

Original Research Article

<https://doi.org/10.20546/ijcmas.2019.803.219>

Effect of Dietary Supplementation of Ginger and Cinnamon on Growth Performance and Economics of Broiler Production

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ABSTRACT

The 140 day old 'Vencob-400' chicks, which were divided into seven treatment groups with four replicates per group (Five chicks per replicate) i.e. 20 chicks per treatment groups. Dietary treatments consisted of basal diet T₀ (Control), T₁, T₂ and T₃ with T₄, T₅ and T₆ consist of 1, 2 and 3 per cent cinnamon while 1, 2 and 3 per cent ginger, respectively. Body weight and feed consumption were recorded at weekly interval. Feed conversion ratio, dressing percentage, economics of broiler production were calculated. Cinnamon and ginger feeding were done separately and compared by completely randomized design (CRD). The body weight of the 2.0% (T₂) cinnamon and 1% ginger (T₄) group was significantly (P<0.05) higher than the other groups. The average feed consumption was significantly highest (3966.85 g/b) in control group and lowest (3793.30 ± 05.94 g/b) in 2.0% cinnamon (T₂) supplemented group. No mortality was observed entire experiment. Highest profit per bird was observed in T₄ (Rs. 24.17) followed by T₂ (21.15), T₁ (18.27) and other treatments while lowest in T₃ (8.47). Similarly highest cost benefit ratio was found in T₄ supplemented with 1% ginger powder followed by T₂, T₁, T₅, T₀, T₃ and T₆. From the result of present study it was concluded that dietary inclusion of 2.0 % cinnamon and 1.0 % ginger can be used as growth promoters for more profit per bird.

Keywords

Broiler, Cinnamon, Ginger, Supplementation, Production, Economics

Article Info

Accepted:
15 February 2019
Available Online:
10 March 2019

Introduction

India is the fourth-largest chicken producer in the world after China, Brazil and the USA. The consumption of chicken meat in India increased from 400 g. per annum, to 2.5 kg per annum in the last five years (Poultry Sector, 2017). Poultry ration (feed) is important and major component of poultry farming, because of 80% cost only for procurement of feed

(Asghar *et al.*, 2003). In the past, antibiotics were the most routinely used feed additives in poultry ration. Antibiotics is not only limited but their use in livestock and poultry industry also have been banned in many countries due to the reasons like alteration of natural gut microbiota and drug resistance As a result, to replace them without affecting the performance of poultry birds, natural growth promoters such as prebiotics, probiotics,

synbiotics, enzymes, plant extracts and natural medicinal products etc., can be used in poultry ration (Borazjanizadeh *et al.*, 2011).

Ginger and cinnamon are natural growth promoters and can be potential alternatives for common artificial growth promoters like antibiotics (Demir *et al.*, 2003). Ginger is the rhizome of the plant *Zingiber officinale*, consumed as a delicacy, medicine or spice. Preliminary research indicates that nine compounds found in ginger may bind to serotonin receptors which may influence gastrointestinal function. Research conducted *in-vitro* shows that ginger extract might control the quantity of free radicals and the peroxidation of lipids (Al-Amin *et al.*, 2006) and have anti-diabetic properties (Morakinyo *et al.*, 2011).

Cinnamon (*Cinnamomum cassia*) commonly known as “dalchini” is important medicinal plants and widely used in India. It belongs to the Lauracea family and is native of Sri Lanka and South India (Jakheta *et al.*, 2010). Cinnamons possess appetite and digestion stimulant properties (Taback *et al.*, 1999). Many essential oils have been extracted from the cinnamon like cinnamic acid, cinnamaldehyde, cinnamate, caryophyllene oxide, eugenol and L-borneol (Tung *et al.*, 2008). Cinnamaldehyde having antibacterial (Chang *et al.*, 2001), antioxidant properties (Singh *et al.*, 2007) and other medicinal properties like antiulcer, anti-diabetic, anti-inflammatory which have recently been reviewed by Jakheta *et al.*, (2010). Considerable attention has been paid to the role of nutritional manipulation in minimizing the total feed cost of production, increasing weights, dressing percentage, feed conversion and economics of broiler production. Keeping the above information in view, the present study was conducted on broilers with the following objectives, i) Study the effect of ginger and cinnamon supplementation on feed

intake and feed conservation ratio in broilers.
ii) Study the growth performance of broilers.
iii) Study the economics of broiler production.

Materials and Methods

The trial was conducted on 140 day old, Vencobb-400 broiler chicks at Poultry Unit, Veterinary Polyclinic and AI Center MPKV, Rahuri-413 722, Dist. Ahmednagar, Maharashtra. The cinnamon and ginger powder was procured from local market. The 140 birds were divided in to 7 treatment group with four replicates of 5 chicks each and housed under deep litter system. The T₀ birds were fed on a basal ration (Control), T₁ Basal ration + 1 % Cinnamon (i.e. 10 g/ kg of feed), T₂ Basal ration + 2 % Cinnamon powder (i.e. 20 g/kg of feed), T₃ Basal ration + 3 % Cinnamon powder (i.e. 30 g/kg of feed), T₄ Basal ration + 1 % Ginger powder (i.e. 10 g/kg of feed), T₅ Basal ration + 2 % Ginger powder (i.e. 20 g/kg of feed) and T₆ Basal ration + 3 % Ginger powder (i.e. 30 g/kg of feed). Immediately arrival of chicks were weighed and distributed randomly in to 7 treatment groups viz, T₀, T₁, T₂ and T₃, T₄, T₅ and T₆ with 20 chicks in each group, on body weight basis.

Body weight and feed consumption were recorded at weekly interval up to 6th weeks of age. Feed conversion efficiency was estimated as quantity (kg) of feed consumed for every kg gain in body weight. Performance efficiency (%) was calculated as the ratio of body weight (kg) and feed conversion efficiency (kg), multiplied by 100. At the end of trial, three birds from each group were randomly selected and slaughtered for estimating dressing percentage. The economics of broiler production was worked out by considering the total cost of production which included the feed cost, chicks, labour, medicines, vaccines and the overhead costs. Proximate composition of broiler ration and feed

additives analysis was carried out as per the method given in A.O.A.C., 2005. The data were analyzed by standard statistical techniques (Snedecor and Cochran, 1994).

Results and Discussion

The data pertaining to growth performance and allied traits as influenced by dietary cinnamon and ginger supplementation in broiler chickens are elucidated here under.

Chemical composition of experimental feed ingredients (%DM basis)

The experimental feeds viz. broiler starter and finisher which were supplemented with cinnamon and ginger powder as per treatment details. The proximate composition of the rations is presented in Table 1.

Starter ration

The crude protein, crude fiber, ether extract, total ash, nitrogen free extract and acid insoluble ash of starter ration were 23.00, 4.60, 4.80, 7.20, 60.40 and 1.25 per cent respectively and calculated metabolizable energy (ME) of the diet was 2863.811 Kcal/kg.

Finisher ration

The crude protein, crude fiber, ether extract, total ash, nitrogen free extract and acid insoluble ash of finisher ration were 20.00, 3.78, 4.30, 6.85, 65.15 and 1.44 per cent respectively and calculated metabolizable energy (ME) of the diet was 2939.75 Kcal/kg.

Proximate composition of feed additives

Composition of Ginger powder observed in the present investigation was in agreement with Najafi and Taherpour *et al.*, (2014) who reported that composition of ginger was 91.00, 10.20, 18.30, 3.20, 4.90 and 54.60 per cent of

dry matter, crude protein, crude fiber, ether extract, ash and nitrogen free extract, respectively. Composition of cinnamon powder observed in the present investigation was similar to that reported by Najafi and Taherpour *et al.*, (2014) as 92.50, 4.10, 45.30, 1.70, 4.40 and 37.00 per cent of dry matter, crude protein, crude fiber, ether extract, ash and nitrogen free extract, respectively. Ademola, *et al.*, (2009) reported that composition of ginger was 87.39, 1.35, 5.85, 2.93, 2.29 and 87.58 per cent of dry matter, ether extract, crude protein, crude fiber, ash and nitrogen free extract, respectively.

Body weight changes (g)

The data on body weight is presented in Table 2, which indicate the highest live weight (g) was obtained in T₂ (2408.5 ± 22) followed by T₄ (2376.75 ± 25.26), T₅ (2326.20 ± 24.13), T₆ (2300.4 ± 25.81), T₁ (2300.08 ± 23.19), T₃ (2290.05 ± 26.89) and T₀ (2169.05 ± 11.18) treatments. The zero days average live weights of each treatment were comparable. The final body weight of birds was significantly (P≤0.05) higher in all supplemented treatment groups in comparison to control. This result was in line with the finding of Sang-oh *et al.*, (2013) who reported that, the body weight of the cinnamon powder groups were increased significantly (P<0.05) when compared to the control group. Farinu *et al.*, (2004) also reported that supplementation of ginger at the levels of 5, 10, or 15 g/kg of feed slightly improved growth in broilers. In constant, El-Deek *et al.*, (2002) observed that a diet containing ginger at the rate of 1 g/kg of feed did not affect growth performance.

Body weight gain (g)

The data on body weight (Table 3) that average gain in body weight in treatment T₄ (633.60 ± 32.53 g) group was significantly (P≤0.05) higher over other treatments. Then followed by T₆ (563.90 ± 27.00 g), T₃ (542.45

± 33.00 g), T₂ (501.85 ± 32.06, T₀ (499.18 ± 18.51 g), T₁ (476.98 ± 25.56 and T₅ (476.70 ± 25.23). Sang *et al.*, (2013) who concluded that cinnamon treated birds had higher body weight gain. Najafi and Taherpour (2014) showed the dietary ginger inclusion leads to significantly (P<0.05) higher body weight gain.

Cumulative feed consumption (g)

The cumulative feed intake (Table 5) was significantly (P≤0.05) improved from 21st day of age. It was evident from the table that average feed consumption vary significantly (P≤0.05) from control group. However, it was observed that either the cinnamon or ginger powder supplementation from 1, 2 and 3 %, in both the supplements the feed intake was significantly less at 2.0% (T₂ and T₅). Present findings were in agreement with, Arshad *et al.*, (2012) who concluded that addition of ginger extract in poultry diet reduced the feed intake. Barazesh *et al.*, (2013) reported that

the effect of herb ginger powder on increasing levels of dietary herb ginger powder caused a significant reduction in feed consumption.

Feed efficiency

It was evident from the table 5 that treatment T₀ (1.87 ± 0.01) showed lowest feed efficiency level whereas, T₄ (1.65 ± 0.02) showed the highest. Data in table 5 indicated that supplementation of 1.0% ginger powder in broilers diet was significantly superior to rest of the treatments. The findings of present study were in accordance with results reported by Kausar *et al.*, (1999) and Moorthy *et al.*, (2009), Najafi and Taherpour (2014).

Dressing percentage

The average dressing percentage (Table 4) among the different treatments groups varied between 77.04 ± 0.02 to 78.69 ± 0.08 per cent. The differences among all the treatment groups were found significant (P≤0.05).

Table.1 Per cent chemical composition of experimental broiler ration on dry matter basis

Nutrients	Broiler ration	
	Starter	Finisher
Crude protein	23.00	20.00
Crude fiber	4.60	3.78
Ether extract	4.80	4.30
Total ash	7.20	6.85
Nitrogen free extract	60.40	65.15
Acid insoluble ash	1.25	1.44
ME (Kcal/kg)	2863.811	2939.75

Table.2 Proximate composition (%) of experimental feed additives on dry matter basis

Plant Products	DM	CP	CF	EE	Ash	NFE
Ginger	89.00	9.20	17.30	3.00	4.10	66.40
Cinnamon	91.50	3.90	45.20	1.80	4.30	44.80

Table.3 Broilers traits in different groups of chicks up to 6th weeks of age

Treat	Body Weight	Weight Gain	Feed Intake	FCR
T₀	2169.05 ^a ± 11.18	499.18 ^a ± 18.51	3966.85 ^c ± 15.01	1.87 ^c ± 0.01
T₁	2300.08 ^b ± 23.19	476.98 ^a ± 25.56	3849.05 ^b ± 13.33	1.75 ^{ab} ± 0.02
T₂	2408.50 ^d ± 22.00	501.85 ^a ± 32.06	3793.30 ^a ± 05.94	1.71 ^b ± 0.04
T₃	2290.05 ^b ± 26.89	542.45 ^a ± 33.00	3804.40 ^a ± 05.64	1.72 ^{ab} ± 0.02
T₄	2376.75 ^{cd} ± 25.26	633.60 ^b ± 32.53	3842.45 ^b ± 10.25	1.65 ^a ± 0.02
T₅	2326.20 ^{bc} ± 24.13	476.70 ^a ± 25.23	3809.35 ^a ± 09.74	1.67 ^a ± 0.02
T₆	2300.40 ^b ± 25.81	563.90 ^{ab} ± 27.00	3860.10 ^b ± 11.44	1.72 ^{ab} ± 0.02
Mean	2310.15 ± 23.16	527.81 ± 28.12	3846.50 ± 10.70	1.72 ± 0.02

Values bearing different superscripts in column differ significantly (P≤0.05)

Table.4 Effect of supplementation cinnamon and ginger on dressing percentage (without skin)

Treatment	Mean Dressing Percentage
T₀	77.04 ± 0.02 ^a
T₁	78.36 ± 0.39 ^d
T₂	78.66 ± 0.17 ^{cd}
T₃	77.40 ± 0.09 ^{ab}
T₄	78.69 ± 0.08 ^c
T₅	78.12 ± 0.01 ^d
T₆	77.90 ± 0.04 ^{bc}

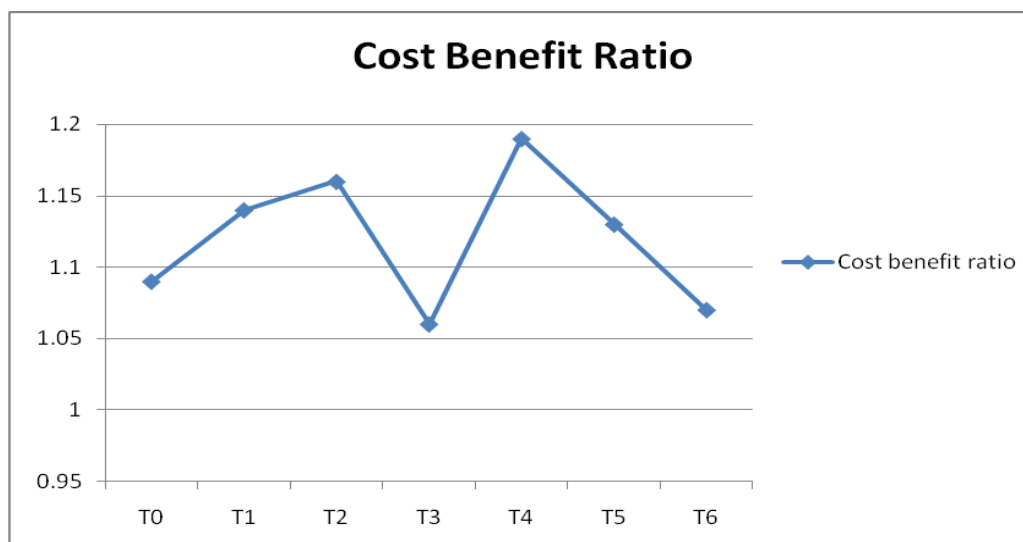
Values bearing different superscripts in column differ significantly (P≤0.05)

Table.5 Effect of supplementation of cinnamon and ginger on weekly cumulative feed consumption (g)

Sr. No.	Particulars	T ₀	T ₁	T ₂	T ₃	T ₄	T ₅	T ₆
1.	Cost of day old chick (Rs.)	18	18	18	18	18	18	18
2.	Cost of feed (Rs/kg)	27	27	27	27	27	27	27
3.	Cost of Ginger and Cinnamon Powder (Rs/Bird)	0.00	1.38	2.89	4.12	1.18	2.32	3.45
4.	Total cost of feed (Rs/kg)	27	28.38	29.89	31.12	28.18	29.32	30.45
5.	Average total feed consumed per bird (Kg)	3.966	3.849	3.793	3.804	3.842	3.809	3.86
6.	Cost of feed consumed per bird (Rs.)	107.9	109.2	113.4	118.4	108.3	111.7	117.5
7.	Average body weight at the end of 6 th week (Kg)	2.169	2.300	2.408	2.290	2.376	2.326	2.300
8.	Feed consumption per kg live weight gain (Kg)	1.828	1.673	1.575	1.661	1.617	1.638	1.678
9.	Cost of feed per kg live weight gain (Rs.)	49.36	47.49	47.08	51.69	45.57	48.01	51.10
10.	Rearing Cost per bird (Rs.)	4	4	4	4	4	4	4
11.	Total cost of production (Rs.) (1+6+10)	129.9	131.2	135.4	140.4	130.3	133.7	139.5
12.	Average price realized @ Rs. 65 per kg live weight (Rs.)	140.99	149.5	156.52	148.85	154.44	151.19	149.5
13.	Net profit per bird (Rs.) (12-11)	11.09	18.27	21.15	8.47	24.17	17.51	9.96
14.	Cost benefit ratio	1.09	1.14	1.16	1.06	1.19	1.13	1.07

Values bearing different superscripts in column differ significantly ($P \leq 0.05$)

Fig.1 Effect of cinnamon and ginger on cost benefit ratio at the end of experiment



Highest dressing percentage was recorded in the treatments T₄ (78.69 ±0.08) and T₂ (78.66 ±0.17) which were at par to each other. Herawati and Marjuki (2011) showed broilers given ration with red ginger showed significantly higher dressed weight (P≤0.05). Park *et al.*, (2013) observed that the dressing percentage were significantly higher in the CNP (Cinnamon powder) groups than the control group (77.08).

Economics of broiler production

The cost of feed (Table 3) in T₁, T₂, T₃, T₄, T₅ and T₆ increased in accordance with the level of addition of cinnamon powder and ginger powder. Moreover, broilers in treatment groups T₂ gained highest body weight (2408.50 ± 22.00 g) with feed cost of Rs. 113.40 and lowest in T₀ (control) group gained weight (2169.05 ± 11.18 g) with feed cost Rs. 107.90 (Fig. 1). Present findings are in agreement with, Ahmed *et al.*, (2006); Mohamed and Yusuf (2011); Arshad *et al.*, (2012); Elmakki *et al.*, (2013); Hossain *et al.*, (2014); Oleforuth-okoleh *et al.*, (2014) reported that increased economic efficiency of broilers diet supplemented with ginger. The highest cost benefit ratio was found in T₄ supplemented with 1% ginger powder followed by T₂, T₁, T₅, T₀, T₃ and T₆.

In conclusion, the effect of dietary supplementation of ginger (*Zingiber officinale*) and cinnamon (*Cinnamomum zeylanicum*) on growth performance indicated that 2.00 % of cinnamon powder or 1.00 % of ginger powder had significantly higher body weight and weekly gain in body weight along with better feed conversion. Highest dressing percentage in T₄ and T₂ group as compare to other treatment group. The highest cost benefit ratio was found in T₄ supplemented with 1% ginger powder as compared to other treatment groups and control. Hence, it was concluded that inclusion of 2 % cinnamon and 1.0 % ginger can be used as growth promoters.

References

- Ademola, S.G., Farinu, G.O., Babatunde, G. M., (2009). Serum lipid, growth and hematological parameters of broilers fed Garlic, Ginger and their mixtures. *World J. Agric. Sci.* 5(1):99-104.
- Ahmed, M.R.O., Hala, M., Wahed, A.E. and Mona, S.R. (2006). Performance and carcass characteristics of broiler chicks fed diets supplemented with some medicinal and aromatic plants. *Poult. Sci.* 85, 1128-1132.
- Al-Amin ZM, Thomson M, Al-Qattan KK, Peltonen-Shalaby R, Ali M. (2006). Anti-diabetic and hypolipidaemic properties of ginger (*Zingiber officinale*) in streptozotocin-induced diabetic rats. *Br J. Nutr.* 96(4), 660-666.
- AOAC (2005). Association of Official Analytical Chemists. Official Method of Analysis. Washington, DC.
- Arshad, M., Kakar, A.H., Durrani, F.R., Akhtar, A., Shakirullah, S., Niamatullah, M. (2012). Impact of Ginger (*Z. Economical and immunological officinale*) extract on broiler chicks. *Pakistan J. Sci.* 64(1), 46-48.
- Asghar, A., Farooq, M., Mian, M.A., Khurshid, A. (2003). Economics of broiler production of Mardan division. *J. Rural Dev.* 32(3), 56–65.
- Barazesh, H., Mohammad B. P., Somaye, S., Tahereh M. A. (2013). The effect of ginger powder on performance, carcass characteristics and blood parameters of broilers. *Int. J. Adv. Bio. and Biomedical Res.* 1(12), 1645-1651.
- Borazjanizadeh, M., Eslami, M., M, Chaji M., Fayazi, J. (2011). The effect of clove and oregano on economic value of broiler chickens diet under hot weather of Khuzesta. *J. Anim. Vet. Adv.* 10(2), 169–173.
- Chang, S.T., Chen, P.F., Chang, S.C. (2001).

- Antibacterial Activity of Leaf Essential Oils and Their constituents from *Cinnamomum osmophloeum*. *J. of Ethno pharmacology*. 77, 123-127.
- Daghir, N.J. (2009). Nutritional Strategies to Reduce Heat Stress in Broilers and Broiler Breeders. *Lohaman Information*. 44(1), 6.
- Demir, E., Sarica, S., Ozcan, M.A, Suicmez, M. (2003). The use of natural feed additives as alternatives for an antibiotic growth promoter in broiler diets. *Br. J. Poultry Sci.* (44), 44–45.
- El-Deek, A.A., Attia, Y.A., Maysa, M., Hannfy, M. (2002). Effect of anise (*Pimpinella anisum*), ginger (*Zingiber officinale* Roscoe) and fennel (*Foeniculum vulgare*) and their mixture on performance of broilers. *Arch. Geflügelkd.* 67, 92–96.
- Elmakki, A. M., AbdelAtti A. K, Dousa M. B., Elagib A. A. H., Malik E. E. H, and Elamin M. K. (2013). Effect of Treated Cowpea Seeds on Broiler Chicken. *Global Journal of Animal Scientific Research*. 1(1), 76-83.
- Farinu, G.O., Ademola, S.G., Ajayi Obe, A.O., Babatunde, G.M. (2004). Growth, haematological and biochemical studies on garlic and ginger-fed broiler chickens. *Moor J. Agric. Res.* 5, 122–128.
- Hashemi S.R., Davoodi, H. (2010). Phytogenics as New Class of Feed Additive in Poultry Industry. *J.Ani.Vet. Adv.* 9, 2295-2304.
- Herawati and Marjuki (2011). The Effect of Feeding Red Ginger (*Zingiber officinale* Rosc.) as phytobiotic on Broiler Slaughter Weight and Meat Quality. *Int. J. Poultry Sci.* 10(12), 983-985.
- Hossain, M.M. Howlader, A.J. Islam, M.N., Beg, M.A.H. (2014). Evaluation of locally available herbs and spices on physical, biochemical and economical parameters on broiler production. *Inter. J. Plant Ani. Environ. Sci.* 4(1), 317-323.
- Jakhetia, V., Patel, R., Khatri, P., Pahuja, N., Garg, S., Pandey, A., Sharma, S. (2010). Cinnamon: a pharmacological review. *J. Adv. Sci. Res.* 1,19-23.
- Kausar, R., Rizvi, F., Anjum, A.D. (1999). Effect of carminative mixture on health of broiler chicks. *Pakistan J. Biol. Sci.* 2(3), 1074-1077.
- Mohammed, A. A., Yusuf, M. (2011). Evaluation of ginger (*Zingiber officinale*) as a feed additive in broiler diets. *Livestock Research for Rural Development*. Volume 23, Article #202. <http://www.lrrd.org/lrrd23/9/moha23202.htm>.
- Moorthy, M., Ravi, S., Ravi kumar, M., Viswanathan, K., Edwin, S.C. (2009). Ginger, Pepper and Curry Leaf powder as feed additives in broiler diet. *Int. J. Poultry Sci.* 8(8), 779-782.
- Morakinyo A.O, Akindele A.J, Ahmed Z. 2011. Modulation of antioxidant enzymes and inflammatory cytokines: Possible mechanism of anti-diabetic effect of ginger extracts. *Afr. J. Biomed. Res.* 9, 195–202.
- Najafi, S. and Taherpour, K. (2014). Effects of Dietary Ginger, Cinnamon, Synbiotic and Antibiotic supplementation on performance of broilers. *J. Anim. Sci. Adv.* 4(1), 658-667.
- Oleforuh-Okoleh, V.U., Chukwu, G.C. and Adeolu, A.I. (2014). Effect of ground Ginger and Garlic on the growth performance, carcass quality and economics of production of broiler chickens. *Global J. Bio. Sci. and Biotech.* 3(3), 225-229.
- Park, B.S. (2008). Effect of dietary cinnamon powder on savor and quality of chicken meat in broiler chickens. *J. Korean Soc. Food Sci. Nutr.* 37(5), 618-624.
- Poultry Sector in India. 2017. <https://www.rvo.nl/sites/default/files/20>

- 17/05/.
- Sang-oh, P., Chae-Min, R., Byung-Sung, P. and Jong, H. (2013). The meat quality and growth performance in broiler chickens fed diet with cinnamon powder. *J. Envi. Bio.* 34, 127-133.
- Singh, G., Maurya, S., Cesar, M.P., Catalan, A.M. (2007). A comparison of chemical, antioxidant and anti-microbial studies of cinnamon leaf and bark volatile oils, oleoresins and their constituents. *Food and Chemical Toxicology.* 45, 1650-1661.
- Snedecor, G. W., Cochran, W. G. (1994). Statistical methods (8th Ed.). The Iowa state college perss, Ames, IOWA, Oxford and I. B. H. publication Co., Calcutta.
- Taback, M., Armon, R., Neeman, I. (1999). Cinnamon extracts inhibitory effect on *Helicobacter pylori*. *J. Ethnopharmacol.* 67, 269-277.
- Tung, Y.T., Chua, M.T., Wang, S.Y., Chang, S.T. (2008). Anti-inflammatory activities of essential oil and its constituents from indigenous cinnamon (*Cinnamomum osmophloeum*) Twigs *Bio resource Tech.* 99, 3908-3913.

How to cite this article:

Gaikwad, D.S., Y.G. Fulpagare, U.Y. Bhoite, D.K. Deokar and Nimbalkar, C.A. 2019. Effect of Dietary Supplementation of Ginger and Cinnamon on Growth Performance and Economics of Broiler Production. *Int.J.Curr.Microbiol.App.Sci.* 8(03): 1849-1857.
doi: <https://doi.org/10.20546/ijcmas.2019.803.219>