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Comprehensive Nutritional Composition of Wild Meat: A Systematic Review Using Data Imputation with Artificial Intelligence

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ABSTRACT

While not promoting wild animal consumption, this study acknowledges its crucial role for Indigenous Peoples and Local Communities (IPLC) worldwide, making comprehensive nutritional data essential for informed dietary assessments and policy decisions. Employing advanced data imputation techniques to address data gaps ethically, this systematic review, following PRISMA guidelines, analyzed 20 peer-reviewed articles and one grey literature document. We focused on the nutritional composition of wild meat from 26 species across mammals, birds, and reptiles. We assessed 10 key nutrients, revealing significant variations. Bird muscle tissue did not demonstrate statistically higher iron concentrations than previously recognized in mammalian muscle ($p < 0.05$), challenging established nutritional understanding of red and white meat. Reptile muscles contained 60% more iron than mammalian muscles, while bird muscles showed 200% higher potassium and omega-6 fatty acid levels compared to mammals ($p < 0.01$). Mammalian muscles exhibited the highest zinc content among taxonomic classes. As in the case of non-wild animals, viscera consistently showed higher mineral concentrations than muscle tissues across all species. These findings enhance understanding of wild meat's nutritional value, contributing vital data to food composition databases and supporting evidence-based policy decisions for communities reliant on these resources.

Keywords: Wild Meat; Nutritional Composition; Food Security; Artificial Intelligence; Systematic Review.

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SIGNIFICANCE STATEMENT

This systematic review offers a detailed analysis of the nutritional composition of wild meat (mammals, birds, and reptiles). By employing AI-driven data imputation, we innovatively address existing gaps while considering conservation and ethical concerns in wild species research. Our findings demonstrate significant variations in nutrient profiles across species and anatomical parts, providing essential data to understand the role of wild meat in food security and ecosystem-based nutrition, particularly for Indigenous Peoples and Local Communities. The study underscores the nutrient-rich potential of viscera. By integrating ethnobiological knowledge with nutritional science, this research supports conservation strategies, sustainable dietary practices, and culturally appropriate food policies for traditional food systems reliant on wild meat.

INTRODUCTION

Wild animals have been integral to human diets throughout history, playing a crucial role in both ecosystem dynamics and food security (Cawthorn and Hoffman 2015). Known as wild meat, bushmeat, or game meat, these resources are particularly vital for Indigenous Peoples and Local Communities (IPLC), who often maintain traditional ecological knowledge about sustainable harvesting practices (Nasi et al. 2018). In this study, we define wild meat as being derived from wild, non-domesticated vertebrates, excluding insects, crustaceans, larvae, mollusks, and fish (Ingram et al. 2021). Globally, an estimated 230 to 833 million people rely on wild meat as a primary protein source, with consumption patterns closely tied to local ecological conditions and seasonal availability (Nielsen et al. 2018; Tregdigo et al. 2020).

Beyond protein provision, wild meat contributes significantly to micronutrient adequacy in traditional food systems (Cawthorn and Hoffman 2015; Fa et al. 2015). For instance, in the Amazon, wild meat consumption correlates with increased hemoglobin levels in rural children (Torres et al. 2022), while in Madagascar, reduced access to wildlife increases anemia risk fourfold among dependent communities (Golden et al. 2011). Despite its importance, the nutritional composition of wild animals remains under-researched, with data dispersed across various fields (Dannenberger et al. 2013; Sevillano-Caño et al. 2020; Zimmerman et al. 2008). This scarcity and dispersion hinder our understanding of how environmental factors and animal diets influence wild meat's nutrient content.

Compounding this challenge is the frequent occurrence of missing data in wild meat nutritional studies. This is often due to the inherent difficulties in obtaining samples and conducting analyses on diverse wild species. Data imputation techniques have emerged as a valuable tool in nutritional research to address these gaps. For example, Wei et al. (2018) successfully employed imputation methods in metabolomics studies to address missing data in nutritional analyses. Masson (1999) noted that wild foods often have datasets with significant gaps, particularly in direct data, making data imputation techniques valuable for filling these gaps. Therefore, by employing artificial intelligence techniques to address missing values (Rizvi et al. 2023), we can maximize the use of existing data while acknowledging the practical constraints of wild meat research.

To address these knowledge gaps, we conducted a systematic review examining how anatomical parts (viscera vs. muscles) and taxonomic classes (mammals, birds, reptiles) influence wild meat's nutritional composition. Different tissues serve distinct physiological functions, and species classification may reflect both physiological and environmental influences on nutrient content (Damodaran and Parkin 2018; Dannemberger et al. 2013). Therefore, we hypothesized that these factors significantly affect the nutritional profiles of wild meat. Our systematic review aims to identify patterns in the nutritional composition of wild meat by compiling existing data and applying artificial intelligence techniques to address missing values. This approach provides a detailed analysis of wild meat's nutritional profile, offering insights crucial for understanding its role in food security and ecosystem-based nutrition. Additionally, it represents a viable strategy in the face of ethical challenges in studying wild species, considering the legal and ethical limitations in sample collection (Soulsbury et al. 2020).

MATERIAL AND METHODS

This systematic review followed PRISMA guidelines (Moher et al. 2009). The protocol was not preregistered due to the non-health-related focus of the research (see Additional File 1).

Selection Criteria and Search

To address the research question posed in this project, "How does the nutritional composition of anatomical parts and taxonomic classes of wild animals vary?", we included original articles in any language, with no date restrictions, that provided data on wild animal meat composition consumed by humans. Articles recommended by experts were also considered if they met these criteria. We excluded studies lacking nutritional data, using secondary data, or without detailed methodologies.

From June 2022 to March 2024, we searched Web of Science, Scopus, and Medline/PubMed using descriptors: (BUSHMEAT OR "WILD MEAT" OR "GAME MEAT" OR "INDIGENOUS MEAT" OR "WILD ANIMALS" OR "HUNTING ANIMALS MEAT") AND ("FOOD CONSUMPTION" OR "FOOD INTAKE" OR DIETARY) AND (MICRONUTRIENT OR NUTRIENT OR NUTRITION OR "FOOD COMPOSITION" OR MINERAL) and received papers recommended by experts.

Study Selection

We used Rayyan to organize records and remove duplicates. Three authors (ALSM, MFAM, ALBO) independently screened articles, excluding those not meeting criteria. Discrepancies were resolved by consulting two additional authors (MCMJ, JKSM). Selected articles were stored in Zotero.

Data Extraction

Three authors independently extracted data, focusing on study characteristics, food composition methods, taxonomy, animal class, analyzed part, and nutrient levels (iron, selenium, zinc, potassium, magnesium, manganese, sodium, proteins, fat, omega-6). Nutritional data were standardized to grams per 100 grams wet weight. Articles with dry weight data were converted using described moisture information. Nutrient values were expressed per Dietary Reference Intakes (Padovani et al. 2006). Raw data from original analyses were not accessible in the primary studies. We also extracted the methods used in food composition analyses from the papers to ensure they were recognized by the AOAC (Association of Official Analytical Chemists), supporting the comparison of the obtained results.

Quality Analysis

We developed a 9-item quality assessment tool, integrating elements from existing protocols such as LatinFoods/FAO, QUADAS, OHAT, Cochrane, and STROBE, to evaluate methodological robustness (see Additional File 2, see also Oliveira et al. 2025). Three evaluators independently assessed articles, with results discussed to refine the tool. Fleiss' Kappa measured inter-rater agreement. Articles were classified as low (0-2.9 points), medium (3.0-5.9 points), or high quality (>6.0 points).

Data Preparation

We tested several imputation methods, selecting the best via cross-validation: Multiple Imputation by Chained Equations (MICE), K-Nearest Neighbors (KNN), Soft Impute, Matrix Factorization, Nuclear Norm Minimization, and Iterative Singular Value Decomposition (SVD). The multivariate approach considered all nutrient data, capturing complex interactions. Imputation performance was evaluated using Symmetric Mean Absolute Percentage Error (SMAPE) and Mean Absolute Error (MAE). All analyses were conducted using Python (see Additional File 3 for Raw data with imputation). Code is available on GitHub (Menezes-Neto 2024).

Variables Related to Hypothesis Testing

The dependent variables were the nutritional compositions of 10 nutrients. For hypothesis 1, the independent variables were anatomical parts (muscle, viscera), and for hypothesis 2, they were animal classes (mammals, birds, reptiles). Although factors such as animal anatomy, cause of death, geographical location, seasonality, physical activity level, and physiological characteristics could act as confounders, we could not control for them due to inconsistent reporting in the primary studies.

Data Analysis

Descriptive statistics summarized findings. Normality was assessed using the Shapiro test. ANOVA or Kruskal-Wallis tests determined significance ($p < 0.05$), with post hoc tests (Tukey or Bonferroni) for significant differences. Analyses were conducted using R through RStudio.

RESULTS

Study Selection

Our database search yielded 565 articles (Web of Science: 68, Medline/PubMed: 325, Scopus: 172) (Figure 1).

After removing 142 duplicates, 423 articles underwent title and abstract screening. Of the 75 articles selected for full-text review, 62 were excluded due to secondary data (5), incomplete information (56), or lack of relevant nutritional data (1). The final analysis included 21 articles: 13 from the database search, 7 expert-recommended articles and 1 grey literature document.

Characteristics of the Studies

The review analyzed 26 species (13 mammals, 6 birds, 7 reptiles; see Additional File 4) from 11 countries, with most studies from Italy, Spain, Poland, and South Africa. Table 2 presents detailed study characteristics.

Table 1. Shows missing data for each nutrient across 76 observations. We used machine learning to impute missing data, framing each as a regression problem. Missing data were classified as Missing Completely at Random (MCAR), justified by limited study availability and legal/ethical constraints (Soulsbury et al. 2020).

Nutrients	Fe	Mn	Se	Zn	K	Mg	Na	Protein	Fat	w6
Missing	51	54	63	46	61	61	63	22	26	57
Available	25	22	13	30	15	15	13	54	50	19
Total	76	76	76	76	76	76	76	76	76	76

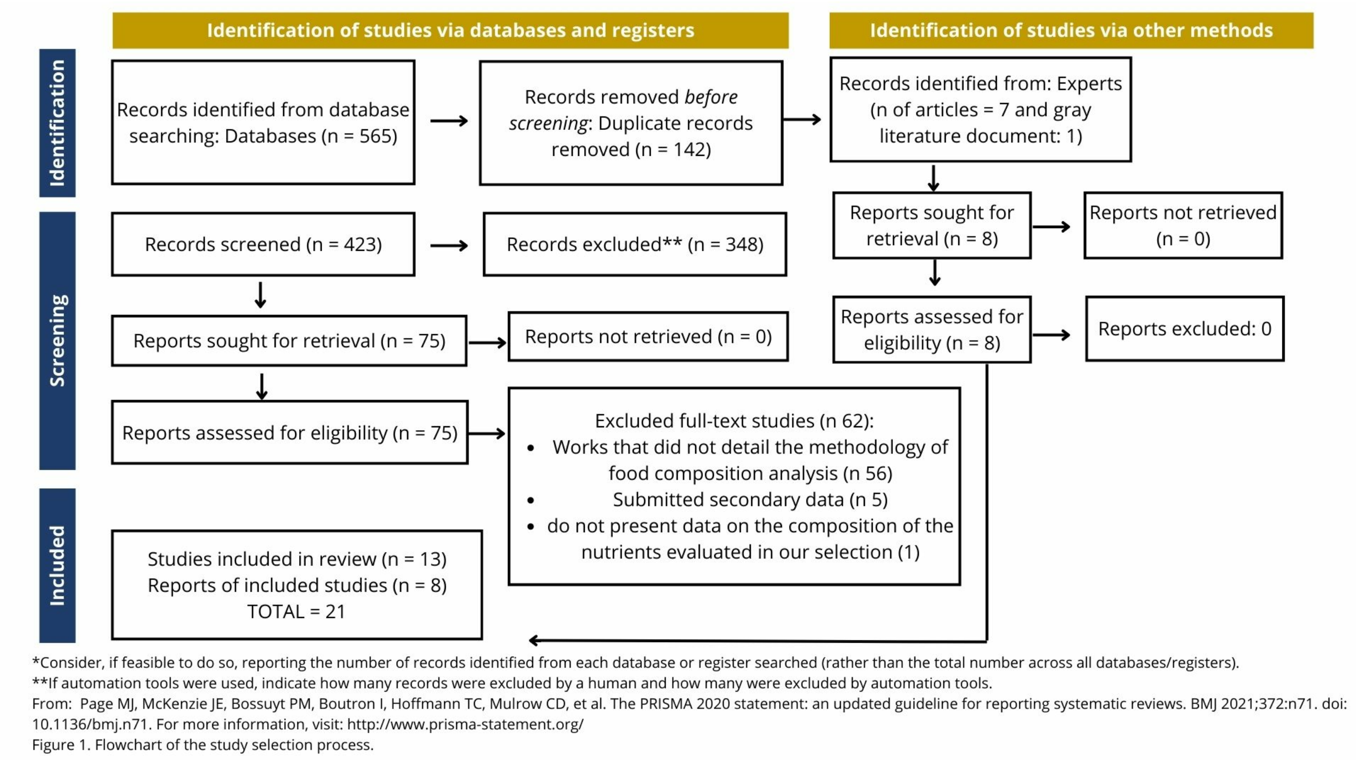

Figure 1. Flowchart of the study selection process.

Quality Analysis

Inter-rater agreement was excellent (Fleiss' Kappa = 1.00). No articles received low-quality ratings, and 72% scored high quality (>6.0 points; Additional File 5). Studies scored highest on sample processing procedures and analysis methods but lower on species nomenclature and funding disclosure.

General Comments on the Dataset

Data imputation techniques with the lowest SMAPE values were selected, showing less error and greater consistency. SMAPE values ranged from 11.06% (protein) to 83.67% (selenium). See Additional File 6 for details.

General Comments on the Nutritional Profile of the Meats

All food composition analysis methods were AOAC-recognized, supporting result comparison (see Additional File 7). Figure 2 presents the main results of our research. Additional File 8 summarizes mean and standard deviation values of nutritional composition. Statistical analysis results are in Additional File 9. Additional File 10 highlights significant specific statistical differences in nutritional composition among wild animal classes and anatomical parts.

Table 2. Characterization of studies on the nutritional composition of wild animals. Names of animals collected are presented exactly as provided in the papers.

n	Publication	Study objective	Key findings	Country of collection	Wild animals	Samples	Analyses performed	Study quality
1	Aguiar (1996)	Analyze samples of wild animal meat obtained from public markets in the Amazon.	Analyses of the samples' composition were conducted. The results were compiled into a centesimal composition table, and a summary of the findings is available for consultation in this article.	Brazil	Cabeçudo (*Peltocephalus dumerilianus*); catitu (*Pecari tajacu*); cutia (*Dasyprocta leporina*); Iaça (*Podocnemis sextuberculat*); jacare-tinga (*Caiman crocodilus*); paca (*Agouti paca*); tartaruga (P*odocnemis expansa*); tracajá (*Podocnemis unifilis*); veado (*Mazama americana*)	31 (muscle) + 4 (viscera)	Protein: Method Kjeldahl - AOAC (1984); Lipid: Soxhlet Method	High (6.50)
2	Amici et al. (2015)	To examine how different geographic hunting areas influence the chemical composition and quality indices of wild boar meat.	The characteristics of wild animal meat varied due to environmental factors, including diet. Dietary diversity appears to influence aspects of the meat, such as color parameters, cooking losses, dry matter content, protein levels, and fatty acid profiles. These differences were observed in relation to the hunting area.	Italy	Wild boar (*Sus scrofa*)	48 (Longissimus thoracis - muscle)	Protein: Method Kjeldahl - AOAC (1995); Lipids: Folch et al. (1957); Lipid Fraction: Method Soxhlet - IUPAC (1992).	Medium (5.50)

to be continued...

n	Publication	Study objective	Key findings	Country of collection	Wild animals	Samples	Analyses performed	Study quality
3	Milczarek et al. (2021)	Compare the proximate nutrient composition of roe deer and wild deer meat.	Regarding the macronutrient profile, no differences were observed with respect to sex, except for the fat content in females, which was higher than in males regardless of the species. As for micronutrients, the levels found are in accordance with the recommended values.	Poland	Roe deer (*Capreolus capreolus*), Red deer (*Cervus elaphus*)	60 (semimembranosus muscles)	Protein: Kjeldahl (990.03); Lipids: Method Soxhlet (991.36); Lipid fractions: GC-FID; Methodology; Minerals: (Cd, Pb, Fe) PN-EN 14084	High (8.33)
4	Dannenberger et al. (2013)	Investigate the effects of gender, age, and region on the macronutrients, micronutrients, and fatty acid profiles of wild boar and deer muscles.	The protein content in deer remained constant regardless of region, age, or sex; however, wild boar meat varied across these factors. Fat in deer varied by region, age, and sex, while in wild boar, they remained stable. Selenium and iron were not influenced by region, age, or sex, except for higher iron levels in older females. Zinc concentrations varied according to region, age, and sex.	Germany	Roe deer (*Capreolus capreolus*), Wild boar (*Sus scrofa*)	203 (longissimus muscle)	Proteins and lipids: Meat Analyzer Food-ScanTM (FOSS Analytic, Hillerod, Denmark); Lipid fractions: Gas chromatography analysis; Minerals: ICP-MS (Se, Cu, Fe, and Zn)	High (6.50)

to be continued...

n	Publication	Study objective	Key findings	Country of collection	Wild animals	Samples	Analyses performed	Study quality
5	Fernandes et al. (2022)	Evaluate the effects of high hydrostatic pressure on the physicochemical parameters of collared peccary meat.	High hydrostatic pressure tenderized the meat of adult collared peccaries and influenced meat quality. The results also showed changes in the protein profiles of animals of different ages subjected to different pressure levels.	Brazil	Peccary (*Pecari tajacu*)	40 (muscle)	Proteins: Method Kjeldahl - AOAC (1995); Lipids: Method Soxhlet - AOAC (1995); Lipid fraction: Bligh and Dyer (1959)	High (6.50)
6	Gálvez et al. (1999)	Determine the nutritional characteristics of wild animal meat.	Wild meats exhibited high protein content and low fat levels.	Peru	Sajino (*Tayassu pecari*), Motelo (*Chelonoidis denticulata*), Majaz (*Cuniculus paca*), Venado colorado (*Mazama americana*)	20 (muscle)	Macronutrients and micronutrientsProteins : Method Kjeldahl - AOAC, 1990; Lipids: Method Soxhlet - .AOAC, 1990	Medium (5.50)
7	Jarzyńska et al. (2011)	To determine the content and composition of micronutrients in red deer, relating them to meat intake rates, human nutritional needs, and associated health impacts.	The meats from muscles and organs of red deer exhibited high concentrations of copper, chromium, cobalt, manganese, selenium, and zinc. Additionally, they contained toxic trace elements such as mercury, lead, cadmium, and titanium. The cadmium levels found in the meats exceed tolerance limits.	Poland	Red Deer (*Cervus elaphus*)	60 (20 muscle; 20 liver 20 de kidney)	Minerals: ICP-AES (Se) , ICP-MS (Ag, Ba, Cd, Co, Cr, Cs, Cu, Ga, Mn, Mo, Pb, Rb, Sb, Sr, Tl, V e Zn)	Medium (4.50)

to be continued...

n	Publication	Study objective	Key findings	Country of collection	Wild animals	Samples	Analyses performed	Study quality
8	Johnson et al. (2007)	Assess the mineral content of horn, liver and forage to measure deficiencies and toxicities.	The levels of minerals found in the liver and horn varied between animals from two different locations. It was found that antler breakage in elk at one of the locations was related to a copper and phosphorus deficiency. The levels of micronutrients found in forage varied according to location and season.	United States of America	Tule elk (*Cervus elaphus*)	240 (liver)	Minerals: Flame atomic absorption spectrophotometry (Cu e Mo); ICP-MS (Ca, Fe, Mg, Mn, S, P, Zn, Cu e Mo)	Medium (5.50)
9	Lima (2009)	To evaluate the yield and chemical composition of *Podocnemis expansa* raised in commercial captivity and from natural habitats.	The meat evaluated in both systems showed a low fat content. And the free-living ones had a higher protein content.	Brazil	Tartaruga-da-amazônia (*Podocnemis expansa*)	45 (muscle) + 15 (viscera)	Proteins : Method Kjeldahl ; Lipid (Bligh e Dyer,1959)	High (8.50)
10	Lorenzo et al. (2019)	Investigating the effects of slaughter age on the levels of macro and microminerals in wild deer meat.	Total fat and fraction contents were affected by the slaughter age, showing higher values in older animals. Regarding cholesterol, its levels decreased with increasing slaughter age.	Spain	Red deer (*Cervus elaphus*)	150 (muscle)	Lipid: Bligh e Dyer; Fraction lipid analysis: Gas chromatography; Minerals: ICP-OES, Ca, K, Mg, Na, P, Fe, Mn, Zn e Cu.	High (8.50)
11	Hoffman et al. (2016)	Determine the proximate and fatty acid composition of zebra meat.	The muscles had high protein content and low fat content. In the fat group, high concentrations of saturated fatty acids were found.	South Africa	Zebra (*Equus quagga*)	20 (longissimus lumborum muscle, longissimus thoracis et lumborum)	Protein: Method Dumas - AOAC 992.15; Lipid: LEE; Fraction lipid analysis: Gas chromatography;	High (7.33)

to be continued...

n	Publication	Study objective	Key findings	Country of collection	Wild animals	Samples	Analyses performed	Study quality
12	Rudman et al. (2018)	Evaluate the sensorial, physical and chemical attributes of wild boar meat.	Analysis of the sensory profile demonstrated that this meat has an undesirable aroma and flavor, described as sour, which was found in the meat of wild boars of all ages. Regarding macronutrient recommendations, these meats were considered healthy sources of protein and polyunsaturated fatty acids.	South Africa	Warthogs (*Phacochoerus africanus*)	31 (Longissimus lumborum)	Protein: Method Dumas - 992.15; Lipids: LEE; Ashes (AOAC, 1992; AOAC, 2002a, 2002b)	High (8.0)
13	Neto et al. (2006)	Determine the proximate composition and cholesterol of meat from the tail and back of alligators, from zoo breeding facilities and natural habitats.	Animals bred in captivity had a lower amount of fat and higher protein levels when compared to animals in their natural habitat.	Brazil	Alligator-swampland (*Caiman yacare*)	12 (muscle)	Proteins : Method Kjeldahl - AOAC,1990; Lipids: Method Soxhlet - AOAC, 1990.	High (8.50)
14	Landi et al. (2018)	Evaluate the nutritional aspects of Eurasian chicken meat.	Urian chicken meat contains high concentrations of high-quality proteins, due to its amino acid composition and low fat content.	Italy	Eurasian woodcock (S*colopax rusticola*)	10 (entire chest and leg muscle, without skin)	Proteins : Method Kjeldahl; lipids: Method Soxhlet - AOAC 991.36; Lipid fractions: GC-FID	High (7.00)

to be continued...

n	Publication	Study objective	Key findings	Country of collection	Wild animals	Samples	Analyses performed	Study quality
15	Pérez-Peña et al. (2021)	Know the microbiological and bromatological status of bush meat during the COVID-19 pandemic from two public markets in the Amazon.	Game meat had a low fat content and a high percentage of protein. The calcium content found in wild meat was higher than in domesticated meat. Phosphorus content was also significant in wild meat.	Peru	P*ecari tajacu*, *Tayassu pecari*, C*uniculus paca*, *Chelonoidis denticulatus*	16 (muscle)	Protein:Kjeldahl; Fat: Soxhlet; Vitamins: Chromatography high pressure liquid (HPLC); Minerals: (zinc, sodium, potassium and iron) by Absorption Spectroscopy Atomic (EAA) and Phosphorus by UV Visible Spectroscopy	High (6.50)

to be continued...

n	Publication	Study objective	Key findings	Country of collection	Wild animals	Samples	Analyses performed	Study quality
16	Serrano et al. (2020)	Assess the combined impact of country of origin and type of slaughter and season on the quality and nutritional value of venison.	Wild deer from Spain had a higher protein concentration than meat from animals raised in New Zealand. The calcium, sodium and phosphorus levels found in meat do not differ between countries. New Zealand farm deer had higher concentrations of magnesium, iron, manganese, copper and lower concentrations of zinc when compared to wild deer from Spain. The nutrient profile of meats also varied depending on the season. Meat from winter hunts had higher levels of calcium, sodium, iron and zinc and lower levels of magnesium and phosphorus compared to meat from summer hunts.	Spain and New Zealand	Red deer (*Cervus elaphus*)	24 (Longissimus thoracis et lumborum)	Lipids: LEE; Protein: DUMAS	High (9.0)

to be continued...

n	Publication	Study objective	Key findings	Country of collection	Wild animals	Samples	Analyses performed	Study quality
17	Sevillano-Caño et al. (2020)	Determine the nutritional and toxicological content of game bird meat.	Iron and chromium contents were similar in all three bird species studied. Meat from thrush had the highest concentrations of copper. Pigeons and doves had the highest concentrations of zinc. The study concluded that the meat of migratory game birds is an excellent dietary source of copper and iron, much better than other types of meat, such as non-wild birds and even red meat.	Spain	Woodpigeon (*Columba palumbus*), Common turtledove (*Streptopelia turtur*), Thrush (*Turdus philomelos*)	89 (breast; thigh)	Cu, Fe, Zn: flame atomic absorption spectroscopy (FAAS, Varian SpectraAA – model 50B); Cr, Co: Electrothermal Atomic Absorption Spectrometry on an Agilent Model 240Z AA	High (6.50)
18	Spiegelaar et al. (2019)	Determine the amino acid and protein composition of wild meats and processed meats	The wild meats analyzed showed high concentrations of proteins and amino acids.	Canada	Moose (*Alces alces*), Canada Goose (*Branta canadensis*), Mallard Duck (*Anas platyrhynchos*)	25 (muscle)	Proteins : Method Kjeldahl - AOAC 981.10; Amino acids: standardized hydrolysis of NaOH and HCl, and ultra-performance liquid chromatography	High (7.50)
19	Strazdiņa et al. (2013)	Compare the nutritional value of the meat of different types of wild animals with analogous domesticated animals.	Wild meat samples had a higher content of proteins, essential fatty acids, iron and zinc compared to non-wild animals. The highest cholesterol levels were found in wild boar (*Sus scrofa*).	Latvia	Elk (*Alces alces*), Deer (*Cervus elaphus*), Wild boar (*Sus scrofa*), Roe deer (*Capreolus capreolus*)	54 (muscle)	Proteins : Method Kjeldahl; Lipids: Method Soxhlet - AOAC 991.36; Lipid fractions: Gas-liquid chromatography; Cholesterol: Colorimetric Blur; Minerals: ICP-AES/ISO 6869-2002	Medium (5.00)

to be continued...

n	Publication	Study objective	Key findings	Country of collection	Wild animals	Samples	Analyses performed	Study quality
20	Zimmerman et al. (2008)	Assess hepatic mineral concentrations of deer from different habitats.	The liver mineral levels found differed. The differences were associated with diet, location and reproductive stage.	United States of America	White-tailed deer (*Odocoileus virginianus*), Mule deer (*Odocoileus hemionus*	83 (liver)	Minerais: ICP-AES Al, Sb, As, Ba, B, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, P, K, Se, Na, S, Tl, Zn	Medium (5.50)
21	Webb et al. (2001)	Evaluate the levels of micronutrients found in buffalo liver and in different regions.	The results demonstrated that there are significant differences in the amounts of micronutrients available in meat depending on the territory in which the buffalo is located.	South Africa	Buffalo *(Syncerus caffer*)	311 (liver)	Minerals: ICP-AES copper, manganese and cobalt	High (6.67)

Nutritional Comparison: Muscle Variation Across Mammals, Birds, and Reptiles

Reptile muscles showed over 60% higher iron ($p < 0.01$) and 75% higher manganese ($p < 0.01$) than mammals, and 400% higher selenium than birds ($p < 0.01$). Bird muscles had the highest potassium and omega-6, surpassing mammals by over 200% ($p < 0.01$). Mammal muscles had the highest zinc, over 100% more than birds ($p < 0.01$), and the lowest fat concentrations.

Nutritional Comparison: Viscera Variation Across Mammals and Reptiles

Mammalian viscera had the highest protein concentrations compared to reptiles ($p < 0.01$). Reptilian viscera had over 300% higher fat content than mammals ($p < 0.01$).

Comparing Anatomical Parts: Macro and Micronutrient Variation in Viscera and Muscle

Reptilian viscera had higher fat (5.37 g) and lower protein (16.33 g) than muscle (2.02 g and 21.34 g, respectively). In mammals, omega-6 was over 400% higher in viscera (1.37 g) than in muscles (0.24 g) ($p < 0.01$). Viscera generally had higher mineral concentrations, with reptilian viscera showing almost 300% more iron and 200% more zinc than muscles. Mammalian viscera had over 300% more iron and manganese, significantly higher selenium, and 90% more zinc than muscles. Potassium was over 60% higher in muscles than in viscera ($p < 0.01$) .

DISCUSSION

This study analyzes the nutritional composition of wild animal meat, revealing key findings: (i) wild meats are significant sources of nutrients often scarce in food-insecure populations; (ii) viscera are particularly mineral-rich compared to muscles, similar to domesticated meats; and (iii) micronutrient profiles vary across animal classes. However, attributing these variations solely to intrinsic class characteristics or individual/environmental factors remains inconclusive based on available data.

Wild meat as a Nutrient Source

Comparing wild meat nutrient content with Dietary Reference Intakes (DRI; Additional File 11) reveals its potential contribution to human nutrition across life stages. wild meats are excellent sources of protein and micronutrients like iron, zinc, and selenium, often deficient in vulnerable groups, particularly women and children in IPLC contexts (Lemke and Delormier 2017). These deficiencies have severe health implications, including growth delays, anemia, immune dysfunction, and dermatological disorders (Malafaia and Maartins 2009; Torres et al. 2022; Pedraza and Sales 2017; Cozzolino 2024). Our findings demonstrate that wild bird, mammal, and reptile meats can contribute significantly to daily nutrient requirements. Restricting access to wild meats through stringent conservation policies or defaunation could negatively impact vulnerable populations reliant on these resources (Jacob et al. 2020).

Viscera of Wild Animals are Important Reservoirs of Nutrients

Visceral meats exhibit distinct nutritional profiles compared to muscles, with higher mineral concentrations. Reptilian viscera show higher fat and lower protein than muscles, while mammalian viscera have comparable protein levels but elevated omega-6 and micronutrients. Lower potassium in viscera likely reflects the higher potassium demands of muscle tissue for contraction. Despite their nutrient density, viscera may contain elevated heavy metal levels, exceeding recommended limits (Danieli et al. 2012), necessitating cautious consumption, especially for children. Interestingly, selenium's potential role in mitigating heavy metal toxicity through chelation (Marco 2007) highlights the complex interplay of nutrients and environmental factors. Promoting holistic food utilization, as practiced in traditional communities, contributes to both sustainability and dietary diversity (Lemke and Delormier 2017; DeClerck et al. 2011).

The Nutritional Composition of Wild Meat Varies Among Classes, Not Necessarily Due to Animal Physiology Factors

Nutrient content in wild meat exhibits significant variability, extending beyond simple taxonomic differences and strongly suggesting the influence of external factors. For example, wild birds often show high levels of potassium, fat, and omega-6, which may be related to their anatomy and migratory lifestyles (Cao and Jin 2020; Price et al. 2011). Discrepancies in iron content observed between wild and domesticated birds further highlight how factors like slaughter methods and dietary diversity can contribute to these variations (Sevillano-Caño et al. 2020). Similarly, the high selenium levels sometimes found in reptiles might be linked to their ability to absorb nutrients directly from their aquatic environments (Gaspar and Silva 2009).

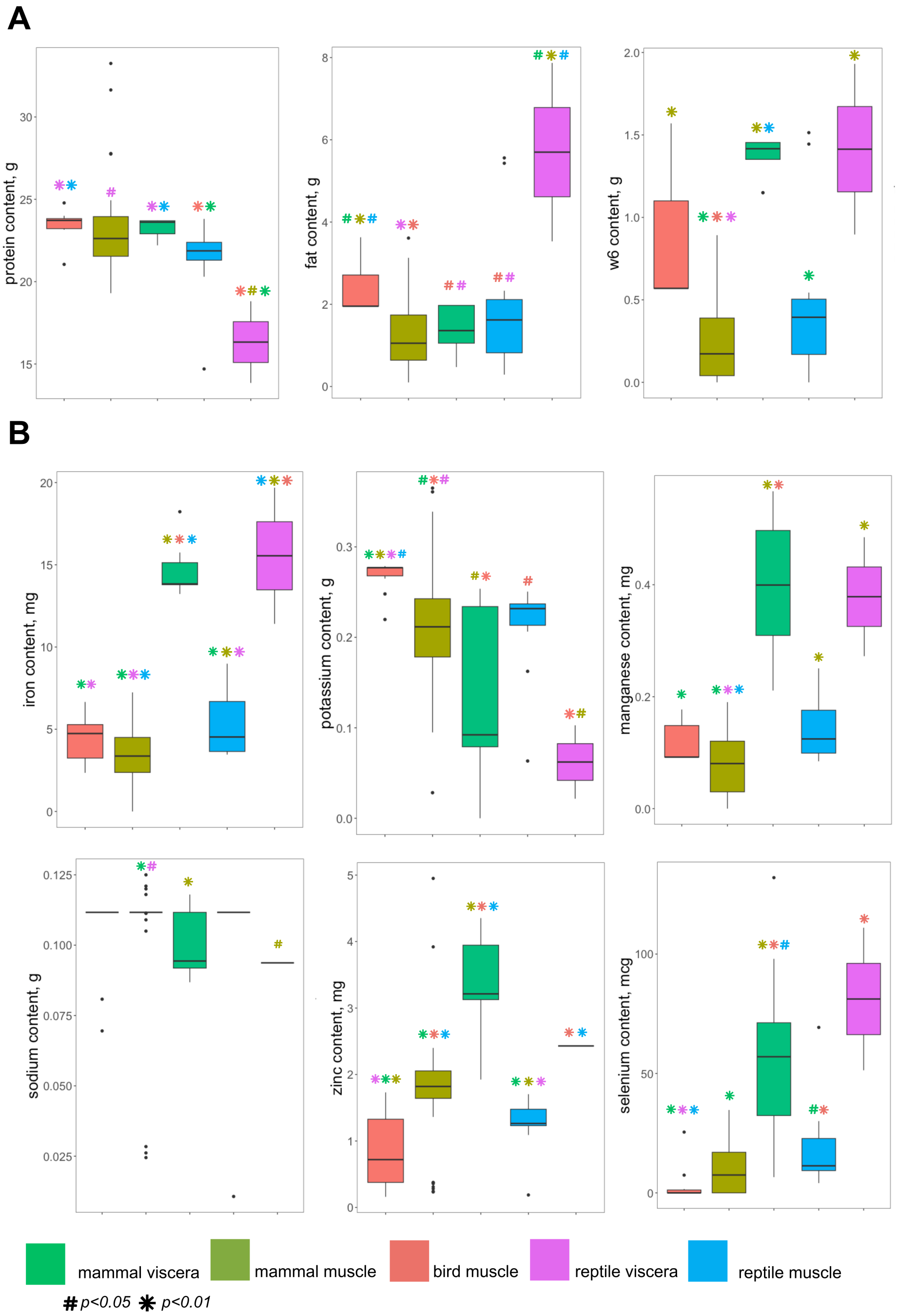

Figure 2. Nutritional composition in muscle and viscera of wild meat, comprising mammals, birds, and reptiles, including original and imputed data. A: Macronutrients. B: Micronutrients.

These examples underscore the critical importance of considering environmental and methodological factors when evaluating the nutritional value of wild meats. Factors such as the animal's diet, geographic location, seasonality, and the method of harvest or death are recognized as key determinants in the variation of nutrient concentrations (Lawrie, 2005).

The existing literature provides concrete examples of how these environmental factors affect nutritional composition. The availability and quality of food in the environment, for instance, directly impact meat nutrient content; studies show that both nutrient excess and deficiency in an animal's diet can lead to atypical development reflected in altered macro- and micronutrient levels (Lawrie, 2005). Regional climate and seasonal temperature variations also play a role, influencing not only food availability but also animal metabolism and potentially hormone levels. According to Lawrie (2005), species in colder regions may accumulate more body fat and develop more compact bodies and thicker fur compared to those in warmer climates. The method of harvest or death is another relevant factor; for example, hunting with firearms can cause internal hemorrhaging, potentially leading to blood loss and an increase in the concentration of certain nutrients in the muscle tissue (Sevillano-Caño, 2020).

Ethical Considerations in Wild Meat Governance

The intersection of food and nutrition security with environmental sustainability in the context of wild meat consumption presents a multifaceted ethical challenge (Smith et al., 2023). Wild animal meat remains a vital source of high-quality protein and essential micronutrients for traditional and Indigenous populations, often constituting a primary component of local diets (Dannenberger et al., 2013). Restricting access to this resource has the potential to exacerbate food insecurity and increase rates of malnutrition, particularly in low-income regions where alternative sources of nutrition are limited or unavailable (Golden et al., 2011).

Conversely, unsustainable exploitation of wild fauna can lead to population declines and species extinctions, thereby compromising ecosystem integrity and triggering cascading ecological effects. Such ecological disruptions may also heighten the risk of zoonotic disease emergence (Machovina et al, 2015; Ripple et al., 2016). These outcomes raise profound ethical concerns related to intergenerational equity, biodiversity stewardship, and the safeguarding of public health.

Addressing these competing imperatives requires the implementation of governance frameworks that recognize and respect the rights and needs of local communities while ensuring the sustainable use of wildlife resources. A participatory approach—engaging local populations, policymakers, and relevant stakeholders in the development and enforcement of regulations—is essential to achieving outcomes that are both ecologically sustainable and socially equitable (Jacob et al., 2023). Potential strategies include community-managed quotas, seasonal harvesting restrictions, and support for alternative livelihoods that reduce pressure on wild animals.

Novelty of the Research

This study is the first to comprehensively analyze nutritional data from a diverse range of wild animal species across three classes. We introduce data imputation techniques, specifically K-Nearest Neighbors, to address missing data, a novel approach in wild meat nutritional analysis. Recognizing the lack of standardized quality assessment tools for this field, we developed a questionnaire (Add File 2) to evaluate methodological robustness, considering the ethical and legal complexities associated with wild meat research.

Limitations

This study is subject to several limitations primarily stemming from the nature of relying on compiled data. Firstly, the inability to access original raw data limited our capacity to fully assess and capture the intrinsic data variability. Secondly, inconsistent reporting of key covariates across the diverse source studies hindered efforts to control for confounding factors and prevented a formal meta-analysis. Despite these challenges, we were able to critically analyze the methodologies of the original studies and identify these reporting gaps by employing a quality assessment questionnaire specifically designed for wild foods analysis. In addition to strengthening this review by providing transparency on data quality, this tool may prove useful for future research on wild meat.

Thirdly, the limited sample size for certain taxonomic groups, notably reptiles, means that results for these groups must be interpreted with caution. Finally, high SMAPE values for specific nutrients highlight the potential uncertainty associated with their predicted concentrations, necessitating careful consideration in any application of these results. Given the acknowledged scarcity of wild meat nutritional data and the ethical constraints on new primary sample collection, we employed data imputation as a necessary step despite these limitations. However, this approach introduces its own caveats. Therefore, we recommend cautious interpretation of results concerning nutrients with higher imputation errors, and the imputed data should be regarded as provisional.

Ultimate accuracy and completeness require the generation of new, robust primary data. Such datasets should comprehensively document factors driving nutritional variations, including diet, age, sex, geographic location, ecological characterization of the collection area, identification of the season and period of harvest, meat storage conditions prior to laboratory analysis, and the method of harvest/slaughter. We underscore the critical need for future research employing standardized, rigorous methodologies to provide more reliable nutritional information on wild animal meat. Additionally, we emphasize the importance of future studies that incorporate a greater diversity of species, anatomical parts, and geographic contexts. We believe that strengthening collaborative research networks, such as research consortiums, can support the development of more robust, reliable, and accessible databases, thereby enhancing the applicability of findings in public policies and strategies aimed at promoting food and nutrition security, especially in communities that rely on wild meat consumption.

CONCLUSION

Wild meat plays a crucial role as a nutrient source for diverse populations. This study reveals significant nutrient variations across animal classes and anatomical parts, emphasizing wild meat's potential to address micronutrient deficiencies in vulnerable groups. While data imputation offers a valuable tool for navigating data scarcity, primary data limitations hinder definitive conclusions regarding the drivers of nutritional variation. Future studies could explore the impact of slaughter methods on nutrient content, environmental influences on selenium levels, and other factors affecting wild meat composition. Enriching databases with detailed information on these variables will enhance wildlife conservation efforts and maximize the benefits of wild meat for IPLC.

DATA AVAILABILITY

The data used in this study is available at "Nutritional Composition Wild Meat" on GitHub: https://github.com/eliasjacob/paper_nutritional_composition_wildmeat

CONFLICT OF INTEREST

The authors report there are no competing interests to declare.

CONTRIBUTION STATEMENT

The authors contributed to the study as follows: ALSM was involved in conceptualization, data curation, methodology, writing the original draft, and review and editing. ALBO and MFAM contributed to data curation, methodology, and review and editing. DT and EBG focused on validation and review and editing. EJMN handled formal analysis, visualization, validation, and review and editing. JKSM and MCMJ were responsible for conceptualization, methodology, project administration, supervision, validation, visualization, funding acquisition, writing the original draft, and review and editing.

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Additional Files

Add File 1. Checklist of Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020).

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	1
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	3
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	3
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	4
Information sources	6	Specify all databases, registers, websites, organizations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	4
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	4
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	4
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	4
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	5
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	5

Continued on next page...

Section and Topic	Item #	Checklist item	Location where item is reported
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	4
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	NA
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	NA
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	5
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	5
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	NA
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	NA
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	NA
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	NA
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	NA
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	Fig 1
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	6
Study characteristics	17	Cite each included study and present its characteristics.	7-16
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	7-16
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	NA
	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	NA

Continued on next page...

Section and Topic	Item #	Checklist item	Location where item is reported
Results of syntheses	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	Table 3
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	NA
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	NA
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	NA
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	NA
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	19-20
	23b	Discuss any limitations of the evidence included in the review.	20
	23c	Discuss any limitations of the review processes used.	20
	23d	Discuss implications of the results for practice, policy, and future research.	20
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	4
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	NA
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	NA
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	20
Competing interests	26	Declare any competing interests of review authors.	20
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	5

From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71

Add File 2. Checklist for Assessing the Quality of Reports on the Nutritional Composition of Wild Animals. Scoring Explanation to each criterion: A score of 0 points indicates the information is not available; 0.5 points denote ambiguity or unclear information; and 1.0 point signifies the information is either available or not applicable.

Item	Section	Criteria	Question	Source
Study design and sample size	Methods	1	They specify the sampling plan (e.g., random, opportunistic) and, when applicable, the method used for sample size calculation?	LatinFoods/FAO; "QUADAS Tool/ Timmer's Analisis Tool"
Sample	Methods	2	Do they mention the scientific name of the species?	Original authorship
Processing	Methods	3	The procedures used for processing the samples are reported (e.g., if the sample was washed, type of water used, type of knife, time after hunting, storage of the game until reaching the laboratory, type of freezing, type of drying).	LatinFoods/FAO, QUADAS Tool
Analysis	Methods	4	The methods of sample analysis are described?	LatinFoods/FAO, QUADAS Tool, Timmer's, OHAT
Analysis	Methods	5	Were the analyses conducted at least in triplicate or on at least three animals of the sampled species?	LatinFoods/FAO / Original authorship
Quantitative variables	Methods	6	Do they present results with coefficients of variance or standard deviation or standard error?	LatinFoods/FAO
Incomplete data	Methods	7	In the case of losses, incomplete results (losses and exclusions during the experiment) were adequately justified?	Cochrane, QUADAS, Timmers
Funding	Other information	8	Do they specify the study's funding source and the role of the funders?	STROBE
Conflicts of interest	Other information	9	Do they report the existence or absence of potential conflicts of interest?	Original authorship

Add File 3. Raw data used for analysis, with imputed data highlighted in red. All values are expressed in g/100g. (classification = C, m = mammal, b = bird, reptile = r), (Muscle = M, Viscera = V)

taxon tfmed	genus	C	country ollects	parts tfmed	Fe	Mn	Se	Zn	K	Mg	Na	Protein	Fat	w6
SS	sus	m	Germany	M	0,0019	0,00009106221605	0,000013	0,0024	0,22027611	0,0184136	0,1116666667	22,5	2,1	0,5712
CC1	capreolus	m	Germany	M	0,00321	0,0000591035807	0,000004	0,00235	0,23574775	0,0184136	0,1116666667	23,5	1	0,266
EQ	equus	m	South Africa	M	0,00401902	0,0001129998393	0,000009463630789	0,00182025	0,20372152	0,0184136	0,1116666667	22,29	1,47	0,00000539
CE	cervus	m	Poland	M	0,003153506448	0,0000759	0,00000462	0,00495	0,25859021	0,0184136	0,118	23,38066667	0,47333333	0,03753911567
CE	cervus	m	Poland	V	0,01364190824	0,000396	0,0000066	0,0033	0,10550066	0,0184136	0,118	23,52133333	0,47333333	1,14965687
CE	cervus	m	Poland	V	0,01364190178	0,0002178	0,000132	0,00429	0,10550238	0,0184136	0,118	23,698	0,47333333	1,1496546
CE	cervus	m	USA	V	0,015131	0,000214	0,00006899335309	0,00204	0,000000082	0,015988	0,11166666	23,698	1,05333333	1,351696766
CE	cervus	m	USA	V	0,013225	0,000211	0,00006898971195	0,001924	0,000000014	0,016113	0,11166666	23,614	1,05333333	1,351597832
SR	scolopax	b	Italy	M	0,00477631	0,0001425301578	0,000001622334867	0,00173118	0,27874793	0,0184136	0,0695275	24	2,75	1,57
SR	scolopax	b	Italy	M	0,00665953	0,0001771961461	0,00002545166003	0,00157166	0,21972185	0,0184136	0,1116666667	21,05	2,6	1,04
CE	cervus	m	Poland	M	0,0038	0,00007251743076	0,00001682398232	0,002044	0,24143027	0,0184136	0,1116666667	21,54	0,16	0,01400752607
CC1	capreolus	m	Poland	M	0,003531	0,00005958437646	0	0,00224258	0,24269201	0,0184136	0,1116666667	23,92	0,1	0,01505224176
PA	phacochoerus	m	South Africa	M	0	0	0	0,00238075	0,36081690	0,0184136	0,1116666667	33,25	1,18	0,000412
PA	phacochoerus	m	South Africa	M	0	0	0	0,0020285	0,33893063	0,0184136	0,1116666667	31,64	1,12	0,000338
CE	cervus	m	New Zealand	M	0,00341	0,000017	0,000007484600198	0,00201	0,365	0,037	0,12	22,7	0,75	0,17818
CE	cervus	m	Spain	M	0,00295	0,000014	0	0,00392	0,297	0,022	0,125	24,1	0,51	0,27552
CP1	columba	b	Spain	M	0,00535	0,00009208805641	0	0,00073	0,27700916	0,0184136	0,11166666	23,82866667	1,95333333	0,5696985835
TP2	turdus	b	Spain	M	0,00508	0,00009208614459	0	0,00061	0,27700996	0,0184136	0,11166666	23,82866667	1,95333333	0,5696889849
ST	streptopelia	b	Spain	M	0,00419	0,00009207968525	0	0,00071	0,27701348	0,0184136	0,11166666	23,41266667	1,95333333	0,5696562898
ST	streptopelia	b	Spain	M	0,00293	0,00009207073613	0	0,000236	0,27701738	0,0184136	0,11166666	23,15266667	1,95333333	0,5696113133
CP1	columba	b	Spain	M	0,00258	0,00009206818842	0	0,000299	0,27701881	0,0184136	0,11166666	23,82866667	1,95333333	0,5695984053
TP2	turdus	b	Spain	M	0,00235	0,00009206657152	0	0,00016	0,27701943	0,0184136	0,11166666	23,15266667	1,95333333	0,569590307
AA	alces	m	Canada	M	0,00450256	0,0001052242388	0,00001474563839	0,00168358	0,20856854	0,0184136	0,1116666667	21,84	1,74	0,3898955465
BC	branta	b	Canada	M	0,00470404	0,0001504320955	0	0,00140134	0,26497294	0,0184136	0,0808061667	24,78	3,63	1,164602933
AP2	anas	b	Canada	M	0,00551813	0,0001653701626	0,000007417101101	0,00110668	0,24798423	0,0184136	0,1116666667	23,61	3,54	1,12023411
SC	syncerus	m	South Africa	V	0,01383719011	0,000567	0,0000245	0,00312616	0,07900123	0,0184136	0,09185133	23,08666667	1,97333333	1,45413893
SC	syncerus	m	South Africa	V	0,01383719008	0,00056	0,0000343	0,00312616	0,07900123	0,0184136	0,09185133	22,20533333	1,97333333	1,454138924
SC	syncerus	m	South Africa	V	0,01383718977	0,000518	0,0000343	0,00312616	0,07900123	0,0184136	0,09185133	22,20533333	1,97333333	1,45413888
SC	syncerus	m	South Africa	V	0,01383718956	0,00049	0,0000266	0,00312616	0,07900123	0,0184136	0,09185133	22,366	1,97333333	1,454138849
OV	odocoileus	m	USA	V	0,018227	0,000387	0,000098	0,003569	0,24924	0,018805	0,086821	23,70866667	1,36	1,415285114
OH	odocoileus	m	USA	V	0,015747	0,000403	0,00005	0,004353	0,24437	0,018605	0,09539	23,698	1,36	1,41736958
OH	odocoileus	m	USA	V	0,015128	0,00034	0,000078	0,004056	0,23058	0,018184	0,098926	23,698	1,36	1,420885875
OV	odocoileus	m	USA	V	0,014043	0,000407	0,000064	0,003909	0,25371	0,018329	0,093343	23,614	1,36	1,415095576
SS	sus	m	Latvia	M	0,000344	0,00004	0,00001002581615	0,000373	0,2116242698	0,001996	0,1116666667	22,92	2,82	0,391698
AA	alces	m	Latvia	M	0,000326	0,00002	0,00000546188719	0,000242	0,2171705759	0,002004	0,11166666	22,72	1,33	0,156009
CE	cervus	m	Latvia	M	0,00023	0,00003	0,00001485013182	0,000233	0,2446918043	0,002105	0,11166666	22,36	1,9	0,32395
CC1	capreolus	m	Latvia	M	0,000206	0,00003	0,000009072168022	0,00031	0,2197948008	0,002076	0,11166666	22,82	1,59	0,270936
TT	tayassu	m	Peru	M	0,00480102	0,0001275633375	0,00001701319306	0,00168358	0,11574680	0,0184136	0,1116666667	21,4	0,64	0,2589891342
CD	chelonoidis	r	Peru	M	0,00345876	0,00008458133256	0,00001111761975	0,00126358	0,16243710	0,0184136	0,1116666667	21,4376	2,33	0,02977349604
CP2	cuniculus	m	Peru	M	0,00605393	0,0001659564331	0,00002199816119	0,00168358	0,02827235	0,0184136	0,1116666667	21,4038	1,94333333	0,5772433648
MA	mazama	m	Peru	M	0,00423877	0,0001229903086	0,000006929259964	0,00180191	0,14130999	0,0184136	0,1113333333	22,8636	1,836666667	0,4304324484
CE	cervus	m	Spain	M	0,00337	0,000017	0	0,001832	0,289	0,03	0,109	24,942	1,05333333	0,102544
CE	cervus	m	Spain	M	0,003142	0,000018	0	0,001641	0,279	0,038	0,121	24,942	1,05333333	0,041952
CE	cervus	m	Spain	M	0,002731	0,000022	0	0,001362	0,288	0,034999	0,105	24,942	1,05333333	0,01911
TT	tayassu	m	Brazil	M	0,00337234	0,00008948746602	0,000007770309886	0,00153441	0,20778914	0,0184136	0,1116666667	22,06	0,5	0,03864843864
TT	tayassu	m	Brazil	M	0,00353133	0,00009387555512	0,000008727818138	0,00153441	0,20669952	0,0184136	0,1116666667	22	0,61	0,06605123296
TT	tayassu	m	Brazil	M	0,00317611	0,00008552172606	0,00000570020017	0,00167941	0,21134246	0,0184136	0,1116666667	22,3	0,49	0,04039925787
TT	tayassu	m	Brazil	M	0,00297030	0,00008056080205	0,000004019985069	0,00212833	0,21384866	0,0184136	0,1116666667	22,46	0,41	0,02257450229
TT	tayassu	m	Brazil	M	0,00107742	0,00004261167485	0	0,00226983	0,24858938	0,0184136	0,1116666667	24,81	0,34	0,04694783748
TT	tayassu	m	Brazil	M	0,00475887	0,0001202686583	0,00002070688408	0,0019815	0,18688471	0,0184136	0,1116666667	20,68	0,81	0,09397402834
TT	tayassu	m	Brazil	M	0,00539223	0,000132235211	0,00002789895238	0,0019815	0,17414667	0,0184136	0,1116666667	19,81	0,77	0,06787997787
TT	tayassu	m	Brazil	M	0,00320421	0,00008918649447	0,000004099693262	0,00193025	0,21554970	0,0184136	0,1113333333	22,62	0,76	0,1161117432
TT	tayassu	m	Brazil	M	0,00237343	0,0000717318753	0	0,00209833	0,22958081	0,0184136	0,1116666667	23,56	0,66	0,1072144174
TT	tayassu	m	Brazil	M	0,00494283	0,0001205341694	0,00002476201068	0,0018135	0,17829667	0,0184136	0,1116666667	20,06	0,52	0,007656123878
SS	sus	m	Italy	M	0,00512365	0,0001441361605	0,00002633328719	0,00184966	0,20141719	0,0184136	0,1116666667	21,2	3,13	0,875461
SS	sus	m	Italy	M	0,00502917	0,0001368075923	0,00002884157632	0,00184966	0,19291984	0,0184136	0,1116666667	20,67	2,66	0,70091
SS	sus	m	Italy	M	0,00399644	0,000115152284	0,00001845169261	0,00205458	0,21016850	0,0184136	0,1116666667	21,84	2,54	0,685292
TP1	tayassu	m	Peru	M	0,00439355	0,0001449946627	0	0,00037719	0,1570768	0,0184136	0,0284185	24,84	3,61	0,892145563
CP2	cuniculus	m	Peru	M	0,00000378	0,00003468341434	0	0,00028207	0,1238664	0,0184136	0,0261632	27,78	1,55	0,4102425726
PQ	pecari	m	Peru	M	0	0,000006453259046	0	0,00035875	0,1378125	0,0184136	0,0245	27,75	0,64	0,1744046962
CD	chelonoidis	r	Peru	M	0,00898679	0,0001964189855	0,00006928973619	0,00018801	0,063328	0,0184136	0,0106866	14,7	0,29	0
PE	podocnemis	r	Brazil	M	0,00452073	0,0001276078253	0,000009264940747	0,00122858	0,23952415	0,0184136	0,1116666667	22,58	1,9	0,5440819576
PE	podocnemis	r	Brazil	M	0,00452890	0,0001245395321	0,00001133181452	0,00126358	0,23445198	0,0184136	0,1116666667	22,2	1,62	0,4646945001
PE	podocnemis	r	Brazil	M	0,00365916	0,000103783393	0,000004103658802	0,00109016	0,24536043	0,0184136	0,1116666667	22,9	1,3	0,3944806361
PE	podocnemis	r	Brazil	V	0,01968904	0,0004849316512	0,0001110314796	0,00242975	0,02159725	0,0184136	0,0937123333	13,85	7,87	1,930686107
PD	peltocephalus	r	Brazil	V	0,01140683	0,0002723729915	0,00005133211999	0,00242975	0,10277222	0,0184136	0,0937123333	18,81	3,53	0,8964133037
PQ	pecari	m	Brazil	M	0,00637246	0,0001590544501	0,0000337336525	0,0018135	0,09492181	0,0184136	0,1116666667	19,45	1,46	0,2386042844
DL	dasyprocta	m	Brazil	M	0,00623789	0,0001539153405	0,00003401430447	0,0018135	0,17086663	0,0184136	0,1116666667	19,3	1,21	0,1727911035
PS	podocnemis	r	Brazil	M	0,00731220	0,0002245804211	0,00001384837592	0,00153025	0,25055729	0,0184136	0,1116666667	23,81	5,56	1,51389034
CC2	caiman	r	Brazil	M	0,00359843	0,00009290570117	0,000009374238716	0,00123183	0,23176397	0,0184136	0,1116666667	21,87	0,46	0,1583077204

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taxon tfmed	genus	C	country ollects	parts tfmed	Fe	Mn	Se	Zn	K	Mg	Na	Protein	Fat	w6
AP1	agouti	m	Brazil	M	0,00724016	0,000190302097	0,00003470687792	0,0018135	0,17728260	0,0184136	0,1116666667	19,92	2,66	0,5595274171
PE	podocnemis	r	Brazil	M	0,00479542	0,0001237728106	0,00001791210479	0,00142633	0,22025633	0,0184136	0,1116666667	21,17	1,1	0,3113956284
PU	podocnemis	r	Brazil	M	0,00606279	0,0001553293684	0,00002764173691	0,00170433	0,20635737	0,0184136	0,1116666667	20,3	1,68	0,4458700338
MA	manzama	m	Brazil	M	0,00252157	0,00007972535929	0	0,00209833	0,23955552	0,0184136	0,1116666667	23,95	1,1	0,2284029172
CY	caiman	r	Brazil	M	0,00363374	0,00009452100072	0,000009194370988	0,00123183	0,23249783	0,0184136	0,1116666667	21,93	0,54	0,1801113897
CY	caiman	r	Brazil	M	0,00871272	0,0002505653274	0,00003005530549	0,00153025	0,22176371	0,0184136	0,1116666667	21,83	5,43	1,444579614

Add File 4. Information on the species, taxonomic classes, and nutrients evaluated in the systematic review, including family, order, popular name, evaluated nutrients, number of studies mentioning the species, number of samples assessed in the original studies for the nutrients of interest, country of collection, and analyzed part. Species names were updated according to The IUCN Red List of Threatened Species.

Taxonomy	Class	Family	Order	Evaluated nutrients	Studies mentioning	Samples	Country	Part
Alces alces	Mammal	Cervidae	Artiodactyla	Iron, manganese, zinc, magnesium, protein, lipid and omega 6	2	13	Canada, Latvia	Muscle
Anas platyrhynchos	Bird	Anatidae	Anseriformes	Protein, lipids	1	5	Canada	Muscle
Branta canadensis	Bird	Anatidae	Anseriformes	Protein, lipids	1	5	Canada	Muscle
Caiman crocodilus	Reptile	Alligatoridae	Crocodylia	Protein, lipids	1	5	Brazil	Muscle, viscera
Caiman yacare	Reptile	Alligatoridae	Crocodylia	Protein, lipids	1	6	Brazil	Muscle, viscera
Capreolus capreolus	Mammal	Cervidae	Artiodactyla	Iron, manganese, selenium, zinc, magnesium, protein, lipids and omega 6	3	88	Latvia, Poland, Germany	Muscle
Cervus elaphus	Mammal	Cervidae	Artiodactyla	Iron, manganese, selenium, zinc, potassium, magnesium, sodium, protein, lipid and omega 6	6	513	Poland, Spain, New Zealand, Latvia, United States of America	Muscle, viscera
Chelonoidis denticulata	Reptile	Testudinidae	Testudines	Zinc, potassium, sodium, protein	2	6	Peru	Muscle
Columba palumbus	Bird	Columbidae	Columbiformes	Iron, zinc	1	24	Spain	Muscle
Cuniculus paca	Mammal	Cuniculidae	Rodentia	Zinc, potassium, sodium, protein	3	15	Peru, Brazil	Muscle, viscera
Dasyprocta leporina	Mammal	Dasyproctidae	Rodentia	Protein,lipids	1	4	Brazil	Muscle, viscera
Equus quagga	Mammal	Equidae	Perissodactyla	Protein, lipids and omega 6	1	20	South Africa	Muscle
Mazama americana	Mammal	Cervidae	Artiodactyla	Protein,lipids	2	9	Peru, Brazil	Muscle, viscera
Odocoileus hemionus	Mammal	Cervidae	Artiodactyla	Iron, manganese, selenium, zinc, potassium, magnesium, sodium	1	38	United States of America	Viscera
Odocoileus virginianus	Mammal	Cervidae	Artiodactyla	Iron, manganese, selenium, zinc, potassium, magnesium, sodium	1	42	United States of America	Viscera

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Taxonomy	Class	Family	Order	Evaluated nutrients	Studies mentioning	Samples	Country	Part
Pecari tajacu	Mammal	Tayassuidae	Artiodactyla	Zinc, potassium, sodium, protein	3	46	Brazil, Peru	Muscle, viscera
Peltocephalus dumerilianus	Reptile	Podocnemididae	Testudines	Protein,lipids	1	4	Brazil	Muscle, viscera
Phacochoerus africanus	Mammal	Suidae	Artiodactyla	Protein, lipids and omega 6	1	31	South Africa	Muscle
Podocnemis expansa	Reptile	Podocnemididae	Testudines	Protein,lipids	1	19	Brazil	Muscle, viscera
Podocnemis sextuberculata	Reptile	Podocnemididae	Testudines	Protein,lipids	1	5	Brazil	Muscle, viscera
Podocnemis unifilis	Reptile	Podocnemididae	Testudines	Protein,lipids	1	4	Brazil	Muscle, viscera
Scolopax rusticola	Bird	Scolopacidae	Charadriiformes	Protein, lipid, omega 6	1	20	Italy	Muscle
Streptopelia turtur	Bird	Columbídeos	Columbiformes	Iron, zinc	1	38	Spain	Muscle
Sus scrofa	Mammal	Suidae	Artiodactyla/ Artiodátilos	Iron, manganese, selenium, zinc, magnesium, protein, lipids and omega 6	3	104	Italy, Germany, Latvia	Muscle
Tayassu pecari	Mammal	Tayassuidae	Artiodactyla	Zinc, potassium, sodium, protein	1	1	Peru	Muscle
Turdus philomelos	Bird	Turdídeo	Passeriformes	Iron, zinc	1	45	Spain	Muscle

Add File 5. Quality Assessment of Included Studies, Based on Reviewers' Judgments Using the Quality Assessment Questionnaire. Scoring Explanation - A score of 0 points indicates the information is not available; 0.5 points denote ambiguity or unclear information; and 1.0 point signifies the information is either available or not applicable.

N°	ARTICLE DATA	QUESTIONS									FINAL NOTE
		1	2	3	4	5	6	7	8	9	
1	DANNENBERGER, D. et al. The effects of gender, age and region on macro- and micronutrient contents and fatty acid profiles in the muscles of roe deer and wild boar in Mecklenburg-Western Pomerania (Germany). Meat Science, [S.L.], v. 94, n. 1, p. 39-46, maio 2013. Elsevier BV. 10.1016/j.meatsci.2012.12.010.	1	0	1	1	1	1	0,5	1	0	6,5
2	HOFFMAN, Louwrens C; GELDENHUYS, Greta; CAWTHORN, Donna-Mareè. Proximate and fatty acid composition of zebra (Equus quagga burchellii) muscle and subcutaneous fat. Journal Of The Science Of Food And Agriculture, [S.L.], v. 96, n. 11, p. 3922-3927, 24 fev. 2016. Wiley. 10.1002/jsfa.7623.	0,5	0,5	1	1	1	1	1	1	0,5	7,33
3	JARZYńSKA, Grażyna et al. Selenium and 17 other largely essential and toxic metals in muscle and organ meats of Red Deer (Cervus elaphus) — Consequences to human health. Environment International, [S.L.], v. 37, n. 5, p. 882-888, jul. 2011. Elsevier BV. 10.1016/j.envint.2011.02.017	0	0	0	1	1	1	0,5	1	0	4,5
4	JOHNSON, Heather E. et al. MINERAL DEFICIENCIES IN TULE ELK, OWENS VALLEY, CALIFORNIA. Journal Of Wildlife Diseases, [S.L.], v. 43, n. 1, p. 61-74, jan. 2007. Wildlife Disease Association. 10.7589/0090-3558-43.1.61.	0,5	0	0	1	1	1	1	1	0	5,5
5	LANDI, Nicola et al. Nutritional profiling of Eurasian woodcock meat: chemical composition and myoglobin characterization. Journal Of The Science Of Food And Agriculture, [S.L.], v. 98, n. 13, p. 5120-5128, 17 maio 2018. Wiley. 10.1002/jsfa.9051.	1	0	1	1	1	1	1	1	0	7
6	MILCZAREK, Anna et al. Health-Promoting Properties of the Wild-Harvested Meat of Roe Deer (Capreolus capreolus L.) and Red Deer (Cervus elaphus L.). Animals, [S.L.], v. 11, n. 7, p. 2108, 15 jul. 2021. MDPI AG. 10.3390/ani11072108.	1	1	1	1	0,5	1	1	1	1	8,33
7	RUDMAN, Monlee et al. Quality characteristics of Warthog (Phacochoerus africanus) meat. Meat Science, [S.L.], v. 145, p. 266-272, nov. 2018. Elsevier BV. 10.1016/j.meatsci.2018.07.001.	1	0,5	1	1	1	1	1	1	0,5	8
8	SERRANO, Martina Pérez et al. Quality of main types of hunted red deer meat obtained in Spain compared to farmed venison from New Zealand. Scientific Reports, [S.L.], v. 10, n. 1, 22 jul. 2020. Springer Science and Business Media LLC. 10.1038/s41598-020-69071-2.	1	1	1	1	1	1	1	1	1	9
9	SEVILLANO-CAÑO, Jesús et al. Trace Element Concentrations in Migratory Game Bird Meat: contribution to reference intakes through a probabilistic assessment. Biological Trace Element Research, [S.L.], v. 197, n. 2, p. 651-659, 24 dez. 2019. Springer Science and Business Media LLC. 10.1007/s12011-019-02014-9.	1	0,5	1	1	1	1	0	0	1	6,5

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N°	ARTICLE DATA	QUESTIONS									FINAL NOTE
		1	2	3	4	5	6	7	8	9	
10	SPIEGELAAR, Nicole et al. Indigenous Subarctic Food Systems in Transition: amino acid composition (including tryptophan) in wild-harvested and processed meats. International Journal Of Food Science, [S.L.], v. 2019, p. 1-14, 27 jun. 2019. Hindawi Limited. 10.1155/2019/7096416.	1	0	0,5	1	1	1	1	1	1	7,5
11	WEBB, Edward C. et al. Copper, manganese, cobalt and selenium concentrations in liver samples from African buffalo (Syncerus caffer) in the Kruger National ParkPresented at ENVIROMIN 2001 at Skukuza, Kruger National Park, South Africa, 14–18 July 2001. Journal Of Environmental Monitoring, [S.L.], v. 3, n. 6, p. 583-585, 6 nov. 2001. Royal Society of Chemistry (RSC). 10.1039/b106307n.	1	1	1	1	1	1	0,5	1	0	6,67
12	ZIMMERMAN, Teresa J. et al. HEPATIC MINERALS OF WHITE-TAILED AND MULE DEER IN THE SOUTHERN BLACK HILLS, SOUTH DAKOTA. Journal Of Wildlife Diseases, [S.L.], v. 44, n. 2, p. 341-350, abr. 2008. Wildlife Disease Association. 10.7589/0090-3558-44.2.341.	1	0	0,5	1	1	1	0	1	0	5,5
13	STRAZDIņA, Vita et al. Nutrition Value of Wild Animal Meat. Proceedings Of The Latvian Academy Of Sciences. Section B. Natural, Exact, And Applied Sciences, [S.L.], v. 67, n. 4-5, p. 373-377, 1 nov. 2013. Walter de Gruyter GmbH. 10.2478/prolas-2013-0074.	1	0	0	1	1	0	0,5	1	0,5	5
14	C., Hugo Gálvez et al. VALOR NUTRITIVO DE LAS CARNES DE SAJINO (Tayassu tajacu), VENADO COLORADO (Mazama americana), MAJAZ (Agouti paca) Y MOTELO (Geochelone denticulata). Revista de Investigaciones Veterinarias del Perú, [S.L.], v. 10, n. 1, 3 jul. 2014. Universidad Nacional Mayor de San Marcos, Vicerectorado de Investigacion. 10.15381/rivep.v10i1.6707.	0,5	0,5	1	1	0,5	1	0	1	0	5,5
15	LORENZO, José M et al. Effect of age on nutritional properties of Iberian wild red deer meat. Journal Of The Science Of Food And Agriculture, [S.L.], v. 99, n. 4, p. 1561-1567, 11 out. 2018. Wiley. 10.1002/jsfa.9334.	1	1	1	1	1	1	0,5	1	1	8,5
16	Hugo Rangel Fernandes Rosires Deliza Otávio Cabral Neto Caroline Mellinger Silva Natália Inagaki de Albuquerque Thayrine Rodrigues Martins See More Amauri Rosenthal; 2022	0	0	1	1	1	1	0,5	1	1	6,5
17	AMICI, Andrea et al. Hunting area affects chemical and physical characteristics and fatty acid composition of wild boar (Sus scrofa) meat. Rendiconti Lincei, [S.L.], v. 26, n. 3, p. 527-534, 1 abr. 2015. Springer Science and Business Media LLC. 10.1007/s12210-015-0412-7.	0	1	1	1	1	1	0,5	0	0	5,5
18	PÉREZ-PEÑA, Pedro Eleodoro et al. Consumo, microbiología y bromatología de la carne silvestre durante la COVID-19 en Iquitos, Perú. Ciencia Amazónica (Iquitos), [S.L.], v. 9, n. 2, p. 51-68, 20 abr. 2022. Universidad Cientifica del Peru. 10.22386/ca.v9i2.339.	0	1	0,5	1	1	1	1	0	1	6,5
19	Lima AT. Caracterização Fisico Quimica da Tartaruga da Amazônia de agua proveniente de cativeiro e de habitat natural do estado do amazonas. Universidade Federal do Amazonas; 2009.	1	1	1	1	1	1	1	1	0,5	8,5
20	Aguiar, Jaime Paiva Lopes et al. Aspectos nutritivos de alguns frutos da Amazonia|(|). Acta Amazonica [online]. 1980, v. 10, n. 4	1	1	1	1	1	0	1	0	0,5	6,5

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N°	ARTICLE DATA	QUESTIONS									FINAL
		1	2	3	4	5	6	7	8	9	NOTE
21	VICENTE NETO, João et al. Composição centesimal e colesterol da carne de jacaré-do-pantanal (Caiman yacare Daudin 1802) oriundo de zoocriadouro e habitat natural. Ciência e Agrotecnologia, [S.L.], v. 30, n. 4, p. 701-706, ago. 2006. FapUNIFESP (SciELO). 10.1590/s1413-70542006000400016.	1	1	1	1	1	1	1	1	0,5	8,5

Add File 6. Metrics resulting from the data imputation process (considering the best imputer for each nutrient).

Imputation technique	Nutrient	RMSE	MAE	SMAPE
KNN (k=15)	Protein	$3.739 \cdot 10^{0}$	$2.283 \cdot 10^{0}$	$1.106 \cdot 10^{1}$
Iterative Imputer (MICE)	Mn	$1.054 \cdot 10^{-4}$	$6.236 \cdot 10^{-5}$	$4.656 \cdot 10^{1}$
KNN (k=3)	Na	$4.074 \cdot 10^{0}$	$1.151 \cdot 10^{0}$	$4.902 \cdot 10^{1}$
Iterative Imputer (MICE)	K	$1.125 \cdot 10^{-1}$	$6.571 \cdot 10^{-2}$	$5.168 \cdot 10^{1}$
Iterative Imputer (MICE)	Fe	$3.308 \cdot 10^{-3}$	$1.870 \cdot 10^{-3}$	$6.228 \cdot 10^{1}$
KNN (k=3)	Total fat	$1.847 \cdot 10^{0}$	$1.225 \cdot 10^{0}$	$6.509 \cdot 10^{1}$
KNN (k=15)	Mg	$2.261 \cdot 10^{-2}$	$1.404 \cdot 10^{-2}$	$6.547 \cdot 10^{1}$
KNN (k=12)	Zn	$1.161 \cdot 10^{-2}$	$3.038 \cdot 10^{-3}$	$6.951 \cdot 10^{1}$
Iterative Imputer (MICE)	Omega-6 fatty acids	$2.553 \cdot 10^{-1}$	$1.775 \cdot 10^{-1}$	$8.153 \cdot 10^{1}$
Iterative Imputer (MICE)	Se	$1.068 \cdot 10^{-3}$	$3.279 \cdot 10^{-4}$	$8.367 \cdot 10^{1}$

Add File 7. Methods used for nutrient analysis by the articles included in the research.

Nutrient	Methods
Protein	AOAC (1984)
	AOAC (1995)
	Kjeldahl (990,03)
	FoodScanTM (FOSS Analytic, Hillerod, Denmark)
	AOAC (992.15)
	DUMAS (992.15)
	AOAC (1990)
	AOAC (981,10)
Fat	Soxhlet Method
	Folch
	AOAC (991.36)
	FoodScanTM
	AOAC (1995)
	Bligh and Dyer (1959) LEE
	AOAC (1990)
	IUPAC (1992) GC-FID
Fat fraction	gas chromatography
w-6	Bligh and Dyer (1959)
	GC-FID

	PN-EN 14084
	ICP-MS
	AOAC (1990)
	ICP-AES
	Flame Atomic Absorption Spectrophotometry
Micronutrients	ICP-OES
	Atomic Absorption Spectroscopy (AAS)
	Flame Atomic Absorption Spectroscopy (FAAS, Varian SpectraAA – Model 50B)
	ICP-AES/ISO (6869-2002)
	ICP-AES Al

Add File 8. Summary of the mean and standard deviation values of the nutritional composition of wild animals included in this systematic review including original and imputed data. The column “n” measurements of classes and parts equal to 76 refer to the number of observations available in the papers. The column "Sample" refers to the number of samples used by authors in the original papers to generate results. We did not have access to the raw data of these samples. Nutrients are measured using units of DRI (Dietary Reference Intakes) as defined by the IOM (Institute of Medicine). All nutrients are expressed on a wet basis.

Nutrient	**Sample**	**Bird muscle (n = 10)**	**Mammal muscle (n = 41)**	**Mammal viscera (n = 12)**	**Reptile muscle (n = 11)**	**Reptile viscera (n = 2)**
Fe (mg)	793	4.41 (1.4)	3.21 (1.95)	14.51 (1.39)	5.39 (2.07)	15.55 (5.86)
Mn (mg)	910	0.12 (0.04)	0.08 (0.05)	0.39 (0.13)	0.14 (0.06)	0.38 (0.15)
Se (mcg)	537	3.45 (8.09)	10.61 (11.03)	57.19 (35.27)	19.37 (18.39)	81.17 (42.24)
Zn (mg)	797	0.86 (0.57)	1.76 (0.9)	3.33 (0.78)	1.24 (0.39)	2.43 (0)
K (g)	498	0.27 (0.02)	0.21 (0.07)	0.13 (0.09)	0.21 (0.05)	0.06 (0.06)
Mg (mg)	539	18.41 (0)	18.52 (7.45)	18.04 (0.94)	18.41 (0)	18.41 (0)
Na (g)	258	0.1 (0.02)	0.11 (0.02)	0.1 (0.01)	0.1 (0.03)	0.09 (0)
Ptn (g)	473	23.46 (0.97)	23.15 (2.87)	23.26 (0.63)	21.34 (2.39)	16.33 (3.51)
Fat (g)	453	2.42 (0.68)	1.27 (0.85)	1.37 (0.54)	2.02 (1.83)	5.7 (3.07)
w-6 (g)	400	0.83 (0.36)	0.24 (0.25)	1.37 (0.11)	0.5 (0.52)	1.41 (0.73)

Add File 9. Results of the Statistical Analyses. Nutrients are measured using units of DRI (Dietary Reference Intakes) as defined by the IOM (Institute of Medicine). Statistical results refer to groups that were significantly different ($p < 0.05$).

Nutrient	**Results**
Iron (mg)	Shapiro-Wilk: p-value = 0.4185 Bartlett: p-value = 0.0725 ANOVA one-way: p-value: <0.00000000000000022 Tukey: ave mus x mam vis: p adj = 0.0000000 rep vis x ave mus: p adj = 0.0000000 mam vis x mam mus: p adj = 0.0000000 rep mus x mam mus: p adj = 0.0129368 rep vis x mam mus: p adj 0.0000000 rep mus x mam vis: p adj 0.0000000 rep vis x rep mus: p adj 0.0000000
Manganese (mg)	Shapiro-Wilk: p-value = 0.169 Bartlett: p-value = 0.00007194 Kruskal-Wallis: p-value = 0.00000002468 Bonferroni: ave mus x mam vis: p-value = 0.00157 mam mus x mam vis: p-value = 0.00000000272 mam mus x rep mus: p-value = 0.00874 mam mus x rep vis: p-value = 0.00713

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Nutrient	Results
Selenium (mcg)	Shapiro-Wilk: p-value = 0.00002133 Kruskal-Wallis: p-value = 0.0000007854 Bonferroni: ave mus x mam vis: p-value = 0.000000937 ave mus x rep mus: p-value = 0.00379 ave mus x rep vis: p-value 0.00161 mam mus x mam vis: p-value = 0.0000114 mam vis x rep mus: p-value = 0.0454
Zinc (mg)	Shapiro-Wilk: p-value = 0.000001639 Kruskal-Wallis: p-value = 0.00000003986 Bonferroni: ave mus x mam mus: p-value = 0.00192 ave mus x mam vis: p-value = 0.0000000756 ave mus x rep vis: p-value = 0.00500 mam mus x mam vis: p-value = 0.000232 mam mus x rep mus: p-value = 0.00938 mam vis x rep mus: p-value = 0.000000551 rep mus x rep vis: p-value = 0.0107

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Nutrient	Results
Potassium (g)	Shapiro-Wilk: p-value = 0.02408
	Kruskal-Wallis: p-value = 0.0002719
	Bonferroni:
	ave mus x mam mus: p-value = 0.00300
	ave mus x mam vis: p-value = 0.0000363
	ave mus x rep mus: p-value = 0.0211
	ave mus x rep vis: p-value = 0.00136
	mam mus x mam vis: p-value = 0.0279
	mam mus x rep vis: p-value = 0.0476
Magnesium (mg)	Shapiro-Wilk: p-value = 0.00000000000001257
	Kruskal-Wallis: p-value = 0.8098
Sodium (g)	Shapiro-Wilk: p-value = 0.00000000000002014
	Kruskal-Wallis: p-value = 0.03357
	Bonferroni:
	mam mus x mam vis: p-value = 0.0107
	mam mus x rep vis: p-value = 0.0316
Protein (g)	Shapiro-Wilk: p-value = 0.0000007099
	Kruskal-Wallis: p-value = p=0.004149
	Bonferroni:
	ave mus x rep mus: p-value = 0.00478
	ave mus x rep vis: p-value = 0.00387
	mam mus x rep vis: p-value = 0.0225
	mam vis x rep mus: p-value = 0.0133
	mam vis x rep vis: p-value = 0.00762

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Nutrient	Results
Lipids (g)	Shapiro-Wilk: p-value = 0.0001092 Kruskal-Wallis: p-value = 0.001214 Bonferroni: ave mus x mam mus: p-value = 0.000327 ave mus x mam vis: p-value = 0.0203 ave mus x rep mus: p-value = 0.0376 mam mus x rep vis: p-value = 0.00965 mam vis x rep vis: p-value = 0.0361 rep mus x rep vis: p-value = 0.0486
Omega 6 (g)	Shapiro-Wilk: p-value = 0.00001904 Kruskal-Wallis: p-value = 0.00000002067 Bonferroni: ave mus x mam mus: p-value = 0.000288 mam mus x mam vis: p-value = 0.0000000153 mam mus x rep vis: p-value = 0.0107 mam vis x rep mus: p-value = 0.00108

Add File 10. Nutritional composition in muscle and viscera of wild meat, comprising mammals, birds, and reptiles, including original and imputed data. Pairs of comparisons with statistically significant differences are highlighted in black.(M=Mammal, B=Bird, R=Reptile)

Nutrient	**M. Viscera x M. Muscle**	**M. Viscera x B. Muscle**	**M. Viscera x R. Viscera**	**M. Viscera x R. Muscle**	**M. Muscle x B. Muscle**	**M. Muscle x R. Viscera**	**M. Muscle x R. Muscle**	**B. muscle x R. Viscera**	**B. Muscle x R. Muscle**	**R. Viscera x R. Muscle**
Protein, g	23.26 x 23.15 (>0.05)	23.26 x 23.46 (>0.05)	23.26 x 16.33 (<0.01)	23.26 x 21.34 (<0.01)	23.15 x 23.46 (>0.05)	23.15 x 16.33 (<0.05)	23.15 x 21.34 (>0.05)	23.46 x 16.33 (<0.01)	23.46 x 21.34 (<0.01)	16.33 x 21.34 (>0.05)
Fat, g	1.37 x 1.27 (>0.05)	1.37 x 2.42 (<0.05)	1.37 x 5.7 (<0.05)	1.37 x 2.02 (>0.05)	1.27 x 2.42 (<0.01)	1.27 x 5.7 (<0.01)	1.27 x 2.02 (>0.05)	2.42 x 5.7 (>0.05)	2.42 x 2.02 (<0.05)	5.7 x 2.02 (<0.05)
w6, g	0.24 x 1.37 (<0.01)	1.37 x 0.83 (>0.05)	1.37 x 1.41 (>0.05)	1.37 x 0.5 (<0.01)	0.24 x 0.83 (<0.01)	0.24 x 1.41 (<0.01)	0.24 x 0.5 (>0.05)	0.83 x 1.41 (>0.05)	0.83 x 0.5 (>0.05)	1.41 x 0.5 (>0.05)
Fe, mg	14.51 x 3.21 (<0.01)	4.41 x 14.51 (<0.01)	14.51 x 15.55 (>0.05)	14.51 x 5.39 (<0.01)	3.21 x 4.41 (>0.05)	3.21 x 5.39 (<0.01)	3.21 x 5.39 (<0.01)	3.21 x 15.55 (<0.01)	4.41 x 5.39 (>0.05)	15.55 x 5.39 (<0.01)
K, g	0.13 x 0.21 (<0.05)	0.13 x 0.27 (<0.01)	0.13 x 0.06 (>0.05)	0.13 x 0.21 (>0.05)	0.21 x 0.27 (<0.01)	0.21 x 0.06 (<0.05)	0.21 x 0.21 (>0.05)	0.27 x 0.06 (<0.01)	0.27 x 0.21 (<0.05)	0.06 x 0.21 (>0.05)

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Nutrient	**M. Viscera x M. Muscle**	**M. Viscera x B. Muscle**	**M. Viscera x R. Viscera**	**M. Viscera x R. Muscle**	**M. Muscle x B. Muscle**	**M. Muscle x R. Viscera**	**M. Muscle x R. Muscle**	**B. muscle x R. Viscera**	**B. Muscle x R. Muscle**	**R. Viscera x R. Muscle**
Mn, mg	0.39 x 0.08 (<0.01)	0.39 x 0.12 (<0.01)	0.39 x 0.38 (>0.05)	0.39 x 0.14 (>0.05)	0.08 x 0.12 (>0.05)	0.08 x 0.38 (<0.01)	0.08 x 0.14 (<0.01)	0.12 x 0.38 (>0.05)	0.12 x 0.14 (>0.05)	0.38 x 0.14 (>0.05)
Na, g	0.1 x 0.11 (<0.01)	0.11 x 0.1 (>0.05)	0.1 x 0.09 (>0.05)	0.1 x 0.1 (>0.05)	0.11 x 0.1 (>0.05)	0.11 x 0.09 (<0.05)	0.11 x 0.1 (>0.05)	0.1 x 0.09 (>0.05)	0.1 x 0.1 (>0.05)	0.09 x 0.1 (>0.05)
Zn, mg	2.43 x 1.24 (<0.01)	3.33 x 0.86 (<0.01)	3.33 x 2.43 (>0.05)	3.33 x 1.24 (<0.01)	1.76 x 0.86 (<0.01)	1.76 x 2.43 (>0.05)	1.76 x 1.24 (<0.01)	0.86 x 2.43 (<0.01)	0.86 x 1.24 (>0.05)	2.43 x 1.24 (<0.01)
Se, mcg	57.19 x 10.61 (<0.01)	57.19 x 3.45 (<0.01)	57.19 x 81.17 (>0.05)	3.33 x 1.24 (<0.05)	10.61 x 3.45 (>0.05)	10.61 x 81.17 (>0.05)	10.61 x 19.37 (>0.05)	3.45 x 81.17 (<0.01)	3.45 x 19.37 (<0.01)	81.17 x 19.37 (>0.05)

Add File 11. Comparison of the nutritional content of 100 g of muscle and offal of wild meat from different classes with the DRI (Dietary Reference Intakes) recommendations for Adequate Intake (AI) or Recommended Dietary Allowances (RDA) for target populations for various nutrients. Reference values for nutritional needs are provided by the Institute of Medicine (IOM).

Life stage	Nutrient	DRI	Bird Muscle	% DRI	Mammal Muscle	%DRI	Mammal viscera	%DRI	Reptile muscle	%DRI	Reptile viscera	%DRI
Children: 01 - 03 a	Fe (mg)	7.0	4.41	63	3.21	45.9	14.51	207.3	5.39	77	15.55	222.1
Men: 31 - 50 a	Fe (mg)	8.0	4.41	55.1	3.21	40.1	14.51	181.4	5.39	67.4	15.55	194.4
Women: 31 - 50 a	Fe (mg)	8.0	4.41	55.1	3.21	40.1	14.51	181.4	5.39	67.4	15.55	194.4
Pregnant women: 19 - 30 a	Fe (mg)	27.0	4.41	16.3	3.21	11.9	14.51	53.7	5.39	20	15.55	57.6
Children: 01 - 03 a	Mn (mg)	1.2	0.12	10	0.08	6.7	0.39	32.5	0.14	11.7	0.38	31.7
Men: 31 - 50 a	Mn (mg)	2.3	0.12	5.2	0.08	3.5	0.39	17	0.14	6.1	0.38	16.5
Women: 31 - 50 a	Mn (mg)	1.8	0.12	6.7	0.08	4.4	0.39	21.7	0.14	7.8	0.38	21.1
Pregnant women: 19 - 30 a	Mn (mg)	2	0.12	6	0.08	4	0.39	19.5	0.14	7	0.38	19
Children: 01 - 03 a	Se (mcg)	20	3.45	17.3	10.61	53.1	57.19	286	19.37	96.9	81.17	405.9
Men: 31 - 50 a	Se (mcg)	55	3.45	6.3	10.61	19.3	57.19	104	19.37	35.2	81.17	147.6
Women: 31 - 50 a	Se (mcg)	55	3.45	6.3	10.61	19.3	57.19	104	19.37	35.2	81.17	147.6
Pregnant women: 19 - 30 a	Se (mcg)	60	3.45	5.8	10.61	17.7	57.19	95.3	19.37	32.3	81.17	135.3
Children: 01 - 03 a	Zn (mg)	3	0.86	28.7	1.76	58.7	3.33	111	1.24	41.3	2.43	81
Men: 31 - 50 a	Zn (mg)	11	0.86	7.8	1.76	16	3.33	30.3	1.24	11.3	2.43	22.1
Women: 31 - 50 a	Zn (mg)	8	0.86	10.8	1.76	22	3.33	41.6	1.24	15.5	2.43	30.4
Pregnant women: 19 - 30 a	Zn (mg)	11	0.86	7.8	1.76	16	3.33	30.3	1.24	11.3	2.43	22.1
Children: 01 - 03 a	K (g)	3	0.27	9	0.21	7	0.13	4.3	0.21	7	0.06	2
Men: 31 - 50 a	K (g)	4.7	0.27	5.7	0.21	4.5	0.13	2.8	0.21	4.5	0.06	1.3
Women: 31 - 50 a	K (g)	4.7	0.27	5.7	0.21	4.5	0.13	2.8	0.21	4.5	0.06	1.3
Pregnant women: 19 - 30 a	K (g)	4.7	0.27	5.7	0.21	4.5	0.13	2.8	0.21	4.5	0.06	1.3
Children: 01 - 03 a	Mg (mg)	80	18.41	23	18.52	23.2	18.04	22.6	18.41	23	18.41	23
Men: 31 - 50 a	Mg (mg)	400	18.41	4,6	18.52	4.6	18.04	4.5	18.41	4.6	18.41	4.6

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Life stage	**Nutrient**	**DRI**	**Bird Muscle**	**% DRI**	**Mammal Muscle**	**%DRI**	**Mammal viscera**	**%DRI**	**Reptile muscle**	**%DRI**	**Reptile viscera**	**%DRI**
Women: 31 - 50 a	Mg (mg)	310	18.41	5.9	18.52	6	18.04	5.8	18.41	5.9	18.41	5.9
Pregnant women: 19 - 30 a	Mg (mg)	350	18.41	5.3	18.52	5.3	18.04	5.2	18.41	5.3	18.41	5.3
Children: 01 - 03 a	Na (g)	1	0.1	10	0.11	11	0.1	10	0.1	10	0.09	9
Men: 31 - 50 a	Na (g)	1.5	0.1	6.7	0.11	7.3	0.1	6.7	0.1	6.7	0.09	6
Women: 31 - 50 a	Na (g)	1.5	0.1	6.7	0.11	7.3	0.1	6.7	0.1	6.7	0.09	6
Pregnant women: 19 - 30 a	Na (g)	1.5	0.1	6.7	0.11	7.3	0.1	6.7	0.1	6.7	0.09	6
Children: 01 - 03 a	Ptn (g)	13	23.46	180.5	23.15	178.1	23.26	178.9	21.34	164.2	16.33	125.6
Men: 31 - 50 a	Ptn (g)	56	23.46	41.9	2.15	41.3	23.26	41.5	21.34	38.1	16.33	29.2
Women: 31 - 50 a	Ptn (g)	46	23.46	51	23.15	50.3	23.26	50.6	21.34	46.4	16.33	35.5
Pregnant women: 19 - 30 a	Ptn (g)	71	23.46	33	23.15	32.6	23.26	32.8	21.34	30.1	16.33	23
Children: 01 - 03 a	Fat (g)	nd	2.42	nd	1.27	nd	1.37	nd	2.02	nd	5.7	nd
Men: 31 - 50 a	Fat (g)	nd	2.42	nd	1.27	nd	1.37	nd	2.02	nd	5.7	nd
Women: 31 - 50 a	Fat (g)	nd	2.42	nd	1.27	nd	1.37	nd	2.02	nd	5.7	nd
Pregnant women: 19 - 30 a	Fat (g)	nd	2.42	nd	1.27	nd	1.37	nd	2.02	nd	5.7	nd
Children: 01 - 03 a	w-6 (g)	7	0.83	11.9	0.24	3.4	1.37	19.6	0.5	7.1	1.41	20.1
Men: 31 - 50 a	w-6 (g)	17	0.83	4.9	0.24	1.4	1.37	8.1	0.5	2.9	1.41	8.3
Women: 31 - 50 a	w-6 (g)	12	0.83	6.9	0.24	2	1.37	11.4	0.5	4.2	1.41	11.8
Pregnant women: 19 - 30 a	w-6 (g)	13	0.83	6.4	0.24	1.8	1.37	10.5	0.5	3.8	1.41	10.8