International Conference on
"Education, Humanities, Business Management,
Engineering, Sciences and Agro-ecology"
(EHBSA-2019)

Effect of Nutrient Rich Diet on Productive Performance and Egg Quality Traits of Vanaraja Layers (Gallus Gallus Domesticus)

Dr Yashaswi Nayak[*1] and Ekta Sinha[2]

[1]Department of Zoology, School of Applied Sciences
Centurion University of Technology and Management, Odisha
[2]Department of Zoology, School of Applied Sciences
Centurion University of Technology and Management, Odisha
E-mail: [1]yashaswi.nayak@cutm .ac.in

Abstract—*This study was designed to determine the effects on laying performance and egg quality resulting from partial substitution of soyabean meal (SBM) with nutrient rich (cereal grains, green moong sprouts, ground nut, flax seed, Sunflower seed and Olive oil) meal in the diet of early phase of laying Vanaraja hens 24 weeks of age. These birds were randomly divided into four groups allocated to three dietary treatments for 5 weeks.*

One group of hens were fed with control diet which contained SBM and rest three groups were fed with diet containing wheat and maize as carbohydrate source ,protein rich diet containing green gram sprouts (Vigna radiata) and ground nut seeds(Arachis hypogea) and fat rich diet containing flax seed and Sunflower seed.

Feed intake was recorded daily and egg production was calculated on hen-day basis. Eggs from each group were daily collected to evaluate egg components and quality.

The partial substitution of SBM with nutrient rich diet(cereal grains, sprouts, groundnut, flax seed , Sunflower seed and Olive oil) did not made any adverse effects on growth performance of laying hens,

Ten eggs per replication were collected to evaluate egg quality like (Haugh unit, egg volume ,egg weight , albumin and yolk weight, shell weight , shell thickness and shape index.

Diets formulated on carbohydrate rich nutrient showed significant improvement in egg shell thickness and egg weight ($P<0.05$). Diets formulated on protein and fat rich nutrient significantly influenced albumin and yolk quality ($P<0.05$).

So in addition to the nutrients already available in the egg if we can incorporate certain health beneficiary nutrient then these eggs will be the choice of food for health conscious people and also can reduce the chances of occurrence of certain diseases without affecting the productive trait

Keywords*: Egg quality, Nutrient rich meal, Vanaraja layers, Egg production*

1. INTRODUCTION

Feed represents the major cost of poultry production contributing 60-65% of the total cost of commercial egg production. In poultry feeding, soybean meal (SBM) is usually the main protein source because it has a high protein content, has a balanced amino acid profile, and is a satisfactory source of essential fatty acids (Hammershoj and Steenfeldt, 2005). An increase in world SBM demand due to the increase in poultry production, associated with a stabilization of SBM production, has led to a decrease in availability and an increase in price of this commodity (Laudadio et al., 2011).

Cereal grains are used as food stuff for human and animals since many years. The trend of using sprouted grains in poultry diet is increasing due to many reasons and sprouting is a simple technique to germinate the seeds to improve their nutritive value (Amal et al.,2007). Sprouted grains contain grass juice factor which is a rich source of nutrient and also have been reported to improve the performance of birds and animals (Nutrigrass,2007) The use of oilseed in rations has stimulated the poultry industry because of its nutritional characteristics. Many studies have shown the benefits of polyunsaturated fatty acids on human health, especially in relation to heart Problems and similar important diseases(Leskanich and Noble,1997) .Apart from from this Protein is a vital nutrient of animal and poultry feeds and along with other major components classes of fats, carbohydrates, minerals, vitamins and water, is substantial for life (Pond et al., 1995; Beski et al., 2015). Proper nutrition is a first step to optimize growth and productive performance in poultry and animals as well as to decrease the adverse effects on the environment (Namroud et al., 2008; Rama Rao et al.,

2011; Zhu et al., 2012; Moraes et al., 2014; Zeng et al., 2015). Maximization of egg output (egg number, egg weight and egg mass) and henceforth profits depends on bird's productive performance, feed and egg prices, as well as farm management. Several factors have certain impacts on performance of laying birds. Factors like nutrient concentrations of the diet must be optimized not maximized to improve returns and economic feasibility (Koreleski and Swiatkiewicz, 2009; Alagawany et al., 2011; Alagawany and Abou-Kassem, 2014). For example, depending on prices of feed and egg, the maximization of productive performance may or may not result in maximum returns/profits (Alagawany et al., 2014a, b). Maintaining or/and improving performance of birds, may be achieved by improving nutrient utilization of feedstuffs). Therefore the aim of the study was to evaluate the performance and the egg quality of Vanaraja layers fed with nutrient rich diet containing cereal grains, sprouts, groundnut, flaxseed and Sunflower seed mixed with olive oil.

2. MATERIAL AND METHODS

The study was conducted in the experimental poultry section located at Centurion University of Technology and Management in Jatani (Bhubaneswar branch) for a period of six weeks (42 days).

A total of 100 Vanaraja laying hens of 24 to 25 weeks of age with an average body weight of 2.150kg± 10 g were used in the experiment . All the hens were individually weighed and divided into four groups of 25 hens each, and were housed in different indoor pens equipped with feeders and drinkers and the area of each house measured about 10 X10 m^2 . Birds were exposed to 13 to 14 hrs of light per day from 5.00 am to 8.00pm.

The birds were fed with four different types of experimental diet twice a day i.e. in the morning and afternoon in the following manner :

Group 1 Birds → control diet: fed with soyabean meal (SBM)(200g per day).

Group 2 Birds → carbohydrate diet: fed with SBM+ Wheat and Maize (100g+ 100g).

Group 3 Birds → protein diet: fed with SBM+Green sprouts and Groundnut (100g+100g).

Group 4 Birds → fat diet : fed with SBM + Flax seed and Sunflower seed(100g+100g).

So each group of hens received 200g of feed daily twice during the experimental period of 42 days and the diets were formulated to meet the nutritional requirements of laying Vanaraja hens.

The proximate composition of feed ingredients were analysed as per AOAC(1990) and the same is furnished in Table (1). The laying diets used in the study were calculated to be isocaloric and isonitrogenous with an average metabolizable energy of 2400 Kcal ,3051 Kcal , 2691 Kcal,2859 Kcal present in Soyabean meal, carbohydrate diet , protein diet and fat diet respectively. Feed consumption and egg production was recorded daily and eggs were collected from each group during the experimental period and stored in the refrigerator at 4^0 C. The eggs were analysed with in 2 days of its lay for external and internal quality characteristics . At the end of the experimental period of 6 weeks a total of 40 eggs were used to evaluate external and internal quality characteristic.

The external egg quality parameters like egg weight was measured in analytical balance of Dhona- 200 (AB – 204), egg length and egg width were measured with a vernier calliper in centimetres, and egg shape index was obtained by the following formula →

$$\text{Shape index} = \frac{\text{width of egg}}{\text{length of egg}} \times 100.$$

For internal egg quality traits individual egg samples were broken out on a flat white tile being cautious not to break the vitelline membrane that encloses the yolk. The parameters measured were as follows.

a) Yolk width was measured as the widest horizontal circumference with a vernier calliper in centimetres.
b) b) Yolk height was measured as the height of yolk at the midpoint with a tripod micrometre.

c) $$\text{Yolk index} = \frac{\text{height of yolk}}{\text{width of yolk}}$$

d) Albumin height of the eggs were broken and albumin heights were measured from at least three places each with tripod micrometre (Froning and Frank, 1958) .

e) Albumin width was measured as the widest horizontal circumference of the thick albumin with a vernier calliper in centimetre.

f) $$\text{Albumin index} = \frac{\text{height of albumin}}{\text{width of albumin}}$$

g) Shell thickness of dry egg shell was measured with a micrometre screw gauge.The mean of three points (the narrow, the broad and middle) was taken as the shell thickness.

h) Haugh unit was determined using the following formula
$HU = 100\text{Log}(H+7.57- 1.7W^{0.37})$
Where HU = Haugh Unit

ISBN: 978-93-85822-84-1

H = height of albumin (mm)
W = weight of egg

Individual Haugh unit (Haugh, 1937) score was calculated using the egg weight and albumin height (Doyon et al., 1986). The mean values were calculated for each trait.

3. STATISTICAL ANALYSIS

Statistical analysis was carried out using Past3-Zip Win RAR.

4. RESULT AND DISCUSSION

Dietary effects on egg quality variables are shown in Table 2. Egg weight was significantly ($P < 0.05$) higher in eggs laid by hens fed with carbohydrate diet (62.69). Also, the type of diet affected ($P < 0.05$) the yolk weight . Yolk weight was higher in protein diet (22.44 g) . Egg weight (EW) showed no significant differences among protein and fat diet. The present results were in agreement with those of Bean and Leeson (2003) and Nain et al. (2012) . On the other hand, the present results were inconsistent with those of Caston et al. (1994) and Schiedeler and Froning (1996) who found a decrease in Egg weight with SBM diet formulated with maize. The present study showed no significant difference in yolk index and shell thickness in all the kinds of diet.

However the results obtained from present study were in agreement with the findings of Robinson and Singh (2001) who noted that adding green sprouts into laying hens diet did not affect the Egg weight, Shape index ,Yolk index and Shell thickness but Albumin weight, Haugh Unit ,Yolk weight, Albumin index and Shell weight differed significantly($P<0.05$).

The eggs of the birds fed with fat diet differed significantly ($P<0.05$) in Albumin and Yolk weight, Albumin index and Shell weight , but no significant difference was observed in egg quality characteristics like Egg weight ,Shape index ,Yolk index, Shell thickness and Haugh Unit.

Birds fed with SBM diet (Control)showed significant differences in all the egg quality parameters except Yolk index ,Shell thickness and Shell weight . which is in close agreement with the findings of Subbaiah and Rao (1989) and Aziz et al (2001).

5. CONCLUSION

From the present study it is concluded that laying hens diet can be formulated with additional nutrients to increase the egg quality characteristics as per the desired requirement as well as to produce organoleptically improved modified eggs which can be consumed by people of all ages.

REFERENCES

[1] A.O.A.C (1990): Official methods of Analysis, 16th ed Association of official Analytical chemists, washington D.C. 2.

[2] Alagawany, M. and Abou-Kassem,D.E. *The combined effects of dietary lysine and methionine intake on productive performance, egg component yield, egg composition and nitrogen retention in Lohmann Brown hens*.(2014). Egypt. J. Nutr. Feeds, 17: 315-328.

[3] Alagawany, M. and Mahrose,K.M.. *Influence of different levels of certain essential amino acids on the performance, egg quality criteria and economics of lohmann brown laying hens*.(2014a,b) Asian J. Poult. Sci., 8: 82-96.

[4] Alagawany, M., El-Hindawy,M.M., Ali,A.A. and . Soliman,M.M.*Protein and total sulfur amino acids relationship effect on performance and some blood parameters of laying hens*.(2011) Egypt. J. Nutr. Feeds, 14: 477-487.

[5] Amal, A. E., Ahmed, M.E., Abdullah, K.A., Effect of dietary grounded level of leucena leucocepala seeds of layer performance and egg quality parameters. (2007) Int. J. Poult. Sci. 8:475-479.

[6] Aziz, M.A., Khandakar ,Z.A and Islam,M *: Effect of replacing protein fish meal, soybean on the performance of; broiler chicken*.(2001) Indian J. Nut. 1891: 23-28.

[7] Bean, L.D. and Leeson.S. *Long term effects of feeding flaxseed on performance and egg fatty acid composition of brown and white hens*.(2003).Poult. Sci. 82: 388-394

[8] Beski, S.S.M., Swick ,R.A.and Iji, P.A. *Specialized protein products in broiler chicken nutrition* (2015) A review. Anim. Nutr., 1: 47-53.

[9] Caston, l.J., Sqljlres E.S and lesson ,S., *: Hen performance, egg quality and sensory evaluation of eggs from SCWL hens fed dietary flax*.(1994) Can. J. Anim. Sei. 74, 347-353.

[10] Froning,G.W. and Frank,D.E.M. *Seasonal variation in quality of egg laid by caged layers and their sisters on the floor*.(1958) Poultry Science, 37:215-223.

[11] G. Doyon, M. Bernier-Cardon, R. M. Hamilton and C.T. Ramdald. Egg quality and Albumin quality of egg from five commercial strains of White Leghorn hens during one period of lay. *Poultry Science*, 42 : 74 – 83. (1986).

[12] Hammershoj, M., and Steenfeldt, S. Effect of blue lupin in organic layer diets and supplementation with foraging material on egg production and some egg quality parameters. (2005) Poult. Sci., 84:723-733.

[13] Koreleski, J. and Swiatkiewicz, S. *Laying performance and nitrogen balance in hens fed organic diets with different energy and methionine levels*.(2009) J. Anim. Feed Sci., 18: 305-312.

[14] Laudadio, V., Ceci, E. and Tuferelli, V. Productive traits and meat fatty acid profile of broiler chickens fed diets containing micronized fava beans as the main protein source. (2011) J. Appl. Poult. Res., 20:12-20.

[15] Leskanich, C.O. and Noble, R.C. *Manipulation of n-3 polyunsaturated fatty acid composition of avian eggs and meat.(1997).* World's Poult. Sci. 53: 157-183

[16] Moraes,T.G., Pishnamazi,A., Mba,E,T Wenger,I.I., Renema,A and Zuidhof, M.J. . *Effect of maternal dietary energy and protein on live performance and yield dynamics of broiler progeny from young breeders*. (2014) .Poult. Sci., 93: 2818-2826.

[17] Nain, S.; Renema, R.A. ; Zuidhof, M.J. and D.R. Korver . *Effect of metabolic efficiency and intestinal morphology on variability in n-3 polyunsaturated fatty acid enrichment of eggs*.(2012) Poult. Sci. 91; 888-898.

[18] Namroud, N.F., Shivazad,S and Zaghari,M. *Effects of fortifying low crude protein diet with crystalline amino acids on*

ISBN: 978-93-85822-84-1

performance, blood ammonia level, and excreta characteristics of broiler chicks.(2008). Poult. Sci., 87: 2250-2258.

[19] Nutrigrass,M.A., Effect of alfa alfa male in birds of laying quails on performance egg quality and some serum parameters. (2007) Arch. Animal Nutrition, 58:255-263.

[20] Pond, W.P.,Church,D.C. and Pond,K.R. Basic Animal Nutrition and Feeding. John Wiley and Sons, (1995).New York.

[21] R. R. Haugh. The Haugh unit for measuring egg quality *US Egg and Poultry Magazine,* 43: 552-55. (1937).

[22] Rama Rao, S.V., Ravindran,V Srilatha,T.,Panda A.K. and Raju,M.V.L.N.*Effect of dietary concentrations of energy, crude protein, lysine and methionine on the performance of White Leghorn layers in the tropics*. (2011) J. Applied Poult. Res., 20: 528-541.

[23] Robinson, D and Singh,D.N.:*Alternative protein sources for laying hens. A report on rural industries and development corporation Kingston Australia* (2001). pp:85-88.

[24] Sheidler,S.E and Froning,G.W: The combined influence of dietary flax seed variety level, form and storage conditions on egg production and among vit-E supplemented hens.(1996). Poultry Science ,75:1221-1226.

[25] Subbaiah, A.W. and Rao,B.S. : *Substitution of fish meal, groundnut cake and soybean meal in broiler ration. Indian J. Poultry* Sci. (1984) 19(3) : 119 - 123.

[26] Zeng, Q.F., Cherry,P. Doster,A., Murdoch,R Adeola,O and Applegate,T.J. *Effect of dietary energy and protein content on growth and carcass traits of Pekin ducks*.(2015) Poult. Sci., 94: 384-394.

[27] Zhu, C., Z.Y. Jiang, S.Q. Jiang, G.L. Zhou, Y.C. Lin, Chen,F and Hong,.P . *Maternal energy and protein affect subsequent growth performance, carcass yield and meat color in Chinese Yellow broilers*.(2012). Poult Sci., 91: 1869-1878

Table 1: Proximate Composition of Different Feed Ingredients

NUTRIENTS	SOYABEAN MEAL(SBM)	CEREAL GRAIN		GREEN GARAM SPROUTS	GROUNDNUT	FLAX SEED	SUNFLOWER
		WHEAT	MAIZE				
CRUDE PROTEIN (%)	46.22	11.75	9.10	23.96	42.10	16.40	18.00
ETHER EXTRACT(%)	19.19	1.29	4.10	1.2	5.03	5.05	6.10
CRUDE FIBRE(%)	5.89	3.33	2.5	3.5	6.69	4.00	3.41
TOTAL ASH(%)	6.89	1.51	3.01	3.88	4.91	4.80	3.18
ENERGY/KCAL/KG	2400	2753	3350	2782	2600	2869	2050

Table 2: Dietary Effects On Different Egg Quality Variables

EGG QUALITY PARAMETERS	CONTROL	CARBOHYDRATE DIET	PROTEIN DIET	FAT DIET
ALBUMIN WEIGHT	40.152±2.356^{a}	39.686±1.645^{b}	41.406±1.357^{c}	42.578±1.881^{a,b,c}
EGG WEIGHT	56.396±1.068^{a}	62.696±1.631^{a}	59.776±1.539	61.92±0.749
SHAPE INDEX	73.794±0.927^{a}	79.236±1.145^{a}	77.41±0.845	78.24±1.365
HAUGH UNIT	80.532±0.762^{a}	83.362±2.386^{b}	89.232±0.684^{a}	70.77±11.14
YOLK WEIGHT	17.084±0.646^{a}	19.10±0^{b}	22.4±0.933^{a,b}	20.944±0.702^{a,b}
EGG VOLUME	58.46±0.872^{a}	61±0.583	62±0.316^{a}	60.2±1.067
ALBUMIN INDEX	71.38±1.501^{a}	70.476±2.387^{b}	73.194±2.6409^{c}	75.72±5.198^{a,b,c}
YOLKINDEX	89.274±1.784	71.784±1.757	90.186±1.437	91.432±0.880
SHELL THICKNESS	0.322±0.039	0.386±0.015	0.334±0.032	0.438±0.623
SHELL WEIGHT	4.47±0.019^{a}	4.298±0.028^{b}	4.09±0.017^{a,b}	5.286±0.016^{a,b}

Means bearing different superscripts with in rows differ significantly at P<0.05.

ISBN: 978-93-85822-84-1