Damanhour Journal of Veterinary Sciences 4 (2), (2020) 7-10

Damanhour Journal of Veterinary Sciences

Journal homepage: https://djvs.journals.ekb.eg/

Impact of Phytogenic Feed Additive on Some Hatching Parameters of Broiler Breeders Eggs

Heba Basha[1], Mona Younis[2,*], Mahmoud Abo ghanima[2]

[1]Department of Animal Husbandry and Animal Wealth Development, Faculty of Veterinary Medicine, Alexandria University, Egypt
[2]Department of Animal Husbandry and Animal Wealth Development, Faculty of Veterinary Medicine, Damanhour University, Egypt

A B S T R A C T

This study was established to investigate the influence of phytogenic supplementation on fertility and hatchability percentages for Broiler breeder flock. A total of 500 females and 55 males Ross 308 broiler breeders were allotted into two groups; the first received one cm of Activo@ * (specific formulation of essential oils) per liter of drinking water for five successive days each month throughout the experimental period (six months of production), while the second was a control one. 64,320 eggs were used for investigating fertility and hatchability traits throughout three production stages; the first one extended from the 6th to the 13th week. The second was extended from the 14th to the 21st week and the third stages extended from the 22nd untill the 29th week of laying. Phytogenic supplementation significantly improved fertility and hatchability percentages (scientific and commercial) as well as the weight of hatched chick. Unhatched and culled percentages were significantly declined especially those of early stages of production. Meanwhile, there was non-significant influence on embryonic mortality, piped live and dead percentages. Supplementation of essential oils to broiler breeders flocks during early stages of production is recommended.

Keywords: Breeders, Phytogenics, Hatchability, Fertility, Embryonic mortality

1. Introduction

Production of healthy and safe chicken foods of high profitability is the main objective of poultry men. Improving feed conversion ratio used to increase production profit; this may be achieved through reducing the activity of digestive microbiota, which competing host for nutrients. Early investigations used in-feed antibiotic growth promoters (AGPs) to suppress sensitive intestinal bacteria and in turn improve chicken performance (Dibner and Richards, 2005; Dahiya et al., 2006 and Castanon, 2007). Whereas, prolonged use of antibiotics creates antimicrobial resistance, that has negatively affected consumer's health (Nue, 1992 and Rahmatnejad et al., 2009). Therefore, the recent scientific trend shifted to alternative, viable, safe and natural non-antibiotic growth promoters. Phytogenic is a group contains substances of plant origin used as feed additive to improve animal's growth performance. Some people used the term essential oil as a Phytogenic. However, they only show the plant-derived compounds category. Phytogenic feed additives are classified into four groups; sensory feed additives affect scenery/organoleptic properties of animal products and increase the palatability of commercial feed). Technological feed additive's antioxidants reduce the mycotoxin in animal feed). Zootechnical feed additives affect immunomodulation; improve digestion).

*Corresponding author:
E-mail address: mona.yonis@vetmed.dmu.edu.eg
Department of Animal Husbandry and Animal Wealth Development, Faculty of Veterinary Medicine, Damanhour University, Egypt

P ISSN: 2636-3003 EISSN: 2636-2996
Received: June 21, 2020; Received in revised form: July 1, 2020; accepted: July 7, 2020.

Promoting the growth from the nonmicrobial origin (improve the quality or performance of animal products, etc.) Singh and Gaikwad, 2020. Biochemical analysis of PFAs showed that these extracts are rich in beneficial biomolecules such as anethole, allicin, allyl-isothiocyanate, cineole, carvacrol, capsaicin, linalool, piperine, and thymol, which improved poultry performance Windisch et al., 2008; Yang et al., 2009; Applegate et al., 2010; Hippenstiel et al., 2011; Puvaca et al., 2013).

Garlic (Allium sativum), thyme (Thymus vulgarus) and cornflower (Echinacea purpurea) have recently been reported to exert a wide range of beneficial effects on the production performance (weight gain, feed conversion, egg production and quality) of broilers and laying hens (Aji et al., 2011; Rahimi et al., 2011; Khan et al., 2012). Ather, (2000) found that supplementation of essential oils to the breeder hens increased egg productivity. Moreover, Alcicek et al., 2003; Cabuk et al., 2006 found out the improvement of laying quality performance and egg production in laying hens after addition of essential oils as feed supplements. Positive effect of dietary essential oils mixture on the strength of egg shell of quail breeders was reported by Olgun and Yildiz, (2014). However, limited reports have documented the effect of phytogenic feed additive on the hatchability performance of breeder's egg in the hatchery. So, this study is tried to investigate the effect of phytogenic feed additive on fertility and hatchability for breeder stock throughout six months of production.

2. Material and methods

A total of 64,320 eggs breeder broilers Ross 308 (500 breeder females and 55 males) were used in this study. The flock was a private farm belongs to a commercial company in Egypt. The flock was reared according to the brochure of the breed and its guidelines either in growing or laying periods. The data was taken after kind agreement of the authorized manager.

2.1. Flock Management:

House floor was 60% slate at the center and 40% deep litter at both sides. Nest boxes were at the slate portion. Egg collection was done at least three times per day. Sex ratio was 9-10 males / 100 females, starting at 21 weeks of age by mixing half of the total number of required males (those that are the most mature), then the second most mature quarter was mixed again, a week later the last quarter was introduced into the flock.

At 5% egg production, feed was changed from grower to breeder laying commercial ration (11.43 ME (MJ/kg), 17% crude protein, 4% crude fiber, 3.5% Calcium). In addition challenged feeding program was practiced to satisfy peak production from feed requirements. Separate sex feeding system was done; female feeding system have grills fitted to prevent accessing of males to their feed, on the other hand male feeding was raised to a height to prevent females to access them. Clean good-quality water was allowed to the flock by Ad libitum access to a nipple drinkers system (9-10bird per nipple). The breeder house was tightly closed, and the light intensity and day length were increased at the laying period to reach 3 – 6 foot-candle (intensity) and 15-hours day length to match the reference standard of the breed requirements. A continuous monitoring for males and females was done (body weights, egg number and egg weights matched with the breed reference).

2.2. Experimental design

The house was divided into two equal parts using wire welded net 5x10 cm. All equipment (especially water lines and their separate tank) and birds (either males or females) were divided in order to allocate two groups of birds; the first one was received 1cm of Activo@ * (specific formulation of essential oils Table 1) per liter of drinking water for successive five days each month for six months experimental period of production, while the second group was received no thing in drinking water as a control one. A total of 64,320 eggs of Ross breeder broiler breed were used in this study; 1340 eggs were incubated once every three days of collection (670 eggs per group) and divided into 5 replicates per hatch per month per group (134 eggs per replicate) throughout the experimental period of 48 hatches started in June until November.

2.3. Incubation and hatching

Eggs were stored only for three days at 18□C with relative humidity (RH %) of 75%. All strict measurements of hatchery cleaning and disinfection were done using Vericon S@ by 10ml per litter of water for disinfection of all hatchery equipment and spraying eggs. Moreover, formaldehyde gas fumigation was used for eggs disinfection (Mixing of 40 ml formalin 40% and 20 g Potassium permanganate, KMNO4) / m3 of cabinet area for about 20 minutes then the gas expelled). Six setters were used for egg incubation throughout the experimental period. Eggs were set vertically with broad end up in the setting trays according to their treatment groups. The temperature was adjusted at 37.5oC and RH % was 60-65%. Eggs were turned automatically every an hour daily until the 18th day of incubation with turning angle was ±45 degree from vertical position. The eggs were transferred to the hatcher at the last three days (18th day of incubation) in chick boxes corresponding to each group of treatment. On hatching day; the chicks were removed to the brooding house while non-hatched eggs were broken and examined for fertility, hatchability and mortality percentages.

2.4. Studied traits

Fertility and hatchability traits were measured on 64,320 Ross 308 breeders' eggs throughout three production stages; the first stage extended from 6th to 13th weeks of production, the second stage from 14th to 21st weeks of production and third stage extended from 22nd till 29th weeks of production.

The measured traits were: Fertility percentage (No. of fertile eggs/Total number of eggs set)*100; Scientific hatchability percentage (No. of hatched eggs/Total number of fertile eggs)*100 and commercial hatchability percentage (No. of hatched eggs/Total number of eggs set)*100. Moreover, clear eggs percentage; embryonic mortalities (early embryonic mortality from zero to seven days of incubation, mid embryonic mortality from eighth to 14th day of incubation and late embryonic mortality from 15th to 21st days of incubation) and piped live and piped dead embryos were measured on more than 15,000 non hatched eggs in addition to culled chicks' percentage.

2.5. Statistical analysis

Data were analysed using SAS software (SAS, 2009).

The effect of treatment on the hatchability parameters were analysed using GLM. According to the following statistical model

$Xij = \mu + Ti + Pk + eikj$

Where:

Xij = Variable measured

μ = Overall mean

Ti = Effect of treatment i

Pk= Effect of period k

eikj = Random error

The results were expressed as means ± SE and $p \leq 0.05$ was considered to be significant.

3. Results

3.1.First production stage (6th:13th weeks)

Inclusion of Activo@ in the drinking water of Ross 308 breeders at the period of the 6th to 13th weeks of egg production had significantly decreased un hatched eggs percentage either as clear eggs or dead embryo percentages. Moreover, within un hatched eggs, percentage of clear eggs was higher than percentage of dead embryos in both treated and control treatments (Table 2). On the other hand, fertility, scientific and commercial hatchability percentages of Ross 308 breeder flock drank water treated with Activo@ revealed non-significant slight effect in comparison to control breeders.

Although Activo@ supplementation during this production period had no significant effect on embryonic mortality percentages (early, mid, late and total), piped (live and dead), culled chicks percentages as well as chick weight ($p<0.05$) (Table 3).

3.2.Second production stage (14th:21st weeks)

The results clarify that eggs obtained from Ross 308 breeder hens treated by Activo@ had significantly higher fertility and scientific hatchability percentages at 14th: 21st weeks of egg production (87.48 and 87.45) compared to those hatched from control hens (83.49 and 85.87). Although, differences between breeder groups drank Activo and control groups for scientific hatchability and hatched chick weight were not significant, activo treated groups reported numerically higher values. On contrary, dead embryos and clear eggs percentages from treated breeders showed significant decrease and dead embryos percentage was higher than clear eggs percentage in either treated or control groups.

Moreover, culled chick percentage significantly ($p<0.05$) decreased from Activo@ received breeder hens groups compared to control groups, (Table 3).

3.3. Third production stage (22nd: 29th weeks)

Hatched Chick weight, scientific and commercial hatchability percentages increased significantly ($p<0.05$) for the eggs hatched from Ross 308 breeders treated by Activo@ at the late period of egg production (Table 2). All other estimated parameters during this production period were better for Activo@ treated groups compared to control but with no significant differences.

3.4. Overall production Period (6th:29th weeks)

Generally, inclusion of Activo@ to drinking water improved hatching performance of the Ross 308 breeder eggs. Where fertility, scientific hatchability, commercial hatchability, unhatched, clear egg percentages as well as chick weight changed significantly ($p<0.05$) for eggs laid from breeder hens drank treated water by Activo@. These results are in contrast to embryonic mortality (Early, mid, late and total), piped (live and dead), and culled percentages, which reported non-significant variation between treated and control hatched eggs.

Figure 1 (A and B) showed the average monthly scientific and commercial hatchability percentages obtained from eggs hatched from Ross 308 breeder flock drank Activo @ group (treated) in comparison to control group during the production period. The trends of these curves clearly demonstrate that the scientific and commercial hatchability percentages for treated breeders exceeded the hatchability of control eggs. In treated eggs the trend of scientific hatchability percentage remained relatively constant around 80% the same as commercial hatchability percentage for the same group at the fifth month. On the other hand, the trends of scientific and commercial hatchability percentages in a control group at the 5th month were abruptly declined from about 81% to 77% and 65% to 57%, respectively.

Table (1) Ingredients and composition of Activo@

Activo@ ingredients	Percentage
Crude protein	0.00%
Crude fat	1.20
Crude fiber	0.00%
Crude ash	0.20%
Sodium	0.10%,
Methionine	0.00%
Lysine	0.00%
Moisture	67.40%

Composition per 1000 ml Oregano oil (origanum vulgar(2b))carvacrol>58.2g)97g, cinnamon oil (cinnamomum zeylanicum(2b))(cinnamaldehyde>>1.65g)3g, citric acid (e330)150g, pectin 44g, sodium chloride 2g, destilled water up to 1000ml

Table (2): Means ± SE for fertility, hatchability percentages, hatching weight (gm) as well as percentages unhatched eggs (dead embryos, clear) from Ross 308 breeder flock (drank Activo @ (treated) versus control group) during different production periods.

Items		Production period (week) 6 - 13 Control	6 - 13 Treated	14 - 21 Control	14 - 21 Treated	22 - 29 Control	22 - 29 Treated	Total (6 – 29) Control	Total (6 – 29) Treated
Fertility (%)		91.78±0.87[b]	94.27±0.86[a]	83.49±0.81[b]	87.48±0.82[a]	76.56±0.94	78.62±0.93	84.25±0.76[b]	87.17±0.76[a]
Hatchability (%)	Scientific	88.23±0.94	89.48±0.93	85.87±0.87[b]	87.45±0.88[a]	78.91±1.01[b]	82.28±0.99[a]	84.66±0.62[b]	86.62±0.62[a]
	Commercial	80.98±1.23	84.38±1.22	71.92±1.14	76.58±1.16	60.38±1.33[b]	64.79±1.31[a]	71.62±1.03[b]	75.76±1.02[a]
Chick weight (gm)		110.05±1.81	114.34±1.79	110.05±1.81	114.34±1.79	94.93±1.68[b]	101.1±1.70[a]	96.56±1.45[b]	101.5±1.44[a]
Unhatched (%)	Dead embryo	8.22±0.87[a]	5.74±0.86[b]	28.08±1.11[a]	23.41±1.13[b]	38.75±1.30	35.22±1.28	28.13±1.00[a]	24.21±1.00[b]
	Clear eggs	19.03±1.2[a]	15.54±1.18[b]	16.51±0.87[a]	12.52±0.82[b]	23.44±0.94	38.62±0.93	15.75±0.76[a]	12.83±0.75[b]

Means within the same raw carry different superscripts for each period are significantly different ($P \leq 0.05$)

Table (3): Means ± SE for Mortality, culled %, piped % of eggs from Ross 308 breeder flock drank Activo @ group (treated) versus control group during different periods of egg production.

Items		Production period (Week) 6 - 13 Control	6 - 13 Treated	14 - 21 Control	14 - 21 Treated	22 - 29 Control	22 - 29 Treated	Total (6 – 29) Control	Total (6 – 29) Treated
Mortality (%)	Early	3.40±0.31	3.17±0.30	3.7±0.28	3.68±0.29	3.56±0.33	2.9±0.32	3.56±0.18	3.28±0.18
	Mid	3.13±0.20	2.77±0.22	2.77±0.19	2.42±0.19	1.7±0.22	1.69±0.21	2.58±0.12	2.32±0.12
	Late	3.3±0.33	2.95±0.33	2.8±0.31	2.76±0.31	5.89±0.36	5.62±0.35	3.85±0.23	3.66±0.23
	Total	10.81+0.68	9.87+0.67	11.58+0.63	10.90+0.64	15.30+0.73	13.84+0.72	12.39+0.42	11.41+0.42
Culled %		0.14±0.09	0.12±0.09	0.42±0.09[a]	0.31±0.09[b]	0.60±0.11	0.58±0.12	0.38±0.06	0.32±0.06
Piped (%)	Live	0.32±0.07	0.28±0.07	0.23±0.07	0.18±0.07	0.37±0.08	0.36±0.08	0.3±0.04	0.26±0.04
	Dead	0.18±0.09	0.25±0.09	0.3±0.08	0.31±0.08	0.46±0.09	0.71±0.09	0.31±0.05	0.41±0.05

Means within the same raw carry different superscripts for each period are significantly different ($P \leq 0.05$)

Fig A

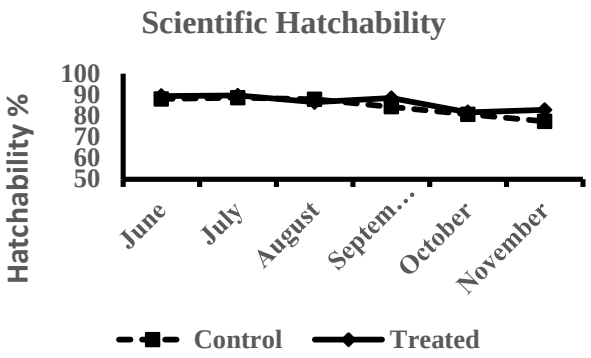
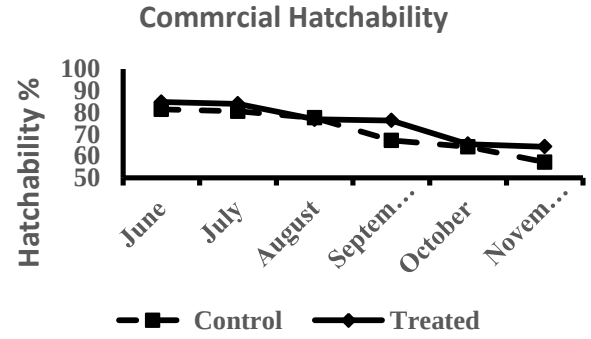


Fig B



4. Discussion

Unfortunately, the scientific investigation covered the effect of inclusion of essential oils on the breeder hatching quality are still lacked. Previous studies assessed the impact of dietary supplementation of essential oils on hen's laying performance and egg quality. Olgun, 2016 stated that dietary supplementation of essential oils upgraded the egg quality parameters of laying hens. Additionally, Ding et al., 2017 reported that inclusions of essential oils in layers diet improved HDEP and FCR at 21-25 weeks of age. Furthermore, Supplementation of a diet with essential oils improved feed efficiency of the broiler breeders who in turn resulted in better average egg production (Ather, 2000). Liu–Fengtlua et al., 1998 demonstrated that addition of essential oils to layer's feed alleviated the hazard effects of heat stress on egg production.

This trial tried to discuss a detailed view about the effect of essential oils supplementation in drinking water during the production period of broiler breeders on the hatching quality throughout six months of egg production. The results showed that inclusion of essential oils in the diet of breeders Ross 308 showed significant increase of the percentages of fertility, scientific and commercial hatchability. These results are compatible with Bozkurt et al., (2009) who argued by supplementation of essential oils in the broiler breeder diet improve fertility and hatchability. However, Olgun and Yıldız, 2014 suggested that addition of different concentration of essential oils to quail feed during 60 days of egg production did not improve egg fertility or hatchability percentages. Moreover, the reported percentages of the embryonic mortality (early, mid and late) maintained with no significant change during the experiment period. Botsoglou et al., (2005) stated that the diet of layer supplemented with mixture of essential oils didn't affect either on the egg production or the feed efficiency significantly. On the other hand, the results of this study showed that supplementation breeder flock by essential oils produce heaviest chick weights the same like Bozkurt et al., (2009) who reported that gradual increase of the dietary dose of essential oils in broiler breeders positively affected on chick weight. These benefits of dietary essential oil supplementation could be attributed to various modes of action from the essential oils that have been shown in earlier broiler and layer case studies, such as antimicrobial, enzymatic, antioxidative, and immune

stimulator effects (Ultee et al., 2002; Jamroz et al., 2003; Basmacioğlu et al., 2004; Botsoglou et al., 2005).

5. Conclusion

The results from this study concluded that the addition of essential oils as phytogenic additives to drinking water of broiler breeders positively affects fertility and hatchability parameters, especially during early stages of production, although it does not affect mortality percentage significantly, further studies are required to explore the definite mechanism of essential oils on hatching parameters of breeder broiler eggs.

6. References

Aji, S. B., Ignatuius, K., Ado, A. Y., Nuhu, J. B., Abdulkarim, A., 2011. Effect of feeding onion (Allium cepa) and garlic (Allium sativum) on some performance characteristics of broiler chickens. RJPS., 4, 22−27.

Alcicek, A., Bozkurt, M., Cabuk, M., 2003. The effect of essential oil combination derived from selected herbs growing wild in turkey on broiler performance. S. Afr. J. Anim. Sci., 33, 89-94.

Applegate, T. J., Klose, V., Steine,r T., Ganner, A., Schatzmayer, G., 2010. Probiotics and phytogenics for poultry: myth or reality? J. Appl. Poul. Res., 19, 194–210.

Ather, M. A. M., 2000. Polyherbal additive proves effective against vertical transmission of IBD World Poult., 16, 50-52.

Basmacioğlu, H., Tokuşoğlu, O., Ergul, M., 2004. The effect of oregano and rosemary essential oils or α-tocopheryl acetate on performance and lipid oxidation of meat enriched with n-3 PUFA's in broilers. S. Afr. J. Anim. Sci., 34, 197–210.

Botsoglou, N. A., Florou-Panerim P., Botsoglou, E., Datos, V., Giannenas, I., Koidis, A., Mitrakos, P., 2005. The effect of feeding rosemary, oregano, saffron and α-tocopheryl acetate on hen performance and oxidative stability of eggs. S. Afr. J. Anim. Sci., 35, 143-151.

Bozkurt, M., Alçiçek, A., Çabuk, M., Küçükyilmaz, K., Çatli, A. U., 2009. Effect of an herbal essential oil mixture on growth, laying traits, and egg hatching characteristics of broiler breeders. Poult. Sci. J., 11, 2368-74

Cabuk, M., Bozkurt, M., Alcicek, A., Akbas, Y., Kucukyilmaz, Y.. 2006. Effect of a herbal essential oil mixture on growth and internal organ weight of broilers from young and old breeder flocks. South Afr. J. Anim. Sci., 36 (2), 135 – 141

Castanon, J. I. R., 2007. History of the use of antibiotic as growth promoters in European poultry feeds. Poult. Sci., 86, 2466–2471.

Dahiya, J. P., Wilkie, D. C., Van Kessel, A. G., Drew, M. D., 2006. Potential strategies for controlling necrotic enteritis in broiler chickens in post-antibiotic era. Anim. Feed Sci. Technol., 129, 60–88.

Dibner, J. J., Richards, J. D., 2005. Antibiotic growth promoters in agriculture: history and mode of action. Poult Sci., 84,634–43.

Ding, X., Yu, Y., Su, Z., Zhang, K., 2017. .Effects of essential oils on performance, egg quality, nutrient digestibility and yolk fatty acid profile in laying hens. Anim. Nutri., 3 ,127-131

Hippenstiel, F., Abdel-Wareth, A. A. A., Kehraus, S., Sudekum, K. H., 2011. Effects of selected herbs and essential oils, and their active components on feed intake and performance of broilers – a review. Archivfür Geflügelkunde, 75, 226–234.

Jamroz, D., Orda, J., Kamel, C., Wiliczkiewicz, A., Wertelecki, T., Skorupinska, J., 2003. The influence of phytogenic extracts on performance, nutrient digestibility, carcass characteristics, and gut microbial status in broiler chickens. J. Anim. Feed Sci., 12,583–596.

Khan, R. U., Nikousefat, Z., Tufarelli, V., Naz, S., Javdani, M., Laudadio, V., 2012. Garlic (Allium sativum) supplementation in poultry diets; Effect on production and physiology. WORLD POULTRY SCI J., 68, 417−424.

Liu–Fengtlua, Xıe–Zhon Quon, Sun–Chao Long, Qian–Zhi Pıng, Li–Chun Hua., 1998. Study of anti–heat stress effect of some Chinese medicinal herbs. Chin. J. Ani. Sci., 34, 28–30

Neu, H. C. 1992. The crisis in antibiotic resistance. Science, 257, 1064-1073.

Olgun, O., Yildiz, A., 2014. Effect of dietary supplementation of essential oils mixture on performance, eggshell quality, hatchability, and mineral excretion in quail breeders. Environ. Sci. Pollut. Res., 21, 13434–13439.

Olgun, O., 2016. The effect of dietary essential oil mixture supplementation on performance, egg quality and bone characteristics in laying hens. Ann Anim Sci., 16, 1115–1125.

Puvaca, N., Stanacev, V., Glamocic, D., Levic, J., Peric, L., Stanacev, V., 2013. Beneficial effects of phytoadditives in broiler nutrition. World Poultry Sci. J., 6, 27–34.

Rahmatnejad, E., Roshanfekr, H., Ashayerizadeh, O., Mamooee, M., Ashayerizadeh, A. , 2009. Evaluation the effect of several non-antibiotic additives on growth performance of broiler chickens. J. Anim. Vet. Adv., 8(9), 1757-1760.

Rahimi. S., Zadeh, T., Karimi, M. A., Omidbaigi, R., Rokni, H., 2011. Effect of the three herbal extracts on growth performance, immune system, blood factors and intestinal selected bacterial population in broiler chickens. J. Agr. Sci. Tech-Iran., 13, 527−539.

SAS 2009. Statistical Analysis System. User's Guide Statistics. SAS Institute Cary, North Carolina.

Singh, J., Gaikwad, D. S., 2020. Phytogenic Feed Additives in Animal Nutrition. Natural Bioactive Products in Sustainable Agriculture, Springer, Singapore, 273-289.

Ultee, A. E., Kets, P. W., Smid, E. J., 2002. Mechanisms of action of carvacrol on the food borne pathogen Bacillus cereus. Appl. Environ. Microbiol., 65, 4606–4610.

Windisch, W. M., Schedle, K., Plitzner, C., Kroismayr, A., 2008. Use of phytogenic products as feed additives for swine and poultry. J. Anim. Sci., 86, 140–148.

Yang, Y., Iji, P. A., Choct, M., 2009. Dietary modulation of gut microflora in broiler chickens: a review of the role of six kinds of alternatives to in-feed antibiotics. World poultry sci. j., 65, 97–114.