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USE OF MEDICINAL PLANTS AS A PANACEA TO POULTRY PRODUCTION AND FOOD SECURITY: A REVIEW

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A R T I C L E I N F O.

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Abstract

Medicinal plants remain the most untapped reservoir of potential therapeutic agents that can be exploited in reducing animal exposure to diseases. Some plants possess significant immune stimulatory, hepatoprotective, anti- inflammatory, antifungal, hypolipidemic and antioxidant activities due to the presence of phytochemicals. Phytochemicals or secondary metabolites are generally regarded as safe, effective, environmental freiendly and relatively cheap. Examples of phytochemicals includes; tannins, flavonoids, phenols, alkaloids, saponins and terpenoids. Concentrations of phytochemicals in plants vary from plant to plants, method of extraction, geographical locations, species and age of plants. Medicinal plants are capable of stimulating feed intake, enhancing growth performance, improving gastrointestinal morphology, immune modulator, nutrient utilization as well as modulating the fatty acid of meat. They are also recommended as one of the potential alternatives to antibiotics and to bridge the gap between food safety and livestock production.

INTRODUCTION

Medicinal plants are reservoirs of bioactive compounds used by humans since early ages in traditional medicine for the treatment and prevention of diseases due to their therapeutic potential (ArunandVarsha, 2014; Dilfuza*et al*., 2015). According to Oluwafemi*et al*. (2020); Adewale*et al*. (2020), there are over 500,000 species of medicinal plants identified globally which has led to the discovery of novel drugs or new pharmaceuticals used for the treatment of various diseases in animals. Recently, the use of medicinal plants is increasingly gaining interest due to the increasing cases of antimicrobial resistance due to the indiscriminate use of antibiotics which has led to increased risk of resistant pathogenic bacteria, environmental pollution and toxic residue in animal products which have negative effect on human health and animals (Shittu*et al*., 2021). The presence of phytochemicals in medicinal plants is generally regarded as safe, effective and natural potential alternatives to produce healthy animals (Alagbe, 2021; Singh *et al*., 2021).Phytochemicals in medicinal plant possess enormous scaffolds that are mimicked in the design of most molecular stuctured synthetic drugs (Mishra and Tiwari, 2011) or even modified further to enhance a drug's biological activity profile (Itokawa *et al*., 2008). Thus, there has been a renewed interest in investigating natural products as leads for new biologically friendly, therapeutic drug candidates (Mishra and Tiwari,2011).

The European Union in 2009 placed a ban on the use of antibiotic growth promoters in animals due to the problems outlined above to promote food safety. According to European surveillance report in 2021 on antimicrobial consumption, European countries have substantially reduced the use of antimicrobials for animals. According to Eckel (2020), healthy animals are the foundation for healthy people and healthy people are the basis for a stable and productive society. Plant based natural constituents can be derived from leaves, stems, flowers, roots, twigs and seeds (Agubosi*et al*., 2022). They have become a source of drugs and are traditionally used for the treatment of numerous diseases in animals such as gastro-intestinal infection, fever, cough, pneumonia, inflammations, skin infections, mental retardation, arthritis, urinary infections and asthma (Šarić-Kundalić, 2010; Voon*et al*., 2012; Philander, 2011).

Medicinal plants can be incorporated into animal feed or water to enhance productivity due to the presence of phytochemicals (tannins, flavonoids, terpenoids, alkaloids, saponins, phenols or bioactive compounds (Agubosi*et al*., 2022) whose concentration vary according to the method of processing or extraction, geographical origin, environmental factors, harvesting seasons and storage conditions (Gadde*et al*., 2017). The presence of phytochemicals enables plants to perform multiple biological activities such as: antimicrobial, antifungal, antiviral, antibacterial, antioxidant, hepato-protective, chemopreventive, neuroprotective, immune-modulatory, antispasmodic, anagelsics and hypolipidemic (Alagbe, 2021). According to Dhan*et al*. (2012), phytochemicals are non-nutritive plant chemicals that have either defensive or disease protective properties. For instance, flavonoidsare capable of scavenging free radicals and alsoposse's anti-inflammatory properties (Okwu*et al*., 2004; Omolere and Alagbe, 2020). Generally, the ability of flavonoids to effectively act as antioxidants depends on a number of factors, i.e., metal-chelating potential that strongly depends on hydroxyls and carbonyl groups arrangement around the molecule, the hydrogen or electron-donating substituent's present and able to reduce free radicals, and the flavonoid's ability to delocalize unpaired electron which lead to stable phenoxyl radical formation (Seelinger*et al*., 2008; Gülçin, 2012; Alagbe and Motunrade, 2019).

According to Asl and Hosseinzeh (2008); Atamgba*et al*. (2015), saponins are useful adjuvants during the production of vaccines and they also have potentials as fertility agents. Tannins are a very complex group of plant secondary metabolites, which are soluble in polar solution and are distinguished from other polyphenolic compounds by their ability to precipitate proteins (Silanikove*et al*., 2001; Alagbe*et al*., 2021). They can be grouped intoeither condensed or hydrolyzable tannins. Condensed tannins are more widely distributed in higher plant species than the hydrolysable ones and they are capable of precipitating proteins (Dykes *et al*., 2005). Tannins are also known to posses' antibacterial and antiviral activitiesand type of tannins synthesized by plants vary considerably depending on plant species, stage of development and environmental condition (Cornell, 2005;Enzo, 2007; Alagbe, 2019). Steroids are considered as great potentials for growth and bone marrow stimulation in the body of animals (Tsado*et al*., 2015; Alagbe, 2019).

Phenolic acids are derivatives of benzoic or cinnamic acids derivatives to form hydroxybenzoic and hydroxycinnamic acids, respectively (Dykes and Rooney, 2006). They are antioxidants whichare capable of reducing oxidative stress in animals (Shittu*et al*., 2021; Alagbe*et al*., 2019).Oxidation is the transfer of electrons from one atom to the other essential for cell metabolism with O_2 as an electron acceptor releasing energy in the form of ATP. It however, becomes problematic when electron flow becomes uncoupled causing the transfer of unpaired single electrons instead of paired ones, generating free radicals (Peréz and Aguilar, 2013; Musa *et al*., 2020). The generated reactive free radicals containing $O_2$are known as reactive oxygen species (ROS), oxidants or pro-oxidants as reported by Gülçin (2012). They include hydroxyl (HO), superoxide (O^-) peroxyl (ROO), alkoxyl (RO) and nitric oxide (NO) (Nikolova, 2012; Shittu and Alagbe, 2020).Phenols are antioxidants capable of preventing degenerative diseases such as cancer, coronary atherosclerosis and Alzheimer's disease (Nikolova, 2012; Uddin *et al*., 2014) and protecting cellular components against oxidative damage (Halliwell and Evans, 2001; Dudonnè*et al*.,2009). Dietary antioxidants have been defined as any substance that when present in low concentrations than that of the oxidizable substrate, significantly delays or inhibits the oxidation of that substrate (Halliwell, 2007).Phytates are capable of interfering with minerals making them biologically unavailable for absorption (Alagbe*et al*., 2020). High oxalate diet can increase the risk of renal calcium absorption and has been implicated as a source of kidney stones (Chai and Liebman, 2004; Alagbe, 2019).Alkaloids in plants possess medicinal benefits which includes anti-malarial, antibacterial and anticancer activities (Sexena*et al*., 2013; Olufunmiso*et al*., 2017).Terpenoidshave also been reported to posse's antimicrobial, anti-carcinogenic and anti-diruetic properties (Oluwafemi*et al*., 2022; Alagbe*et al*., 2020).

In view of the abundant potential in medicinal plants, this review is a collection of different herbs, its inclusion level as well as its effect in poultry production.

Table 1: Medicinal plants, dosage and their various activities in animals

Plants	Dosage	Effect on birds	References
Ginger (*Zingiberofficinale*)	0.2 % - 0.4 %	Improved intestinal morphology and efficient growth performance	Oluwafemi*et al*. (2021); Hanan (2015), Burt (2004); Brenes and Roura (2010)
Garlic (*Allium sativum*) oil	200 mg/kg diet	Improved body weight gain	Jamroz et al. (2015); Mitsch et al. (2004)
Ginger + garlic oil	0.2 – 0.4 %	Improved blood count and efficient growth performance	Oluwafemi*et al*. (2021); Hanan (2015), Nouzarian et al. (2011).
*Moringaolieifera*oil	0.1 – 0.3 %		Agubosi*et al*. (2022); Lee et al. (2004)
Sunflower (*Helianthus annus*) oil	0.2 % – 0.4 %	Improves intestinal morphology and efficient growth performance	Agubosi*et al*. (2022); Platel and Srinivasan (2000); Rajput et al. (2012).
Albizialebbeck stem bark extract	20 – 40 ml/lit of water	Increased weight gain and dressing percentage	Alali et al. (2013); Hong et al. (2014)
Balanitesaegyptiaca and *Alchorneacordifolia* stem bark mixture	10 – 40 mL/ lit of water	Improves intestinal morphology and efficient growth performance	Khattak et al. (2014); Burt (2004)
CymbopogonCitratus oil	100 mg – 300 mg/kg feed	Increased weight gain and dressing percentage	
Garlic (*Allium sativum*) oil	150 mg – 300 mg/kg feed	Modulation of fatty acid components of breast and thigh muscles	Mitsch et al. (2004); Jamroz et al. (2005); Kirkpinar et al. (2011).
Moringaoliefera leaf extract	60-90 mL/ litre of water	Increased weight gain and dressing percentage	Alabi et al. (2016), Hassan et al. (2004),

Savory oil	100 – 150 mg/kg feed	Improves intestinal morphology and efficient growth performance	Mousapour et al. (2020), Dehghani et al. (2018); Kirkpinar et al. (2011), Ghalamkari et al. (2011), Goodarzi et al. (2014), Movahhedkhah et al. (2019).
Oregano oil	0.2 – 0.5 mL/kg feed	Better feed conversion ratio and fatty acid modulation in broilers meat	Botsoglou et al. (2002), Giannenas et al. (2016), Avila et al. (2012), Castillo et al. (2007), Florou et al. (2006), Giannenas et al. (2005), Alp et al. (2012); Cabrera et al. (2008)
*Lavandulaangustifolia*oil	0.2 – 0.4 mL/litre of water	Suppress the activities of pathogenic bacteria, maintain good egg quality	Adaszynska et al. (2018), Yarmohammadi et al. (2018), Torki et al. (2021), Mokhtari et al. (2018), Wells et al. (2018).
Cinnamon essential oil	0.1 – 0.3 mg/kg feed	Improves growth performance, maintain and prevents dysbiosis	El-Atki et al. (2019), Aami et al. (2010), Abo et al. (2020)
Clove bud extract	10-30 mL/litre water	Improved body weight gain and feed intake	Ismail et al. (2017), Jamroz et al. (2003); Brenes and Roura (2010).
Nigella sativa oil	0.1% - 0.3 %	Improved growth performance and carcass traits.	Burits et al. (2000), Burts (2004), Calo et al. (2015).
*Ixoracoccinea*root extract	1-2mL/lit. of water	Increased average daily weight gain and feed intake and decreased feed conversion ratio in broiler chickens.	Annapurna et al. (2003), Al-Harthi (2002); Burt (2000)
Achyranthes japonica root extract	0.025 % - 0.050 %	Improved growth performance and carcass traits.	Dang et al. (2021); Ravangard et al. (2017)
*Achyranthesaspera*extract	1-5 mL/ lit of water	Improved body weight gain, increased red blood cells.	Long et al. (2020); Park and Kim (2020)
Turmeric powder	0.2 – 0.4 %	Scavenge free radicals and improved body weight gain	Al-Noor et al. (2011); Al-Nazawi et al. (2012); Amin and Abdou (2012); Arshami et al. (2013).
Luffa aegyptiaca leaf extract	10 – 30 mL/ lit of water	Improved weight gain and nutrient digestibility	Alagbe (2019)
Turmeric powder	2g – 5g	Increased immunoglobulins and antibody titres against Newcastle disease	Toghyani et al. (2010; 2011), South et al. (1997)

Ginger root powder	100 – 200 g / ton	Reduce oxidative stress and scavenge free radicals in birds	Habibi et al. (2014); Alili et al. (2013)
Prosopisafricana oil	100-200 mg/kg feed	Increased red blood cell and heamoglobin count, increased body weight gain and nutrient utilization	Alagbe (2022); Burt (2004); Jamroz et al. (2005).
Anogeissusleio carpus stem bark	10 – 50 mL/ lit of water	Modulation of fatty acid of thigh muscle	Alagbe et al. (2022)

CONCLUSION

Medicinal plants or herbs have been reported to contain phytochemicals or bioactive chemicals (alkaloids, flavonoids, tannins, terpernoids, saponins, phenols etc.) and also loaded minerals, vitamins, amino acids and other nutrients. They have also been reported to be cheap, safe and effective without having causing any negative effect on the health of an animal. Various plant bioactive compounds that play a significant defensive role against herbivory and pathogen attack, inter-plant competition, and abiotic stresses (Biswal*et al*., 2012) can be utilized for therapeutic purposes (Briskin, 2000; Olafadehan*et al*., 2020). This is because, plant phytochemicals possess enormous scaffolds that are mimicked in the design of most molecular stuctured synthetic drugs (Mishra and Tiwari, 2011) or even modified further to enhance a drug's biological activity profile (Itokawa *et al*., 2008).

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