



مجلة جامعة سبها للعلوم البحتة والتطبيقية
Sebha University Journal of Pure & Applied Sciences

Journal homepage: www.sebhau.edu.ly/journal/jopas



Impact of Dietary Supplementation with Different Levels of Clove Powder on Growth Performance and Carcass Traits of Broiler Chickens

Abdalkhalek Aburas^{a*}, Majdi Kairalla^b

^aDepartment of Animal Production, Faculty of Agriculture, University of Zintan, Zintan, Libya.

^bDepartment of Animal Production, Faculty of Agriculture, Sebha University, Sebha, Libya.

Keywords:

Cloves.
Broiler.
Growth Performance.
Carcass Traits.

ABSTRACT

There has been increased interest in using natural alternatives, such as phytochemical feed additives, to enhance chicken performance. The purpose of this study was to analyse the influence of clove powder (*Syzygium aromaticum*) on growth performance and carcass characteristics of broiler chickens. A total of 192 one-day-old broiler chicks (Cobb 500 strain) were individually weighed and randomly assigned to four dietary treatments. Each treatment consisted of four replicates, each containing 12 chicks. Clove powder was supplied at concentrations of 0.0%, 0.1%, 0.2%, and 0.3%. At the end of the trial, one chicken from each replicate was selected to assess slaughter traits. In this study, broiler weight and feed intake were measured at the beginning and then weekly to determine body weight gain (BWG) and calculate the feed conversion ratio (FCR). Overall, the broilers' growth, including weight gain and their efficiency in converting feed into body weight, improved significantly ($P < 0.05$) in the groups receiving diets with 0.2% and 0.3% clove powder compared with the control and 0.1% groups. Carcass yield also increased significantly ($P < 0.05$) in birds fed diets supplemented with 0.2% and 0.3% clove powder. In summary, the inclusion of 0.2% and 0.3% clove powder in feed as a growth promoter enhances growth performance and carcass traits in broiler chickens.

تأثير المكملات الغذائية باستخدام مستويات مختلفة من مسحوق القرنفل على أداء النمو وخصائص الذبيحة لدجاج اللحم

عبدالحكيم ابوراس^{a*} ومجدي خيرالله^b

^aقسم الإنتاج الحيواني، كلية الزراعة، جامعة الزنتان، ليبيا.

^bقسم الإنتاج الحيواني، كلية الزراعة، جامعة سبها، سبها، ليبيا.

الكلمات المفتاحية:

القرنفل.
دجاج اللحم.
معدلات النمو.
صفات الذبيحة.

الملخص

هناك اهتمام متزايد باستخدام البدائل الطبيعية، مثل إضافات الأعلاف النباتية، لتحسين أداء الدجاج. وكان الهدف من هذه الدراسة هو دراسة تأثير مسحوق القرنفل (*Syzygium aromaticum*) على أداء النمو وخصائص الذبيحة لدجاج اللحم. تم وزن عدد 192 ككتوكًا من دجاج اللحم بعمر يوم واحد (سلالة Cobb500) بشكل فردي وتوزيعهم عشوائيًا إلى أربع معاملات غذائية. تتكون كل معاملة من أربع مكررات، ويحتوي كل مكرر على 12 ككتوكًا. تم توفير مسحوق القرنفل بتركيزات 0.0% و 0.1% و 0.2% و 0.3%. وفي نهاية التجربة، تم اختيار طائر واحد من كل تكرار لتقييم قياس صفات الذبيحة لدجاج اللحم. في هذه الدراسة، تم قياس استهلاك العلف لدجاج اللحم وبعد ذلك على أساس أسبوعي لتحديد زيادة وزن الجسم (BWG) وحساب معامل التحويل الغذائي (FCR) تبعًا لذلك. تحسن النمو العام لدجاج اللحم، بما في ذلك زيادة الوزن وكفاءته في تحويل العلف إلى زيادة وزن الجسم، بشكل معنوي ($P < 0.05$) لدى الطيور التي تناولت علائق تحتوي على مسحوق القرنفل بنسبة 0.2% و 0.3%، مقارنةً بمجموعتي الضابطة و 0.1%. كما زاد إنتاج الذبيحة بشكل معنوي ($P < 0.05$) لدى الطيور التي تغذت على علائق غنية بمسحوق القرنفل بنسبة 0.2% و 0.3%، على التوالي.

*Corresponding author.

E-mail addresses: abdalkhalek.aburas@uoz.edu.ly, (M.Kairalla) Maj.kairalla@sebhau.edu.ly.

1. Introduction

Herbs, spices, and other natural plant-derived compounds have demonstrated efficacy as alternatives to antibiotics by promoting growth, eradicating harmful microbes, and offering additional health benefits [1, 2]. These substances are being investigated as potential alternatives to antibiotics due to their ability to enhance performance, treat bacterial infections, and improve general health.

Phyto-additives, or phyto-genic feed additives (PFAs), are natural growth enhancers derived from herbs, spices, or other botanical sources. Research shows that these additives possess appealing sensory properties, digestion-enhancing effects, and antibacterial activity [3-5]. As a result, several plant-based commercial supplements, regarded as natural products by consumers, have been endorsed for broiler chickens. These compounds have garnered growing interest as potential substitutes for antibiotic growth promoters, offering benefits for broiler health and nutrition [6].

Employing natural compounds to support broiler health represents an effective strategy for ensuring better safety and sustainability in poultry production [7]. Cloves are considered one of the most versatile spices, containing several biologically active compounds such as eugenol acetate and β -caryophyllene. Eugenol constitutes 70,80% of the primary physiologically active components in cloves. Several studies have evaluated the effects of clove powder on broiler performance [8-10].

Given the promising health benefits of clove and its bioactive constituents, the present study aimed to investigate the effects of dietary clove supplementation on growth performance and carcass traits in broiler chickens.

2. Materials and Methods

2.1. Study Location

The experiment was conducted in the Animal Production Department, Faculty of Agriculture, Zintan University, Libya.

2.2. Procurement and Preparation of the Test Ingredient

Commercially available clove buds were purchased from the local market in Zintan City, Libya. The dried buds were cleaned, broken into smaller pieces, sun-dried for 24 hours, and stored in airtight bags for future use.

2.3. Bird Management

A total of 192 one-day-old broiler chicks (Cobb 500 strain) were obtained from a local hatchery. The study followed a completely randomised design. Chicks were randomly assigned to four treatment groups (48 birds per treatment), with four replicates per group (12 birds per replicate). The birds were housed in ground pens measuring 1.5 \times 1.5 m, lined with wood shavings for bedding. Feed and water were provided ad libitum. All chicks were vaccinated against common infectious diseases. During the trial, ambient temperatures ranged from 18.2°C to 33.3°C, and relative humidity varied between 25% and 80%.

2.4. Investigational Diets

Experimental diets were formulated to meet nutritional standards specified by [11]. Diets were supplemented with clove powder at 0%, 0.1%, 0.2%, and 0.3%. All diets were nearly isonutritive and consistent with the study's objectives. The feeding programme consisted of a starter phase (21 days) and a finisher phase (42 days), as shown in Table 1. Birds were weighed at the start of the trial and at regular intervals to record live body weight (LBW), body weight gain (BWG), feed intake (FI), and feed conversion ratio (FCR). Mortality was also recorded for each treatment.

2.5. Slaughter Test

At day 42, one bird per replicate (4 birds per treatment) was randomly selected and fasted for 12 hours. Birds were slaughtered via halal neck cut, weighed, and eviscerated. The carcass, giblets, edible components, abdominal fat, and lymphoid organs (spleen and bursa) were collected, weighed, and expressed as a percentage of live body weight.

2.6. Statistical Analysis

All data were expressed as mean \pm standard error of the mean (SEM). One-way analysis of variance (ANOVA) was performed using SPSS software version 24.0 (SPSS Inc., Chicago, IL, USA). Duncan's multiple range test was applied for post-hoc comparisons when significant differences were observed. A probability value of $P \leq 0.05$ was considered statistically significant.

Table 1: Composition of Chemical and Nutritional Content (%) of Broiler Feed.

Ingredient, (%)	Starter (0 to 21 Day)	Finisher (22 to 42 days)
Yellow Corn	54.00	60.00
Soybean Meal 44%	29.50	24.00
Corn Gluten Meal	8.00	8.24
Di-calcium phosphate	2.15	2.05
Lime stone	1.10	1.00
Salt (NaCl)	0.25	0.25
Veg. oil	4.50	4.00
L-lysine	0.15	0.15
DL-Methionine	0.05	0.01
Vitamin and Mineral Premix *	0.30	0.30
Total	100	100
	Calculated analysis	
Crude protein (%)	22.25	18.10
M.E (kcal/ kg)	2995	3185
C/P	134.60	175.96
Fat (%)	3.75	6.25
Crude Fiber (%)	2.40	2.60
Calcium (%)	1.03	0.97
1.Available phosphorus (%)	0.44	0.39
Methionine (%)	0.54	0.43
Lysine (%)	1.15	0.99

3. Results and Discussion

Table 2 illustrates the impact of clove supplementation on the performance of broilers. The outcomes indicate that birds receiving diets with 0.2% and 0.3% clove powder gained significantly more weight and exhibited better feed efficiency in comparison with those diets containing 0% and 0.1% clove powder. No substantial disparities in feed intake were noted during the interventions of dietary. Additionally, the findings showed the impact of clove supplementation on the mortality rate. The data indicated that diets supplemented with clove powder led to a statistically insignificant reduction in mortality rate when compared to the control group.

Table 3 shows the impact of clove supplementation on dressing percentages. The outcomes indicated that diets supplemented with 0.2% and 0.3% clove powder resulted in considerably greater carcass weight (g) ($P < 0.05$) in comparison with controls and the 0.1% clove group. The results showed that providing clove powder to diets did not significantly change the amount of giblets, edible parts, abdominal fat, or lymphoid organs (spleen and bursa) in comparison with the control. The results align with the studies conducted by [12] [13] [14] [15], which indicated that the addition of clove powder to the basal diet of broilers enhanced growth performance. The improved growth seen with clove-based diets supports the results of [16], which showed that clove powder helped broiler chicks grow better, depending on the level of supplementation. The improvement in broiler performance may be due to the effects of plant-based additives, which could help boost growth and nutrient use because of the active ingredient eugenol found in clove. The enhancement of broiler performance attributed to clove is probably owing to its properties of antibacterial in addition to antifungal properties, which contribute to improved health levels. Spices and herbs may positively influence the digestion of feed. Body weight and the health of other organs may increase through enhanced nutrient absorption. Additionally, research has shown that giving broiler chicks 100 and 200 mg/kg of clove oil led to improved growth and health compared to those that did not receive the supplement [16]. Similarly, clove has demonstrated efficacy in enhancing the growth performance of broiler chickens in prior studies [17].

These results match what [18]. Found, showing that adding a mix of clove and cinnamon essential oils to the diet helped chickens use their feed more efficiently. Conversely, [19]. Demonstrated that incorporating a 200 mg/kg blend of oregano, clove, and anise oils into broiler diets improved daily weight increase. Furthermore, [8]. Discovered that clove oil (600 mg/kg) enhanced the ultimate body weight of broilers in comparison to both the control and antibiotic-treated groups. The outcomes by [20]. Substantiated that there was a substantial elevation in body weight gain among broiler chickens that were subjected to a dosage of 450 mg/kg of clove oil during the period extending from 23 to 42 days of age.

Moustafa et al. (2020) indicated that the supplementation of 100 mg/kg cinnamon and clove oils significantly enhanced the FCR in broiler chickens [21, 22]. Noted that carcass traits in Japanese quails fed a clove oil-enriched diet surpassed those of the control group. Nonetheless, some researchers did not see a beneficial impact on body weight gain or feed conversion with the use of essential oils or their primary constituents. [23, 24]. The outcomes of this study align with those reported by [25], indicating diminished growth performance in broiler chicks given elevated amounts of clove. The findings of this study contradict the assertions made by [26], who indicated that elevated amounts of clove powder reduced feed intake and perhaps influence palatability due to the effects of eugenol, which functions as an analgesic and thus reduces gastrointestinal motility. The inclusion of cloves over 2% apparently adversely impacted the performance of broiler chickens [27]. Ebrahiem (2021) reported no improvement in FCR [17]. Hussein et al. (2023) observed that broiler chicks administered varying concentrations of clove extract exhibited a greater feed intake in comparison to the controls [28]. The performance of chicks influenced up to 5 weeks of age in this experiment was influenced, showing that adding clove extract significantly ($P < 0.01$) enhanced feed intake and weight gain compared to both clove extract alone and the control treatment.

This outcome is not agreeable. According to [29, 30], the application of clove extract did not significantly impact the FCR of broilers in comparison to controls in the experimental treatments. The dressing, giblets, and some immune organ sizes were higher in the chicks given essential oil compared to the control group, but the amount of abdominal fat was lower in the essential oil-supplemented chicks than in the control. [28] In certain instances, it has been asserted that elevated dietary levels can reduce feed consumption, impede growth rates in chickens, and exhibit toxicological consequences [31]. Azadegan et al. (2014) could not find any substantial enhancement in carcass attributes for broilers administered a diet supplemented with clove oil [20]. In contrast, [32] reported a rise in the dressing percentage and breast weight of chickens that were fed cloves. The abdominal fat results from this study do not align with those of [33], which observed a significant ($P < 0.05$) reduction in abdominal fat content associated with a high amount of clove extract in the broiler diet. Conversely, [34] observed that the inclusion of clove oil in poultry diets did not influence carcass parameters.

Table 2: Productive performance of broiler chicks reared on various

Traits	cloves levels*				S.E.M	P. Value
	0.0%	0.1%	0.2%	0.3%		
LBW (kg)	1987.81 ^b	1991.83 ^b	2331.89 ^a	2389.32 ^a	0.060	0.001
BWG(g)	1945.09 ^b	1948.93 ^b	2289.0 ^a	2346.67 ^a	25.99	0.000
FI(kg)	4030	4010	4095	4090	0.490	0.287
FCR	2.07 ^a	2.05 ^a	1.78 ^b	1.75 ^b	0.020	0.000
Mortality %	2.11	2.05	2.15	2.37	0.490	0.288

^{A,B}Means with different superscripts within a row are significantly different ($P \leq 0.05$).

LBW (Live body weight), BWG (Body Weight gain), FI (Feed intake), FCR(feed conversion ratio).

Table 3: Carcass characteristics of broiler chicks reared on various

Traits	cloves levels*				S.E.M	P. Value
	0.0%	0.1%	0.2%	0.3%		
Carcass (g)	1635.18 ^b	1655.20 ^b	1825.65 ^a	1845.21 ^a	21.580	0.000
Carcass yield%	76.53	76.65	75.62	74.98	0.230	0.088
Giblets (%)	3.74	3.51	3.62	3.81	0.041	0.120
Edible parts (%)	79.10	79.05	79.00	78.97	0.210	0.122
Abdominal (%)	1.04	1.05	1.06	1.05	0.077	0.071
Spleen (%)	0.11	0.10	0.11	0.12	0.013	0.074
Bursa (%)	0.11	0.12	0.11	0.11	0.016	0.065

^{A,B}Means with different superscripts within a row are significantly different ($P \leq 0.05$).

4. Conclusion

A diet enriched with 0.2% and 0.3% clove powder significantly improved broiler performance. It can be concluded that clove powder at these levels acts as an effective natural growth promoter, enhancing health and boosting growth in broiler chickens.

5. Acknowledgements

The authors express their sincere gratitude to the Animal Production Department, Faculty of Agriculture, Zintan University, Libya, for providing the facilities and support required to conduct this study.

6. References

- [1]- Abou-Elkhair, R., H. Abdo Basha, W. Slouma Hamouda Abd El Naby, J. S. Ajarem, S. N. Maodaa, A. A. Allam, and M. A. E. Naiel. 2020. Effect of a diet supplemented with the Moringa oleifera seed powder on the performance, egg quality, and Gene expression in Japanese laying quail under heat-stress. *Ani mals* 10:809.
- [2]- Naiel, M. A. E., N. E. Ismael, S. S. Negm, M. S. Ayyat, and A. A. Al Sagheer. 2020. Rosemary Leaf Powder-Supplemented Diet Enhances Performance, Antioxidant Properties, Immune Status, and Resistance against Bacterial Diseases in Nile Tilapia (*Oreochromis niloticus*). *Aquaculture* 526:735370.
- [3]- Zhang, K.Y., Yan, F., Keen, C.A. and Waldroup, P.W. (2005). Evaluation of micro-encapsulated essential oils and organic acids in diets for broiler chickens. *International Journal of Poultry Science*, 4(9): 612-619.
- [4]- Kairalla, M. A., Alshelmani, M. I., & Aburas, A. A. (2022). Effect of diet supplemented with graded levels of garlic (*Allium sativum* L.) powder on growth performance, carcass characteristics, blood haematology, and biochemistry of broilers. *Open Veterinary Journal*, 12(5), 595-601.
- [5]- Kairalla, M. A., & Alshelmani, M. I. (2025). The influence of supplementation of licorice powder (*glycyrrhiza glabra*) to broiler diets on growth performance, haematological parameters and serum lipids. *Archives of Veterinary Medicine*, 18(1), 129-143.
- [6]- Kairalla, M. A., Aburas, A. A. & Alshelmani, M. I. 2022. Effect of diet supplemented with graded levels of ginger (*Zingiber officinale*) powder on growth performance, haematological parameters, and serum lipids of broiler chickens. *Archives of Razi Institute*, 77, 2077-2083.
- [7]- Kairalla, M. A., Alshelmani, M. I., and Imdakim, M. M. 2023. Effect of diet supplemented with different levels of moringa powder on growth performance, carcass characteristics, meat quality, haematological parameters, serum lipids, and economic efficiency of broiler chickens. *Archives of Razi Institute* 78:1421-1430.
- [8]- Mukhtar, M. A. 2011. The effect of dietary clove oil on broiler performance. *Aust. J. Basic Appl. Sci.* 5:49–51.
- [9]- Mustafa, D.B.M. (2016). Effect of mixture of three herbal essential oils on performance, carcass yield and blood serum constituents of broiler chicks. *MSC Thesis. Sudan University of Science and Technology, Khartoum, Sudan*.
- [10]- Hussein n, M. M., M. E. Abd El-Hack, S. A. Mahgoub, I. M. Saadeldin, and A. A. Swelum. 2019. Effects of clove (*Syzygium aromaticum*) oil on quail growth, carcass traits, blood components, meat quality, and intestinal microbiota. *Poult. Sci.* 98:319–329.
- [11]- National Research Council. National 1994. A academy of Science, Washington D. C, USA. Of Pimpine llaanisum. *Phytochemistry*, 48:455-460.
- [12]- Al-Kassie G.A.M. 2009. Influence of two plant extracts derived from thyme and cinnamon on broiler performance. *Pakistan Veterinary Journal*, 29, 169–173
- [13]-Tiihonen, K., Kettunen, H., Bento, M. H. L., Saarinen, M., Lahtinen, S., Ouwehand, A. C., and Schulze, H. (2010). The effect

- of feeding essential oils on broiler performance and gut microbial ecology. *British Poultry Science*, 51(3), 381-392.
- [14]- Arif, M., Rehman A., Naseer K., Abdel-Hafeez S.H., Alminderej F.M., El-Saadony M.T., Abd ElHack, M. E., Taha A.E., Ernest, S.S., Salem H.M. and Alagawany M. 2022. Effect of Aloe vera and clove powder supplementation on growth performance, carcass and blood chemistry of Japanese quails. *Poult. Sci.* 101:101702.
- [15]- Ibigbami D, Adegoke A, Odutayo O, Babalola B, Adebajo O.2024. Growth performance and serum antioxidant properties of broiler chickens to clove and cinnamon powder organic growth promoter. *Niger J Anim Prod.* 19:1457–1460
- [16]-Agositini, P.S., Sola-Oriol, D., Nofrarias, M., Barroeta, A.C., Gasa, J. and Manzanilla, E.G. (2012). Role of in-feed clove supplementation on growth performance, intestinal microbiology and morphology in broiler chickens. *Livestock Science*, 46: 157-165.
- [17]- Ebrahiem M.A (2021) Effect of Supplemented Graded Levels of Clove Extract on broiler chick performance. *J Anim Sci Livest Prod*, Vol: 5,No:4
- [18]- Isabel B. and Santos Y. 2009. Effects of dietary organic acids and essential oils on growth performance and carcass characteristics of broiler chickens. *J. Appl. Poult. Res.* 18:472–476 doi: 10.3382/japr.. 2008-00096
- [19]- Osman Nihat Ertas, Talat Guler, Mehmet Ciftci, Bestami Dalkilic and U. Gulcihan Simsek, 2005. The Effect of an Essential Oil Mix Derived from Oregano, Clove and Anise on Broiler Performance. *International Journal of Poultry Science*, 4: 879-884.
- [20]- Azadegan, Mehr.M.H.A., H. Nasiri Moghaddam and H. Kermanshahi, 2014. Supplementation of clove essential oils and probiotics to the broiler's diet on performance, carcass traits and blood components. *Iran J., Appl. Anim Sci.*, 4:117-22.
- [21]- Moustafa, N., Abeer Aziz, Ola Orma, M. Tarek, 2020. Effect of supplementation of broiler diets with essential oils on growth performance, antioxidant status, and general health. *Mansoura Veterinary Medical Journal*, 21(1): 14-20.
- [22]- Abd El-Hack, M. E., and M. Alagawany. 2015. Performance, egg quality, blood profile, immune function, and antioxidant enzyme activities in laying hens fed diets with thyme powder. *J. Ani. Feed Sci.* 24:127 133.
- [23]- Cross, D. E., McDevitt, R. M., Hillman, K., & Acamovic, T. (2007). The effect of herbs and their associated essential oils on performance, dietary digestibility and gut microflora in chickens from 7 to 28 days of age. *British Poultry Science*, 48(4), 496–506. <https://doi.org/10.1080/00071660701463221>
- [24]- Demir, E., Kilinc, K., Yildirim, Y., Dincer, F. and Eseceli, H. (2008) Comparative Effects of Mint, Sage, Thyme and Flavomycin in Wheat-Based Broiler Diets. *Archiva Zootechnica*, 11, 54-63.
- [25]- Mohammadi, Z., S. Ghazanfari, and M. A. Moradi. 2014. Effect of supplementing clove essential oil to the diet on microflora population, intestinal morphology, blood parameters and performance of broilers. *Eur. Poult. Sci.* 78:51.
- [26]-Daniel, A.N., Santoretto, S.M., Schmidt, G., Caparroz,-Assef, S.M., Bersani,-Amado, C.A. and Cuman, R.K. (2009). Anti-inflammatory and antinociceptive activities of eugenol essential oil in experimental animal models. *Revised Bras. Farmacogn-Braz. Journal Pharmacogn*, 19: 212-217.
- [27]- Al-Mufarrej I., Fazea E.H., Al-Baadani H.H. and Qaid M.M. 2019. Effects of clove powder supplementation on performance, blood biochemistry, and immune responses in broiler chickens. *South African Journal of Animal Science*, 49 (No. 5); 835-844
- [28]- Hussein EA, El-Kassas NE, Alderey AA. 2023. Effect of dietary supplementation of clove, peppermint, cinnamon oils, and their blends on growth performance, carcass characteristics, blood biochemical parameters and antioxidant status of broiler chicks. *Egypt J Anim Prod.* 60(1):33–41. doi10.21608/ejap.2023.180272.1052:
- [29]- Heba, S; Mahrous, A. H; El-Far, M. Sadek; Mervat, A. A. (2017). Effect of Different levels of clove Bud Dietary supplementation on Immunity, Antioxidant status, and performance in broiler chickens, *Alexandria Journal of VVeterinary Sciences, AJvs.*Vol 54(2):29-39.
- [30]-Weerasingha, A. S, and Atapattu, N. S. B.M. (2013). Effect of Fenugreek seed Powder on Growth performance, visceral organ weight, serum cholesterol levels and the nitrogen retention of broiler chicken, *Tropical Agricultural Research* Vol 24(3): 289-295.
- [31]- M. Y. Miah, M.S. Rahman, M.K. Islam and M.M. Monir, 2004. Effects of Saponin and L-Carnitine on the Performance and Reproductive Fitness of Male Broiler. *International Journal of Poultry Science*, 3: 530-533.
- [32]- Tariq, H., P. R. Rao, R. S. Raghuvanshi, B. Mondal, and S. Singh. 2015. Effect of Aloe vera and clove powder supplementation on carcass characteristics, composition and serum enzymes of Japanese quails. *Vet. World.* 8:664.
- [33]- Dalkiliç, B., and T. G€uler. 2009. The effects of clove extract supplementation on performance and digestibility of nutrients in broilers. *FUSag Bil Vet. Derg* 23:161 168.
- [34]- Chaudhary, S. K., J. J. Rokade, G. N. Aderao, A. Singh, M. Gopi, A. Mishra, and K. Raje. 2018. Saponin in poultry and monogastric animals: a review. *Int. J. Curr. Microbiol. Appl. Sci.* 7:3218–3225.