The experiments of the current study were carried out in the poultry scientific research house in Gardarasha/ Animal resource Dept.- Collage of Agricultural Engineering Sciences, Salahaddin University- Erbil Kurdistan region, Iraq. This study included two experiment, each of seven treatments with three replicates. Two stocking densities were applied in both experiments. The first experiment was for the broiler, 705 days- old chicks commercial Ross 308 were raised in 2m2 in each pen for 35 days, the stocking density as followings; T0 (negative control, standard density) 75 chicks, 25 chicks (12-13 birds/ m2) per replicate. From T1 till T6 the chicks were reared under high stocking density105 chicks for each treatment and each replicate was obtained 35 birds (17-18 birds/ m2). The second experiment was conducted for layer, from 10th August till 1st December, 240 (31) weeks- old commercial ISA-Brown layers were reared for 16 weeks in different conditions of the experiment and the stocking density was as the following; T0 (negative control, normal density) 8 layers/ 1.20 m2 (7 layers/ m2). From T1 till T6 the layers were under stocking density 12 layers / 1.30 m2 (9 layers/ m2).

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Productive Performance of poultry Supplementation of Medicinal Plants

Productive Performance, Behavioral, Physiological of Broilers and Layers used Medicinal Plants under Stocking Density

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Dedication

I dedicate this book;

To the holly prophet Mohammed Mustafa (peace and blessing Allah be upon him) and his companions.

To my supervisor prof. Dr. Ihsan Tofeeq Tayeb.

To my mother, father, brother and sisters.

To all friends and people who supported and encouraged me during my Ph.D research.

…….. Alaa ……..……..

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Summary

The experiments of the current study were carried out in the poultry scientific research house in Gardarasha/ Animal resource Dept.- Collage of Agricultural Engineering Sciences, Salahaddin University- Erbil Kurdistan region, Iraq. The study duration was from 10th of June 2020 till 1st of December 2020 at the farm and three months more at a laboratory.

This study aimed to evaluate the influence of dietary medicinal herbs (sage and lavender and their combination powders) on performance productivity, some physiological, immunological, behavior parameters, as well as welfare and economical evaluation of broiler and layer under higher stocking density. This study included two experiment, each of seven treatments with three replicates. Two stocking densities were applied in both experiment. The first experiment was for the broiler, from 20 June till 15 July, 705 days- old chicks commercial Ross 308 were raised in 2m^2 in each pen for 35 days, the stocking density as followings; T0 (negative control, standard density) 75 chicks, 25 chicks (12-13 birds/ m^2) per replicate. From T1 till T6 the chicks were reared under high stocking density105 chicks for each treatment and each replicate was obtained 35 birds (17-18 birds/ m^2). The second experiment was conducted for layer, from 10th August till 1st December, 240 (31) weeks- old commercial ISA-Brown layers were reared for 16 weeks in different conditions of the experiment and the stocking density was as the following; T0 (negative control, normal density) 8 layers/ 1.20 m^2 (7 layers/ m^2). From T1 till T6 the layers were under stocking density 12 layers / 1.30 m^2 (9 layers/ m^2). The herbs powder supplementations rate were the same in both experiments as following; T0 negative control and T1 positive control provided standard diet (no supplementations), T2 (0.7% sage powder+ standard diet), T3 (0.9% sage powder+ standard diet), T4 (0.7% lavender powder+ slandered diet), T5 (0.9% lavender powder+ standard diet), T6

(0.7% mixed (0.35 sage+0.35 lavender powder+ standard diet).The productive performance, some physiological, immunity, behavior, welfare and economic efficiency were studied. The results were summarized as the followings;

-A highly significant (P≤0.01) increase of body weight gain (BWG) was observed in density groups with herbal treatments about 25% in T3, T4 and T6 led to be close T0 and compared to T1.

-A highly significant (P≤0.01) increase of hen day egg production (HD%) about 40% and egg mass (g/hen/week) were noticed in density groups with herbal treatments T4, T5 and T6 and close to T0 while differences with T1.

-Significantly (P≤0.05) improved by diet herb the weekly feed intake (FI), feed conversion ratio (FCR) for both broiler and layer, production index (PI), carcass characteristics, dressing percentage, lymphoid organs for broilers and egg quality traits for layers.

-Significantly (P≤0.01) improved by dietary supplementation of sage and lavender powders the behavior traits particularly eating, laying, comfort behaviors, decreasing stress and aggressive behaviors.

-Significant (P≤0.05) improvement was observed in herbal treatments of hematological parameters erythrocyte profile, thrombocyte, leukocyte profile, thyroid hormones, decreasing H/L ratio, cholesterol, glucose and cortisol as a (stress indicators). While there was no effect observed on layers.

-Antibodies titer against New castle disease virus (NDV) and Infectious bronchitis virus (IBV) were significantly (P≤0.01) increased in herbs treatments.

-The welfare status of broilers and layers was improved according to the improvement of behavior and hematological traits.

- Significantly (P≤0.01) increased economic profit due to increasing meat and eggs production in herb treatments compared with control groups(T0 and T1).

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CHAPTER ONE
INTRODUCTION

In response to the rising population and the demand for poultry products. Poultry production is expanded and more projects are continuously establishing all over the world. Poultry meat and eggs are always in the human meal as a source of animal protein (Guardia *et al.*, 2011). Therefore effects are spending to increase such main protein sources. Increasing the stocking density is the most possible method to increase poultry production. However overcrowding is one of the most critical stress factors in poultry farming in terms of production and yield (Kakhki *et al.*, 2018).

For both meat and egg production, stocking density can be defined as the mass or number per square meter of floor surface area (Tayeb *et al.*, 2011, Berg and Yngvesson, 2012). Stocking density is really important in all conditions, mostly in summer, due to higher mortality, lower quality of meat, immunosuppression occurring in broilers at greater stocking densities (Türkyilmaz, 2008). In addition, crowding stress changes in behavior, reduce production and loss of yield (Elitok and Bingüler, 2018). Furthermore, broilers treated with stocking density showed an increase in both the H/L ratio and glucose (Kridtayopas *et al.*, 2019, Sugiharto, 2022).

The negative impact of stocking density could get decreased by some modifications in nutrition and management. So new nutritional strategies should get applied. Nowadays, antibiotics have been prohibited as growth promoters by the European Union because antibiotic strains have caused severe problems in public health and livestock productivity (El-Garhy, 2018, Daramola, 2019 and Torki *et al.*, 2021). Accordingly, using of herbs and phytogenic products as potential alternatives to antibiotic has growing interests by researchers. Several herbs such as clove, lavender, moringa, green

tea and garlic have been used in poultry as an alternative to antibiotics and growth promoters. These herbs are also used as antimicrobials, antioxidant and immunomodulatory agents (Pliego *et al*., 2020).

The sage plant (*Salvia officinalis*) and Lavender (*Lavandula angustifolia*) are used as feed additives to reduce the effect of stocking density and heat stress. These two herbs are belonging to the *Lamiaceae* family used as important medicinal plants because its content of strong active compounds. The sage plant contains phenolic acids, flavonoids and the active ingredient that caused by the compounds of the volatile oil (Al-Sherify, 2015). On the other hand, lavender plant contains linalool, which has appetizing properties due to a desirable smell and stimulating the digestion processes (Lipiński *et al.*, 2019, Torki *et al.*, 2021).

These two plants are powerful aromatic herbs that could use as a feed additives can influence on physiological activities in broilers and layers, as well as help to maintain good health, welfare and boost performance productivity (Jalali-Heravi *et al.*, 2015, Salajegheh *et al.*, 2018). Furthermore, Sage also helps to improve blood profile by lowering the H/L ratio and glucose levels. Immunity titers was increased against Newcastle disease and avian influenza viruses (Farhadi *et al.*, 2020). Lavender aromatherapy's significance in anxiety and stress relief (Suyono and Wijaya, 2020). In addition, including medicinal herbs, particularly lavender, in poultry promotes calm, reduces aggressive behavior and alleviates depression (Abo Ghanima *et al.*, 2021).

The objective of this study was to evaluate the effects of two medicinal plants (sage and lavender) powder and their combinations on performance productivity, some physiology, immunity, behavior, welfare and economic efficiency of broiler and layer.