patterns (Figure 4). For example, both Djibouti and Egypt experienced relative changes of -13% in pregnant women and -21% in nonpregnant women over the research period. Jordan reported a relative change of 2% in pregnant women and 26% in nonpregnant women (Tables II and III).

This analysis revealed a strong inverse association between the prevalence of anaemia and country income among both pregnant and nonpregnant women for the entire study period (2000–2019) ( $p = 0.001$ ) (Table IV). When individual time points were examined, the same substantial inverse cor-

**Table I.** Mean anaemia prevalence (%) according to income class in the EMR from 2000 from 2019

Year	Income	Low income	Lower middle income	Upper middle income	High income	Total	
2000	Pregnant women	Mean	47.0	35.5	36.2	31.8	37.6
		Interval	37.2–50.7	29.7–48.5	32.2–40.2	25.4–38.4	25.4–50.7
	Nonpregnant women	Mean	45.7	32.9	36.1	32.1	36.7
		Interval	34.2–67	26.4–39.8	32.6–39.5	24–43.7	24.0–67
2005	Pregnant women	Mean	45.6	34.0	34.3	29.8	35.9
		Interval	35.5–59.1	26.1–48.1	30.7–37.8	23.4–36.4	23.4–59.1
	Nonpregnant women	Mean	44.0	31.4	33.2	29.5	34.5
		Interval	34.3–64.9	24.5–41.2	30.7–35.7	21.1–40.3	21.1–64.9
2010	Pregnant women	Mean	44.0	32.7	31.6	28.0	34.1
		Interval	33.5–58.3	24.3–47.4	29–34.2	22.2–34.7	22.2–58.3
	Nonpregnant women	Mean	42.4	30.3	29.9	27.4	32.5
		Interval	32–62.5	22.9–42.2	28.8–30.9	20.3–37	2.3–62.5
2015	Pregnant women	Mean	43.0	32.2	30.3	27.6	33.2
		Interval	33.1–57.8	23.7–45.8	29–31.6	23.2–34.1	23.2–57.8
	Nonpregnant women	Mean	42.4	30.7	28.7	27.3	32.3
		Interval	31.8–61.6	22.9–41.7	28.4–28.9	22.4–35.7	22.4–61.6
2019	Pregnant women	Mean	42.5	31.9	30.2	27.5	33.0
		Interval	33.2–57.5	23.8–44	29.4–30.9	23.7–33.5	23.7–57.5
	Nonpregnant women	Mean	43.3	31.7	29.2	28.1	33.1
		Interval	32.8–61.8	24.1–41.1	28.4–29.9	23.7–35.5	32.7–61.8
Total	Pregnant women	Mean	44.4	33.3	32.5	28.9	34.8
		Interval	33.1–59.7	23.7–48.5	29–40.2	22.2–38	22.2–59.7
	Nonpregnant women	Mean	43.6	31.4	31.4	28.9	33.8
		Interval	31.8–67	22.9–42.2	28.4–39.5	20.3–43.7	20.3–67
	Pregnant women	Absolute change	-4.5	-3.6	-6.1	-4.3	-4.6
		Relative change	-9%	-10%	-17%	-13%	-12%
	Nonpregnant women	Absolute change	-2.3	-1.1	-6.9	-4.1	-3.6
		Relative change	-5%	-3%	-19%	-13%	-10%

relation was observed most of the time. In pregnant women, a considerable gap between anaemia prevalence and country income group persisted across all time points analysed ( $p = 0.015, 0.014, 0.028, 0.018$ , and  $0.029$  for 2000, 2005, 2010, and 2019, respectively). In nonpregnant women, a similar gap was found at most time intervals ( $p = 0.030, 0.017$ , and  $0.017$  for 2010, 2015, and 2019, respectively), with marginal, nonsignificant correlations observed in 2000 and 2005 ( $p = 0.108$  and  $0.07$ , respectively) (Table IV).

#### Country-specific patterns by pregnancy status

Our comparative analysis revealed notable country-specific patterns and differences. In

2000, the average prevalence of anaemia among pregnant women was 37.6%, compared to 36.6% among nonpregnant women, and by 2019, this prevalence had dropped to 33.0% for pregnant women and 33.1% for nonpregnant women (Figure 5). During the study period, the relative change was -12% for pregnant women and -10% for nonpregnant women (Table I).

In low-income countries (Figure 1), the two study groups had consistently high anaemia rates. In Yemen and Somalia, pregnant women had a 50% prevalence, yet in 2019, the relative changes were only -4% and -5%, respectively, indicating minimal progress (Table II). Nonpregnant individuals in Yemen reported an approximately 60% prevalence, while Somalia's was approximately 40% (Table III).

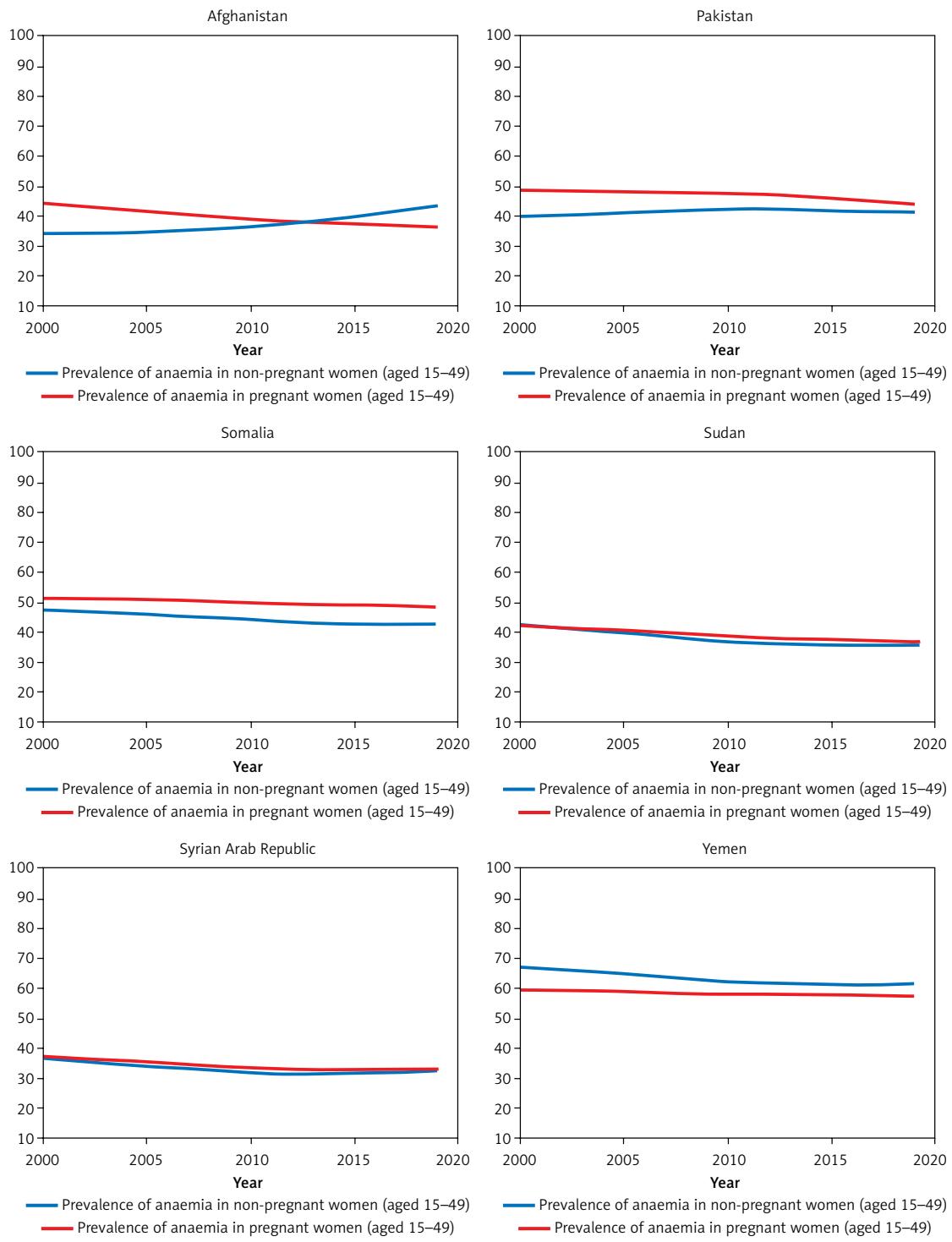
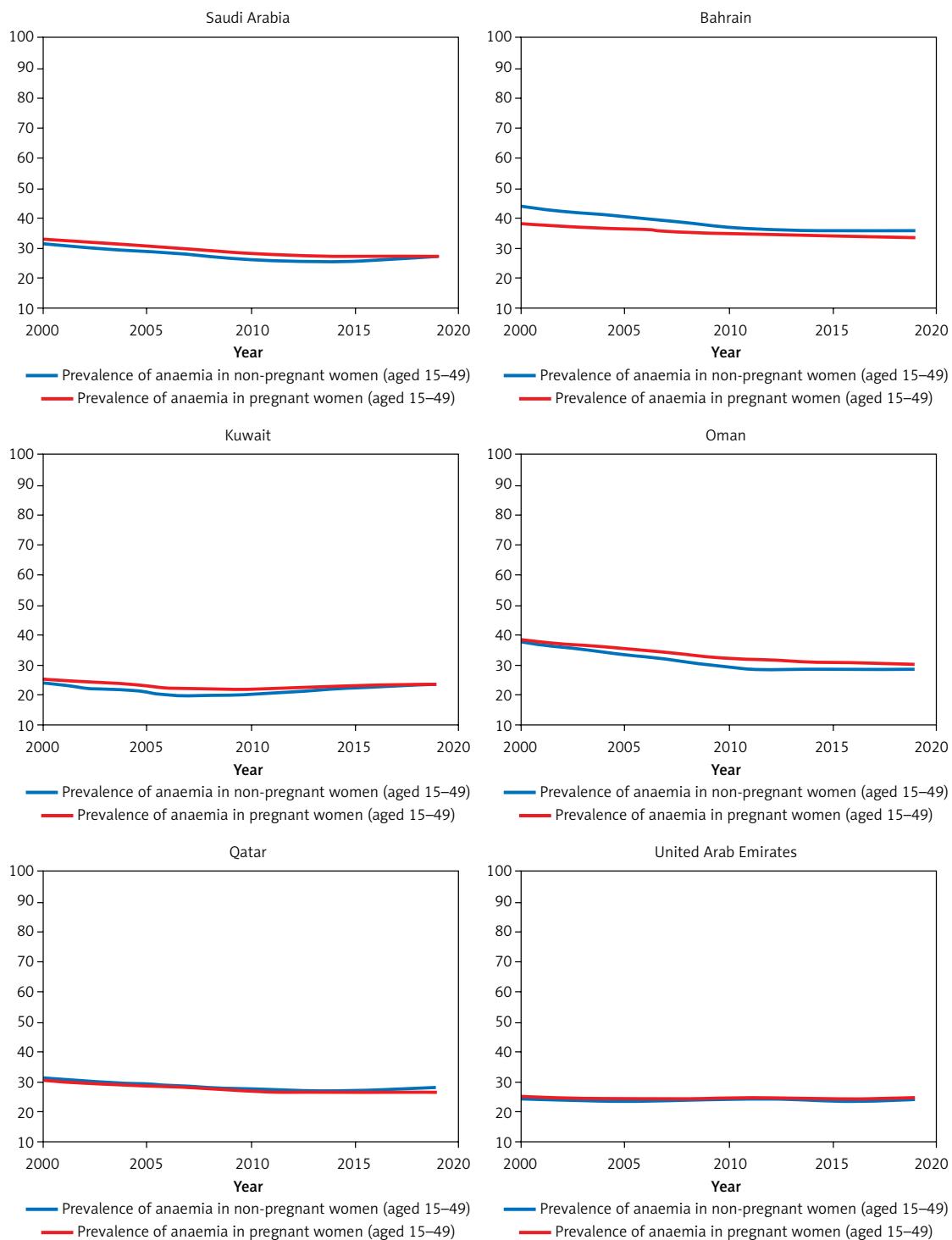


Figure 1. Anaemia prevalence among pregnant vs. nonpregnant women in low-income countries: EMR from 2000 to 2019

Iraq and Oman exhibited the most remarkable improvement. From 2000 to 2019, Iraq saw relative changes of  $-23\%$  for pregnant women and  $-28\%$  for nonpregnant women. Oman achieved relative changes of  $-21\%$  for pregnant women and  $-23\%$  for nonpregnant women (Tables II and III). Jordan demonstrated a pattern of stagnation, with the prevalence of anaemia among pregnant wom-

en changing from  $33.2\%$  in 2000 to  $33.7\%$  in 2019 – a  $2\%$  increase – while the prevalence among nonpregnant women increased from  $30.2\%$  to  $38\%$ . A similar example is Pakistan, which saw a rise in the prevalence of anaemia among non-pregnant women ( $39.8\%$  in 2000 to  $41.1\%$  in 2019), whereas the prevalence among pregnant women decreased (from  $48.5\%$  in 2000 to  $44\%$ ).



**Figure 2.** Anaemia prevalence among pregnant vs. nonpregnant women in high income countries in the EMR from 2000 to 2019

Although high-income countries maintained low prevalence rates, an unexpected pattern was noted (Figure 2). The United Arab Emirates made no progress in reducing anaemia among nonpregnant women (24.3% between 2000 and 2019), while in Kuwait, the prevalence among pregnant women decreased from 25.4% in 2000 to 23.7% in 2019.

Afghanistan, a low-income country, demonstrated a unique pattern (Figure 1), with a significant drop in anaemia (18%) among pregnant women between 2000 and 2019 (44.4% to 36.5%). The same country saw a 26% increase among nonpregnant women, from 34.2% in 2000 to 43.2% in 2019 (Tables II, III). This trend was also observed in Lebanon, a lower-middle-income country

**Table II.** Anaemia among pregnant women in the EMR from 2000 to 2019: prevalence, absolute change, and relative change

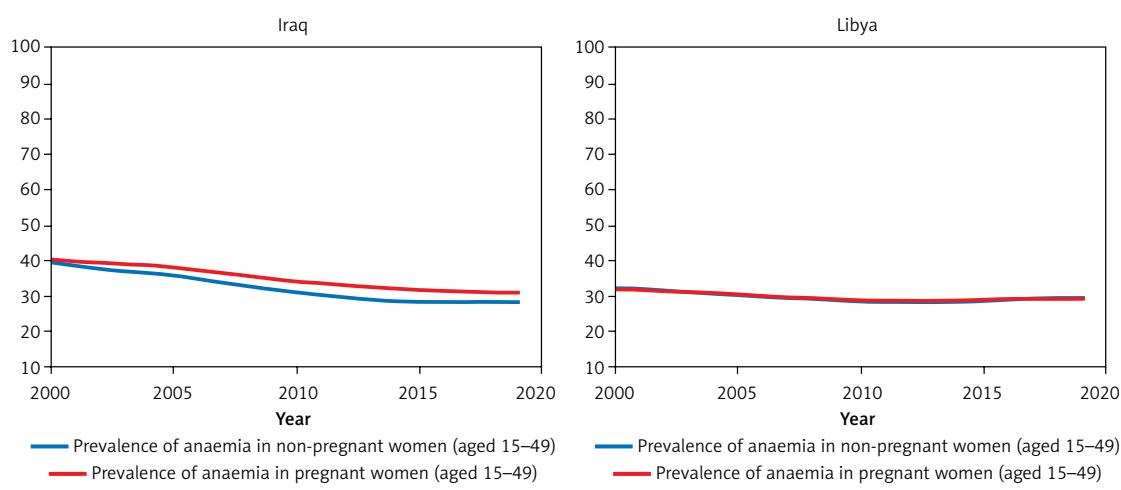
Location	Income	Year	Prevalence %	Absolute change %	Relative change	Average annual rate of reduction (95% CI)
Afghanistan	Low income	2000	44.4	-7.9	-18%	-0.42 (-0.48, -0.35)
		2019	36.5			
Bahrain	High income	2000	38	-4.5	-12%	-0.24 (-0.30, -0.18)
		2019	33.5			
Djibouti	Lower middle income	2000	42.6	-5.6	-13%	-0.29 (-0.42, -0.16)
		2019	37			
Egypt	Lower middle income	2000	29.9	-3.9	-13%	-0.21 (-0.30, -0.11)
		2019	26			
Iran (Islamic Republic of)	Lower middle income	2000	29.8	-6	-20%	-0.32 (-0.47, -0.16)
		2019	23.8			
Iraq	Upper middle income	2000	40.2	-9.3	-23%	-0.49 (-0.59, -0.38)
		2019	30.9			
Jordan	Lower middle income	2000	33.2	0.5	2%	0.03 (-0.10, 0.15)
		2019	33.7			
Kuwait	High income	2000	25.4	-1.7	-7%	-0.09 (-0.24, 0.06)
		2019	23.7			
Lebanon	Lower middle income	2000	29.7	-2	-7%	-0.11 (-0.18, -0.03)
		2019	27.7			
Libya	Upper middle income	2000	32.2	-2.8	-9%	-0.15 (-0.25, -0.05)
		2019	29.4			
Morocco	Lower middle income	2000	36.8	-4.2	-11%	-0.22 (-0.27, -0.17)
		2019	32.6			
Oman	High income	2000	38.4	-8.2	-21%	-0.43 (-0.54, -0.32)
		2019	30.2			
Pakistan	Lower middle income	2000	48.5	-4.5	-9%	-0.24 (-0.32, -0.15)
		2019	44			
Qatar	High income	2000	30.6	-3.9	-13%	-0.21 (-0.29, -0.13)
		2019	26.7			
Saudi Arabia	High income	2000	33	-5.7	-17%	-0.30 (-0.42, -0.18)
		2019	27.3			
Somalia	Low income	2000	51.2	-2.5	-5%	-0.13 (-0.16, -0.10)
		2019	48.7			
Sudan	Low income	2000	42.5	-5.7	-13%	-0.30 (-0.35, -0.25)
		2019	36.8			
Syrian Arab Republic	Low income	2000	37.2	-4	-11%	-0.21 (-0.31, -0.11)
		2019	33.2			
Tunisia	Lower middle income	2000	33.5	-3	-9%	-0.18 (-0.20, -0.11)
		2019	30.5			
United Arab Emirates	High income	2000	25.3	-1.6	-6%	-0.08 (-0.15, -0.02)
		2019	23.7			
Yemen	Low income	2000	59.7	-2.2	-4%	-0.12 (-0.14, -0.09)
		2019	57.5			

**Table III.** Anaemia among nonpregnant women in the EMR from 2000 to 2019: prevalence, absolute change, and relative change

Location	Income	Year	Prevalence %	Absolute change %	Relative change	Average annual rate of reduction (95% CI)
Afghanistan	Low income	2000	34.2	9	26%	0.47 (0.32, 0.63)
		2019	43.2			
Bahrain	High income	2000	43.7	-8.2	-19%	-0.43 (-0.57, -0.3)
		2019	35.5			
Djibouti	Lower middle income	2000	36.7	-4.6	-13%	-0.24 (-0.45, -0.03)
		2019	32.1			
Egypt	Lower middle income	2000	35.9	-7.5	-21%	-0.40 (-0.47, -0.32)
		2019	28.4			
Iran (Islamic Republic of)	Lower middle income	2000	27.3	-3.2	-12%	-0.17 (-0.34, -0.004)
		2019	24.1			
Iraq	Upper middle income	2000	39.5	-11.1	-28%	-0.58 (-0.77, -0.40)
		2019	28.4			
Jordan	Lower middle income	2000	30.2	7.8	26%	0.41 (0.12, 0.70)
		2019	38			
Kuwait	High income	2000	24	-0.3	-1%	-0.02 (-0.25, 0.22)
		2019	23.7			
Lebanon	Lower middle income	2000	26.4	1.9	7%	0.10 (-0.04, 0.24)
		2019	28.3			
Libya	Upper middle income	2000	32.6	-2.7	-8%	-0.14 (-0.28, -0.01)
		2019	29.9			
Morocco	Lower middle income	2000	35.2	-5.4	-15%	-0.28 (-0.42, -0.15)
		2019	29.8			
Oman	High income	2000	37.7	-8.6	-23%	-0.45 (-0.66, -0.25)
		2019	29.1			
Pakistan	Lower middle income	2000	39.8	1.3	3%	0.06 (-0.05, 0.18)
		2019	41.1			
Qatar	High income	2000	31.5	-3.3	-10%	-0.17 (-0.31, -0.03)
		2019	28.2			
Saudi Arabia	High income	2000	31.6	-4.1	-13%	-0.22 (-0.41, -0.02)
		2019	27.5			
Somalia	Low income	2000	47.3	-4.9	-10%	-0.23 (-0.33, -0.19)
		2019	42.4			
Sudan	Low income	2000	43	-6.5	-15%	-0.34 (-0.48, -0.21)
		2019	36.5			
Syrian Arab Republic	Low income	2000	36.8	-4	-11%	-0.21 (-0.37, -0.05)
		2019	32.8			
Tunisia	Lower middle income	2000	31.4	0.7	2%	0.04 (-0.06, 0.13)
		2019	32.1			
United Arab Emirates	High income	2000	24.3	0	0%	0.00 (-0.10, 0.10)
		2019	24.3			
Yemen	Low income	2000	67	-5.2	-8%	-0.27 (-0.34, -0.16)
		2019	61.8			

**Table IV.** Analysis of anaemia prevalence by income groups across different periods using Kruskal-Wallis H test and ANOVA

Prevalence of anaemia in grouping variable: income	Prevalence of anaemia in pregnant women (aged 15–49)		Prevalence of anaemia in nonpregnant women (aged 15–49)	
	Test value	P-value	Test value	P-value
All	178.891	< 0.001	163.958	< 0.001
2000	4.673	0.015	6.071	0.108
2005	4.751	0.014	6.976	0.073
2010	9.091	0.028	8.927	0.030
2015	10.106	0.018	10.182	0.017
2019	9.004	0.029	10.201	0.017

**Figure 3.** Anaemia prevalence among pregnant vs. nonpregnant women in upper middle income countries in the EMR from 2000 to 2019

(Figure 4), where the prevalence decreased among pregnant women but increased by 7% among nonpregnant women (Table III).

## Discussion

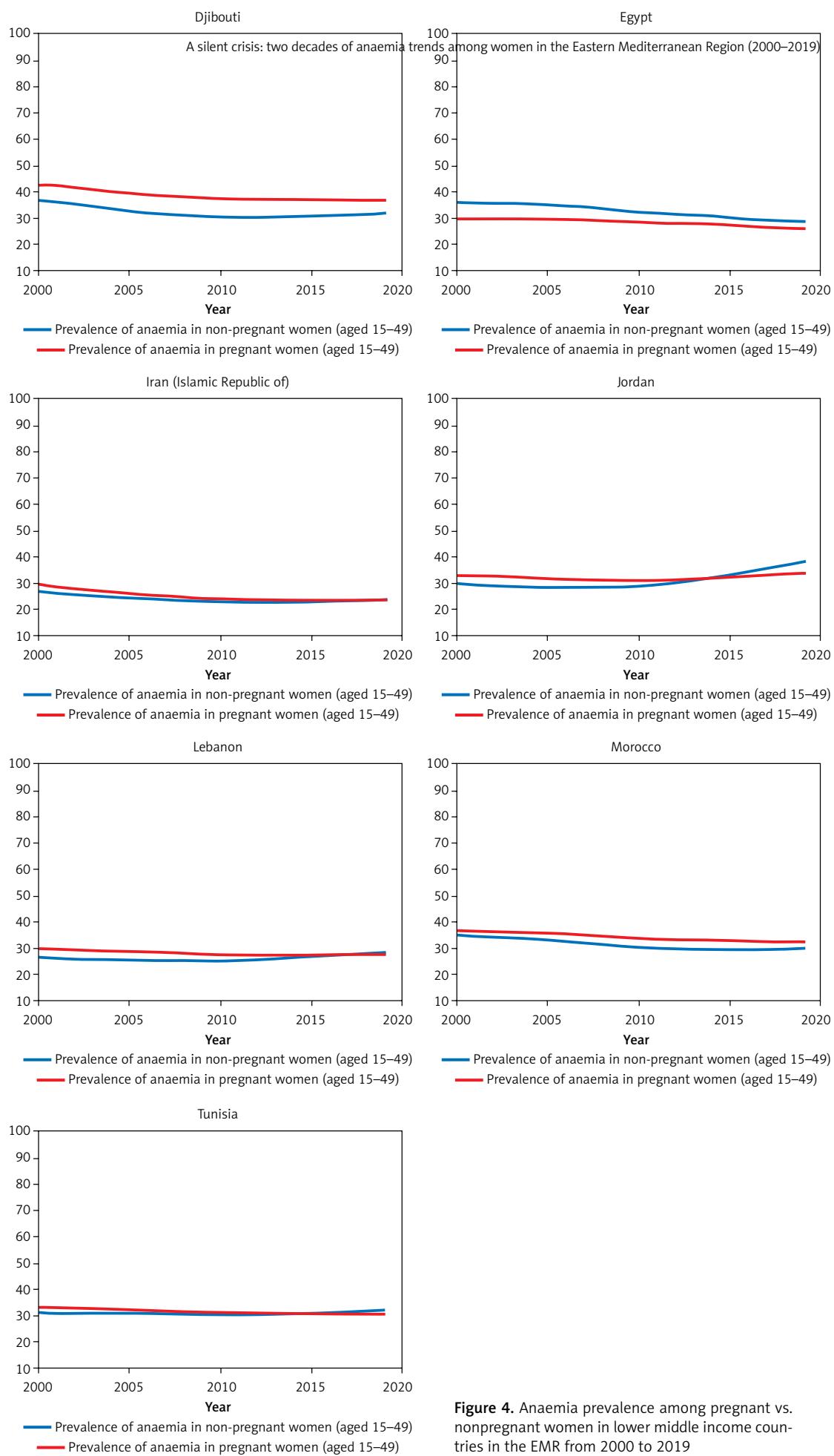
This study examined the prevalence of anaemia and changes therein among pregnant and nonpregnant women in 21 EMR countries from 2000 to 2019, noting associations between prevalence and national income. Our research revealed a general improvement in anaemia rates among both study populations over the study period, even though the prevalence of anaemia remains high, particularly in low-income nations. The drop in prevalence was more evident in the first decade (2000–2010), whereas the second decade witnessed stagnation – particularly in low-income nations, where pregnant women underwent a greater relative reduction than nonpregnant women. This result is consistent with earlier research, which indicated a decrease in anaemia prevalence during this period [5, 21].

Many factors may have contributed to the stagnation in the second decade, including decreases in global health interventions pertinent to ana-

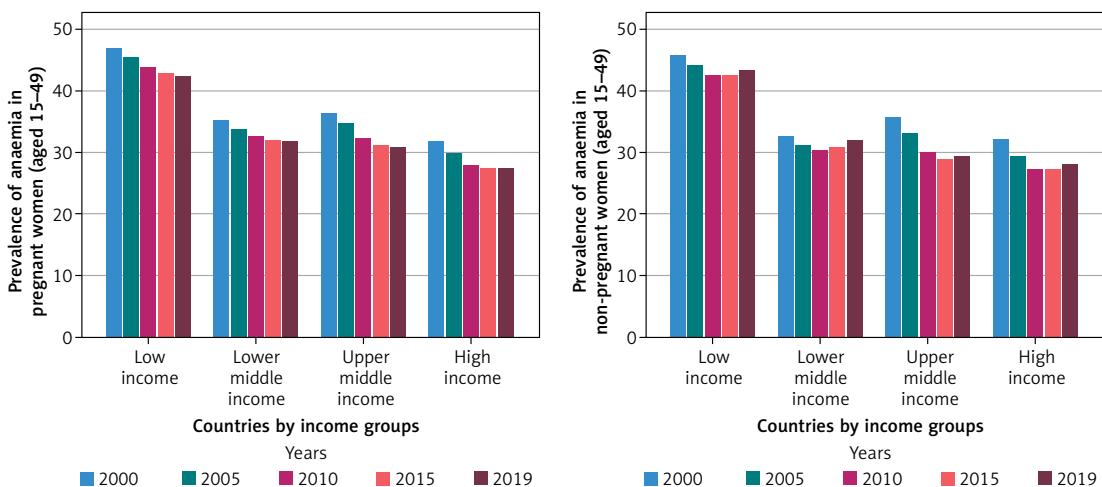
mia, in the implementation of food fortification programmes, in the supplementation of food with iron and folic acid, and in the administration of malaria control programmes [23, 24]. The consistently observed gap between prevalence rates in pregnant and nonpregnant women warrants further exploration, as this may point to physiological and dietary differences between the two study groups [1, 25, 26]. It could also indicate disparities in healthcare access between these groups.

This research revealed a substantial inverse relationship between national income and anaemia prevalence ( $p < 0.001$ ). Low-income countries have a higher prevalence of anaemia [27–29]. In 2000, the mean prevalence of anaemia in both groups exceeded 45%. Although these countries reported some progress, after two decades, they achieved a relative change of less than –10% for both pregnant and nonpregnant women. High-income countries achieved greater anaemia reductions in both groups by 2019.

This indicates the crucial role of socioeconomic status in determining health [5, 30, 31]. Low-income countries face many challenges in this respect, such as food supply insecurity, poor healthcare for women, limited access to nourish-



**Figure 4.** Anaemia prevalence among pregnant vs. nonpregnant women in lower middle income countries in the EMR from 2000 to 2019



**Figure 5.** Trends in the prevalence of anaemia among pregnant and nonpregnant women in countries in the EMR from 2000 to 2019

ing food, and insufficient infrastructure for health services [32–34]. On the other hand, high-income countries provide strong healthcare services, an adequate food supply, and extensive anaemia prevention efforts [6, 35, 36]. These disparities warrant urgent and targeted interventions to reduce anaemia rates.

This study revealed significant gaps between economic groups. For example, among the upper-middle-income class, Iraq reported a significant drop in anaemia prevalence among both pregnant and nonpregnant women, indicating a positive effort to enhance health services. In the same income class, however, Libya achieved a smaller reduction in both groups. This may reflect sociopolitical instability in Libya during the study period [37, 38]. These disparities also characterised lower-middle-income countries. For example, Egypt reported a notable decrease in both pregnant and nonpregnant women, and this reduction was greater among pregnant women. In the same income group, Jordan saw stagnation in the prevalence of anaemia among pregnant women and a notably worse prevalence among nonpregnant women. These disparate trends may reflect differences in the provision and implementation of health service programmes [39, 40].

Throughout the study period, the prevalence of anaemia in nonpregnant women was consistently higher than that in pregnant women, although this gap decreased over time. This disparity between the two groups may indicate prioritisation of pregnant women in health service programmes, such as antenatal care involving the provision of folic acid and iron supplements [41–43]. This high prevalence of anaemia in nonpregnant women suggests that healthcare programmes should devote greater attention to these individuals. Fur-

thermore, large-scale health strategies should be implemented, including all WRA, in efforts to prevent anaemia. After all, they could become pregnant in the future.

Many nations, including Iraq, Oman, and Saudi Arabia, have achieved substantial progress in reducing anaemia prevalence. This accomplishment may be attributed to the successful strategies used to address this challenge, such as screening and treating procedures, nutrition fortification programmes, increases in nutritional diversity, and investments in antenatal care services [44–49]. On the other hand, nations such as Jordan exhibit concerning trends, with anaemia frequency increasing among both pregnant (2%) and nonpregnant (26%) women. Studies have identified many important determinants of anaemia prevalence, including educational factors; limited health resources, health facilities, medical services [50–52], and access to nutritional knowledge; and folate deficiency [53].

Although the prevalence of anaemia has generally decreased in high-income nations, unexpected trends were observed in some countries. For example, the United Arab Emirates did not demonstrate any progress in reducing anaemia among nonpregnant women across the whole study period. Similarly, Kuwait reported a minimal decline in anaemia among nonpregnant women. This could indicate that anaemia rates are influenced by more than just national income. This lifestyle could also be induced by poor dietary habits, an increasing rate of obesity, chronic diseases [49, 54–59], or a lack of adherence to WHO recommendations. Vitamin D and iron deficiencies have also been associated with anaemia [60]. One study reported that half of the healthy Emirati population has abnormal complete blood count values [61].

Anaemia in Afghanistan exhibits a unique pattern. Although the prevalence has decreased substantially among pregnant women in this country (~18%), there was a rise among nonpregnant women (26%). This paradoxical trend may imply improved antenatal care but limited success in dealing with anaemia concerns among nonpregnant women [62–64], as well as high levels of poverty and food insecurity [65]. We also found a study from Afghanistan that supports a link between sheep ownership and anaemia risk [66]. Similarly, the prevalence decreased among pregnant women but increased among nonpregnant women.

There is an urgent need for targeted interventions to minimise anaemia. These interventions should be tailored to the relevant country's health and economic circumstances. In low-income nations, large-scale food fortification programmes have demonstrated success in reducing anaemia prevalence [67]. Developing community-based food supplementation programmes and improving prenatal care can also help reduce this prevalence [68, 69]. In lower-middle-income countries, such as the Philippines, Tanzania, Nigeria, and India, programmes such as school-based iron supplementation and deworming have been shown to reduce anaemia [70, 71]. Such programmes could be used elsewhere under similar circumstances. Upper-middle-income countries, such as Malaysia, have shown success in integrating national educational strategies for anaemia prevention into broader maternal and child health initiatives, significantly diminishing anaemia rates [72]. In high-income countries, where anaemia may be linked to dietary habits and chronic disease, the focus should be on ensuring regular medical check-ups, implementing educational programmes about nutritional balance, and addressing obesity-related micronutrient deficits.

This study provides important insights regarding the prevalence of anaemia in the EMR, but several limitations should be acknowledged. This study is based on WHO data, which may have been subject to bias when being collected and reported. Variation in methodologies as well as disparities between the quality of national surveys may have led to inaccuracies in the estimations of anaemia prevalence, especially in areas affected by conflict or those with limited resources. Furthermore, these data do not take into account cultural and sociodemographic data that can help assess the prevalence of anaemia, such as nutritional habits, access to health services, and treatment-seeking behaviours. Furthermore, this study does not differentiate between nutritional and non-nutritional causes of anaemia, and it does not consider the severity of the cases. The exclusion of these po-

tential determinants may have led to an incomplete understanding of the underlying causes of trends in anaemia prevalence.

In conclusion, this study emphasises the lingering burden of anaemia among pregnant and nonpregnant women in the EMR, revealing significant variation by pregnancy status and country income. Although the overall prevalence of anaemia decreased between 2000 and 2019, there were discrepancies in this progress. In particular, low-income countries lagged behind in anaemia prevention efforts.

These data emphasise the need for immediate and continuous country-specific strategies to address this concern, particularly among nonpregnant women, who consistently exhibit a higher anaemia prevalence. Implementing food fortification programmes, ensuring a continuously secure food supply, improving health services, and providing nutritional supplements are all important steps in reducing anaemia prevalence. Furthermore, the stagnation observed in some high-income nations highlights the significance of immediate monitoring and the implementation of targeted interventions to address this condition. Furthermore, the implementation of general health programmes to prevent anaemia in women of reproductive age is critical for improving women's health.

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The authors declare no conflict of interest.

## References

1. Alem AZ, Efendi F, McKenna L, et al. Prevalence and factors associated with anemia in women of reproductive age across low- and middle-income countries based on national data. *Sci Rep* 2023; 13: 20335.
2. Michalak SS, Rupa-Matysek J, Hus I, Gil L. Unexplained anemia in the elderly – a real life analysis of 981 patients. *Arch Med Sci* 2020; 16: 834-41.
3. WHO. Prevalence of anaemia in non-pregnant women (aged 15–49) (%) [Internet]. [cited 2025 Feb 5]. Available from: [https://www.who.int/data/gho/data/indicators/indicator-details/GHO/anaemia-in-non-pregnant-women-prevalence-\(-\)](https://www.who.int/data/gho/data/indicators/indicator-details/GHO/anaemia-in-non-pregnant-women-prevalence-(-))
4. WHO. Anaemia in women and children [Internet]. [cited 2025 Mar 4]. Available from: [https://www.who.int/data/gho/data/themes/topics/anaemia\\_in\\_women\\_and\\_children](https://www.who.int/data/gho/data/themes/topics/anaemia_in_women_and_children)
5. Safiri S, Kolahi AA, Noori M, et al. Burden of anemia and its underlying causes in 204 countries and territories, 1990–2019: results from the Global Burden of Disease Study 2019. *J Hematol Oncol* 2021; 14: 185.

6. Chaparro CM, Suchdev PS. Anemia epidemiology, pathophysiology, and etiology in low- and middle-income countries. *Ann N Y Acad Sci* 2019; 1450: 15-31.
7. Elmore C, Ellis J. Screening, treatment, and monitoring of iron deficiency anemia in pregnancy and postpartum. *J Midwifery Womens Health* 2022; 67: 321-31.
8. Gunes S, Aldemir R, Gunes A, Ekinici O. Parent-reported sleep problems in children and adolescents with sickle cell disease: relationship to health-related quality of life. *Arch med sci* 2021; 18: 659-65.
9. Brown B, Wright C. Safety and efficacy of supplements in pregnancy. *Nutr Rev* 2020; 78: 813-26.
10. Jouanne M, Oddoux S, Noël A, Voisin-Chiret AS. Nutrient requirements during pregnancy and lactation. *Nutrients* 2021; 13: 692.
11. Rogerson SJ. Management of malaria in pregnancy. *Indian J Med Res* 2017; 146: 328-33.
12. Arndt MB, Abate YH, Abbasi-Kangevari M, et al. Global, regional, and national progress towards the 2030 global nutrition targets and forecasts to 2050: a systematic analysis for the Global Burden of Disease Study 2021. *Lancet* 2024; 404: 2543-83.
13. Al-Jermmy ASM, Idris SM, Coulibaly-Zerbo F, Nasredine L, Al-Jawaldeh A. Prevalence and correlates of anemia among adolescents living in Hodeida, Yemen. *Children* 2022; 9: 977.
14. Anwary Z, Stanikzai MH, Wyar WM, Wasiq AW, Farooqi K. Anemia among women who visit bost hospital for delivery in Helmand Province, Afghanistan. *Anemia* 2021; 2021: 9358464.
15. Kadhim EJ. Iron-deficiency anemia in relation to body mass index among Iraqi primigravida women. *J Med Life* 2023; 16: 868-72.
16. Swareldhab ESE, Al-Jawaldeh A, Qureshi AB, et al. Assessment of micronutrient situation among reproductive-age women (15-49) and under-five children in Sudan. *Nutrients* 2021; 13: 2784.
17. Alsaeed M, Ahmed SS, Seyadi K, Ahmed AJ, Alawi AS, Abulsaad K. The prevalence and impact of anemia in hospitalized older adults: a single center experience from Bahrain. *J Taibah Univ Med Sci* 2022; 17: 587-95.
18. Mikki N, Abdul-Rahim HF, Stigum H, Holmboe-Ottesen G. Anaemia prevalence and associated sociodemographic and dietary factors among Palestinian adolescents in the West Bank. *East Mediterr Health J Rev Sante Mediterr Orient Al-Majallah Al-Sihhiyah Li-Sharq Al-Mutawassit* 2011; 17: 208-17.
19. Arabyat R, Arabyat G, Al-Taani G. Prevalence and risk factors of anaemia among ever-married women in Jordan. *East Mediterr Health J Rev Sante Mediterr Orient Al-Majallah Al-Sihhiyah Li-Sharq Al-Mutawassit* 2019; 25: 543-52.
20. Al Kaabi SZ, Al-Saad DS, Al-Rubaye AK, Alkinani AAA. The association between the severity of anemia and socio-demographic factors among children under five years of age in Kut City. *J Public Health Afr* 2023; 14: 2676.
21. Al-Jawaldeh A, Taktouk M, Doggui R, et al. Are countries of the eastern mediterranean region on track towards meeting the world health assembly target for anemia? A review of evidence. *Int J Environ Res Public Health* 2021; 18: 2449.
22. Eltayeb R, Binsaleh N, Barnawi H, Ali RM, Kanwal R, Alyahyawi AR. A persistent burden: global prevalence of and changes in anaemia by country income in children aged 6-59 months (2000-2019). *Arch Med Sci* DOI: <https://doi.org/10.5114/aoms/197062>
23. Loechl CU, Datta-Mitra A, Fenlon L, et al. Approaches to address the anemia challenge. *J Nutr* 2023; 153: S42-59.
24. de Romaña DL, Mildon A, Golan J, Jefferds MED, Rogers LM, Arabi M. Review of intervention products for use in the prevention and control of anemia. *Ann N Y Acad Sci* 2023; 1529: 42-60.
25. Sappani M, Mani T, Asirvatham ES, Joy M, Babu M, Jeyaseelan L. Trends in prevalence and determinants of severe and moderate anaemia among women of reproductive age during the last 15 years in India. *PLoS One* 2023; 18: e0286464.
26. Wu Y, Ye H, Liu J, et al. Prevalence of anemia and sociodemographic characteristics among pregnant and non-pregnant women in southwest China: a longitudinal observational study. *BMC Pregnancy Childbirth* 2020; 20: 535.
27. Kinyoki D, Osgood-Zimmerman AE, Bhattacharjee NV, Kassebaum NJ, Hay SI. Anemia prevalence in women of reproductive age in low- and middle-income countries between 2000 and 2018. *Nat Med* 2021; 27: 1761-82.
28. Araujo Costa E, de Paula Ayres-Silva J. Global profile of anemia during pregnancy versus country income overview: 19 years estimative (2000-2019). *Ann Hematol* 2023; 102: 2025-31.
29. Hasan MM, Soares Magalhaes RJ, Garnett SP, et al. Anaemia in women of reproductive age in low- and middle-income countries: progress towards the 2025 global nutrition target. *Bull World Health Organ* 2022; 100: 196-204.
30. GBD 2021 Anaemia Collaborators. Prevalence, years lived with disability, and trends in anaemia burden by severity and cause, 1990-2021: findings from the Global Burden of Disease Study 2021. *Lancet Haematol* 2023; 10: e713-34.
31. Liu Y, Ren W, Wang S, Xiang M, Zhang S, Zhang F. Global burden of anemia and cause among children under five years 1990-2019: findings from the global burden of disease study 2019. *Front Nutr* 2024; 11: 1474664.
32. Leppäniemi H, Ibrahim ET, Abbass MMS, et al. Nutrition profile for countries of the eastern mediterranean region with different income levels: an analytical review. *Children* 2023; 10: 236.
33. Ciapponi A, Lewin S, Herrera CA, et al. Delivery arrangements for health systems in low-income countries: an overview of systematic reviews. *Cochrane Database Syst Rev* 2017; 2017: CD011083.
34. Liu X, Huang X, Yang Y, et al. Maternal anaemia prevention and control in China: a policy review. *Matern Child Nutr* 2024; 20: e13653.
35. da Silva Lopes K, Yamaji N, Rahman MO, et al. Nutrition-specific interventions for preventing and controlling anaemia throughout the life cycle: an overview of systematic reviews. *Cochrane Database Syst Rev* 2021; 2021: CD013092.
36. Benfo A, Zumesew F, Akoto EB, et al. Exploring the perspective of young adults about anaemia prevention; the contributions of knowledge about at-risk groups and consequences of anaemia. *BMC Public Health* 2023; 23: 2081.
37. Mokdad AH, Forouzanfar MH, Daoud F, et al. Health in times of uncertainty in the eastern Mediterranean region, 1990-2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet Glob Health* 2016; 4: e704-13.
38. Leppäniemi H, Ibrahim E, Abbass MMS, et al. Nutrition profile for countries of the eastern Mediterranean re-

gion with different income levels: an analytical review. *Child Basel Switz* 2023; 10: 236.

39. Mokhtar G, Youssef A, Abdel Baky A, et al. Evidence-based Egyptian clinical practice guidelines: for the prevention and management of iron deficiency and iron deficiency anemia in infants, children and adolescents. *Bull Natl Res Cent* 2023; 47: 162.

40. Khader Y, Al Nsour M, Abu Khudair S, Saad R, Tarawneh MR, Lami F. Strengthening primary healthcare in Jordan for achieving universal health coverage: a need for family health team approach. *Healthcare* 2023; 11: 2993.

41. Erzse A, Desmond C, Hofman K, Barker M, Christofides NJ. Identifying pregnant and postpartum women's priorities for enhancing nutrition support through social needs programmes in a resource-constrained urban community in South Africa. *BMC Public Health* 2024; 24: 2231.

42. WHO. Prioritizing quality of care in maternal health [Internet]. [cited 2025 Feb 5]. Available from: <https://www.who.int/activities/prioritizing-quality-of-care-in-maternal-health>

43. Ramavhoya TI, Maputle MS, Lebese TR. Developing and prioritising strategies to improve the implementation of maternal healthcare guidelines in South Africa: the nominal group technique. *Afr J Prim Health Care Fam Med* 2022; 14: 3184.

44. <http://bitwize.com.lb> B. Times of Oman. [cited 2025 Feb 5]. Oman nutrition strategy to ensure healthy, sustainable diet for all. Available from: <https://timesofoman.com/article/117126-oman-nutrition-strategy-to-ensure-healthy-sustainable-diet-for-all>

45. Al Hinai H, Al Mufarji K, Al Siyabi H, Al Anqoudi Z, Al Saadi R, Al Awaidy S. Health promotion strategy as part of Vision 2050 in Oman: the way forward. *Glob Health Promot* 2020; 27: 145-9.

46. Gosadi IM. National screening programs in Saudi Arabia: overview, outcomes, and effectiveness. *J Infect Public Health* 2019; 12: 608-14.

47. AlQurashi WS, Abdulgader RA, Gari RA, Badawi MA. Screening for iron deficiency among pregnant women. *Npj Womens Health* 2024; 2: 1-6.

48. Bin Sunaid FF, Al-Jawaldeh A, Almutairi MW, et al. Saudi Arabia's healthy food strategy: progress & hurdles in the 2030 road. *Nutrients* 2021; 13: 2130.

49. Alnasser A. The palm or the plate? An assessment of dietary guideline promotion, awareness, and preferences among Saudis: cross-sectional survey. *BMC Public Health* 2023; 23: 1984.

50. Al-Kharabsheh AM, Alahmad IF, Al-Tamimi MM, Abufraijeh SM, Alnawaiseh N. Prevalence of maternal anemia in Southern Jordan: findings from a cross-sectional study and 5-year review. *Healthcare* 2024; 12: 2495.

51. Karami M, Chaleshgar M, Salari N, Akbari H, Mohammadi M. Global prevalence of anemia in pregnant women: a comprehensive systematic review and meta-analysis. *Matern Child Health J* 2022; 26: 1473-87.

52. Abu-Baker NN, Eyadat AM, Khamaiseh AM. The impact of nutrition education on knowledge, attitude, and practice regarding iron deficiency anemia among female adolescent students in Jordan. *Helyon* 2021; 7: e06348.

53. The Jordan National Micronutrient Survey (JNMNS) 2019 | UNICEF Jordan [Internet]. [cited 2025 Feb 26]. Available from: <https://www.unicef.org/jordan/reports/jordan-national-micronutrient-survey-jnmns-2019>

54. Opoku MP, Moustafa A, Anwah N, et al. Nutritional needs of children with disabilities in the UAE: understanding predictors and mediators of nutritional knowledge and practices. *BMC Nutr* 2022; 8: 109.

55. AlBlooshi S, Khalid A, Hijazi R. The barriers to sustainable nutrition for sustainable health among Zayed University students in the UAE. *Nutrients* 2022; 14: 4175.

56. Faris ME, Al Gharaibeh F, Islam MR, et al. Caffeinated energy drink consumption among Emirati adolescents is associated with a cluster of poor physical and mental health, and unhealthy dietary and lifestyle behaviors: a cross-sectional study. *Front Public Health* 2023; 11: 1259109.

57. Almansour FD, Allafi AR, Al-Haifi AR. Impact of nutritional knowledge on dietary behaviors of students in Kuwait University. *Acta Bio-Medica Atenei Parm* 2020; 91: e2020183.

58. Alkhulaifi F, Al-Hooti S, Al-Zenki S, AlOmrah H, Darkoh C. Dietary habits, meal timing, and meal frequency in Kuwaiti adults: analysis of the Kuwait National Nutrition Surveillance Data. *Nutrients* 2023; 15: 4537.

59. Hajat C, Harrison O, Shather Z. A profile and approach to chronic disease in Abu Dhabi. *Glob Health* 2012; 8: 18.

60. Al Sabbah H, Assaf EA, Al-Jawaldeh A, et al. Nutrition situation analysis in the UAE: a review study. *Nutrients* 2023; 15: 363.

61. Al-Dabbagh B, Shawqi S, Yasin J, Al Essa A, Nagelkerke N, Denic S. Half of the emirati population has abnormal red cell parameters: challenges for standards and screening guidelines. *Hemoglobin* 2014; 38: 56-9.

62. Maher B, Shah T, Shaikh K, et al. Uncovering the hidden health burden: a systematic review and meta-analysis of iron deficiency anemia among adolescents, and pregnant women in Pakistan. *J Health Popul Nutr* 2024; 43: 149.

63. Ali SA, Abbasi Z, Shahid B, et al. Prevalence and determinants of anemia among women of reproductive age in Thatta Pakistan: findings from a cross-sectional study. *PLoS One* 2020; 15: e0239320.

64. Qadir MA, Rashid N, Mengal MA, et al. Iron-deficiency anemia in women of reproductive age in urban areas of Quetta District, Pakistan. *BioMed Res Int* 2022; 2022: 6677249.

65. Afghanistan: Acute Food Insecurity Situation for March – April 2024 and Projection for May - October 2024 | IPC – Integrated Food Security Phase Classification [Internet]. [cited 2025 Feb 26]. Available from: <https://www.ipcinfo.org/ipc-country-analysis/details-map/en/c/1157027/>

66. Flores-Martinez A, Zanello G, Shankar B, Poole N. Reducing anemia prevalence in afghanistan: socioeconomic correlates and the particular role of agricultural assets. *PLoS One* 2016; 11: e0156878.

67. Keats EC, Neufeld LM, Garrett GS, Mbuya MNN, Bhutta ZA. Improved micronutrient status and health outcomes in low- and middle-income countries following large-scale fortification: evidence from a systematic review and meta-analysis. *Am J Clin Nutr* 2019; 109: 1696-708.

68. Ndiaye M, Siekmans K, Haddad S, Receveur O. Impact of a positive deviance approach to improve the effectiveness of an iron-supplementation program to control nutritional anemia among rural Senegalese pregnant women. *Food Nutr Bull* 2009; 30: 128-36.

69. Mason JB, Saldanha LS, Ramakrishnan U, et al. Opportunities for improving maternal nutrition and birth outcomes: synthesis of country experiences. *Food Nutr Bull* 2012; 33 (2 Suppl): S104-137.

70. Girum T, Wasie A. The effect of deworming school children on anemia prevalence: a systematic review and meta-analysis. *Open Nurs J* 2018; 12: 155-61.
71. Risonar MGD, Tengco LW, Rayco-Solon P, Solon FS. The effect of a school-based weekly iron supplementation delivery system among anemic schoolchildren in the Philippines. *Eur J Clin Nutr* 2008; 62: 991-6.
72. Abd Rahman R, Idris IB, Md Isa Z, Abd Rahman R. The effectiveness of a theory-based intervention program for pregnant women with anemia: a randomized control trial. *PLoS One* 2022; 17: e0278192.