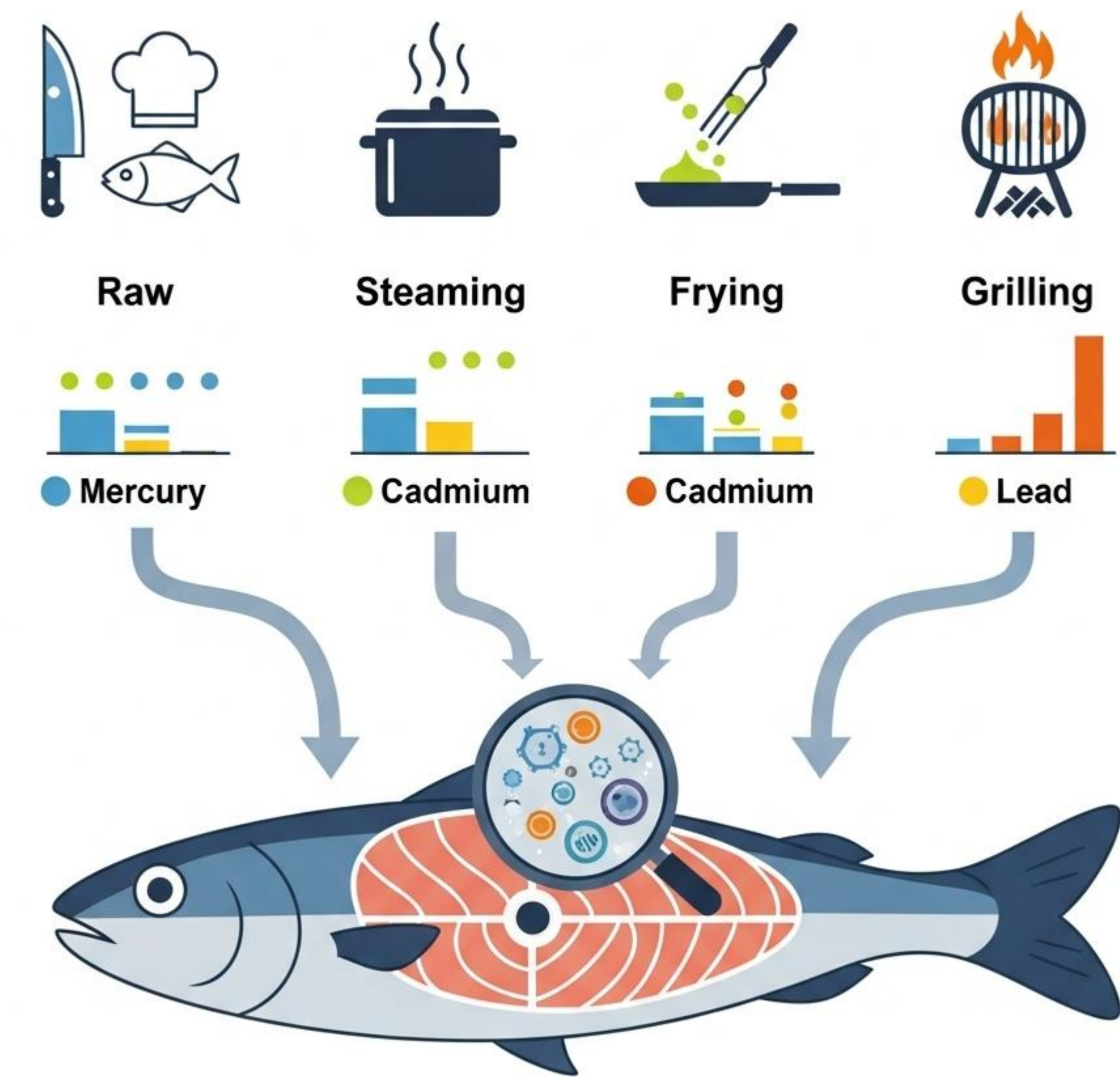


Impact of Cooking Methods on Metal Concentrations and Health Risks Assessment in Horse Mackerel and Hake from Ogbomoso, Nigeria

Aderibigbe Deborah O.¹ Dabo S. Olawale¹, Olajire S.¹ and Giwa Abdur-Rahim A.¹

¹Department of Pure and Applied Chemistry, Ladoké Akintola University of Technology, Ogbomoso, Nigeria

Cooking Methods & Metal Levels in Fish



Fish Sample Collection

Cooking Method Application (Boiling, Grilling and Frying)

Metal Content Analysis of Head, Gills, Flesh and Bones using Atomic Absorption Spectroscopy (AAS)

Health Risk Assessment (EDI, THQ and HI)

Introduction & Background

-Over 210 million people in Sub-Saharan Africa face food insecurity and poor nutrition.

-Ogbomoso, a city in Nigeria is not an exemption in this case

-Fish consumption provides high-quality protein and essential nutrients, serving as a key strategy against malnutrition, therefore, the contamination of fish if not well managed can result into hazardous conditions in humans

-Cooking methods can significantly alter concentrations of both beneficial and toxic metals in fish.

-This study aims to evaluate how boiling, frying, and grilling affect metal levels in Horse Mackerel and Hake and assess associated health risks.

References

Aberoumand, A., & Masoudi, M. (2022). The effect of the cooking method on Rainbow Trout (*Oncorhynchus mykiss*) fillets. *Potravinarstvo Slovak Journal of Food Sciences*, 16, 287–295. <https://doi.org/10.5219/17>

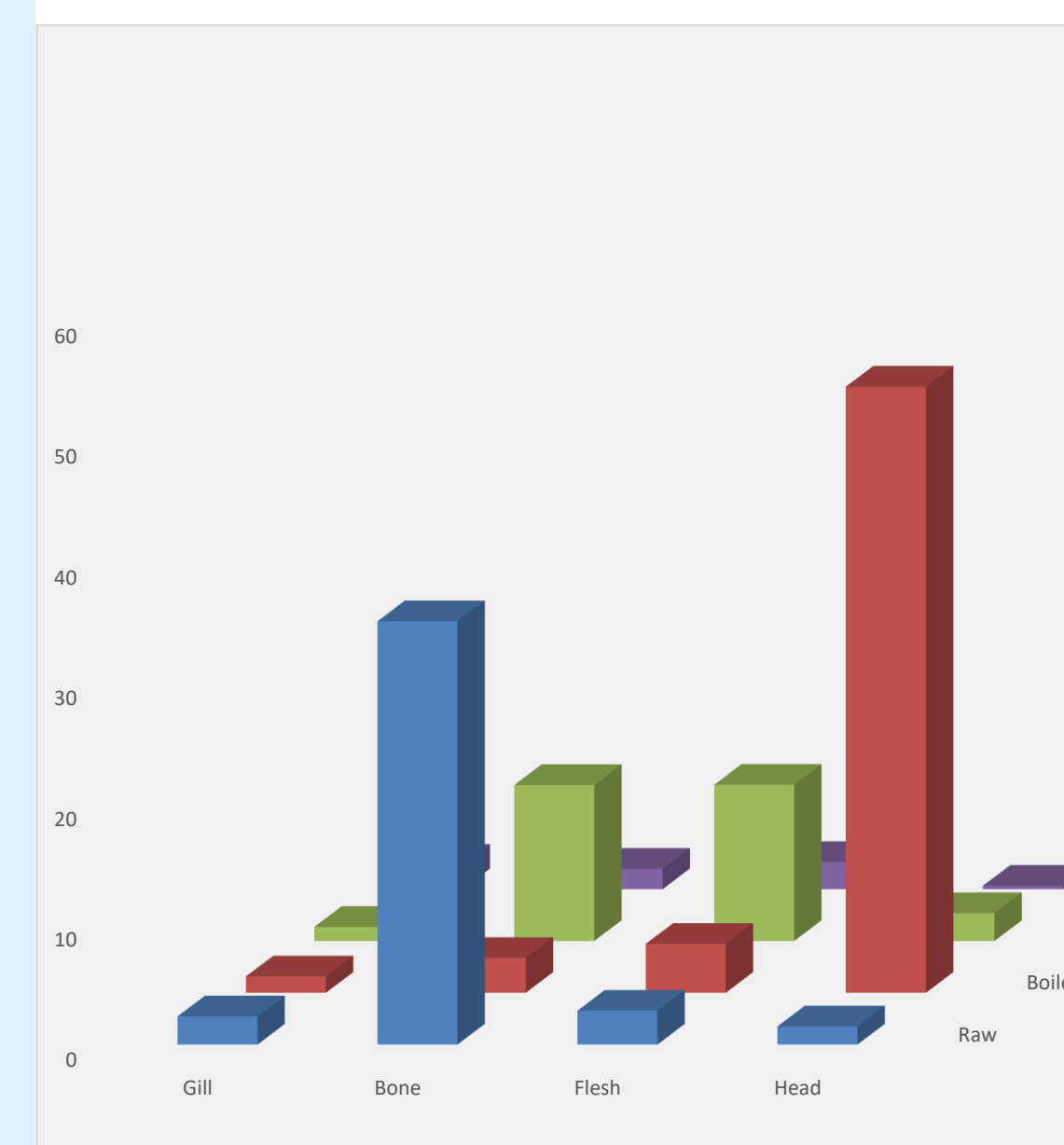


Fig 1: Level of Pb in the four parts of Horse mackerel and under different cooking methods.

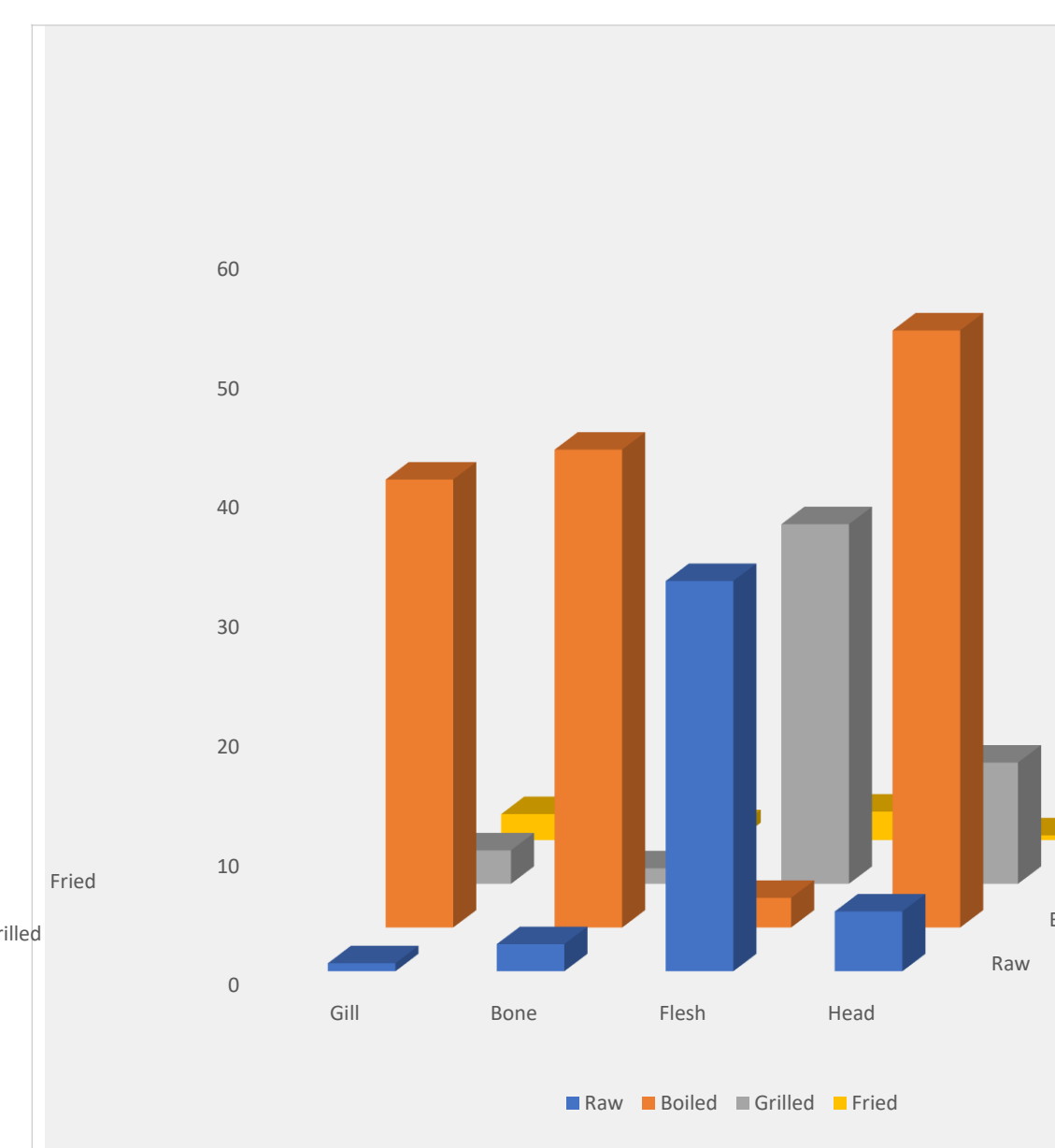


Fig 2: Level of Pb in the four parts of Hake and under different cooking methods

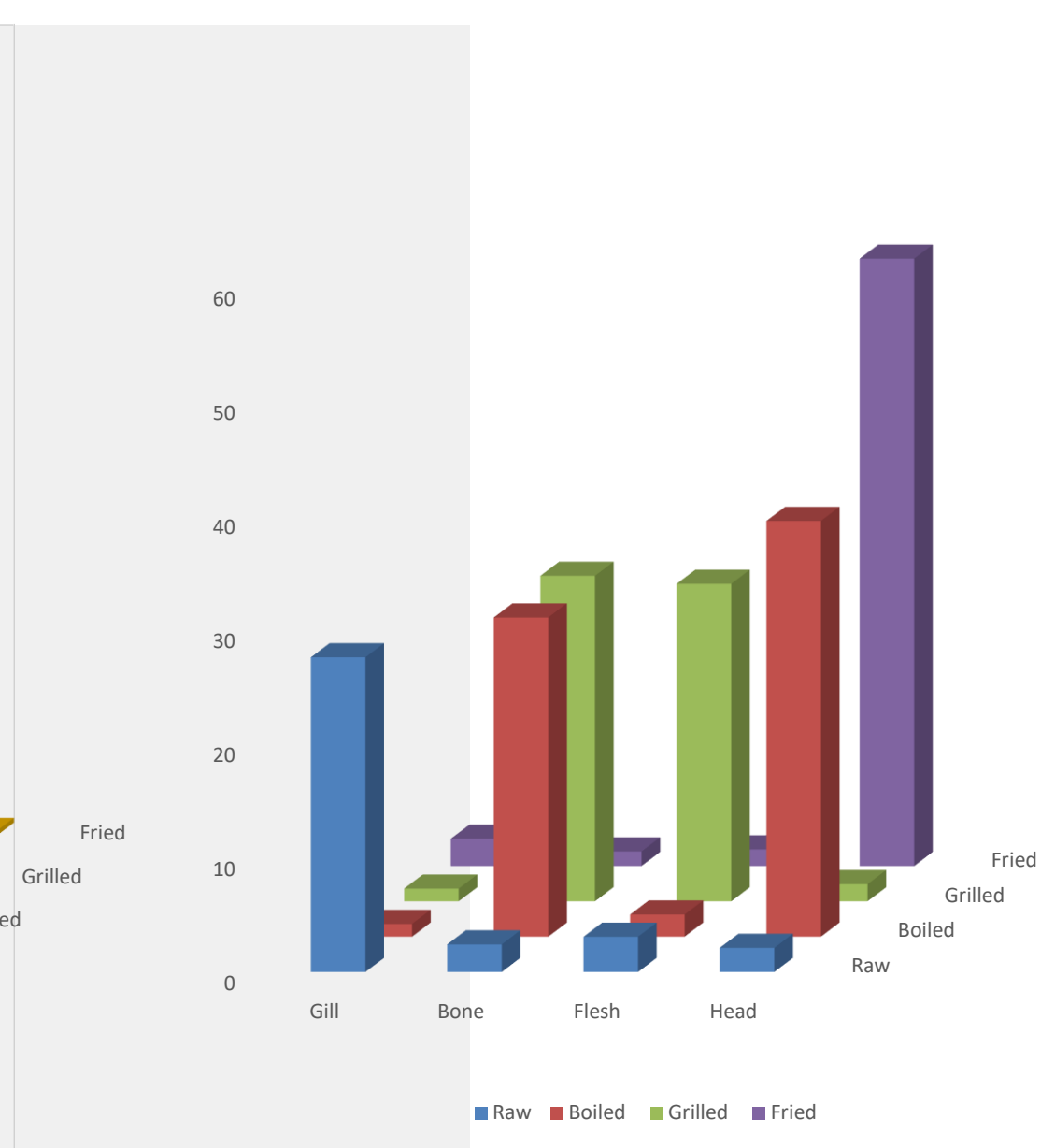


Fig 3: Level of Cd in the four parts of Horse Mackerel and under different cooking methods

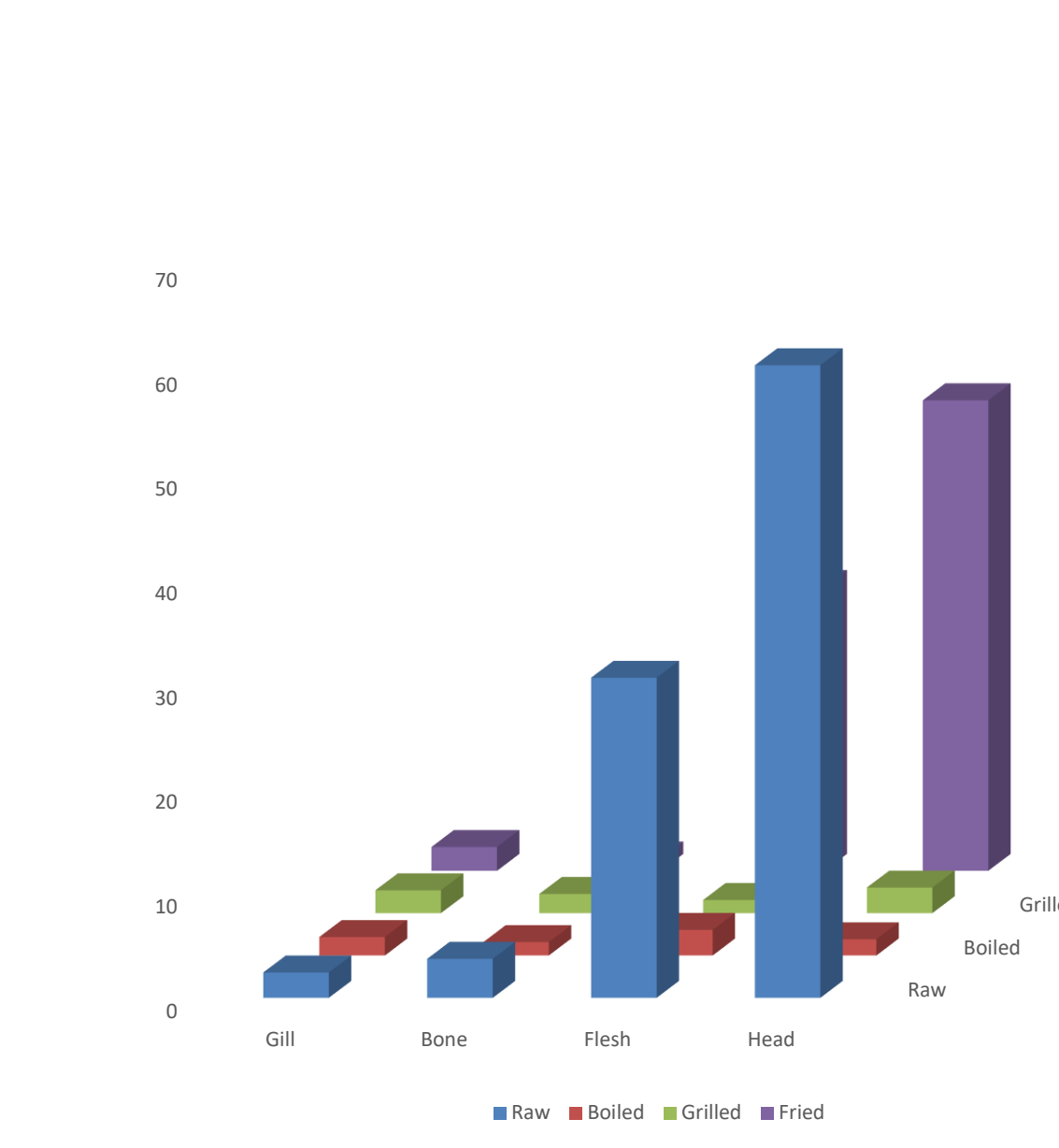
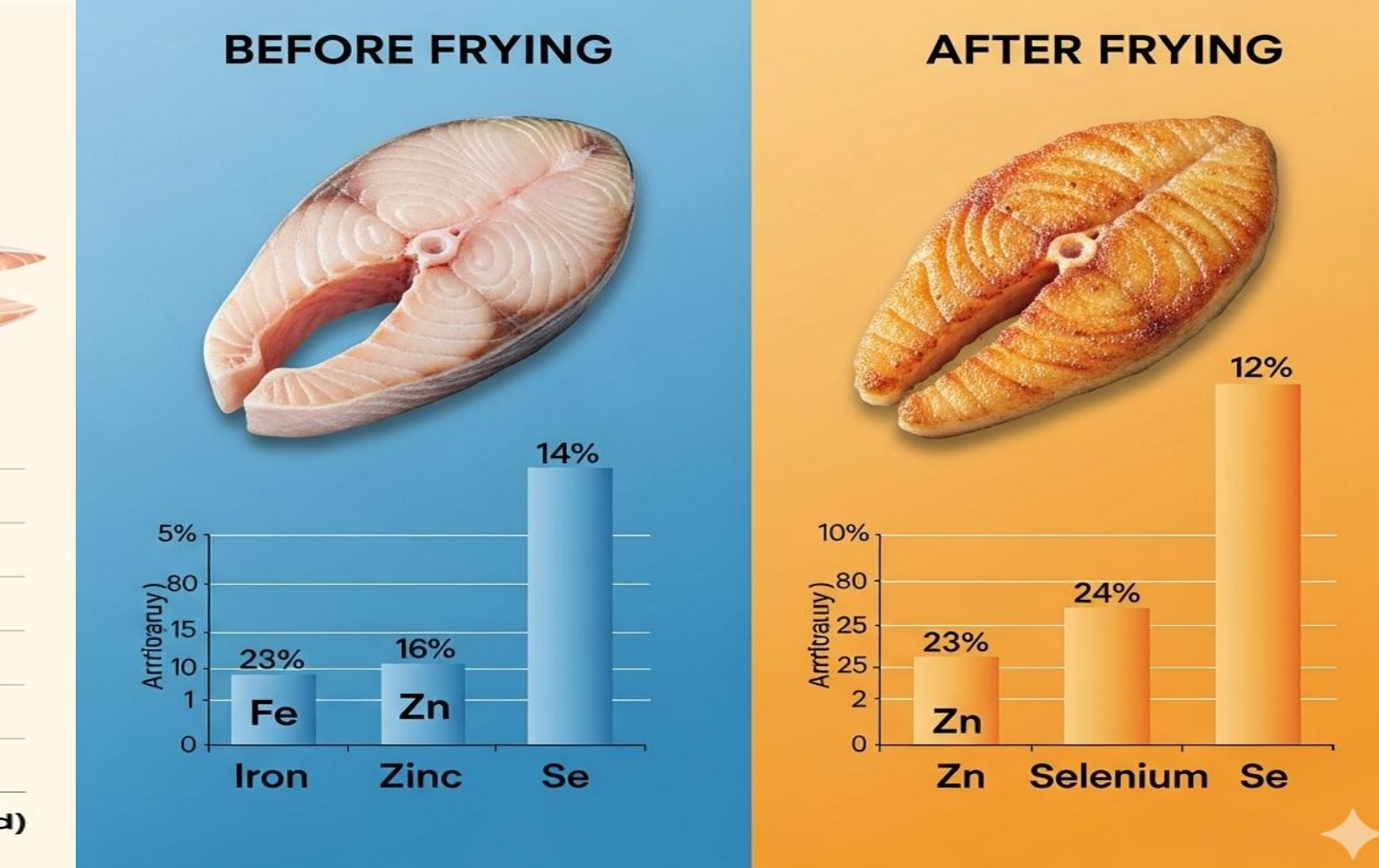
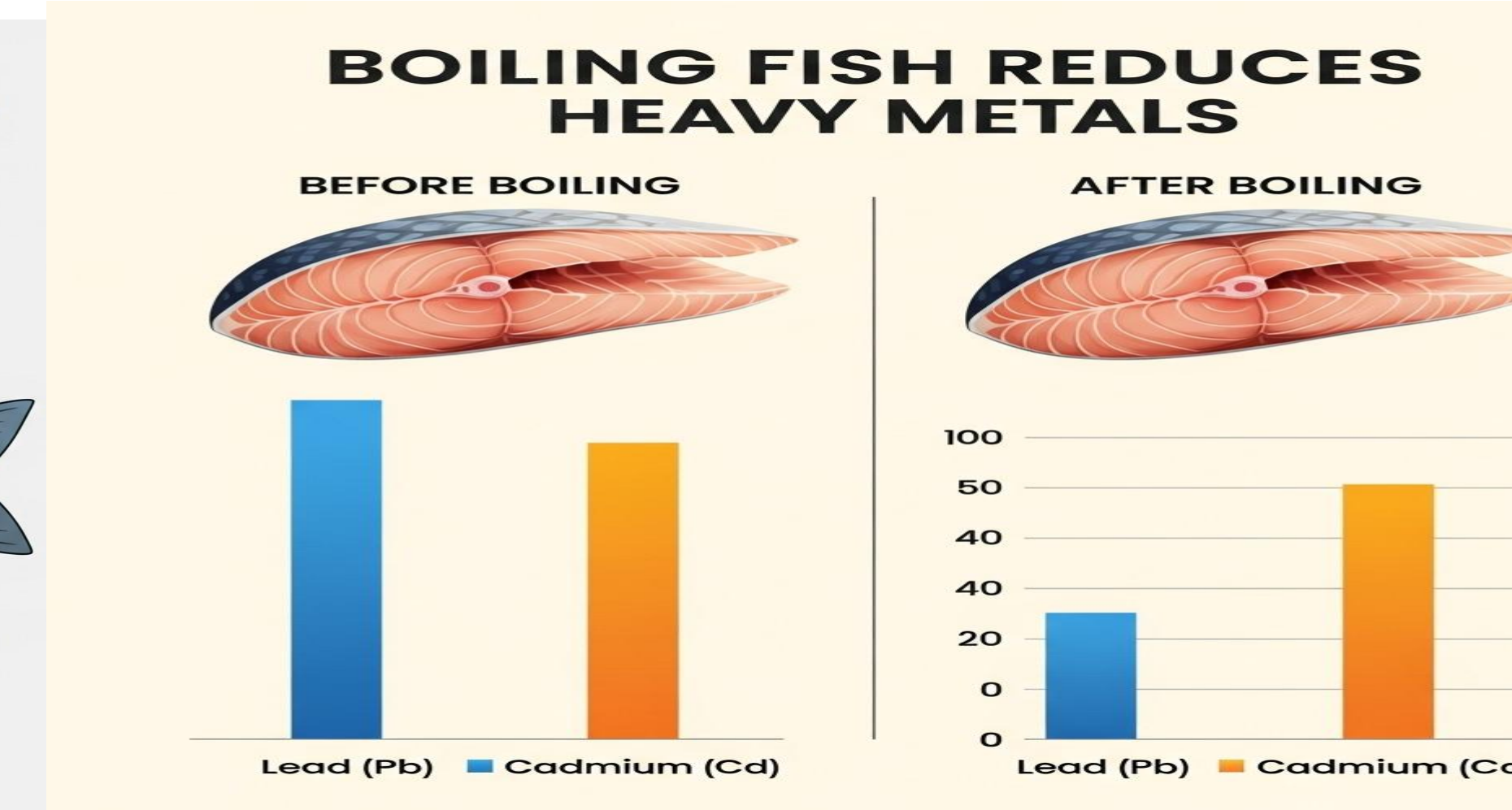
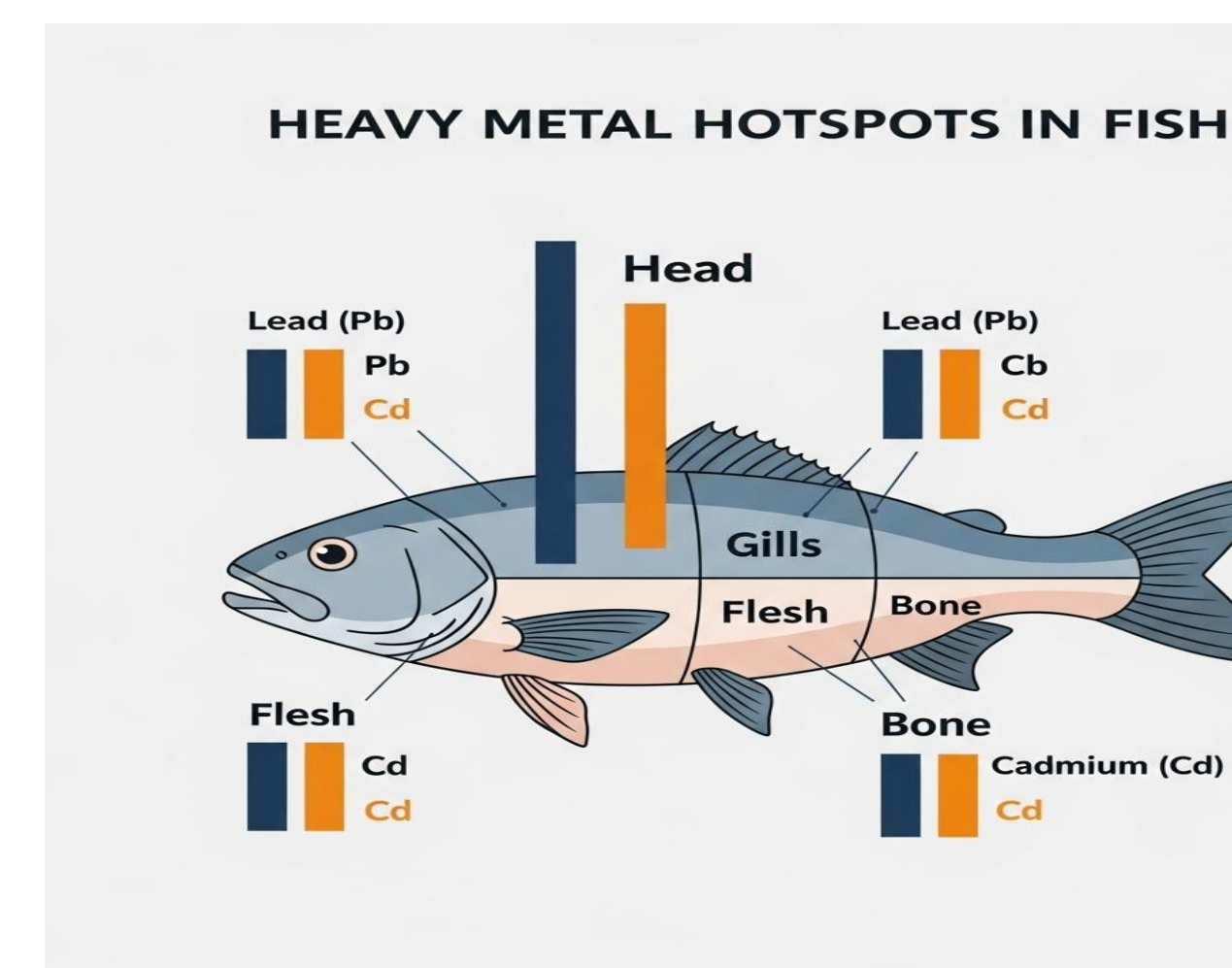


Fig 4: Level of Cd in the four parts of Hake and under different cooking methods



Key Findings

-Cooking methods significantly alter toxic metal concentrations in Horse Mackerel and Hake ($p < 0.05$).

-Boiling and grilling reduce Pb in Horse Mackerel gills but increase it in the head; Pb increases in Hake gills with all cooking methods.

-Cd levels decrease with frying and boiling in Horse Mackerel gills and consistently reduce across Hake parts with all cooking methods.

-Health risk indices (EDI, THQ, HI) are within safe limits, indicating no non-carcinogenic health risks from consumption regardless of cooking method.

Conclusions

-Cooking methods impact the distribution and levels of toxic and essential metals in fish, affecting food safety and nutritional value.

-The finding that all cooking methods result in safe consumption levels supports the nutritional role of Horse Mackerel and Hake despite metal variations.

-Mixed trends in essential metals suggest cooking method selection may influence nutritional intake.

-This study contributes valuable data to the evaluation of fish safety in food-insecure regions of Sub-Saharan Africa.

-Further research may focus on long-term monitoring and assessment of other fish species and cooking practices.

Results

Effects of Cooking on Toxic Metal Concentrations

-Boiling and grilling significantly reduced lead (Pb) levels in Horse Mackerel gills but increased Pb in the head ($p < 0.05$).

-In Hake, all cooking methods increased Pb in gills; boiling and grilling also increased Pb in the head.

-Frying and boiling reduced cadmium (Cd) in Horse Mackerel gills, whereas grilling increased Cd.

Changes in Cadmium and Essential Metals

-All cooking methods consistently decreased cadmium (Cd) in all parts of Hake.

-Essential metals such as iron (Fe), zinc (Zn), and calcium (Ca) showed mixed trends across cooking methods and fish parts.

-[Specific numerical data not provided for essential metals trends.]

Health Risk Assessment Outcomes

-Estimated Daily Intake (EDI) values for metals were within safe limits for all cooking methods and fish parts.

-Target Hazard Quotient (THQ) and Hazard Index (HI) values for all metals in both fishes were below one.

-Consumption of Horse Mackerel and Hake, regardless of cooking method, poses no non-carcinogenic health risk.