

**ANTIBIOTIC-FREE EGG PRODUCTION:  
SPECIAL DIETARY INCLUSIONS AND  
COMPARISON OF PRODUCTION WITH A  
TRADITIONAL LAYER FARM**



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A production report submitted as per approved style and content

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## Summary

Antibiotic free egg is being popular day by day due to elevated realization of people about antibiotic resistance and health issues. Many countries has been already banned the use of antibiotics in poultry feed thus using alternatives of antibiotic in layer farms is increasing day by day. Objectives of this study is mainly to see the fact if spices like garlic, ginger, black cumin and turmeric can be effective enough in antibiotic-free egg production with increased egg production or not.

To investigate these facts, 2 groups of 52-week-old laying hen were observed, fed a basal ration with and without ginger, garlic, turmeric powder and black cumin seeds. Supplementation of these dietary inclusions increased the feed intake rate but they kept a positive influence in increasing egg production. Whereas, hen fed only basal ration with antibiotics, produced less egg compared to the first group. It is concluded that use of ginger, garlic, turmeric, black cumin is effective in antibiotic free egg production and capable of giving better production than a traditional farm.

***Key words:*** Antibiotic, egg, inclusion, production

## 1. Introduction

As a consequence of expanding concerns of health issues, demand and supply of antibiotic free egg is rising continuously. In the production system of this kind of egg, management protocol of the farm must be too strong. Bio-security, hygiene and sanitation, immunization, proper ration etc. have to be well maintained and well managed. Especially, the feed management and finding alternatives of antibiotic which will keep positive effect on production percentage is mandatory (Suresh et al., 2018). Most of the alternatives are herbal and are widely used as replacement of antibiotic in many farms (Ahmad et al., 2016). Among them different spices like, ginger (Wen et al., 2019), garlic (Leontiev et al., 2018), turmeric (Gouda and Bhandary., 2018), and black cumin (Aydin et al., 2008) are popular enough for their antimicrobial properties and special influence in egg production.

Ginger is a medicinal herb and spice which contain gingerol that poses antimicrobial, antioxidant, and anti-inflammatory characteristics (Semwal et al., 2015). It was confirmed that potential use of ginger extract in layer ration helps to improve egg production and egg quality as well as increase antioxidant level and antimicrobial power of hen (Akbarian et al., 2011). Unlike ginger, black cumin also poses some useful qualities like antibacterial (Mouhajir et al., 2008) and anti-parasitic (Mahmoud et al., 2022) activity. Also this medicinal spice increases egg production, egg mass, decreases mortality and egg cholesterol significantly (Akhtar et al., 2003). Allicin, a sulphur containing compound are present as active compound in garlic, said to be inhibitor of many pathogenic bacteria. It was reported that garlic improves laying rate may be due to its hypocholesterolemic property (Khan et al., 2007). Another medicinal spice turmeric has a bioactive compound called curcumin which have antimicrobial, anti-inflammatory, anti-cancerous and antioxidant properties (Aggarwal et al., 2009). There is also proof that it works as natural antibiotic and

immunomodulator and works instantly against invaded pathogens (Kurkure et al., 2000). Gouda and Bhandary (2018), suggest that, turmeric can be used as alternative of antibiotic and as a helpful natural growth promoter in the poultry industry. As it is seen that, all these medicinal spices has capacity to fight against pathogenic microbes as well as helps in production of laying hen, the can be good choice to be used as replacement of antibiotic in case of antibiotic free egg production system. Besides, although antibiotic act as growth promoter and increase egg production, it has so many adverse effect in bird health as well as its residue can keep alarming effect in human health.

Therefore, the present study was conducted to see the effectiveness of these medicinal and herbal spices for successful production of antibiotic free egg and to compare the production level with birds having non-herbal feed and taking antibiotic for different purposes.

## **2. Background**

Antibiotic-free egg is important to avoid health risk issues which are created due to antibiotic resistance development and to reduce negative effect of antibiotics. As this has relation to public health, substitute of antibiotics and antibiotic growth promotor in poultry feed has been a must pre-requisite in a laying farm now a days. The main goal of this study is to observe effectiveness of some alternatives of antibiotics in laying hen and their egg production, which are mainly herbal spice in nature.



### **3. Objectives**

The objectives of this study are to see the use and effect of different ingredients like garlic, ginger, black cumin and turmeric in layer ration, to observe if they work as alternative of antibiotic or not and also observing a statistical comparison of production of egg of the birds fed this ration with the other birds which were fed conventional ration excluding these ingredients and where antibiotic was also used.

## 4. Materials and method

### 4.1. Study area and duration:

The study was conducted at Sakina Poultry Farm and Mosharaf's Poultry Farm which are situated at Sitakund sub-district in Chattogram, Bangladesh. At the month April 2022, hens were observed and data of four weeks of duration were collected of them.

### 4.2. Study population:

During the study, total 100 laying hen of 52 week aged from Sakina Poultry Farm and total 100 laying hen of 52 week aged from Mosharaf's Poultry Farm were considered for data collection.

### 4.3. Study design:

Hens of Sakina Poultry Farm were fed customized ration which was made in their farm with commercially brought top graded ingredients. They included ginger, black cumin, garlic and turmeric in their ration which is shown in [Table 1](#). These medicinal herbal spices were purchased from well-known organic source. All the dietary ingredients of the ration are also presented in [Table 1](#). No antibiotic or antibiotic growth promoter was used during study period. Hens were kept in cage, lighting was given for 16 hours, vaccination and deworming were done regularly. Biosecurity and sanitation of the farm was well maintained. On the other hand, hens of Mosharaf's Poultry Farm were fed commercially purchased regular feed which is lack of ginger, black cumin, garlic and turmeric. The feed was mainly a ready-feed and was purchased from local market. The ration and its dietary ingredient is shown in [Table 2](#). Antibiotic and antibiotic growth promoter were used to this hen according to necessity. Others criteria like housing, lighting, vaccination and deworming were

similar to Sakina Poultry Farm. Hens of both farm were given scheduled access of feed and ad libitum of water.

**Table 1** Feed ingredients of Sakina poultry farm    **Table 2** Feed ingredients of Mosharaf's poultry farm

Ingredients
Maize
Rice polish
Soybean meal
Garlic
Ginger
Black cumin
Turmeric
Lime stone
Di calcium phosphate
Common salt
Vitamin-mineral premix

Ingredients
Whole maize meal
Maize bran
Soybean meal
Fish meal
Limestone powder
Di calcium phosphate
Common salt
Vitamin -mineral premix

#### 4.4. Data recording and measurement:

Egg production record from both farms was taken regularly on weekly basis. Feed intake in gram per hen per day was recorded during study period. Weight of eggs of both farms were recorded weekly. FCR and egg mass were calculated by using different formulas.

•*FCR (Feed Conversion Ratio) calculation formula:*

$$\frac{\text{Feed intaken (g)}}{\text{Total egg mass (g)}}$$

•*Egg mass calculation formula:*

$$\frac{\text{Production \%} \times \text{No. of bird} \times \text{Egg weight}}{100} \text{ (g)}$$

#### **4.5. Data management and statistical analysis:**

All data were entered, stored and managed in Microsoft Excel 2013 (15.0.4420.1007). Then the data were transferred to STATA-16 (Stata Corp, LLC, MP-Parallel Edition, College Station, Texas 77845 USA) for performing statistical analysis.

Relationship between FCR and production percentage were expressed in a graph where mean of FCR of both farm were calculated using STATA. Comparison of egg mass of both farm were done by calculating difference in mean and was shown in a pie chart.

Finally, a two sample two tailed T-test was carried out to observe the significant difference in production percentage at the level of 5% significance. The result was expressed in mean and *p*-value.

## 5. Result

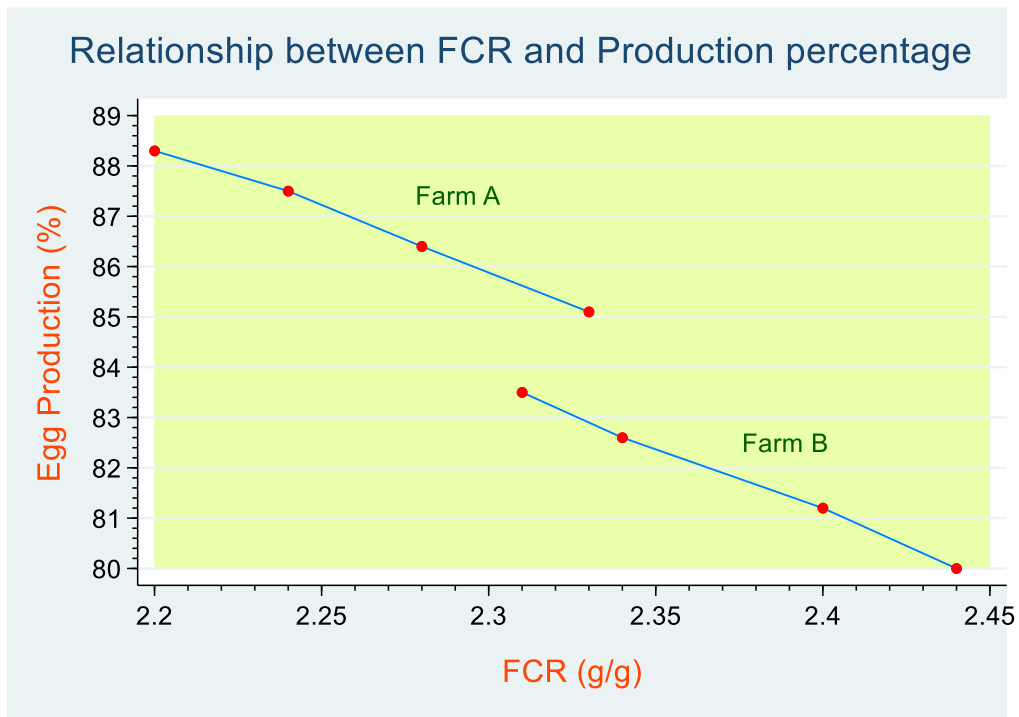
The production performance, amount of feed taken, FCR, egg weight and egg mass of 52 to 56 week aged hens of both farms are shown in [Table 3](#). For easy understanding, Sakina Poultry farm is denoted as A and Mosharaf's poultry farm is denoted as B.

[Table 3](#) represents that, farm A has better performance in every aspect than farm B. Though, feed intake amount is higher in farm A, but ultimately the FCR of this farm is better than farm B due to its higher egg production percentage, increased egg weight and egg mass.

**Table 3 Performance of bird and laying performance of Farm A & B**

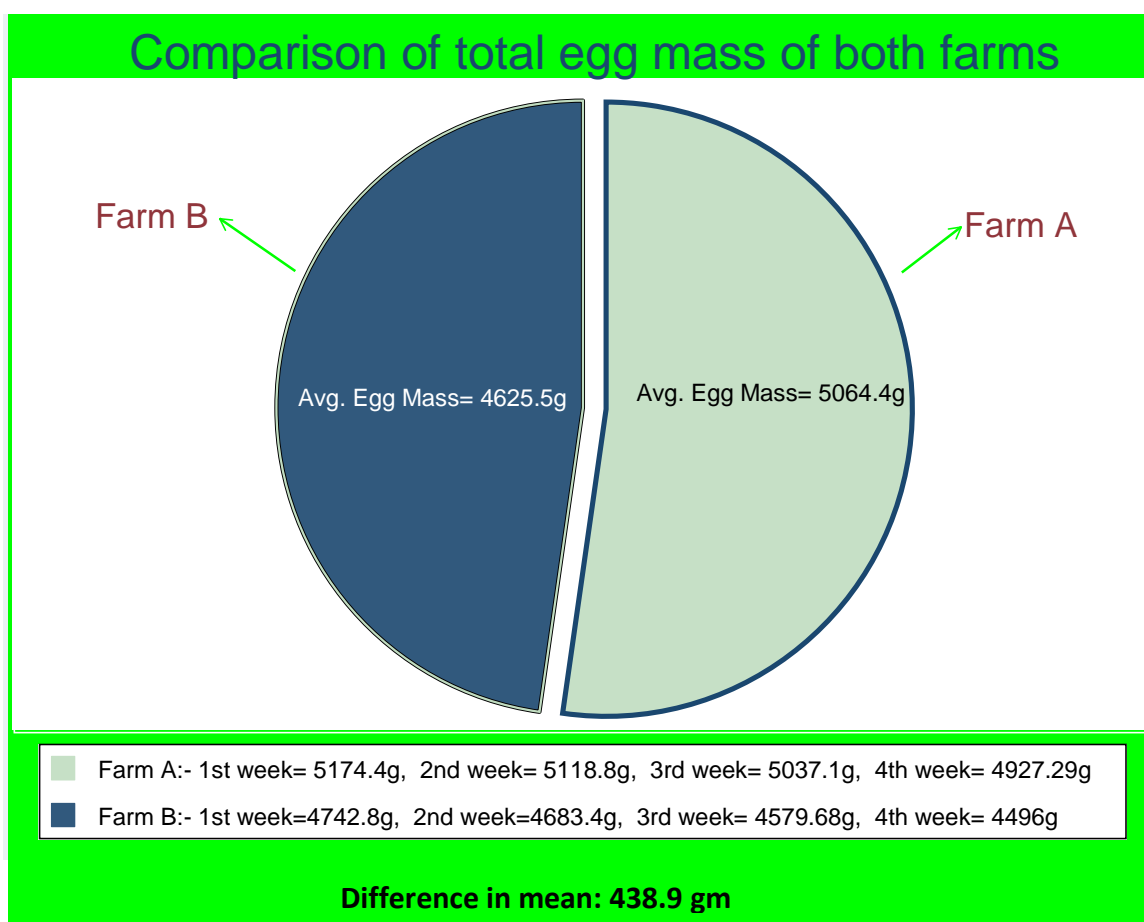
Farm A						Farm B					
Week	Feed intake (gm/day/bird)	FCR	Egg Production (%)	Egg Weight (gm)	Egg Mass (gm/100 bird)	Week	Feed intake (gm/day/bird)	FCR	Egg Production (%)	Egg Weight (gm)	Egg Mass (gm/100 bird)
1	115	2.2	88.3	58.6	5174.4	1	110	2.31	83.5	56.8	4742.8
2	115	2.24	87.5	58.5	5118.8	2	110	2.34	82.6	56.7	4683.4
3	115	2.28	86.4	58.3	5037.1	3	110	2.4	81.2	56.4	4579.68
4	115	2.33	85.1	57.9	4927.29	4	110	2.44	80	56.2	4496

In comparison of both farms, it seems that, the average FCR of farm A is 2.26 that is lower than farm B, which is 2.49. As, lower FCR is related to better production, a higher line is found in case of farm A and a lower line is found in case of farm B which is represented in [Figure1](#) as a double lined graph. In this figure, we can see a clear graphical presentation of relationship of FCR and production performance of both farms.



**Figure 1** Effect of FCR in production percentage

Figure 2 shows a pie chart, where we see average egg mass of farm A, which covers more than 50% of the pie. On the other hand, average egg mass of farm B covers less than 50% of the pie. So, difference in mean of both farm is quite significant. There were approximately 438.9g of increase in the egg mass from laying hens fed with spices supplemented diet instead of antibiotic, compared with the other group without this kind of diet.



**Figure 2** A pie chart reflecting comparative figure of egg mass of between the farms

In the production of antibiotic free egg, the effect of inclusion of different spices keeps how much effect in production, can be assured from Table 4. Inclusion of garlic, ginger, turmeric and black cumin in diet, not only work as alternative of antibiotic, but also significantly ( $P < 0.05$ ) keeps positive influence in egg production (Farm A) compared to the farm which uses antibiotic without any feed inclusions (Farm B).

**Table 4** Comparison of egg production of farm A (Antibiotic free) & B (Antibiotics added) with and without using spices inclusions in diet

F arm ID	Observation (Week)	Mean	Std. Error	Std. Deviation	[95% Conf. Interval]
A	4	86.825	.694473	1.388946	84.61488-89.03512
B	4	81.825	.770687	1.541374	79.37233-84.27767
<b>Difference</b>		5.000002 <sup>a</sup>			
					t = 4.8196 degrees of freedom = 6

<sup>a</sup> means values has significant difference (  $P < 0.05$  )



## 6. Discussion

Use of herbal spices as alternative of antibiotic in egg production is appreciated in many studies. Effects of these spices in bird health and laying percentage is described and examined in, previous studies and the outcomes are almost similar to present study. In this study, the FCR of bird having herbal spices is found 2.26 that is better than the traditional farm. That means this herbal based ration is capable of utilize nutrient more efficiently and can convert them into egg mass more effectively. Herbal based supplementation improved the FCR of laying birds in an experiment by Sunder et al (2013), which supports the present study. Abd El-Hack et al., (2022) also agreed that, herbal extracts stimulate feed intake and digestive enzymes in bird.

Laying characteristics of birds upgrades while herbal spices are included in basal ration instead of antibiotic sources. In the literature of Sunder et al., (2013), it was found that after including herbal spice, birds started to lay eggs having more weight than previous. Present study shows that, egg weight of the farm having herbal spices, is quite higher, which comply with the study of Sunder et al., (2013). Ultimately, total egg mass is 5064.4g of spice fed birds, whereas it is 4625.5g in case non spice fed birds. So the egg mass is improved when spice inclusions are used.

When garlic (Khan et al. 2007), ginger (Wen et al., 2019), black cumin (Aydin et al., 2008) and turmeric (Kosti et al., 2020) is used instead of using commercial antibiotics, they improves the production percentage in many ways. If we see the result of this study, we can see that, the egg production percentage of the farm using spices, is 86.82% that is significantly ( $P < 0.05$ ) differ and higher then the traditional farm having 81.82% production. Suopporting our result, Al-Harhi et al, (2009) reported that they used spice mixture that significantly increased egg weight, egg mass and laying rate. This happens due to presence of potentiality of the herbal spices in controlling microbial growth (Ahmad et al., 2016). Inhibition of pathogenic bacteria and afla toxin producing fungi is done by allicin, an active component of garlic

(Samanta and Dey, 1993). There is evidenced that, ginger oil is capable to work as antimicrobial (*Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Escherichia coli*) as well as antifungal (*Candida albicans*, *Aspergillus niger*) (Sharma et al., 2016). Turmeric works as antibiotic and maintains bird's gut environment by controlling growth and colonization of various pathogenic bacteria (Samarasinghe et al., 2003). Black cumin has almost 67 components which can influence pharmacological action in opposition to some pathogenic bacteria like *Staphylococcus* sp, *E. coli* etc. (Al-Jabre et al., 2003).

If we shift to laying section we see that, productive performance and egg quality of hen improves when garlic powder is fed (Aqil 2016). Ginger root produces plasma MDA (Malondialdehyde, a final product of polyunsaturated fatty acids peroxidation) concentration that helps to increase egg production (Akbarian et al., 2011). Black cumin enhances bird's health condition together with the reproductive performance by some valuable nutrients and active compounds (Akhtar et al., 2003). Turmeric does synthesis of vitellogenin which deposits on egg yolk and also manipulates egg production by improving HDL cholesterol (Dalal and Kosti., 2018).

Ultimately, all these combined functions or characteristics of the herbal spices, make birds capable of healthy living without antibiotics & results in aggravated egg production of laying hens.

## **Conclusion**

Antibiotic free egg is a desired food at this day and age. To attain this demand, substitute of antibiotics has to be used. Current study implies that different plant origin spices like garlic, ginger, turmeric and black cumin are able to act as replacement of antibiotics in poultry sector without hampering the production rate. Although, disease diagnosis was not done and birds were selected randomly, it is seen that, production percentage elevates due to essential health effects of the alternatives. Therefore, utilizing these kind of dietary inclusions is convenient to meet up ongoing demand of egg production omitting antibiotics.

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## **Biography**

I am Israt Jerin Tonni, daughter of Md. Mosarraf Hossain & Shirin Akter, from Sitakund, Chattogram. I passed Secondary School Certificate examination from Bangladesh Mahila Samiti Girls' High School & College in 2013 and Higher Secondary Certificate examination from Chittagong College in 2015. Now, I am studying as an intern student in Chattogram Veterinary and Animal Sciences University under the Faculty of Veterinary Medicine to accomplish my graduation in Doctor of Veterinary Medicine. In the future I would like to work in the field of research related to veterinary profession.

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