

Phytotherapy: the role of medicinal plants in maintaining the health of broiler chickens

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Abstract Current poultry farming systems focus on ensuring the best possible health of the flocks, a key factor in achieving high production performance and increasing economic efficiency. Amid growing concerns regarding the use of antibiotics in farm animals, phytotherapy is gaining more supporters due to the antioxidant, anti-inflammatory, and immunomodulatory properties of plants, which is why it is considered the most viable natural alternative to synthetic additives.

Introduction Today, modern poultry farming is one of the fastest-growing agricultural sectors in the global food industry, playing a vital role in providing protein to an ever-expanding population and contributing significantly to global food security. Global meat consumption and demand are influenced by:

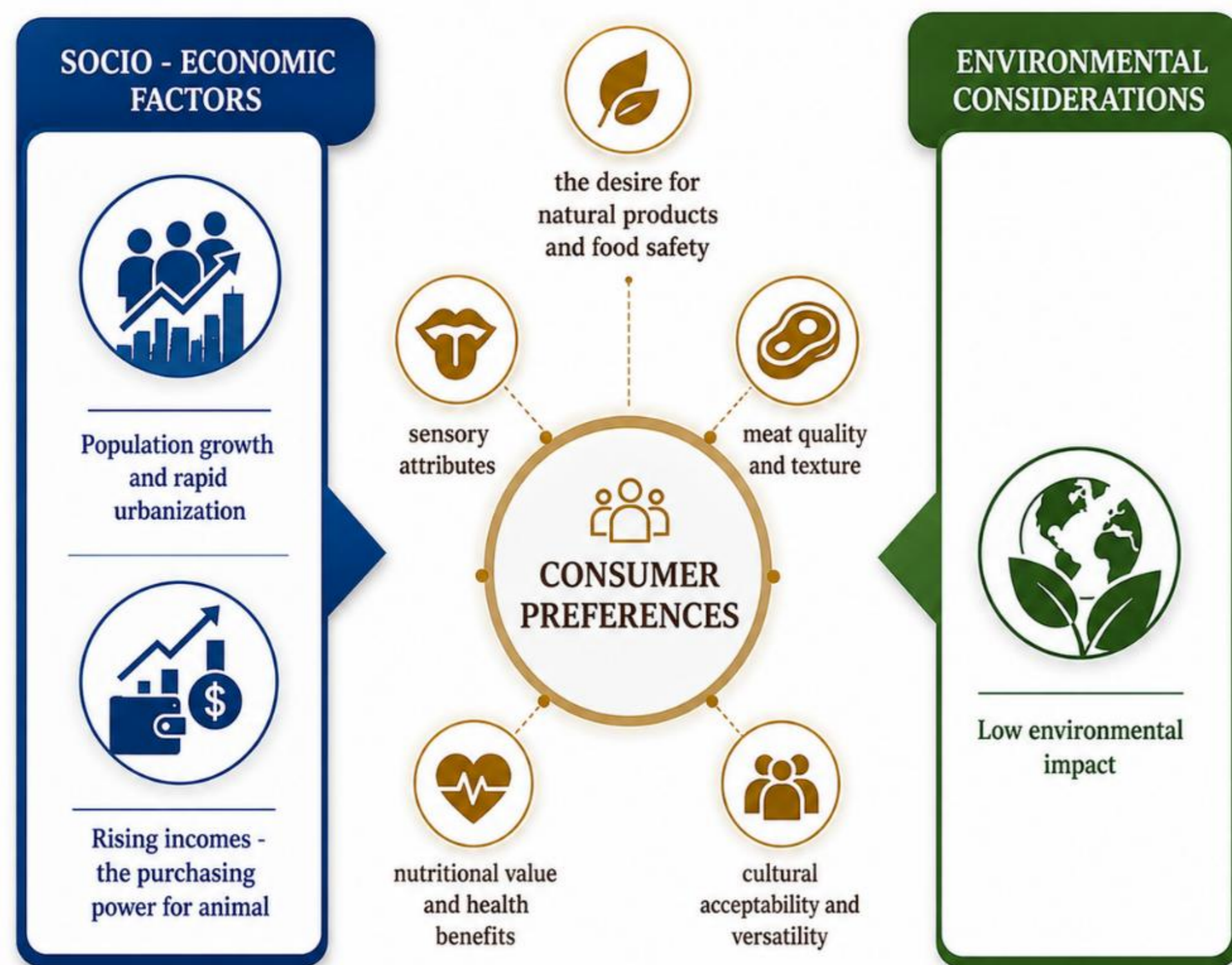


Figure 1. Set of socio-economic factors, environmental considerations, and consumer preferences. (AI generated image)

Materials and methods Bibliographic sources were identified by consulting established scientific databases, such as Web of Science, Elsevier, PubMed, and Google Scholar, focusing on articles published in English with full-text access, focused on performance indicators, intestinal morphology, gut microbiota, antioxidant status, and immune response.

Results and discussions The process of replacing antibiotics is based on the ability of plant compounds to replicate or even enhance the beneficial effects of antibiotics. Phytogetic feed additives (PFAs), also known as phytobiotics or botanical products, represent a class of naturally derived products incorporated into animal feed to improve animal health and performance.

Monitoring gut health is essential in broiler chicken production, as a healthy gastrointestinal tract is fundamental to growth performance and feed conversion efficiency, representing a comprehensive approach that integrates structural, microbial, functional, and molecular indicators (Table 1).

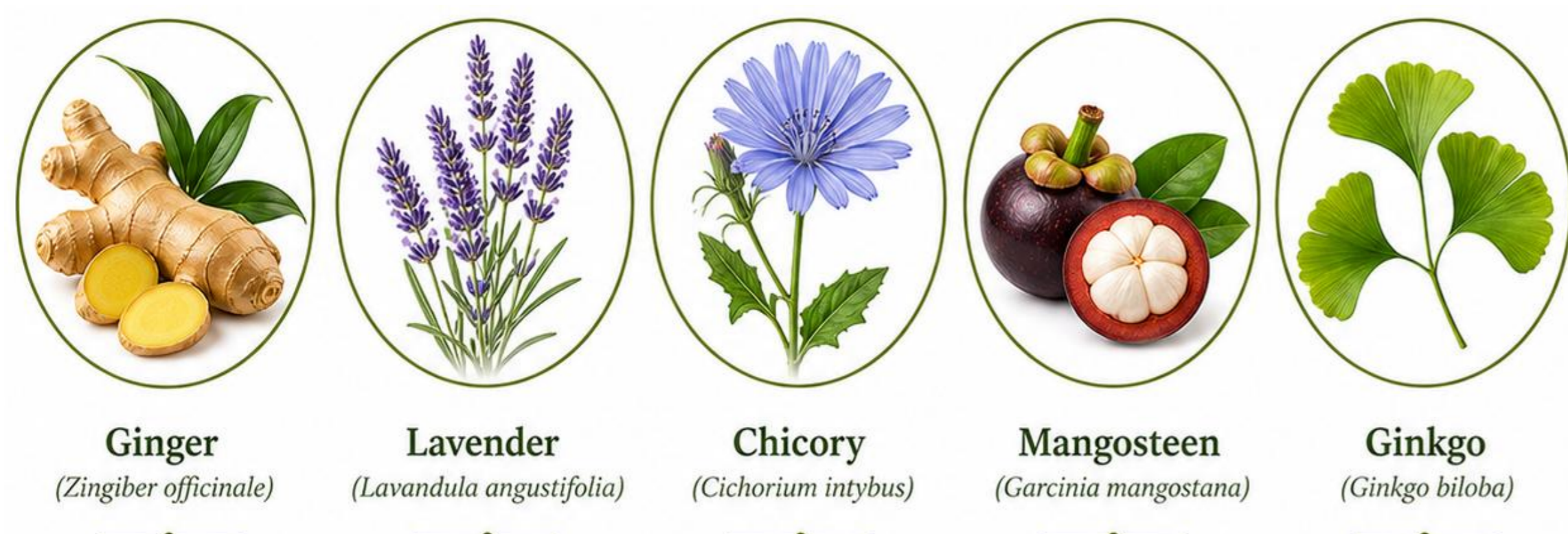


Figure 2. Medicinal plant species exerting beneficial effects on the homeostasis and functionality of the gastrointestinal tract. (AI generated image)

Table 1. Medicinal plants and their effects on the gastrointestinal system.

| Plant | Broiler | Dose | Effects |
|---|-------------|--------------------|---|
| Lavander (<i>Lavandula angustifolia</i>) (EO) | Arbor Acres | 300 / 600 mg/kg | - reduction in the <i>E. coli</i> population (ileum/cecum); - increase in the number of lactic acid bacteria; - increase in villus height. |
| Ginger (<i>Zingiber officinale</i>) (extract) | Ross 708 | 0.375 - 3% | - reduction in <i>E. coli</i> concentration (cecum/feces); - increase in the number of <i>Lactobacillus spp</i> / <i>Bifidobacterium spp</i> . |
| Chicory root (<i>Cichorium intybus</i> L.) (powder) | Vencobb | 0.5% / 1% / 1.5% | - decreased pH in the duodenum/ jejunum/ ileum/ cecum; - reduced levels of <i>E. coli</i> and <i>Salmonella</i> ; - increased number of calcareous cells; - increased villus height. |
| Mangosteen (<i>Garcinia mangostana</i>) (powder / extract) | Ross 308 | 2% / 0.05 - 1% | - a decrease in the concentrations of isobutyrate and branched-chain fatty acids in the cecal digestion. |
| Ginkgo (<i>Ginkgo biloba</i>) + Mangosteen (<i>Garcinia mangostana</i>) (blend) | Arbor Acres | 50, 100, 200 mg/kg | - reduction of cecal lesions specific to <i>Eimeria tenella</i> ; - decrease in cecal nitric oxide concentration; - improvement in crude fat digestibility. |

The antioxidant capacity of phytoadditives is assessed by their ability to reduce reactive oxygen species and prevent macromolecular damage, through activation of the vitagen system (activation of the Nrf2 transcription factor), stimulating antioxidant enzymes such as superoxide dismutase (SOD), catalase (CAT), and glutathione peroxidase (GPx) (Table 2).



Figure 3. Medicinal plant species exhibiting antioxidant properties and immunomodulatory activity. (AI generated image)

Table 2. Effects of medicinal plants on the antioxidant system and the immune system.

| Plant | Broiler | Doze | Effects |
|---|-------------|------------------------|---|
| Turmeric (<i>Curcuma longa</i> L.) | Cobb 500 | 10 g/kg | - reduction of oxidative stress; - upregulation of Nrf2; - downregulation of p65, IL-6, and TNF- α . |
| Moringa (<i>Moringa oleifera</i>) (leaf) | Arbor Acres | 1 - 15% (diet) | - increased total antioxidant capacity (TAC); - increased activity of SOD and GPx enzymes; - decreased MDA levels in muscle and plasma. |
| Oregano (<i>Origanum vulgare</i> L.) (aqueous extract) | Arbor Acres | 400 - 700 mg/kg (diet) | - improves immune homeostasis; - regulates the expression of the cytokines IL-10 and IL-4; - increases SigA levels in the ileum. |
| Garlic (<i>Allium sativum</i> L.) (extract) | Broiler | 2 - 4 ml/bird | - increased levels of monocytes and lymphocytes; - increased SOD activity; - decreased MDA levels; - decreased heterophil-to-lymphocyte ratio. |
| Olive (<i>Olea europaea</i> L.) (pomace extract) | Ross 308 | 750 ppm | - increases the expression of the anti-inflammatory cytokines TGF- β 4; - decreases the expression of IL-8. |

¹FI - feed intake; ²GPx - glutathione peroxidase; ³IBD - infectious bursal disease; ⁴IFN - γ - interferone gamma; ⁵IL - interleukine; ⁶MDA - malondialdehyde; ⁷mRNA - messenger RNA; ⁸Nrf2 - nuclear factor erythroid 2 - related factor 2; ⁹SigA - secretory immunoglobulin A; ¹⁰SOD - superoxide dismutase; ¹¹TAC - total antioxidant activity; ¹²TGF- β 4 - transforming growth factor beta 4; ¹³TNF- α - tumor necrosis factor alpha.

Conclusions Numerous studies highlight the fact that the introduction of phytogetic additives into the broiler chicken diet can improve feed conversion, average daily gain, the balance of the intestinal microbiota, and intestinal morphology, while simultaneously reducing inflammatory reactions and oxidative stress effects that significantly contribute to increased welfare, reduced morbidity, and improved production efficiency in broiler flocks. However, the intensity of the biological response depends on numerous factors, such as the plant species used, the inclusion level in the diet, the duration of administration, the form of administration, the age of the birds, stress factors, the composition of the feed ration, and the technological conditions of the operation.