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COMPARISON OF THE EFFECT.OF ADDING.DIFFERENT.LEVELS OF DIGESTAROM AND PROBIOTICS TO THE DIET ON CARCASS CUT AND ANATOMICAL CHARACTERISTICS OF THE DIGESTIVE SYSTEM OF BROILER CHICKENS ROSS (308)

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Abstract

This experiment was conducted in a private field in Karbala Governorate for a period of 5 weeks from 10/1/2022 to 11/4/2022, with the aim of comparing the effect of adding different levels of Digestarom and Probiotic in the diet of broilers (Ross 308) on some aspects and anatomy of the digestive system. The research used 450 one-day-old broiler chicks, which were reared for five weeks. They were randomly distributed among six treatments, 75 chicks for each treatment, and the chicks from one treatment were distributed into three equal replicates, 25 chicks for each replicate. The control treatment was administered after the first treatment (T1) of chickens, which were fed a simple feed devoid of any additives. The second treatment (T2) chicks were fed a standard diet to which Digestarom powder was added at a weight of 2.5 gm/kg/feed. The chicks in the third treatment (T3) were given a basic diet plus probiotic powder (2.5 gm/kg/feed); the chicks in the fourth treatment (T4) were given a basic diet plus Digestarom powder (5 gm/kg/feed); and the chicks in the fifth treatment (T5) were given a basic diet plus probiotic powder (5 gm/kg/feed), and the sixth treatment (T6) hens were fed a basic meal supplemented with (2.5 gm/kg/feed) of Digestarom powder and (2.5 gm/kg/feed) of probiotic powder. The duodenum, jejunum, and ileum which are representative of the small intestine were used to compute the villus height and villus breadth during the experimental period. The results showed that adding a mixture of Digestarom powder at a rate of (2.5 gm/kg/feed) + probiotic powder at a rate of (2.5 gm/kg/feed), represented by the sixth treatment (T6), led to a significant improvement in the level of ($P \leq 0.05$) histological sectioning of the intestine. Average weight of the main carcass cuts (chest and thigh) and the secondary ones (wings, neck and back), with significant differences between the treatments with regard to the carcass cuts for the treatments (T5 and T6), which recorded the highest value, followed by the fourth treatment (T4) in (weight of the chest, weight of the neck and back) and recorded the lowest. Weight increase in the weight of carcass pieces in treatment (T2). Microvilli (villus height and villus width). The results obtained compared to the control treatment (T1) were a significant.improvement.at the. level of ($P \leq 0.05$) with respect to the histological segmentation of the intestine (duodenum, jejunum, and ileum). There was a.

significant. improvement at. the. level of ($P \leq 0.05$) in the height and width of the villi in favor of The sixth treatment (T6), while the two treatments (T2 and T3) recorded the least significant differences from the previous ones, while the lowest height and width of the villi was in the control treatment (T1).

Introduction

Nutrition plays a major role in the profitable production of broilers and represents on average about 80-90% of the total production cost. Modern broilers can reach 2 kg body weight by consuming 3 kg of feed within 5 weeks (Choct, 2009). A healthy digestive tract plays a key role in the optimal growth performance of broilers because it supports better digestion and absorption of nutrients. Therefore, a healthy digestive tract is essential for profitable poultry production. Well-functioning and healthy intestines (Qaisrani et al., 2015). Researchers directed their efforts to evaluate herbs as feed additives for broiler production, as they are good, fast, cheap, and a source of white meat, as they found that plant additives for feed have combinations that improve weight gain of broilers, feed efficiency, and reduce mortality rates. and increasing the ability to live (Ansari et al., 2008). Plant extracts known as digestaroms are made from a variety of aromatic herbs and spices. The entirety of the plant, its seeds, fruits, leaves, or roots, as well as essential oils and other forms of physiologically active substances including phenols, flavonoids, and alkaloids (Cetin and Gocmen, 2013) are examples of digestaroms (Upadhaya and Kim et al., 2017). The little intestine has three components: the ileum, jejunum, and duodenum. One of the features of these sections is their inner surface. The small intestine appears microscopically, consisting of numerous. Folds. called. (plicae circulares). When examined. microscopically, intestinal. villi. were seen. These structures are protrusions in the mucous membrane toward the lumen. Digestarom is of increasing interest due to its many positive modulatory effects on gut microbiome and metabolic activity (Hashemipour et al., 2013), anti-inflammatory immune response (Franciosini et al., 2015), and intestinal barrier properties (Zou et al., 2006). Regarding meat chickens the height of the villi in the small intestine of broiler chickens is an indication of the morphological changes in the digestive system's tissues (Hong et al., 2012). These changes improve the absorptive surface area as well as the efficiency of digestion and nutrient absorption. According to Baurhoo et al. (2007), an increase in the size of the villi may also result in an increase in the activity of the enzymes produced from the tips of the villi, which promote digestibility. According to reisinger et al. (2011), one of the digestarome's other roles is to stimulate and increase the number of goblet cells and confirmed by (Tsirtsikos et al., 2012), who carried out research in which they concluded that there was an increasing trend in the broiler chickens' duodenum's mucous layer thickness. Linearity with rising digestarome concentrations as previously observed (Jamroz et al., 2006), supporting digestarome's possible beneficial effects on intestinal architecture Probiotics are living communities of beneficial microorganisms that, when introduced in sufficient quantities into the host’s digestive tract, will play a role in supporting its health and safety from diseases. Researchers Quigley and Sanders (2010) indicated that the term probiotics should only be used for products. Which contain beneficial microorganisms at effective levels and which have been tested in rigorous clinical

experiments on animals. Probiotics are included as nutritional additives in special foods in accordance with the US Food and Drug Administration (FDA), as their use has been proven among the basic and healthy materials that have received wide spread. Its efficiency in improving the health condition of the animal (Bartlett 2009; Weichselbaum 2010). Poultry are often fed with probiotics to increase feed intake and retain nutrients represented by carbohydrates, water, sugars, enzymes and proteins (Ghareeb et al., 2012). According to studies, it continuously improves gastrointestinal health and broiler production performance by having a positive impact on microbial populations, nutrient absorption, intestinal barrier function, antioxidant capacity, apoptosis, and immune responses (Rodjan et al., 2018; He et al., 2019; Wu et al., 2019). According to Palamidi et al. (2016), Yazhini et al. (2018), and Vase-Khavari et al. (2019), feed intake, body weight increase, and feed conversion rate are frequently factors that determine how helpful probiotics are for poultry and other food animals. The current study seeks to assess intestinal length in broiler chickens and ascertain the impact of plant extracts, represented by Digestarome, on various anatomical parameters for the digestive system, in comparison to microorganisms, represented by probiotics.

Herbs and plant parts used in Digestrom.

Parts utilized	Latin name	Common name
Seeds	***Pimpinella anisum***	anise
Seeds	***Carum carvi***	cumin
Shell	***Cinnamomum verum***	cinnamon
Flowers	***Matricaria recutita***	Chamomile
Shell	***Citrus sp.***	citrus fruits
Buds	***Syzygium aromaticum***	Cloves
Seeds	***Foeniculum vulgare***	fennel
bulb	***Allium sativum***	garlic
Root	***Zingiber officinale***	ginger
Leaves	***Melissa officinalis***	honey

bulb	***Allium cepa***	onion
Leaves	***Origanum vulgare***	marjoram
Leaves	***Mentha piperita***	Mint
Leaves	***Rosmarinus officinalis***	Rosemary
Leaves	***Salvia officinalis***	Sage plant
Leaves	***Thymus vulgaris***	zaatar
Root	***Valeriana officinalis***	Valerian plant

.(Syed Basharat, 2015).

Materials and Methods

Date and location of the experiment

This experiment was conducted in a private (domestic) field in the Hindiyah District of Karbala Governorate for a period of 5 weeks from 10/1/2022 to 11/4/2022, with the aim of evaluating some production characteristics and the histological image of the intestines of broilers fed diets containing different levels of: Digestrom powder, probiotic powder, and their mixture.

Preparing the chickens

I used 450 unsexed one-day-old broiler chicks of the 308 (ROS) breed, which were prepared from the Al-Baz hatchery/ near the city of Al-Zawar Al-Imam Al-Hassan, Karbala Governorate. They were raised in a hall divided by barriers, and the chicks were randomly distributed at one day of age into six equal treatments. Each treatment contained 75 chicks, with three replicates for each treatment, and each replicate contained 25 chickens.

Intestinal morphology of broiler chickens

Three birds from each replication had their histology samples taken during a 35-day period. A 0.6 cm segment of the mid-duodenum, jejunum, and ileum was removed longitudinally at the antimesenteric connection, and it was carefully cleaned with NaCl (9 g L-1). And it was made right. These samples were left in a 90 ml L-1 formalin buffer solution for 12 to 24 hours at 4°C. After that, they were cleaned and kept in 70% ethanol at 4°C until they were analyzed. Using a dissecting microscope, the villi and crypts were meticulously separated. After mounting the preparation between slides and coverslips, an aqueous agent was injected in preparation for microscopy. (Enhanced. Aqua mount. gun, VWR, West. Chester, PA). Using a light microscope, ten villi and ten Liepercone crypts were measured from each section of each bird. Two birds from each line representative of the BW sample of their ileum, jejunum, and duodenum, which were

rehydrated with PBS and stored at 4°C until analysis. Following that, a liquid was inserted in each sample.Embedding medium with nitrogen added, cut with a cryostat at -20°C to create a micrometer-thick cross-section, and put on glass slides that had been gelatinized. Three cross sections were obtained from each sample for further inspection. It was a conventional procedure using Meyer Hemalun and Eosin (Sigma Chemical Company). Aqueous agent was then used for microscopic inspection after the preparation had been placed between slides and coverslips. Two images were taken of each part of each sample using a final 10x magnification thanks to the light microscope's built-in video camera, which was utilized to inspect the slides. Next, the thickness of the muscle layer in each part of the photographs was assessed using analysis software (FiJi version 2.0) in (Boroojeni. et al., 2019) and colleagues.

statistical analysis

By using a complete random design (CRD) and the statistical software Statistical Analysis System -SAS (2012), the data was analyzed to examine the impact of various parameters on the traits under study. The multinomial test was utilized to compare any significant differences between the means (Duncan, 1955) .

Result and Discussion

Crypt width and villis height of broiler chickens

The results of the statistical analysis shown in Table (1) show the height and width of the villi in the digestive tract of Ross broiler chicks (308) in experimental treatments at the age of 35 days. The results indicated a significant superiority of the experimental treatments over the control group in terms of the height and width of the villi in the digestive tract. Regarding the height and width of the villi of the digestive tract represented by the duodenum, the mixture treatment (T6), whose diet contained digestive and probiotics at a level of (2.5 gm/kg/feed for each), achieved the highest rate of height and width of the villi of the digestive tract compared with the control treatment (T1), followed by the treatment The fourth treatment (T4) differed significantly from the rest of the experimental treatments, after which came the fifth treatment (T5). While the two treatments T2 and (T3) recorded no significant.differences between.them in terms.of the rate of height and width of the villi, while the control treatment (T1) had the lowest rate of height and width of the villi, which It was significantly similar to the second treatment (T2). As for the height and width of the villi of the part of the intestine represented by the jejunum, the mixture treatment (T6) recorded the highest rate compared to the control treatment (T1) and the rest of the treatments, followed by the fifth treatment (T5), which differed with the rest of the experimental treatments. The fourth treatment (T4) was followed.by treatments.T2 and (T3), which did not show significant differences between them. While the lowest rate of villus height and width was found in the control treatment (T1). As for the villus height and width of the part of the intestine represented by the ileum, it was recorded in the control treatment (T1). The treatment (T2), which was considerably different from the other experimental treatments, came in second for both the height and depth of the villi. The two treatments (T3) and T4, which were strikingly identical to one another, were next. The fifth

treatment (T5) was shown to have the lowest rate of villus breadth and height, whereas the combination treatment (T6) had the greatest incidence. Digstarom and probiotic substances are known to play a function in the height and width of the villi in the digestive system. Research has demonstrated that plant-based chemicals can improve the intestinal activities of lipase, amylase, and trypsin in broiler chickens. Digstarom has been observed to have potential in plant genetics. effects on the morphological characteristics of the intestine Jamroz et al., (2006) where it was found that the extract of cinnamon, thyme and cloves is effective against many bacteria. Moreover, stimulating the digestive system's secretions of bile and saliva and improving enzyme activities are of great nutritional importance (Platel and Srinivasan, 2004).

The table(1) effect of adding different levels of digestrom and probiotics and their mixture to the diet on histological sectioning of the intestines of Ross (308) broiler chicks (average ± standard error).

group **Intestine(µm)**	T1	T2	T3	T4	T5	T6
Duodenum						
Villus height (µm)	989.56 1.41 ± e	998.98 5.89 ± de	1007.19 6.44 ± d	1252.85 3.91 ± b	1155.61 3.10 ± c	1458.5 4.02 ± a
Crypt width (µm)	222.7 1.49 ± e	232.69 2.95 ± de	245.94 2.39 ± d	315.64 2.82 ± b	271.19 2.06 ± c	360.34 2.98 ± a
Jejunum						
Villus height (µm)	596.97 1.20 ± e	646.99 1.73± d	633.48 1.53 ± d	732.19 7.49 ± c	814.04 3.22 ± b	1085.66 7.47 ± a
Crypt width /(µm)	149.63 0.33 ± e	211.59 2.13 ± d	198.07 1.71 ± d	252.91 1.40 ± c	294.16 2.23 ± b	363.20 1.35 ± a
Ileum						

Villus height /(µm)	263.79 1.01 ± e	299.95 5.68 ± d	399.58 3.59 ± c	411.19 2.31 ± c	531.95 6.02 ± b	599.08 1.95 ± a
Crypt width (µm)	95.10 0.45 ± e	118.38 1.50 ± d	168.45 1.67 ± c	179.63 2.37 ± c	196.09 0.34 ± b	209.49 0.48 ± a
Moral level	*	*	*	*	*	*

* Different letters within one column mean that there are significant differences between the averages of the treatments at the level ($p<0.05$).:T1: control treatment,: T2 (2.5 g/kg digestivestrum feed), T3: (2.5 g/kg probiotic feed), T4: (5g/kg digestivestrum feed), T5: (5g/kg probiotic plant feed), T6: (2.5g/kg feed; for both digestivestrum + probiotics).

Average carcass weights and cuts

The following table (2) shows the interpretation of the results to a significant superiority of the the average weight of the experimental treatments in comparison to the control treatment (T1).of the main carcass parts, represented by (the thighs, the chest) and the secondary ones, represented by (the wings, the neck, and the back). We notice.that the mixture.treatment recorded.the highest significant.value in the weight.of the thigh and. was better than It was followed by the treatment on the remaining experimental treatments. (T5) compared to the control.treatment (T1), which recorded. the lowest.significant increase in thigh.weight, while the two.treatments (T2 and T3) did not.differ from each.other on the one.hand, and they differed .significantly.from the treatment.(T4) on the other.hand. As for chest weight gain, the two treatments (T1 and T2), which were significantly similar to each other, recorded the lowest value for chest weight and in turn differed from treatment (T3), while the two treatments (T4 and T6), which were significantly similar to each other, recorded the highest value for chest weight gain, followed by treatment (T5). We also notice that treatment (T5) outperformed the rest of the treatments in the average weight of the wings, The two treatments (T4 and T6), which were comparable to one another, came next, but they differed from the treatment (T2), which recorded the lowest value for the average weight of the wings, while we note that the two treatments (T1 and T3) were significantly similar in terms of Between them, they recorded the lowest value for the weight of the wings. In terms of neck weight, the two treatments (T4 and T5) were comparable to one another because they obtained the highest average neck weight value. These were followed by the two treatments (T3 and T6), which were highly comparable to one another and distinct from the control treatment (T1), which obtained the lowest average neck weight value and was therefore different from the two treatments (T2 and T3), which did not exhibit a significant difference between them. Regarding back weight,

we observe a notable superiority and weight increase that was observed in treatments (T5, T4, and T6), which did not significantly differ from one another and that resulted in the largest increase in back weight, followed by treatments (T1 and T2), which did not differ significantly among themselves, and in turn, the treatment (T3) did not differ with Transaction (T2) recorded the lowest value. As for the weight of the carcass without entrails, we notice from the table that the two treatments (T1 and T2) were significantly similar to each other and recorded the lowest value for this carcass weight on the one hand, and on the other hand the two treatments (T3 and T5) that did not differ significantly among themselves came with the lowest value for the weight of the whole carcass without entrails, while The mixture treatment (2.5 g/kg/feed for both probiotics and digstaroms) had the highest value in carcass weight, followed by the fourth treatment (T4). The improvement in the average weights of carcass pieces in the experimental treatments is attributed to the role of the active compounds in the digstaroms and probiotics because they contain eugenol compounds. Quercetin, which has an antioxidant and antibacterial effect, also contains factors that stimulate digestion and increase the efficiency of the process of digesting and absorbing feed materials, and as a result, the average body weight increases, and this reflects positively on the weight of some carcass pieces. Digestarom also increases feed efficiency and average carcass weights due to the components of natural products that contain useful biologically active compounds such as eugenol and quercetin, which have the ability to improve the biological development of broiler chickens and which affect the secondary metabolites of herbs such as alkaloids and flavonoids positively on the health of poultry, as they possess Antimicrobial, anti-inflammatory and antioxidant properties (Mohammadi Gheisar et al., 2018). The results agreed with (Yeoman et al., 2014), who indicated that there was a significant improvement in the average weight of the thigh and breast of broilers when equal levels of digstarome and the probiotic, represented by probiotics, were added. They also indicated that there was a significant improvement in the weight of the secondary carcass parts (back and neck). (and wings) when equal levels of digstarome and the prebiotic represented by probiotics are added to the diet of broilers Ross (308). This superiority is attributed to the properties of these compounds present in additives and their important and effective role in regulating the balance of the ecosystem and microbial system of the digestive canal and reducing the body's infection with microbial and fungal digestive diseases as a result of their containment of polyphenols, terpenoids, glycosides, phenolic alkaloids, etc., and probiotics. As a result, the work and performance of the digestive canal is improved by increasing Weights.

The Table(2) Effect of adding Digestrom, probiotics and their mixture to the diet on the average carcass weights of Ross broiler chicks (308) (average ± standard error).

Carcass cuts	Weight of thighs	Chest weight	Weight of wings	Neck weight	Back weight	Carcass weight

Transactions						
T1	466.13 0.71± e	692.00 0.57± d	188.33 0.33± c	95.33 0.33± d	255.16 0.40± b	1696.95 0.87± d
T2	471.80 0.05± d	702.00 0.57± d	177.33 0.33± d	112.70 0.47 ± c	246.89 1.12± bc	1710.72 1.052± d
T3	481.26 0.33± d	738.33 0.33± c	196.33 0.33± c	118.53 0.29± bc	237.13 0.34± c	1771.58 0.59± c
T4	521.13 0.57± c	863.66 0.88± a	202.00 0.57± b	140.01 0.29± a	268.76 0.60± ab	1995.55 1.164± b
T5	542.33 0.78± b	788.00 0.57 ± b	219.66 0.33± a	132.960.543 ± a	276.40 0.45± a	1959.35 1.964± c
T6	564.30 0.55 ± a	872.33 1.20± a	208.33 0.343± b	127.33 0.331± b	284.10 0.34± a	2056.39 1.195± a
Moral level	*	*	*	*	*	*

* Different letters within one column mean that there are significant differences between the averages of the treatments at the level ($p<0.05$).:T1: control treatment,: T2 (2.5 g/kg digestivestrum feed), T3: (2.5 g/kg probiotic feed), T4: (5g/kg digestivestrum feed), T5: (5g/kg probiotic plant feed), T6: (2.5g/kg feed; for both digestivestrum + probiotics).

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