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Title	Insights into Optimal Ferritin Level for Erythropoiesis: The First Study in Asians Using Hospital Big Data Approach
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Abstract

Introduction:

Treating iron deficiency is important in optimising erythropoiesis as well as cognitive development in children. Serum ferritin is commonly used to diagnose iron deficiency, but the optimal cutoff for diagnosis remains controversial. The World Health Organization (WHO) defines iron deficiency using cutoff levels <15 μg/L for adults and <12 μg/L for children. The Royal College of Pathologists Australasia (RCPA) recommends a cut-off of <20 μg/L (<45 pmol/L) for diagnosing paediatric iron deficiency and <30 μg/L (<68 pmol/L) for diagnosing adult iron deficiency. Functional relationship between ferritin and red cell parameters has been studied previously in Caucasians but not in Asians. This is the first study aiming to determine the erythropoiesis-based ferritin cutoffs for iron deficiency in Asian population using a hospital big data approach.

Methods:

The complete blood count (CBC) and ferritin results of patients aged <65 years in the New Territories West Cluster between July 2019 and December 2023 were retrieved using the Laboratory Information System. The analysers used were Beckman Coulter DxH 800 haematology analyser for CBC and Abbott Alinity analyser for ferritin test. Same patient results after the first episode were excluded. CBC and ferritin test results on the same date from the same patient were merged for analysis. Data were analysed separately for young children (<5 years), older children (5-12 years), adolescents (13-17 years), and adults (18-64 years) (further separated into male and female groups). Red cell parameters were analysed using a quadratic plateau model in R software to derive threshold ferritin values.

Results:

195,887 CBC and 87,786 ferritin results for the adult group and 35,918 CBC and 2,816 ferritin results for the paediatric and adolescent group were retrieved, with 4,481 and 446 merged results in the adult group and the paediatric and adolescent group respectively with ferritin ≦60 μg/L after data cleaning and filtering. In all groups, the Hb, MCV, MCH and MCHC values showed a positive correlation (negative correlation for RDW) with ferritin until a threshold value (summarized in the Table). The derived threshold ferritin values are in general higher than the WHO cutoff with some of them also higher than the RCPA cutoff.

Table

CBC Parameters	**Threshold ferritin value (μg/L)**				
	Age <5 years	**Age 5 to <13 years**	**Age 13 to <18 years**	**Adult male**	**Adult female**
Hb	10.2	19.1*	14.9	20.7*	18.9*
Hct	9.5	16.4*	13.8	19.9*	18.6*
MCV	11.8	10.1	17.1*	27.4*	19.7*
MCH	12.0*	14.0	18.5*	25.1*	19.7*
MCHC	10.7	26.6**	17.6*	21.1*	17.9*
RDW	21.2**	26.4**	19.2*	35.7**	22.8*
Established ferritin cutoff value (μg/L)					
WHO	<12	<15	<15	<15	<15
RCPA	<20	<20	<20	<30	<30

*: threshold ferritin value > WHO cutoff
**: threshold ferritin value > both WHO and RCPA cutoffs

Conclusion:

This is the first study in Asians showing that iron-restricted erythropoiesis potentially occurs earlier than the established ferritin cutoffs for iron deficiency. Further exploration is needed to assess the clinical significance of diagnosing and managing patients using erythropoiesis-based ferritin cutoffs.

Reference:

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