Ferritin Levels in US Women Aged 18–49

NHANES 2021–2023 Analysis

1. Introduction

Ferritin is a blood protein that reflects the body's iron stores. Structurally, ferritin forms a protein shell that can store up to approximately 4,500 iron atoms in its central cavity. Adequate iron levels are essential for energy metabolism, cognitive performance, oxygen transport, and overall health. Women of reproductive age are particularly vulnerable to low iron stores due to menstruation, pregnancy, and increased physiological iron demands. Globally, iron deficiency remains a major public health concern: the World Health Organization (WHO) estimates that 42% of children under 5 years of age and 40% of pregnant women are anaemic. Iron deficiency, haemoglobinopathies, and malaria are considered the three top causes of anaemia worldwide (WHO, 2021).

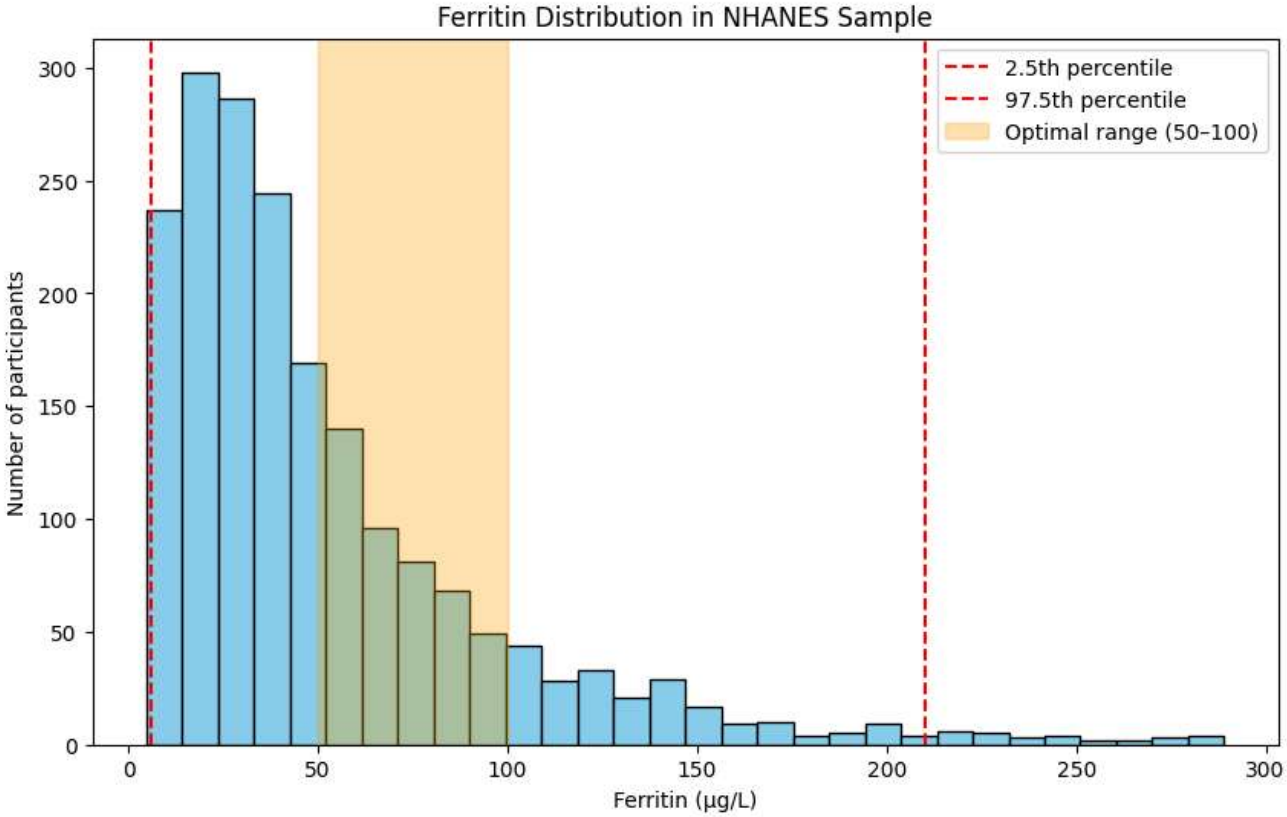
Laboratory reference ranges often define iron deficiency at ferritin levels below 10–15 µg/L. However, clinical literature suggests that iron stores may already be depleted below 30 µg/L, even in the absence of anemia. This analysis aims to examine ferritin levels in US women aged 18–49 using NHANES 2021–2023 data and to estimate how iron stores are distributed at the population level.

	SEQN	WTPH2YR	LBXFER	LBDFERSI
0	130380.0	8.532884e+04	13.3	13.3
1	130381.0	5.397605e-79	NaN	NaN
2	130382.0	5.963893e+04	24.4	24.4
3	130388.0	3.286429e+04	NaN	NaN
4	130390.0	6.142701e+04	52.1	52.1

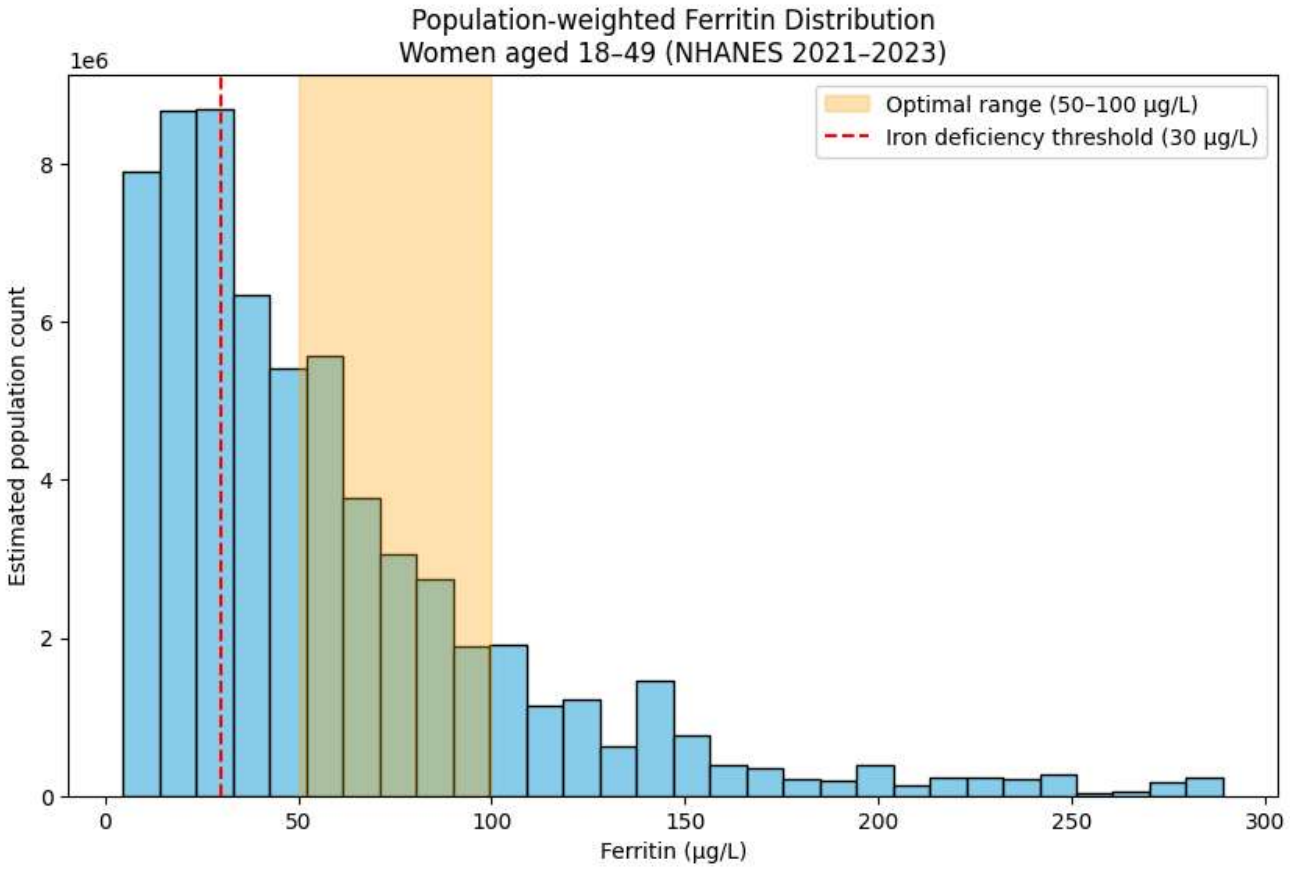
	SEQN	WTPH2YR	LBXFER	LBDFERSI
count	2564.000000	2.564000e+03	1950.000000	1950.000000
mean	136369.672387	3.885291e+04	55.713882	55.713882
std	3451.322818	3.555767e+04	61.955185	61.955185
min	130380.000000	5.397605e-79	2.050000	2.050000
25%	133364.750000	1.523371e+04	21.625000	21.625000
50%	136482.500000	3.211649e+04	38.000000	38.000000
75%	139351.750000	5.470767e+04	67.275000	67.275000
max	142307.000000	2.534788e+05	984.000000	984.000000

(2564, 4)

Lower quantile from sample: 6.07175
Upper quantile from sample: 210.37499999999932



(1467, 5)



2. Data and Methods

Data were obtained from NHANES 2021–2023.

The full ferritin dataset included n = 2,564 participants, spanning multiple age groups, including children aged 1–5 years and women aged 12–49 years.

For this analysis, the focus was restricted to **women aged 18–49**, resulting in a final analytical sample of **n = 1,467** women with available ferritin measurements.

NHANES sampling weights (WTPH2YR) were applied to estimate population-level percentages for US women aged 18–49.

Ferritin values were categorized into descriptive ranges:

- < 30 µg/L
- 30–50 µg/L
- 50–100 µg/L
- 100–115 µg/L
- > 115 µg/L

These categories are interpretative and descriptive, not diagnostic. There is currently no universally agreed "optimal" ferritin threshold. While most clinical sources agree that ferritin levels should exceed 50 µg/L to indicate adequate iron stores, upper and optimal boundaries vary across literature (commonly cited ranges include 70, 90, or even 110 µg/L). Therefore, the ranges used here aim to provide a balanced and transparent stratification rather than impose rigid clinical cut-offs.

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Ferritin < 30 µg/L: 33.4% - Iron deficiency / depleted stores
Ferritin 30–50 µg/L: 20.6% - Low iron stores
Ferritin 50–100 µg/L: 27.3% - Optimal Range
Ferritin 100–115 µg/L: 3.5% - Slightly elevated
Ferritin > 115 µg/L: 12.6% - High
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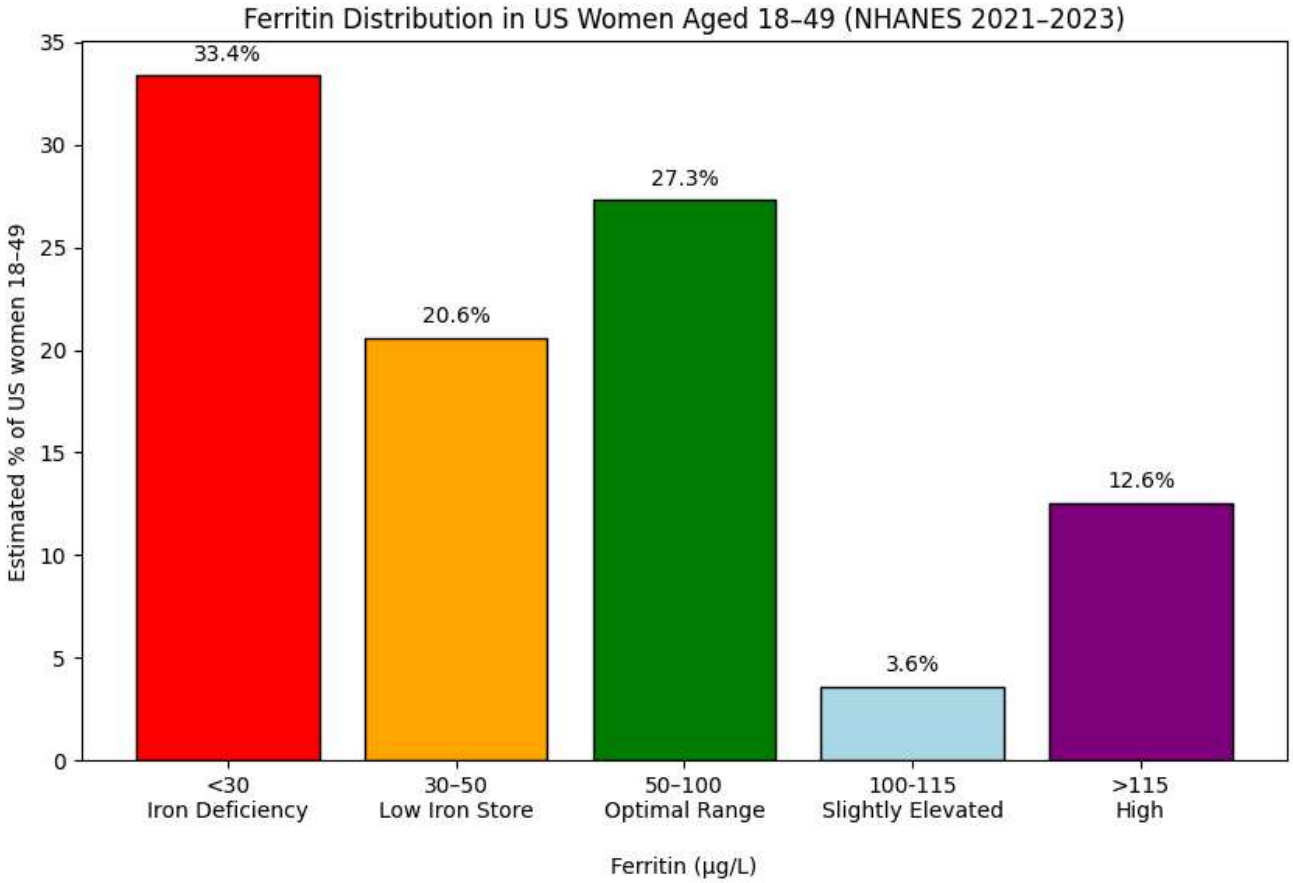

3. Results

In the weighted population of US women aged 18–49:

33.4% had ferritin below 30 µg/L (consistent with depleted iron stores)

20.6% had ferritin 30–50 µg/L (low iron stores)

27.3% had ferritin 50–100 µg/L (adequate / commonly referenced optimal range)

3.5% had ferritin 100–115 µg/L (slightly elevated; may reflect supplementation or physiological states such as pregnancy. Ferritin is also an acute phase reactant and may be elevated in inflammatory states)

12.6% had ferritin above 115 µg/L (high)

These results indicate that **over half of US women aged 18–49 have ferritin levels below 50 µg/L**, a threshold widely considered necessary for sufficient iron stores.

4. Interpretation and Conclusion

This analysis suggests that a substantial proportion of women of reproductive age in the United States may have low or borderline iron stores, even if they do not meet strict laboratory criteria for iron deficiency.

Importantly, laboratory lower reference limits are based on statistical population distributions rather than physiological adequacy. As such, reliance solely on laboratory reference cut-offs may underestimate the prevalence of suboptimal iron status.

While this analysis applies NHANES sampling weights to estimate population percentages, it does not account for complex survey design elements such as stratification and clustering.

Further research is warranted to explore the clinical implications of these findings and to evaluate whether current reference standards sufficiently reflect functional iron needs in women of reproductive age.

5. References

WHO. (2021). Ferritin Guidelines Brochure. Retrieved from https://www.who.int/docs/default-source/micronutrients/ferritin-guideline/ferritin-guidelines-brochure.pdf?sfvrsn=76a71b5a_4

Centers for Disease Control and Prevention (CDC). National Health and Nutrition Examination Survey (NHANES) 2021–2023: Documentation and Datasets. Available at: https://www.cdc.gov/nchs/nhanes/index.htm