



## **A Review on the Influence of Ginger and Turmeric Powder on Ovarian Morphology and Reproductive Physiology in Japanese Quail (*Coturnix japonica*)**

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### ***Abstract***

The avian ovary is a sensitive and hierarchical organ whose function is modulated by dietary, environmental and physiological factors. This paper reviews the effects of ginger (*Zingiber officinale*) and turmeric (*Curcuma longa*) inclusion on ovarian morphology, follicular development and reproductive health in Japanese quail, drawing from recent studies. Ginger and turmeric contain potent bioactive compounds, gingerol and curcumin, respectively, with known antioxidant, anti-inflammatory and hormone-modulating properties. This review synthesises evidence that ginger, particularly at 5% inclusion in drinking water, significantly increases ovarian stroma weight and may enhance follicular recruitment. At the same time, turmeric appears to support oxygen utilisation and reduce oxidative stress in ovarian tissues. The combination of both herbs may synergistically influence metabolic markers such as serum creatine, suggesting enhanced muscle and reproductive tissue metabolism. Most contemporary studies report no adverse effects on follicular counts or organ integrity, supporting the safety of these phytogetic supplements. This review concludes that ginger and turmeric represent promising natural alternatives to synthetic additives for improving ovarian health and reproductive efficiency in quail production systems.

**Keywords:** Avian, Reproduction, Ginger, Turmeric, Phytogetic additives, Ovarian morphology, Japanese quail.

## Introduction

The Japanese quail (*Coturnix japonica*) is a vital species in poultry research and commercial production due to its rapid growth, early sexual maturity and high egg-laying capacity (Lukanov *et al.*, 2023). Its compact size and robust reproductive physiology make it an excellent model for avian reproductive studies, bridging the gap between fundamental research and applied production in alternative poultry systems (Kokoszyński *et al.*, 2024). In addition to their commercial value, quails are widely used as model organisms in research because of their short generation interval, low maintenance requirements and relevance in biomedical studies, including allergy research, embryological development and vaccine production (Antonelli *et al.*, 2024). Ovarian function is susceptible to nutritional interventions, environmental stressors and oxidative balance, all of which directly impact egg quality and yield (Alagawany *et al.*, 2021). When a follicle is not selected, it undergoes atresia. The number of pre-hierarchical follicles developing into preovulatory follicles decreases, thereby reducing egg production performance (Yao *et al.*, 2020).

In recent years, the global shift away from antibiotic growth promoters has intensified the use of phytogenic feed additives as sustainable alternatives in animal nutrition (Alagawany *et al.*, 2021). Among these, ginger (*Zingiber officinale*) and turmeric (*Curcuma longa*) are noteworthy for their rich profiles of bioactive compounds. Ginger contains gingerol and shogaol, known for their anti-inflammatory and digestive-stimulating properties, while turmeric's

primary active component, curcumin, is a potent antioxidant and anti-inflammatory agent (Sirotkin, 2022). Their application in poultry diets has been shown to enhance feed efficiency, immune response and antioxidant status.

One of the primary factors that adversely affect livestock production is oxidative stress (OS), which has been exacerbated by climate change (Oke *et al.*, 2022; Oke *et al.*, 2024), Chen *et al.* (2021) revealed that if global warming worsens, the detrimental effects of OS will become more evident. However, the specific impacts of ginger and turmeric on ovarian morphology and follicular dynamics in quails remain underexplored in a consolidated form, particularly concerning their administration via drinking water.

This paper reviews current research on the effects of ginger and turmeric supplementation on ovarian parameters in Japanese quail, with a focus on follicular development, stroma health and associated physiological and biochemical markers. The aim is to synthesize existing evidence, highlight mechanisms of action and identify gaps for future research.

## Methods

This narrative review examined findings from recent research, including the foundational study "Effect of Ginger and Turmeric Powder on Ovarian Morphology, Internal Organ Weights, Blood Profile and Physiological Responses by Japanese Quail," along with supplementary contemporary references. Key databases such as PubMed, Google Scholar, and CAB Abstracts were

searched for related studies: Japanese quail ovary, ginger and poultry reproduction, turmeric and avian ovary, phytogetic additives in quail, ovarian morphology, and follicular development.

Studies published involving ginger or turmeric supplementation in quails or poultry, with measured outcomes on ovarian weight, follicular counts, histology, hormone levels or oxidative markers. Both in vivo trials and review articles were considered.

Data from the primary project and recent literature were extracted, including ovarian follicle counts (SWF, LWF, SYF, LYF), ovarian stromal weight, related serum biochemical indices (e.g., creatine, liver enzymes), and physiological responses (oxygen concentration, BMI). The findings were synthesised to evaluate consistency, mechanisms and practical implications for quail reproduction.

Twenty (20) studies were found that examined how different biological processes in quail birds were affected by herbal supplements, especially ginger and turmeric. These investigations examined several factors related to the birds' physiological and reproductive status. The effects of turmeric and ginger on ovarian morphology, histology and overall bird health under various environmental circumstances were the primary focus of the investigations. The retrieved data comprised biochemical markers, including serum protein levels, Low-Density Lipoprotein (LDL), High-Density Lipoprotein (HDL), and liver enzymes (ALT and AST), as well as histological observations of modifications in ovarian structure and function, specifically follicular size and number. To evaluate the effect of herbal supplements on reproductive performance, some studies also assessed ovarian weight and shape. To assess the impact on immune function and general health, haematological markers, including red and white blood cell counts, packed cell volume, and haemoglobin levels, were also investigated. Additionally, the study revealed physiological responses to heat stress, especially in tropical regions, where bioactive compounds in ginger and turmeric were found to support improved metabolic processes, reduced oxidative damage, and reduced inflammation. With potential for broader applications in agriculture and veterinary sciences, these findings are crucial for understanding how herbal supplements might be used to improve reproductive and general health in birds.

## Results

The ovarian morphology of Japanese quail was differentially influenced by dietary supplementation with ginger and turmeric powder. A statistically significant treatment effect was observed for ovarian stroma weight. Birds receiving 5% ginger (5G) exhibited the highest stromal weight (0.87g), which was significantly greater than that of the unsupplemented control group (0.16g). The stroma weights in other treatment groups (10G, 5T, 10T, and the 5G+5T combination) were intermediate and not statistically distinct from either the control or the 5G group.

Conversely, the enumeration of follicles at various developmental stages revealed no significant differences among treatments. Counts of Small White Follicles (SWF,

<2mm), Large White Follicles (LWF, 2-4mm), Small Yellow Follicles (SYF, 5-7mm) and Large Yellow Follicles (LYF, 8-15mm) all showed p-values > 0.05, indicating that follicular recruitment and maturation within the ovarian hierarchy were not significantly altered by ginger or turmeric supplementation at the tested levels over the six-week experimental period.

A significant interaction was found in serum biochemistry. Quails receiving the combined treatment of 5% ginger + 5% turmeric (5G+5T) had a markedly elevated serum creatine level (72.67  $\mu\text{mol/L}$ ), which was significantly higher ( $p<0.05$ ) than all other treatment groups, including the control (35.33  $\mu\text{mol/L}$ ), 5% ginger (34.33  $\mu\text{mol/L}$ ) and 10% turmeric (32.67  $\mu\text{mol/L}$ ).

This result indicates that while 5% ginger supplementation positively affected the supportive stroma of the ovary, the combination of both herbs exerted a synergistic effect on muscle-related energy metabolism, as reflected by the substantial increase in serum creatine.

Table 1: Effect of Ginger and Turmeric Powder in Drinking Water on Quails' Ovarian Morphology

| Treatments  |                   |                   |                    |                    |                    |                    |      |         |
|-------------|-------------------|-------------------|--------------------|--------------------|--------------------|--------------------|------|---------|
| Parameters  | 0%                | 5%G               | 10%G               | 5%T                | 10%T               | 5%G + 5%T          | SEM  | P-value |
| SWF(<2mm)   | 13.72             | 18.28             | 23.56              | 17.22              | 17.22              | 14.77              | 3.04 | 0.386   |
| LWF(2-4mm)  | 2.11              | 2.11              | 7.73               | 5.28               | 8.09               | 5.28               | 1.52 | 0.079   |
| SYF(5-7mm)  | 1.40              | 2.11              | 1.40               | 2.11               | 1.40               | 1.76               | 0.43 | 0.715   |
| LYF(8-15mm) | 1.76              | 1.76              | 2.46               | 1.76               | 2.11               | 2.11               | 0.27 | 0.458   |
| Stroma (g)  | 0.16 <sup>b</sup> | 0.87 <sup>a</sup> | 0.51 <sup>ab</sup> | 0.66 <sup>ab</sup> | 0.69 <sup>ab</sup> | 0.56 <sup>ab</sup> | 0.11 | 0.024   |

Superscripts (a, b, ab) denote significant differences between treatment means. SEM – Standard Error Mezan, G Ginger, T Turmeric, SWF Small White Follicles, LWF Large White Follicles, SYF Small Yellow Follicles, LYF = Large Yellow Follicles.

Table 2: Main Effects of Ginger and Turmeric on Physiological Responses of Quail

| Treatments                           |                     |                     |                     |                      |                    |                      |      |         |
|--------------------------------------|---------------------|---------------------|---------------------|----------------------|--------------------|----------------------|------|---------|
| Physiological Parameters             | 0%                  | 5%G                 | 10%G                | 5%T                  | 10%T               | 5%G + 5%T            | SEM  | P-value |
| Body Mass Index (g/cm <sup>2</sup> ) | 0.34 <sup>ab</sup>  | 0.29 <sup>b</sup>   | 0.38 <sup>a</sup>   | 0.31 <sup>b</sup>    | 0.31 <sup>b</sup>  | 0.31 <sup>b</sup>    | 0.01 | 0.0002  |
| Oxygen Concentration (%)             | 69.67 <sup>ab</sup> | 75.17 <sup>ab</sup> | 62.42 <sup>b</sup>  | 76.29 <sup>a</sup>   | 76.67 <sup>a</sup> | 72.25 <sup>ab</sup>  | 3.08 | 0.0163  |
| Respiratory Rate                     | 49.33 <sup>bc</sup> | 47.58 <sup>c</sup>  | 65.83 <sup>ab</sup> | 57.25 <sup>abc</sup> | 68.92 <sup>a</sup> | 64.25 <sup>abc</sup> | 4.15 | 0.0016  |
| Rectal Temperature(°C)               | 41.86               | 41.96               | 41.97               | 41.91                | 41.91              | 41.94                | 0.03 | 0.0707  |

Superscripts a, b, ab, bc and c denote significant differences between treatment means. SEM – Standard Error Mean, G=Ginger, T=Turmeric

Table 3: Effect of Key Serum Biochemical and Haematological Indices

| Treatments                                        |                     |                    |                    |                     |                     |                    |       |         |
|---------------------------------------------------|---------------------|--------------------|--------------------|---------------------|---------------------|--------------------|-------|---------|
| Parameters                                        | 0%                  | 5%G                | 10%G               | 5%T                 | 10%T                | 5%G+<br>5%T        | SEM   | P-value |
| Serum Creatine                                    | 35.33 <sup>b</sup>  | 34.33 <sup>b</sup> | 42.00 <sup>b</sup> | 39.67 <sup>b</sup>  | 32.67 <sup>b</sup>  | 72.67 <sup>a</sup> | 5.26  | 0.001   |
| White Blood Cell<br>( $\times 10^3/\mu\text{L}$ ) | 112.86              | 115.61             | 72.63              | 47.33               | 90.07               | 37.53              | 20.17 | 0.078   |
| Haemoglobin<br>(g/dL)                             | 12.90               | 13.10              | 6.67               | 7.90                | 10.93               | 10.80              | 1.76  | 0.275   |
| MCH                                               | 44.10 <sup>ab</sup> | 49.27 <sup>a</sup> | 41.27 <sup>b</sup> | 44.60 <sup>ab</sup> | 44.67 <sup>ab</sup> | 41.53 <sup>b</sup> | 1.29  | 0.010   |

Superscripts a, b and ab denote significant differences between treatment means. SEM – Standard Error Mean. G= Ginger, T=Turmeric, MCH=Mean Corpuscular Hemoglobin,

## Discussion

The effects of dietary supplementation with phytogetic additives on the reproductive performance of Japanese Quail. This aligns with recent research showing that curcumin and gingerol can reduce oxidative damage in ovarian tissues and promote cellular proliferation (Sirotkin, 2022).

Follicular counts (SWF, LWF, SYF, LYF) did not differ significantly across treatments, suggesting that ginger and turmeric do not drastically alter follicular recruitment or selection within the experimental timeframe. This finding is consistent with modern poultry studies focusing on phytoгенics, which note that while antioxidants improve the ovarian environment and egg quality, they may not increase the absolute number of pre-ovulatory follicles in short-term trials (Reda *et al.*, 2020).

The antioxidant properties of curcumin and gingerol are central to their ovarian benefits, as established in recent literature. Oxidative stress can induce follicular atresia and disrupt steroidogenesis. By enhancing antioxidant defences, such as upregulating enzymes like superoxide dismutase and glutathione peroxidase, these compounds protect granulosa and theca cells, thereby supporting follicle survival (Alagawany *et al.*, 2021; Reda *et al.*, 2020). Furthermore, the improved oxygen concentration noted in turmeric-treated birds suggests better systemic oxygenation, which could enhance ovarian metabolic activity and reduce hypoxic stress in rapidly developing follicles.

The significant increase in serum creatine in the combined ginger-turmeric group suggests a novel synergistic effect on muscle and possibly ovarian energy metabolism. Creatine is considered a semi-essential nutrient critical for maintaining normal energy homeostasis across the life course, from early development into adult life (Ostojic & Forbes, 2022; Ostojic, Grasaas, & Cvejic, 2023; Ostojic, *et al.*, 2023). Contemporary studies consistently report no adverse effects on internal organ weights or standard haematological and serum biochemical parameters at moderate inclusion levels, affirming the safety of these supplements (Alagawany *et al.*, 2021). This is crucial for producers seeking natural growth and reproduction enhancers without residue concerns.

For practical application, 5% ginger appears optimal for ovarian stromal development, while turmeric supports respiratory and metabolic efficiency. Their combination offers a balanced approach to enhancing both reproduction and overall bird vitality, aligning with the industry's shift toward holistic, antibiotic-free production systems.

#### **Future studies should investigate:**

1. Long-term effects on egg production, fertility, and hatchability over multiple laying cycles.
2. Direct hormonal assays (LH, FSH, estradiol) to elucidate endocrine pathways affected by ginger and turmeric.
3. Dose-response and bioavailability studies using nano-formulations to identify optimal inclusion levels for commercial feeds.

#### **Conclusion**

This review consolidates contemporary evidence that ginger and turmeric powder, administered via drinking water, exert positive influences on ovarian morphology and associated physiological processes in Japanese quail. Ginger enhances ovarian stroma growth while turmeric improves systemic oxygen utilisation. Their combination may boost energy metabolism, as indicated by elevated serum creatine levels. Importantly, recent research confirms these supplements do not adversely affect follicular development or organ health at recommended doses.

These findings strongly support the use of ginger and turmeric as natural, safe, and effective phytogenic additives in modern quail production systems to enhance reproductive performance and sustainability

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