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## Evaluating Haemato-Biochemical Parameters Across Chicken Breeds: Insights from a Systematic Review of Selected Studies

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### **Abstract:**

**Background:** Understanding the haemato-biochemical parameters of chicken breeds is crucial for optimizing health, productivity, and genetic selection strategies. Despite individual studies on various breeds, a comprehensive comparison and synthesis of these parameters are lacking, leading to fragmented insights into breed-specific physiological profiles.

**Objective:** This review aims to systematically evaluate and synthesize existing research on haemato-biochemical parameters across different chicken breeds, identifying patterns, variations, and gaps in the current knowledge base.

**Methodology:** We conducted a thorough search in Scopus, Web of Science, and PubMed, identifying 124 studies initially. Applying rigorous inclusion and exclusion criteria focused on relevance, methodology, and quality, we narrowed our selection to 32 studies for detailed analysis. Our methodology included a thematic analysis to identify common threads and a comparative approach to elucidate breed-specific differences.

**Findings:** The review revealed significant variability in haemato-biochemical parameters among chicken breeds, with clear distinctions that could be linked to genetic, environmental, and management factors. Key themes emerged around the influence of breed on parameters such as hemoglobin levels, leukocyte counts, and biochemical markers like glucose and cholesterol levels. Several studies highlighted the potential for using these parameters in selective breeding programs to enhance desirable traits.

**Conclusion:** The systematic review underscores the importance of breed-specific haemato-biochemical profiles in the management and genetic improvement of chickens. It highlights the need for standardized methodologies in future research to enable more accurate comparisons and the development of breed-specific health and productivity strategies.

**Keywords:** Chicken breeds, haemato-biochemical parameters, systematic review, thematic analysis, breed-specific variations, poultry science.

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## **Introduction**

### **Background**

In the realm of poultry science, the assessment of haemato-biochemical parameters plays a pivotal role in deciphering the health status, productive capabilities, and underlying genetic diversity among chicken breeds. These parameters, encompassing a wide range of blood and biochemical markers, offer invaluable insights into the physiological well-being, nutritional status, and immune responses of chickens. Understanding these metrics is essential for optimizing poultry management practices, enhancing disease resistance, and guiding the selection of breeds for specific traits, thereby contributing to the sustainability and profitability of poultry farming. Despite their importance, the literature presents a fragmented view, with studies often isolated to specific breeds or regions, lacking a comprehensive synthesis that could illuminate broader patterns and breed-specific nuances.

### **Objective**

The primary objective of this systematic review is to evaluate and synthesize the existing research on haemato-biochemical parameters across a variety of chicken breeds. By systematically compiling and analyzing data



from a range of studies, this review aims to identify consistent trends, significant variations, and potential correlations between specific haemato-biochemical markers and breed characteristics. Through this evaluation, the review seeks to construct a cohesive understanding of how these parameters vary among breeds and what these variations imply for the management, health, and selective breeding of chickens.

### ***Rationale***

The motivation for this review stems from the observed gaps and inconsistencies in the existing body of literature. Individual studies often provide valuable insights into the haemato-biochemical profiles of specific chicken breeds; however, without a comprehensive and comparative analysis, the broader implications of these findings remain underexploited. Moreover, the increasing interest in genetic diversity and breed-specific management strategies for health and productivity enhancement underscores the need for a systematic synthesis of available data. By bridging these gaps, this review aims to offer a foundational resource that can inform future research directions, improve breed-specific management practices, and contribute to the genetic improvement of poultry breeds. Through the integration of diverse study findings, the review endeavors to enhance the understanding of haemato-biochemical parameters as a tool for advancing poultry science and optimizing the genetic potential of chicken breeds worldwide.

### **Methodology**

#### ***Search Strategy***

Our systematic search was executed across three major databases: Scopus, Web of Science, and PubMed. This search aimed to comprehensively capture studies from the past decade, reflecting the most recent advances in haemato-biochemical research in chicken breeds. The search terms employed were a combination of subject-specific keywords, such as "chicken breeds," "haematology," "biochemistry." Boolean operators ("AND," "OR") were used to construct complex search strings to ensure a broad yet specific retrieval of relevant studies.

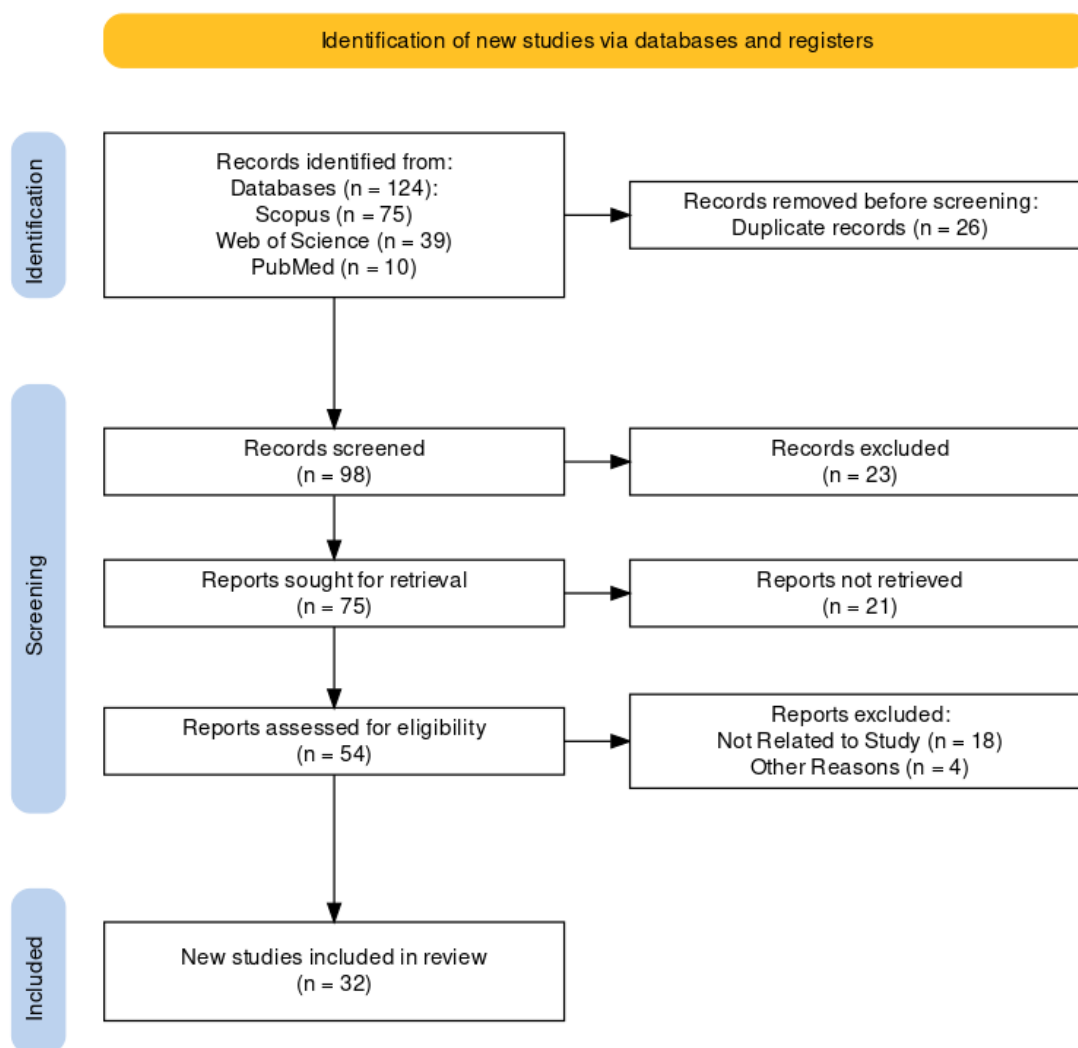
#### ***Inclusion Criteria***

- Original research articles focused on the haemato-biochemical parameters of chicken breeds.
- Studies published within the last 10 years to ensure the timeliness of the data.
- Articles available in full text, ensuring the comprehensive assessment of methodologies and findings.
- Studies reporting specific haemato-biochemical data, such as blood cell counts, enzyme levels, and metabolic markers.

#### ***Exclusion Criteria***

- Studies outside the 10-year range to maintain the review's currency and relevance.
- Literature reviews, case reports, opinion pieces, and editorial letters, as these do not provide original research data.
- Studies that do not report specific haemato-biochemical parameters or only report general health outcomes.
- Articles not available in full text, which precludes a thorough quality and content assessment.
- Non-peer-reviewed articles, conference abstracts, and thesis papers due to potential variability in the review process and study quality.

#### ***Selection Process***



**Fig1. PRISMA Statement 2020**

Following the PRISMA 2020 guidelines, the search identified 124 records initially. After the removal of duplicates (26), 98 records were screened by title and abstract, resulting in the retrieval of 75 articles after removing studies published before the span of 10 years (23 studies). These articles (remaining 75) were sought for retrieval of their full-texts. 21 studies, not being open access, were removed at this stage of the PRISMA. The remaining 54 studies were rigorously assessed for eligibility based on our inclusion and exclusion criteria. The full texts of these 54 studies were read and this process led to the selection of 32 studies for inclusion in the systematic review.

### **Quality Assessment**

The selected studies were subjected to a rigorous quality assessment to ensure methodological soundness and reliability. This assessment utilized a standardized checklist to evaluate study design, data collection, statistical analysis, and the clarity of reporting results. Any disagreements between reviewers during this process were resolved through discussion or, when necessary, arbitration by a third reviewer.

### **Thematic Analysis**

We conducted a thematic analysis using R-Studio with the Bibliometrix and Biblioshiny packages. Bibliometrix allowed for a quantitative assessment of the literature, facilitating the identification of prevalent research themes and trends. Biblioshiny provided a user-friendly interface for the visualization of the data, helping to elucidate the relationships between themes and to identify clusters within the research landscape.

This detailed methodological approach ensured a comprehensive and systematic evaluation of the selected literature, abiding by the latest PRISMA guidelines and employing advanced thematic analysis tools to



synthesize and interpret the haemato-biochemical research conducted on various chicken breeds in the past decade.

**Literature Summary Table:**

Author & Year of Study	Publication / Journal	Key Note
Omeje Vo (2022)	Jordan J Biol Sci	The study found no clinical signs of disease in 100 healthy 6 weeks old <i>C. gariepinus</i> juveniles after infection with avian pathogenic microorganisms, including <i>Pasteurella multocida</i> , and concluded that serotype A1 did not cause infection.
Hosseini Ng (2019)	J Hell Vet Med Soc	The study found that Iranian poultry farms can use native probiotic <i>Bacillus</i> spp. to enhance growth performance, immunity, intestinal microflora, and MUC2 gene expression in broiler chickens. The native probiotic improved immunity and performance, making it a valuable poultry feed supplement.
Gosai As (2023)	Indian J Anim Sci	The study found that pomegranate peel powder supplementation improved growth performance, carcass characteristics, haemato-biochemical parameters, and return over feed cost in broiler chickens, with T4 being the most effective treatment.
Sharma S (2023)	Anim Nutr Feed Technol	The study found that Phyto biotics like garlic powder and cinnamon extract improved broiler performance, nutrient utilization, and feed to gain ratio, while CE1 supplementation increased broiler meat production by 5.6%.
Khalil Kki (2020)	J Adv Biotechnol Exp Ther	The study reveals that dietary acidifier and lysozyme supplementation in broiler chicken feed enhances growth performance and body defense, reducing cholesterol and increasing it, thereby improving health.
Nopparatmaitree M (2022)	J Adv Vet Anim Res	The study found that broiler chickens on diets supplemented with trimmed asparagus by-products (TABP) and probiotics had lower cholesterol, low-density lipoprotein cholesterol, and reduced atherogenic indices, suggesting that up to 30 g/kg TABP combined with 2 g/kg probiotics could lead to healthier chickens.
Ogbuewu Ip (2023)	Heliyon	The study found that <i>Dialium guineense</i> stem-bark (DGSB), a phytogetic feed additive, improved the performance of Ross 308 broiler chickens by increasing their live weight and daily gain, and positively affecting blood traits, suggesting its potential for broiler chicken nutrition.
Singh Vb (2016)	Anim utr Feed Technol	The study found that supplementing 250 day-old Vencobb-400Y broiler chicks with 2.5% PFA improved performance, with higher mean WBC count, lower H:L ratio, lower serum cholesterol, and lower ALT and AST levels, with higher economic gain than NCON.
Modisaojang-Mojanaga Mm (2019)	Comp Clin Pathol	High feed material costs in developing nations prompt search for sustainable alternatives. Moringa, a tropical plant with high carotenoid content, is a promising feed for broiler production.



Hossain (2022)	Me	Trop Anim Health Prod	The study examined the impact of vegetable-based high-energy mash diets supplemented with NaHCO <sub>3</sub> , L-arginine+vitamin C, and vegetable oils on tachycardia and polycythemia in broiler chickens.
Zabir M (2021)		J Adv Vet Anim Res	The study found that broiler chickens at higher stocking density rates experienced stress, dirtiness, and footpad dermatitis, resulting in decreased live body weight and reduced welfare, while birds at lower densities achieved optimal growth and feed conversion.
Oloruntola (2022)	Od	Acta Sci Anim Sci	A study on 300 broiler chickens found that dietary Mucuna leaf meal supplementation improved performance, haemato-biochemical indices, oxidative status, and meat. A 1.5% MLM supplementation improved body weight gain, reduced cholesterol, and increased antioxidant activity.
Reuben (2021)	Rc	Sci Rep	The study found that multi-strain probiotics improved growth performance, feed efficiency, and reduced intestinal pathogens in 120 poultry, while also upregulating anti-inflammatory genes, suggesting their dietary inclusion can mitigate inflammatory reactions and mortality.
Chinya (2022)	A	Explor Anim Med Res	The study found that the haemolymph of <i>Telescopium telescopium</i> , a marine gastropod, can effectively control caecal coccidiosis in broiler chickens, reducing oocyst output and improving haematological parameters during infection recovery.
Dubey (2015)	M	Indian J Anim Sci	A study on 288 day old Ven cobb broiler chicks found that a diet containing 3% crude soy lecithin increased average body weight at 6 weeks, with no significant effect on feed conversion ratio, dry matter metabolizability, or cholesterol content.
Kumar P (2014)		Anim Nutr Feed Technol	The study found that vitamin C supplementation significantly improved performance and haemato-biochemical parameters in broiler chickens in Leh-Ladakh, India, by decreasing serum cholesterol, ALP, glucose, and protein concentrations, while increasing albumin and uric acid concentrations.
Abudabos (2018)	Am	Pak J Zool	A study on the impact of a commercial vitamin C supplement on broiler performance found a significant interaction between body weight gain and feed intake, but no significant impact on cumulative performance or plasma mineral status.
Kumar R (2021)		Trop Anim Health Prod	The study compared MOALE and ascorbic acid supplementation on tropical broiler chickens, finding MOALE improved growth performance, feed efficiency, antioxidant profile, and immunity against NDV in both treatment groups.
Nadeem (2021)	Sm	Ind J Ani Res	A study on 100 broiler chicks revealed significant changes in hematology, biochemical, immunohistochemical, and histopathological responses to CIAV, including changes in hemoglobin levels, packed cell volume, leukocytopenia, and thrombocytopenia.



Saied (2022)	Am	J Anim Feed Sci	The study investigates the effects of adding cinnamon oil to broiler chicken diets, finding that CO-treated birds had higher body weight, lower cholesterol, increased IgM content, and decreased caecal microbial count, suggesting it as a natural growth promoter.
Wamboi (2020)	P	Int J Vet Sci Med	Ecto- and endo-parasites are found in marketed indigenous chickens in Kiambu County, Kenya, potentially altering haematobiochemical parameters in sub-clinically infected chickens, suggesting clinico-pathological parameter testing for improved disease diagnosis.
Omeke (2021)	Jn	Notulae Sci Biologicae	The study examined the effects of Anarcaduimoccidentale root extract on cockerels, finding no significant differences in body weights or white blood cell count, but significant changes in serum biochemistry and internal organ lesions.
Azine Pc (2018)		J Adv Vet Anim Res	The study found that Jumbo Cube, a dietary source of Monosodium Glutamate, significantly reduced feed intake, increased LBW and WG, and FCR, but also increased lactic bacteria and E. coli counts, indicating potential growth improvement.
Gupta Sk (2017)		Ind J Ani Res	A study dividing 90 Vanaraja birds into three groups showed no significant differences in live weight or carcass weight, but increased stocking density improved growth performance, FCR, and dressing percentage.
Singh (2018)	Vb	Anim Nutr Feed Technol	The study found that supplementing 250 day-old Vencobb-400Y broiler chicks with 2.5% PFA improved performance, with higher mean WBC count, lower H:L ratio, lower serum cholesterol, and lower ALT and AST levels, with higher economic gain than NCON.
Jimoh (2022)	Oa	J Anim Sci Technol	A study on 200-day-old broilers found that phytogenic supplements like moringa, Phyllanthus, and mistletoe leaves can improve performance and survival rates during heat stress, suggesting that these supplements can help mitigate the negative effects on broiler chickens.
Hassan (2022)	Rim	Life	The study found that 1% Spirulina platensis supplementation improved the productivity, carcass characteristics, and economic efficiency of Fayoumi broiler chickens, while reducing feed intake and feeding behavior, and improving blood biochemical parameters and growth performance.
Jamil (2015)	Abmr	J Adv Vet Anim Res	The study found that Spirulina, a natural feed additive, significantly increased body weight, decreased FCR, and hematological parameters in broiler chickens, despite a decrease in ESR.
Egbu Cf (2022)		Agric	The study found that oral administration of Moringa oleifera seed extract improved nutrient digestibility, growth performance, and haematological parameters in one-day-old Cobb 500 male broilers, leading to increased water intake and weight gain.



Dwivedi (2015)	Vk	Anim Nutr Feed Technol	The study found that ashwagandha, a phyto-genic herbal growth promoter, significantly increased weight gain, growth rate, FCR, and hemato-biochemical parameters in broiler chickens, despite having the lowest H:L ratio and serum cholesterol concentrations.
Mashkoor (2023)	J	Front Vet Sci	The study found that arsenic and chromium damage broiler chickens, leading to a decline in erythrocytic parameters, total proteins, and oxidation stress. Vitamin E and bentonite can alleviate these effects, while co-administration of these substances can partially alleviate these effects.
Reuben (2022)	Rc	Vet Med Sci	The study evaluated the impact of novel probiotics on Cobb 500 broilers' growth, intestinal microbiota, and haemato-biochemical parameters. Results showed probiotic supplementation improved weight gain, feed conversion ratio, intestinal Enterobacteria counts, and increased hemoglobin levels.
Quaye B (2023)		Vet Med Sci	A study found that Aloe vera, an alternative to antibiotics, did not significantly affect growth or carcass traits in broiler chickens. However, it significantly reduced mortality rates and increased red blood cell count, suggesting it could be a viable alternative.

#### Breed of Chicken in Selected Studies:

Author & Year of Study	Publication / Journal	Breed of Chicken
Safiyu Kk (2023)	Trop Anim Health Prod	broiler chickens
Hosseini Ng (2019)	J Hell Vet Med Soc	Broilers
Gosai As (2023)	Indian J Anim Sci	broiler chickens
Sharma S (2023)	Anim Nutr Feed Technol	Vencobb-400 Broilers
Khalil Kki (2020)	J Adv Biotechnol Exp Ther	broiler chicken
Nopparatmaitree M (2022)	J Adv Vet Anim Res	Ross 308 chicks
Ogbuewu Ip (2023)	Heliyon	Ross 308 broiler chickens
Singh Vb (2016)	Anim Nutr Feed Technol	Vencobb-400Y broiler chicken
Modisaojang-Mojanaga Mm (2019)	Comp Clin Pathol	broiler chickens
Hossain Me (2022)	Trop Anim Health Prod	Ross-308
Oloruntola Od (2022)	Acta Sci Anim Sci	broiler chickens
Reuben Rc (2021)	Sci Rep	broiler chickens
Chinya A (2022)	Explor Anim Med Res	Vencobb-400 broiler chicken
Dubey M (2015)	Indian J Anim Sci	Vencobb
Kumar P (2014)	Anim Nutr Feed Technol	broiler chickens
Abudabos Am (2018)	Pak J Zool	Ross 308 broiler chickens
Nadeem Sm (2021)	Ind J Ani Res	broiler chickens
Saied Am (2022)	J Anim Feed Sci	Arbor Acre broiler chicks
Azine Pc (2018)	J Adv Vet Anim Res	Ross 308
Gupta Sk (2017)	Ind J Ani Res	Vanaraja chickens
Singh Vb (2018)	Anim Nutr Feed Technol	Vencobb-400Y broiler chicken
Hassan Rim (2022)	Life	Fayoumi Broilers
Egbu Cf (2022)	Agric	Cobb 500 male broilers
Reuben Rc (2022)	Vet Med Sci	Cobb 500 broilers
Quaye B (2023)	Vet Med Sci	broiler chickens

#### Thematic Analysis:



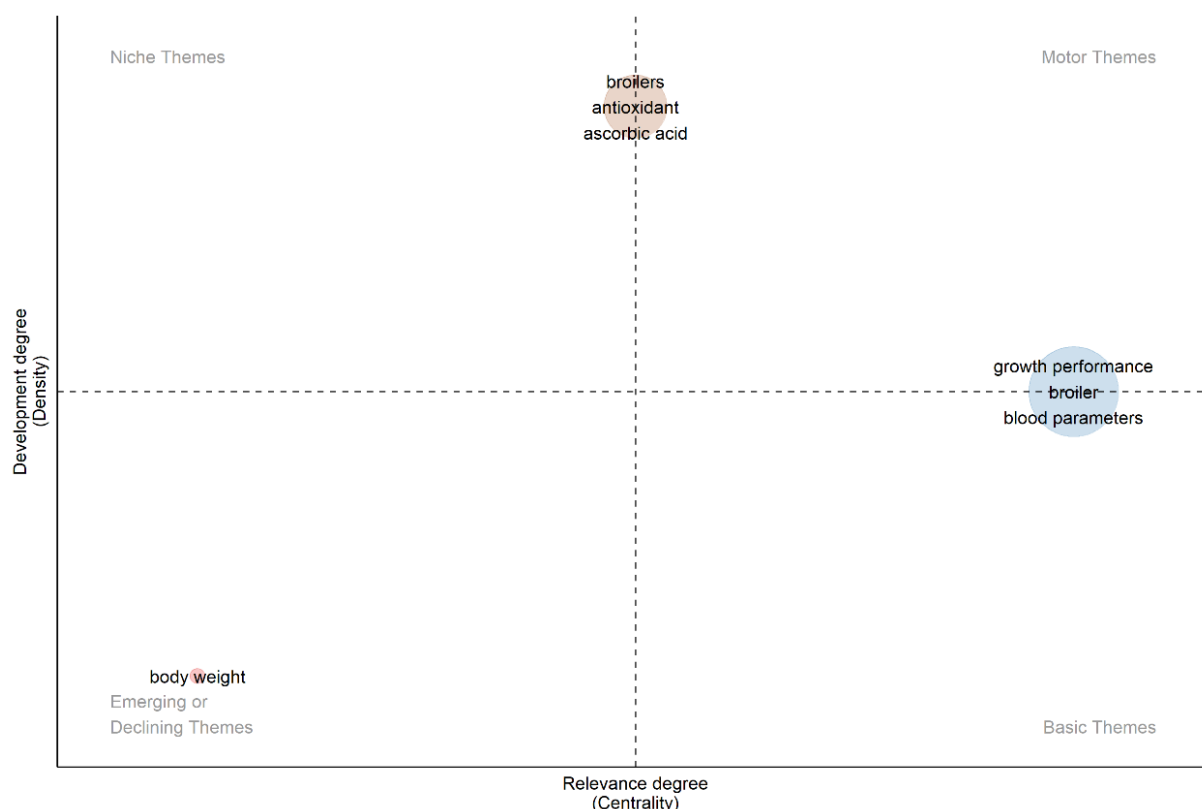


Fig. Thematic Map

The thematic analysis figure is a strategic diagram often used in bibliometric studies. This type of visualization helps to categorize the main themes identified within a body of literature based on two dimensions: centrality and density. Here's a brief interpretation of the quadrants:

**Motor Themes (High centrality, high density):** These are well-developed and pivotal themes within the field that have received a lot of attention and have numerous connections with other research areas. In your case, "growth performance," "broiler," and "blood parameters" fit into this category, indicating that these topics are central and significant in haemato-biochemical research on chickens.

**Niche Themes (Low centrality, high density):** These themes are highly specialized and developed but are less central in the research network. "Broilers," "antioxidant," and "ascorbic acid" are niche themes that may represent important, but more focused, lines of inquiry within the broader research landscape.

**Emerging or Declining Themes (Low centrality, low density):** "Body weight" falls into this quadrant, suggesting that it may be an emerging topic of interest or a once-popular topic that is losing prominence in recent research.

**Basic Themes (High centrality, low density):** There are no items in this quadrant in diagram, but typically, themes here would be fundamental to the field with potential for development, serving as building blocks for research.

## Discussion

**Implications:** The findings underscore the complexity of haemato-biochemical parameters in chickens, emphasizing their sensitivity to genetic, environmental, and management variations. Practically, this knowledge aids in refining breed management practices, tailoring nutritional and health interventions to breed-specific needs, and enhancing productivity. Theoretically, it contributes to our understanding of the genetic basis of physiological traits, supporting the development of genetic markers for selection and breeding programs aimed at improving resilience and efficiency in poultry production.





**Limitations:** The review acknowledges several limitations, including potential publication biases favoring studies with significant findings, variable quality across included studies, and the scope of the search strategy, which may have missed relevant studies published in languages other than English or in less accessible journals. These factors could influence the review's comprehensiveness and the generalizability of its conclusions.

**Future Research:** Future studies should focus on expanding the genetic diversity of chicken breeds studied, employing standardized methodologies to measure haemato-biochemical parameters, and exploring the interaction between genetic factors and environmental conditions. Investigating the molecular mechanisms underlying breed differences in these parameters could unveil new targets for genetic improvement. Additionally, longitudinal studies examining the stability of these parameters over time and their response to interventions could provide deeper insights into optimizing breed management and health strategies.

## Conclusion:

This study offers a comprehensive analysis of haemato-biochemical parameters across various chicken breeds, shedding light on the intricate interplay between genetics, environment, and management practices. Our findings underscore the importance of considering breed-specific physiological profiles in the optimization of poultry health and productivity. Recognizing the variability among breeds provides a foundation for tailored management strategies, contributing significantly to the advancement of poultry science and genetic research. However, the study's limitations, including potential biases and the scope of the search strategy, highlight the need for further research. Future studies should aim to broaden the genetic diversity of the breeds studied and standardize measurement methodologies, thereby enhancing our understanding of physiological variations and their implications for breed management and genetic improvement. In conclusion, our review not only enriches the current body of knowledge in poultry science but also paves the way for future research directions, ultimately aiming to improve the efficiency and sustainability of poultry production systems worldwide.

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