

Priority micronutrient density in foods

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Article

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Abstract

Background: Despite concerted efforts to improve diet quality and reduce malnutrition, micronutrient deficiencies remain widespread globally, especially in low- and middle-income countries and among population groups with increased needs, where diets are often inadequate in iron, zinc, folate, vitamin A, calcium, and vitamin B₁₂. There is a need to understand the density of these micronutrients and their bioavailability across diverse foods and the suitability of these foods to help meet requirements for populations with high burdens of micronutrient malnutrition.

Objective: We aimed to identify the top food sources of these commonly lacking micronutrients, which are essential for optimal health, to support efforts to reduce micronutrient malnutrition among various populations globally.

Methods: We built an aggregated global food composition database and calculated recommended nutrient intakes for five population groups with varying requirements. An approach was developed to rate foods according to their density in each and all priority micronutrients for various population groups with different nutrient requirements.

Results: We find that the top sources of priority micronutrients are organs, small fish, dark green leafy vegetables, bivalves, crustaceans, beef, goat, eggs, milk, cheese, and canned fish with bones. Lamb, mutton, goat milk, and pork are also good sources, and to a lesser extent, yogurt, fresh fish, pulses, and teff.

Conclusions: The results provide insight into which foods to prioritize to fill common micronutrient gaps and reduce undernutrition.

Full Text

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Figures

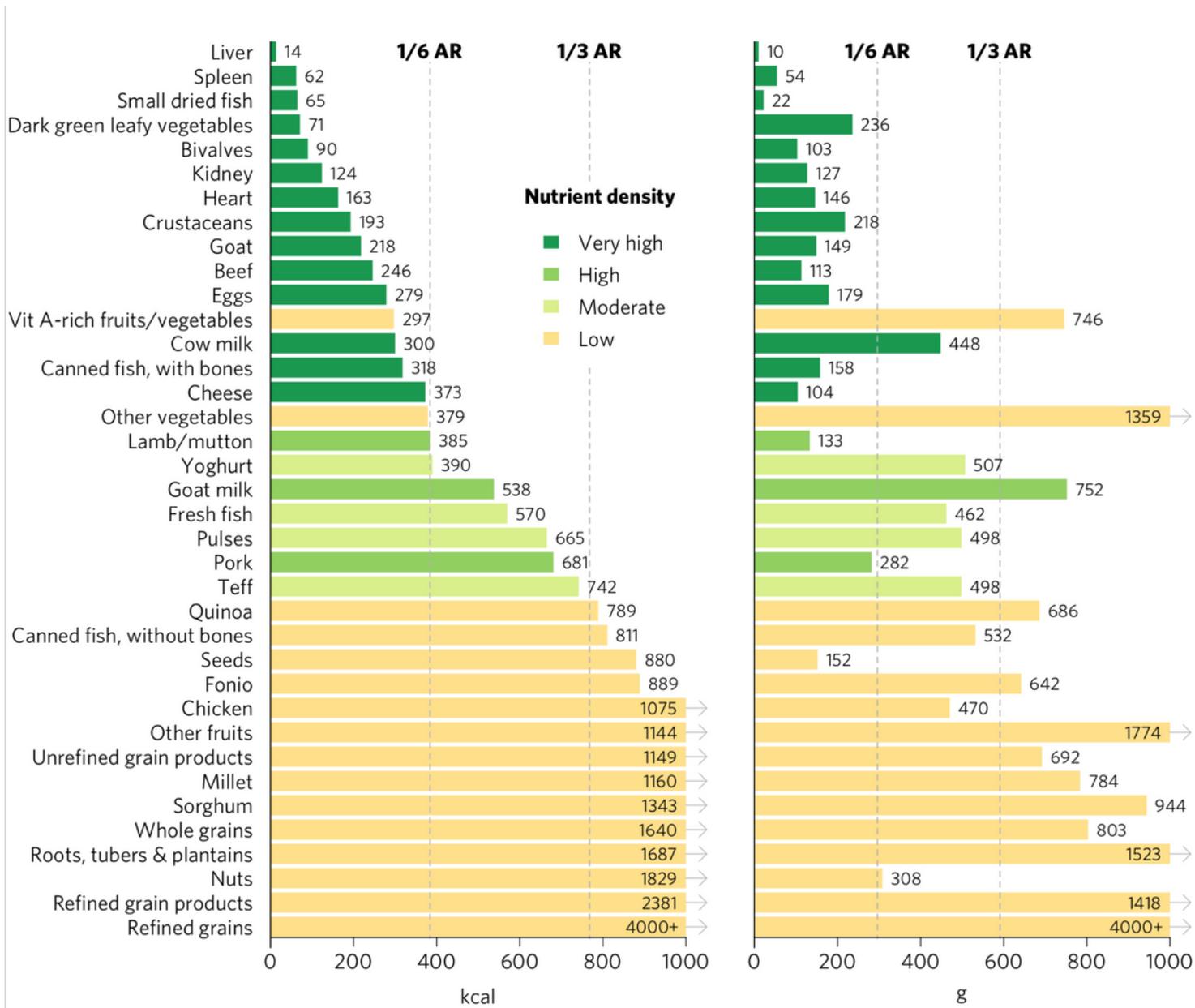


Figure 1

Calories and grams needed to provide an average of one-third of recommended intakes of vitamin A, folate, vitamin B12, calcium, iron, and zinc for women of reproductive age. Each micronutrient's contribution is capped at 100% of recommended intakes. Hypothetical average requirements for mass are based on an energy density of 1.3 kcal/g. AR, average requirement; Vit, vitamin.

	2+ nutrients	Iron	Zinc	Vitamin A	Calcium	Folate	Vitamin B ₁₂
Liver	Very high	Very high	Very high	Very high	Low	Very high	Very high
Spleen	Very high	Very high	Very high	Low	Low	Low	Very high
Small dried fish	Very high	Very high	Very high	Very high	Very high	Low	Very high
Dark leafy greens	Very high	High	Low	Very high	Very high	Very high	Low
Bivalves	Very high	Very high	Very high	Very high	Very high	Moderate	Very high
Kidney	Very high	Very high	Very high	High	Low	High	Very high
Heart	Very high	Very high	Very high	Low	Low	Moderate	Very high
Crustaceans	Very high	Moderate	Very high	Low	Moderate	Low	Very high
Goat	Very high	Very high	Very high	Low	Low	Low	Very high
Beef	Very high	High	Very high	Low	Low	Low	Very high
Eggs	Very high	Moderate	Very high	Very high	Low	Very high	Very high
Cow milk	Very high	Low	High	Very high	Very high	Low	Very high
Canned fish w/bones	Very high	Moderate	Very high	Low	Very high	Low	Very high
Cheese	Very high	Low	Very high	Very high	Very high	Low	Very high
Lamb/mutton	High	Low	Very high	Low	Low	Low	Very high
Goat milk	High	Low	Moderate	High	Very high	Low	Low
Pork	High	Low	Very high	Low	Low	Low	Very high
Yoghurt	Moderate	Low	Low	Low	Very high	Low	Very high
Fresh fish	Moderate	Low	Moderate	Low	Low	Low	Very high
Pulses	Moderate	Moderate	Moderate	Low	Low	Very high	Low
Teff	Moderate	Very high	Moderate	Low	Low	High	Low
Vit A-rich fruit/veg	Low	Low	Low	Very high	Low	High	Low
Other vegetables	Low	Low	Low	Low	Low	Low	Low
Quinoa	Low	Moderate	Moderate	Low	Low	Very high	Low
Canned fish w/o bones	Low	Low	Moderate	Low	Low	Low	Very high
Seeds	Low	Low	High	Low	High	High	Low
Fonio	Low	Moderate	Moderate	Low	Low	Moderate	Low
Chicken	Low	Low	High	Low	Low	Low	High
Other fruits	Low	Low	Low	Low	Low	High	Low
Unrefined grain prod	Low	Low	Moderate	Low	Low	Moderate	Low
Millet	Low	Moderate	Moderate	Low	Low	Moderate	Low
Sorghum	Low	Moderate	Low	Low	Low	Low	Low
Whole grains	Low	Low	High	Low	Low	Low	Low
Roots/tubers/plantains	Low	Low	Low	Low	Low	Low	Low
Nuts	Low	Low	Low	Low	Low	Low	Low
Refined grain products	Low	Low	Low	Low	Low	Low	Low
Refined grains	Low	Low	Moderate	Low	Low	Low	Low

Figure 2

Aggregate and individual micronutrient density scores for women of reproductive age. prod, products; veg, vegetables.

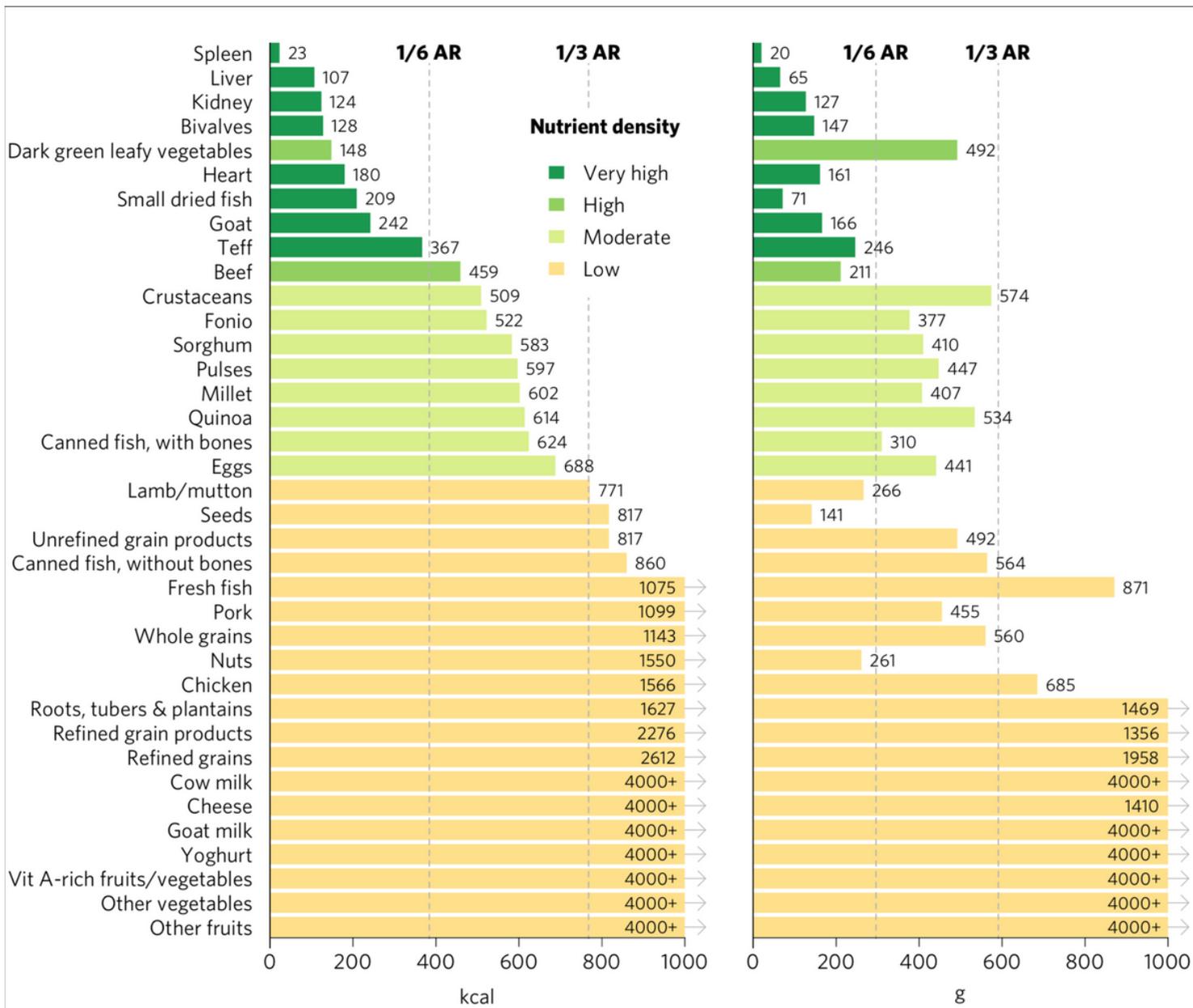


Figure 3

Calories and grams needed to provide one-third of recommended iron intakes for women of reproductive age. Hypothetical average requirements for mass are based on an energy density of 1.3 kcal/g. AR, average requirement; Vit, vitamin.

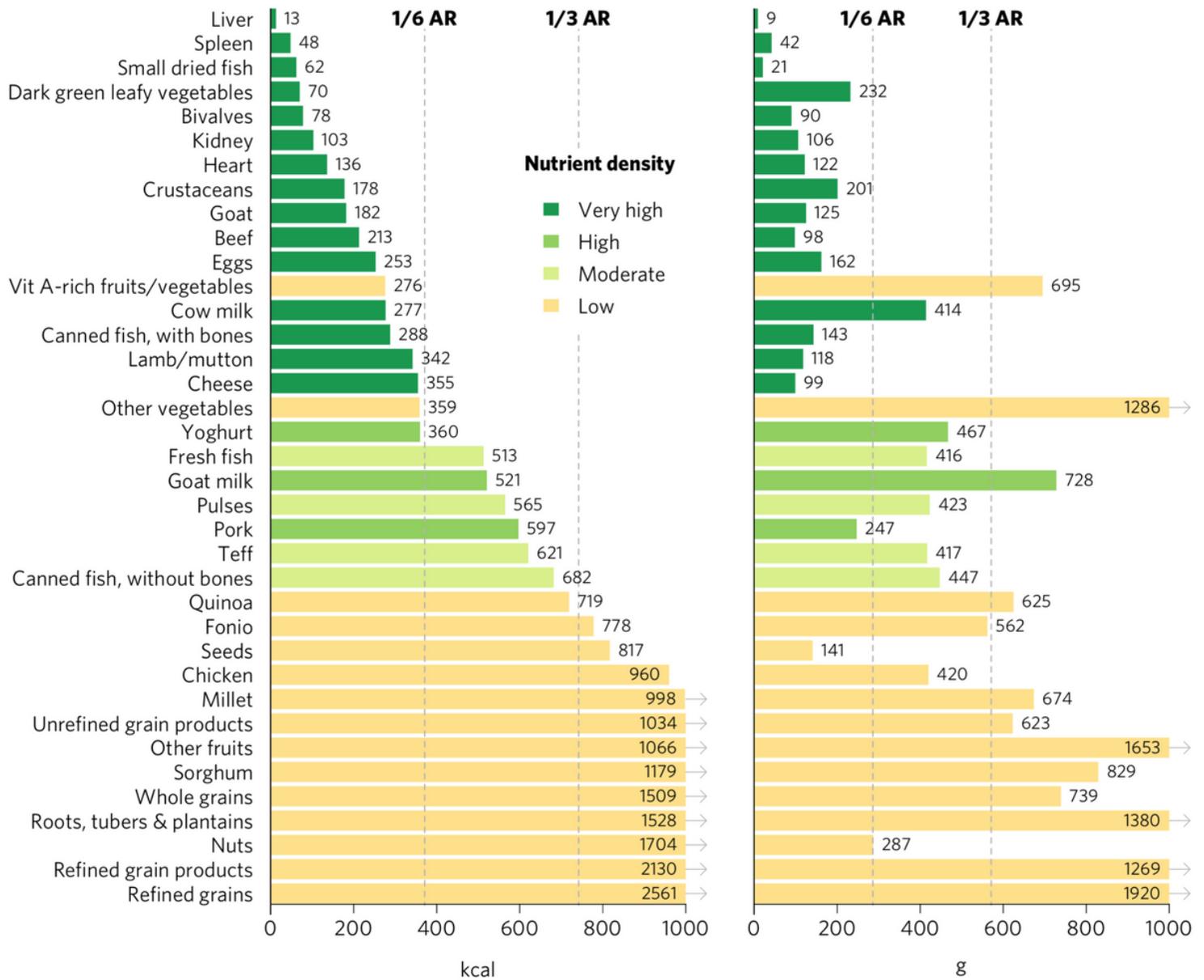


Figure 4

Calories and grams needed to provide an average of one-third of recommended intakes of vitamin A, folate, vitamin B12, calcium, iron, and zinc for adults ≥ 25 . Each nutrient's contribution is capped at 100% of recommended intakes. Hypothetical average requirements for mass are based on an energy density of 1.3 kcal/g. AR, average requirement; Vit, vitamin.

	2+ nutrients	Iron	Zinc	Vitamin A	Calcium	Folate	Vitamin B ₁₂
Liver	Very high	Very high	Very high	Very high	Low	Very high	Very high
Spleen	Very high	Very high	Very high	Low	Low	Low	Very high
Small dried fish	Very high	Very high	Very high	Very high	Very high	Low	Very high
Dark leafy greens	Very high	High	Low	Very high	Very high	Very high	Low
Bivalves	Very high	Very high	Very high	High	Very high	Mod	Very high
Kidney	Very high	Very high	Very high	High	Low	High	Very high
Heart	Very high	Very high	Very high	Low	Low	Mod	Very high
Crustaceans	Very high	High	Very high	Low	Mod	Low	Very high
Goat	Very high	Very high	Very high	Low	Low	Low	Very high
Beef	Very high	Very high	Very high	Low	Low	Low	Very high
Eggs	Very high	High	High	Very high	Low	High	Very high
Cow milk	Very high	Low	High	Very high	Very high	Low	Very high
Canned fish w/ bones	Very high	High	High	Low	Very high	Low	Very high
Lamb/mutton	Very high	High	Very high	Low	Low	Low	Very high
Cheese	Very high	Low	Very high	High	Very high	Low	Very high
Yoghurt	High	Low	Low	Low	Very high	Low	Very high
Goat milk	High	Low	Mod	High	Very high	Low	Mod
Pork	High	High	Very high	Low	Low	Low	Very high
Fresh fish	Mod	Mod	Mod	Low	Low	Low	Very high
Pulses	Mod	Very high	Mod	Low	Low	Very high	Low
Teff	Mod	Very high	Mod	Low	Low	High	Low
Canned fish w/o bones	Mod	Mod	Mod	Low	Low	Low	Very high
Vit A-rich fruit/veg	Low	Low	Low	Very high	Low	High	Low
Other vegetables	Low	Low	Low	Low	Low	Low	Low
Quinoa	Low	High	Mod	Low	Low	Very high	Low
Fonio	Low	Very high	Mod	Low	Low	Mod	Low
Seeds	Low	High	High	Low	High	High	Low
Chicken	Low	Low	High	Low	Low	Low	High
Millet	Low	Very high	Mod	Low	Low	Mod	Low
Unrefined grain prod	Low	Mod	Mod	Low	Low	Mod	Low
Other fruits	Low	Low	Low	Low	Low	Low	Low
Sorghum	Low	Very high	Low	Low	Low	Low	Low
Whole grains	Low	Mod	Mod	Low	Low	Low	Low
Roots/tubers/plantains	Low	Low	Low	Low	Low	Low	Low
Nuts	Low	Low	Low	Low	Low	Low	Low
Refined grain products	Low	Low	Low	Low	Low	Low	Low
Refined grains	Low	Low	Mod	Low	Low	Low	Low

Figure 5

Aggregate and individual micronutrient density scores for adults ≥ 25 . Mod, Moderate; prod, products; veg, vegetables.

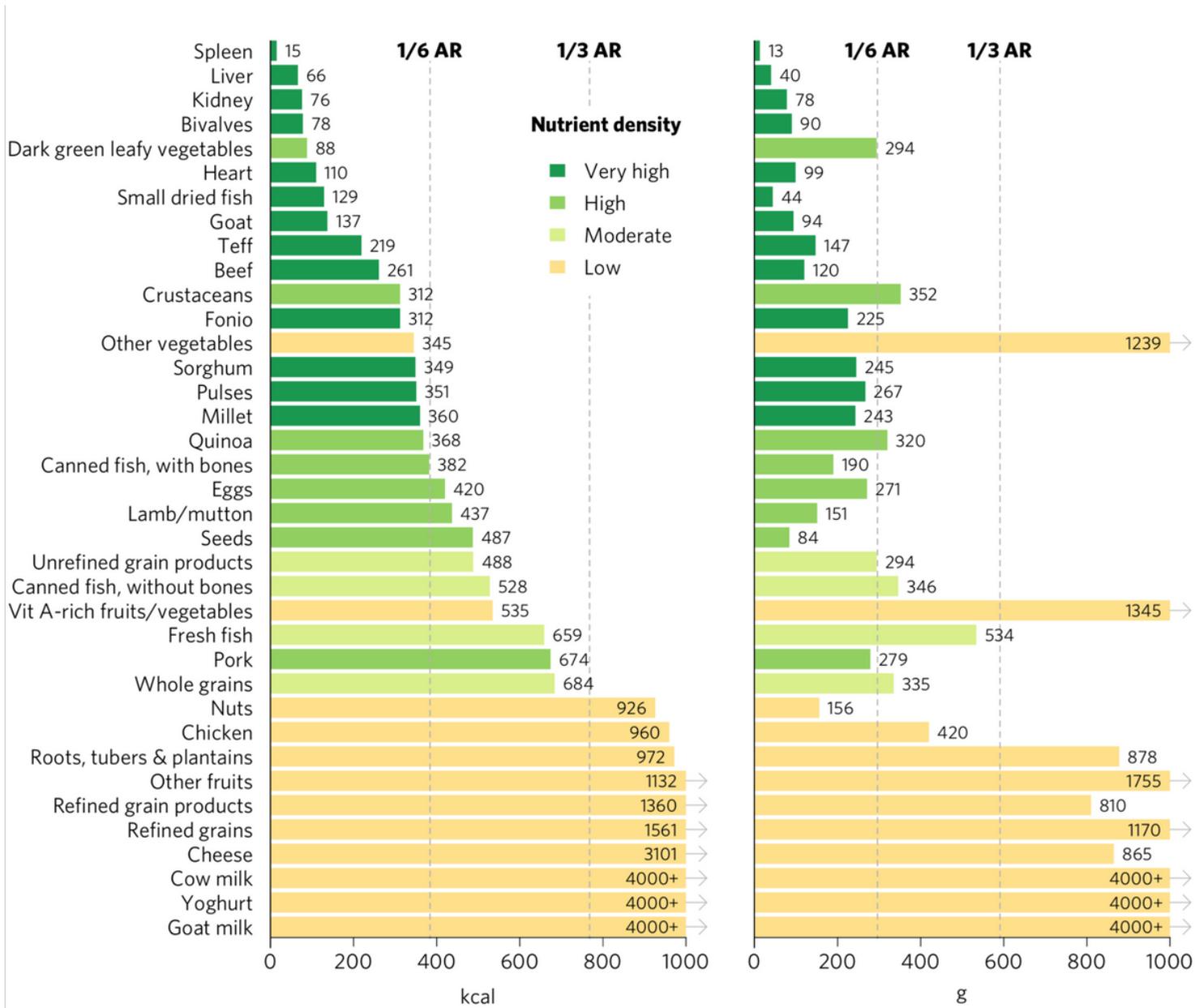


Figure 6

Calories and grams needed to provide one-third of recommended iron intakes for adults ≥ 25 . Hypothetical average requirements for mass are based on an energy density of 1.3 kcal/g. AR, average requirement; Vit, vitamin.

Supplementary Files

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- [Nutrientdensitiesupplementalmaterialv4.pdf](#)