



# Anemia etiology in Ethiopia: assessment of nutritional, infectious disease, and other risk factors in a population-based survey of women, men, and children

Christopher T. Andersen, Amare Worku Tadesse, Sabri Bromage, Habtamu Fekadu, Elena C. Hemler, Simone Passarelli, Donna Spiegelman, Christopher R. Sudfeld, Alemayehu Worku, Yemane Berhane, Wafaie W. Fawzi

Presenter Affiliation:

Addis Continental Institute of Public Health

Addis Ababa, Dec 8-10, 2021

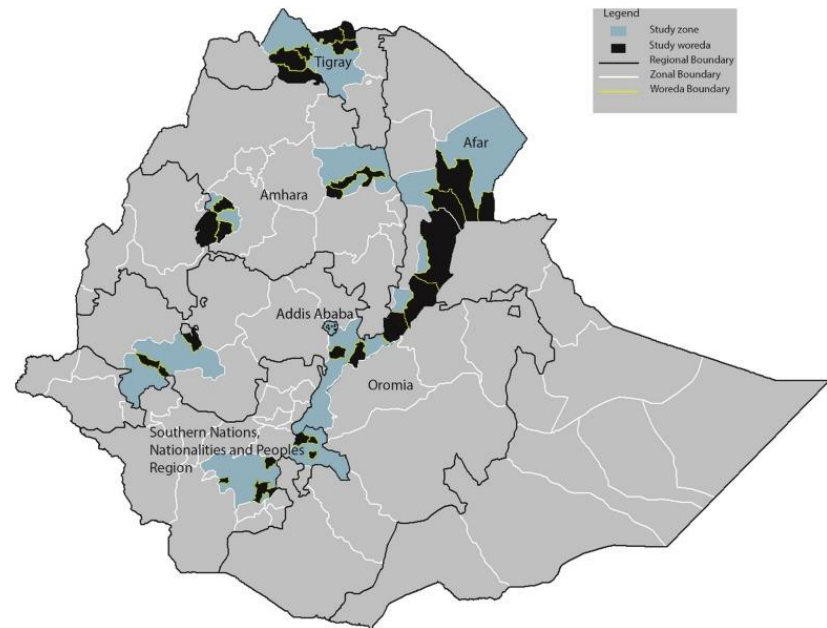
# Study Aims

---

- 1) Determine the prevalence of anemia among children, adult women and adult men in six regions of Ethiopia.
- 2) Determine the relative contribution of risk factors for anemia among children, adult women and adult men in six regions of Ethiopia.

# Sampling methodology

- Stratified by region, then random selection of zone, woreda, kebele
- 30 eligible households identified, and 17 selected within
- 17 women (15-49 y), 10 children (6-59 mo), 7 men (15-49 y)
- Two seasons



# Field data collection

---

- Field teams consisted of enumerators, phlebotomist, and a supervisor
- Standard operating procedures piloted in one urban and one rural kebele
- Informed consent for both survey and blood draw
- Data collection included household questionnaire, diet questionnaires, blood specimen (hemoglobin, malaria, ferritin, C-reactive protein, vitamin B12, folate), and stool (helminths)

# Prevalence of anemia among women

	Overall weighted % (95% CI) <sup>1</sup>	Dry season weighted % (95% CI)	Wet season weighted % (95% CI)
<b>Women aged 15-49 y</b>			
All regions <sup>2</sup>	16.6 (12.8, 21.4)	14.3 (11.3, 18.0)	18.9 (12.3, 27.9)
Addis Ababa	10.4 (8.8, 12.3)	12.6 (10.8, 14.6)	8.4 (6.1, 11.4)
Afar	41.7 (36.3, 47.3)	49.7 (45.2, 54.2)	33.6 (24.0, 44.8)
Amhara	17.8 (8.7, 32.9)	16.8 (11.3, 24.3)	18.8 (4.8, 51.4)
Oromia	17.7 (11.5, 26.2)	12.3 (6.6, 21.7)	23.1 (13.5, 36.6)
SNNPR	12.3 (10.5, 14.4)	10.8 (7.5, 15.3)	13.8 (13.0, 14.7)
Tigray	16.9 (14.3, 19.9)	17.9 (14.3, 22.3)	15.9 (12.4, 20.1)

1. Hb <12 g/dL for women; adjusted for altitude.
2. Average weighted by regional population size.

# Prevalence of anemia among men

	Overall weighted % (95% CI) <sup>1</sup>	Dry season weighted % (95% CI)	Wet season weighted % (95% CI)
<b>Men aged 15-49 y</b>			
All regions <sup>2</sup>	8.1 (5.8, 11.3)	8.0 (5.6, 11.2)	8.3 (5.5, 12.5)
Addis Ababa	2.2 (0.9, 5.5)	1.8 (0.2, 14.8)	2.7 (0.6, 11.3)
Afar	12.8 (7.5, 20.9)	17.0 (9.3, 29.1)	9.5 (3.5, 23.0)
Amhara	9.3 (7.9, 11.0)	10.9 (5.7, 19.8)	7.4 (2.7, 18.9)
Oromia	5.6 (1.6, 17.8)	5.3 (2.1, 12.7)	5.9 (1.6, 19.1)
SNNPR	10.9 (8.7, 13.6)	8.5 (3.5, 18.9)	13.5 (6.8, 25.1)
Tigray	13.6 (6.1, 27.7)	12.3 (5.7, 24.8)	15.4 (6.2, 33.3)

1. Anemia defined as Hb <13 g/dL for men; adjusted for altitude.
2. Average weighted by regional population size.

# Prevalence of anemia among children

	Overall weighted % (95% CI) <sup>1</sup>	Dry season weighted % (95% CI)	Wet season weighted % (95% CI)
<b>Children aged 6-59 mo</b>			
All regions <sup>2</sup>	22.1 (18.6, 26.0)	20.7 (15.8, 26.6)	23.5 (17.9, 30.2)
Addis Ababa	21.4 (14.6, 30.2)	17.1 (8.3, 31.9)	23.4 (13.2, 38.1)
Afar	31.4 (21.2, 44.0)	30.5 (17.9, 46.9)	32.6 (20.8, 47.3)
Amhara	23.0 (17.3, 30.0)	18.1 (10.5, 29.5)	28.2 (17.7, 41.7)
Oromia	25.0 (17.2, 34.8)	25.5 (15.3, 39.4)	24.4 (11.3, 44.9)
SNNPR	14.7 (9.8, 21.4)	11.5 (7.5, 17.2)	17.2 (9.4, 29.6)
Tigray	22.1 (17.1, 28.0)	24.2 (15.5, 35.6)	19.9 (14.2, 27.1)

1. Anemia defined as Hb <11 g/dL for children; adjusted for altitude.
2. Average weighted by regional population size.

# Population attributable percent: women

Proportion of anemia cases attributable to risk factors among women aged 15-49 years in six regions of Ethiopia, 2019

	Risk ratio		Population attributable risk percent	
	RR	95% CI	%	95% CI
<b>Proximal factors model</b>				
Low serum ferritin	2.05	(0.95, 4.41)	11	(-1, 22)
Low serum folate	<b>1.74</b>	<b>(1.08, 2.82)</b>	<b>25</b>	<b>(4, 40)</b>
Low serum vitamin B12	0.55	(0.31, 0.99)	-13	(-23, -3)
High C-reactive protein	<b>2.81</b>	<b>(1.58, 4.98)</b>	<b>9</b>	<b>(2, 16)</b>
Malaria	<b>2.49</b>	<b>(1.65, 3.77)</b>	<b>3</b>	<b>(2, 4)</b>
Helminth infection	0.30	(0.07, 1.32)	-2	(-4, 0)



# Population attributable percent: men

Proportion of anemia cases attributable to risk factors among men aged 15-49 years in six regions of Ethiopia, 2019.

Proximal factors model	Risk ratio		Population attributable risk percent	
	RR	95% CI	%	95% CI
Low serum ferritin	<b>3.33</b>	<b>(1.17, 9.47)</b>	<b>9</b>	<b>(0, 17)</b>
Low serum folate	<b>2.18</b>	<b>(1.35, 3.51)</b>	<b>28</b>	<b>(11, 42)</b>
Low serum vitamin B12	0.32	(0.16, 0.62)	-29	(-45, -14)
High C-reactive protein	2.43	(0.76, 7.79)	8	(-6, 21)
Malaria	<b>14.11</b>	<b>(4.81, 41.46)</b>	<b>8</b>	<b>(3, 13)</b>
Helminth infection	1.00	(0.41, 2.43)	0	(-6, 6)

# Population attributable percent: children

Proportion of anemia cases attributable to risk factors among children aged 6-59 months in six regions of Ethiopia, 2019

	Risk ratio		Population attributable risk percent	
	RR	95% CI	%	95% CI
<b>Proximal factors model</b>				
Low serum ferritin	<b>1.91</b>	<b>(1.17, 3.10)</b>	<b>19</b>	<b>(3, 33)</b>
Low serum folate	1.24	(0.84, 1.84)	6	(-4, 15)
Low serum vitamin B12	0.85	(0.59, 1.22)	-3	(-10, 3)
High C-reactive protein	<b>1.58</b>	<b>(1.14, 2.17)</b>	<b>5</b>	<b>(2, 9)</b>
Malaria	0.10	(0.02, 0.56)	-1	(-2, -1)
Helminth infection	0.31	(0.05, 1.85)	-3	(-5, -1)

# Summary of key findings

---

- This survey is the first in Ethiopia to estimate proportion of anemia attributable to risk factors using individual-level data, including both serum nutrient and dietary intake data
- Anemia is an important public health problem, particularly among women and children
- Low serum ferritin and folate, along with inflammation, appear to be the primary drivers of anemia in Ethiopia
- Interventions should be evaluated to enhance the intake of bioavailable folate and iron, such as behavior change communication or fortification of staple foods
- Targeted interventions such as supplementation or point of use fortification may also be considered

---

# Thank you!!

Addis Ababa, Dec 8-10, 2021