Growth Rate and Sexual maturity of Layers Fed different Levels of Hasawi Rice Hulls

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ABSTRACT:

Several methods have been used to delay sexual maturity in order to obtain a larger egg size at the onset of production. These methods, ranged from a complete cessation of feed to decrease the density of certain nutrients in the diets. This study was conducted to investigate the effect of diluting the grower diet with Hasawi rice hulls on growth rate and sexual maturity of Single Comb (S. C.) White Leghorn Layers and to determine the chemical composition of Hasawi rice hulls.

Four dietary levels of Hasawi rice hulls, 0, 15, 30 and 50 % were mixed with grower diet and fed to 360 pullets from 5 to 8, 5 to 10 and 5 to 12 weeks of age. Proximate analysis was conducted on the Hasawi rice hulls.

The result of this study showed that inclusion of 50 % Hasawi rice hulls in the grower diet have significantly delayed sexual maturity and numerically increased early egg size. However, the rate of egg production was lower in the birds, fed 50 % rice hulls than that of the control. The chemical analysis of the Hasawi rice hulls showed a 93.3 % DM, 40.5 % CF, 15.3 % Ash, 3.9 % EE, and 7.45 % CP.

Under the circumstances of this study it is suggested that diluting the grower diet with 50 % Hasawi rice hulls may be beneficial in delaying sexual maturity, obtaining relatively larger early egg size and reducing the cost of production.

Key Words: Hasawi Rice Hulls, Sexual Maturity, Egg size

INTRODUCTION:

Feed restriction has been practiced for years in an attempt to minimize the amount of feed consumed by the birds. Different methods of feed restrictions have been applied ranging from complete cessation of feed in certain times of the day to decrease the density of certain nutrients in the feed (Najib, 1988; Najib and Al-Mulhim, 1992; Plavnik and Hurwitze, 1985; Rosebrugh *et al.*, 1986; and Washburn, 1990).

Dilution of feed by certain feedstuff may be used to limit the feed intake without adversely affecting growth rate. Leeson and Summers (1991) indicated the possibility of obtaining comparable growth at 42 days of age to the control by diluting the diet with rice hulls up to 51 % from 4 – 11 days of age. Their results showed the amazing ability of broilers to compensate for the drastic reduction in nutrient intake. The use of rice hulls in grower's diet may have different objective, since grower pullets may need to limit their feed intake to delay sexual maturity.

If this was true with broilers, then rice hull can be used in the rations of pullets to limit their growth so they reach sexual maturity in a later age and consequently their first eggs are larger.

Egg size is an important economic factor since about one-fourth of the eggs produced over one year of production are too small to command maximum market price. North (1984) indicated that egg size become larger as birds start their production in older age .

In an attempt to increase the size of early egg, Najib and Sullivan (1989, 1986) added different levels of Sulfur Amino Acids and linoleic acid in the layer ration. They concluded that in order to get an increased early egg size, feed manipulation should be started in the growing period.

This study was designed to investigate the effect of diluting the grower diet with Hasawi rice hulls on growth rate and sexual maturity of S. C. White Leghorn pullets and to determine the chemical composition of Hasawi rice hulls

MATERIALS AND METHODS:

The birds:

Three hundred sixty, day-old chicks were purchased from a local hatchary. They were brooded in starter cages for 4 weeks. Starting from the 5^{th} week, chicks were randomly distributed among 36 grower cages, each containing 10 pullets and representing a replicate. These cages were located in a completely closed house, where cooling device was installed. Lighting hours were fixed for 9 hours daily during the growing period.

The treatments:

Four dietary levels of hasawi rice hulls, 0, 15, 30 and 50 % were mixed with commercial grower diet. Each diet was offered to three experimental groups of three replicates at different age periods from 5 to 8, 5 to 10 and from 5 to 12 weeks of age . This resulted in a 4 X 3 factorial design experiment with three periods each having the same treatments, repeated three times (3 age periods X 3 reps X 4 levels X 10 birds=360 total number of birds). The feed and water were given to the birds ad-libitum. The calculated composition of the basal diets are presented in table 1.

Table (1) : The calculated composition of the basal diets

Nutrients	0-4 wks Starter	5-20 wks Grower	21-36 wks Layer
Metabolizable energy, ME (Kcal/Kg)	3070.0	2880.0	2847.0
Crude Protein, %	20.8	18.0	17.2
Crude fat, %	3.8	3.8	3.3
Crude fiber, %	1.0	3.2	2.2
Ca, %	1.0	0.9	3.5
Total P, %	0.7	0.6	0.5
Lysine, %	1.1	1.0	0.9
Meth+Cyst, %	0.8	0.8	0.7

Chemical Analysis:

Hasawi rice samples were ground using mill machine (Christy and Norris, Chelmsford-England). Samples were evaluated for chemical analysis using the methods of American Association of Cereal Chemists (AACC 1994). Moisture was determined according to (AACC, 44-16) using (Memmert 854 Schwabach) at 100 C for 3 hrs, Ash contents were determined according to (AACC, 08-01) using a gallenkamp muffle furnace. Crude protein (CP) was determined according to (AACC, 46-10) using kjeldahl (Kjeltec auto 1030 analyzer). Crude Fat (CF) was determined according to (AACC, 30-25) using Soxhlet, HT2 1045 Extraction Unit., and Crude Fiber (CF) was determined according to (AACC,32-10) using Lab Conco, corporation Kansas City, Missouri.

***The criteria, measured*:**

In this experiment and during the growing period; days to first egg, days to 50 % production, weight of the commencing eggs and body weight at 5 weeks of age were measured. However, during the production period, egg production was recorded daily along with any mortality. Hen-day production and mortality were calculated based on that. Feed intake was recorded and determined for each replicate hen at the end of each period. Eggs from three days collection were weighed individually to estimate average egg weight and to perform specific gravity on the eggs.

Statistical Analysis:

Statistical analysis of the data, using the General Linear Model (GLM) procedure of SAS (1988) was based on 4 X 3 factorial design. Differences among means were detected by Duncan Multiple Range Test (SAS 1988).

RESULTS AND DISCUSSION:

The Chemical analysis of the Hasawi rice hulls is presented in table 2. Level of crude fiber in the sample is high (about 40 %) which indicating the bulky texture of the hulls. However, levels of other nutrients such as Ether Extract, and crude protein contents are relatively high. Chemical analysis of the rice hulls as reported by Ensminger and Olentine (1978) were much lower than those reported in this study (Table 2).

The high fat, and protein contents of rice hull, found in this study, could be attributed to the possible contamination of the hulls with some of the Rice Polishings (the main by-product of of rice processing). Degree of purification of the Rice hulls is not known. McNab (1987) tested 14 samples of rice bran and found them to vary from 2 to 20 % in oil and the range of 13 – 14 % crude protein. Similarly, Panda (1970) reported that rice bran contained 1 to 14 % oil and 13 – 14 % crude protein. The degree of hull contamination with other constituent of whole rice may depend on the degree of polishing. Those figures were close to 12 % crude protein and 12 % oil as reported by Scott *et al.,* (1982).

NRC (1984) did not report proximate analysis figures for rice hulls to compare with. Furthermore, the rice hulls used in this experiment were polished from brown rice, indigenous to Al-Hassa area of the eastern province of Saudi Arabia, where it's name was derived.

Table (2) : The Chemical Analysis of the Hasawi Rice hulls

Nutrients	DM %	CF %	Ash %	EE %	CP %
This study	93.3	40.5	15.34	3.89	7.45
Literature[1]	92.0	40.1	18.90	0.70	2.80

DM = Dry matter
CF = Crude fiber
EE = Ether Extract
CP = Crude protein
[1]Ensminger and Olentine (1978)

Inclusion of Hasawi rice hulls, during certain period of time, in the grower ration was found to have some effects on the growth parameters (Table, 3). Interaction between period of inclusion and level of rice hulls did not significantly affect the growth traits, therefore discussion will be focused on each factor independently.

Period of inclusion had no significant effect on any of the criteria. However, level of hasawi rice hulls significantly ($P<0.05$) affected days to first egg, days to 50 % production, and body weight at 5 weeks of age. Birds, fed 50 % rice hulls remain significantly ($p<0.05$) longer period of time to reach sexual maturity, 50 % production and produced numerically larger eggs (Table 3). Birds larger in size, mature earlier, therefore they produce smaller eggs (North, 1984). In this study, the birds offered 50 % rice hulls, although they were larger in size at 5 weeks of age, they were the smallest at 20 weeks of age when the production commenced. These birds remained small till the age of 36 weeks when the study was terminated

(Table 4). However, the average size of the eggs during the production period was not significantly different from that of the control (Table 4).

Table (3) : The effect of Hasawi Rice Hull inclusion in the grower diet of Single Comb White Leghorn pullets

Source of Variation	DEF	D50%	EW	W5
Among periods				
	NS	NS	NS	NS
G1 (5-8 Wks)	139.2	147.1	43.67	142.5
G2 (5-10 wks)	139.2	148.5	44.08	142.8
G3 (5-12 wks)	138.7	149.1	44.42	141.1
P>F	0.848	0.425	0.931	0.862
Among Hulls levels				
	**	**	NS	*
0	136.6[a]	145.4[a]	43.89	135.0[a]
15	138.9[a]	148.2[a]	44.44	145.6[b]
30	137.8[a]	147.1[a]	43.00	144.7[b]
50	143.0[b]	152.1[b]	44.89	143.2[b]
P>F	0.0005	0.0075	0.8585	0.0369
Periods X levels	NS	NS	NS	NS

DEF = Days to first egg
D50% = Days to 50% production
EW = Egg weight, gm
W5 = Body weight at week 5 of age
G1, G2 and G3 = Duration of treatments
0 - 50 % levels of rice hull in the ration

Average egg production rate of the birds offered 50 % rice hulls containing diet was significantly ($P<0.05$) lower than that of the control (Table 4). This is probably due to the lower feed intake of this age group birds (Table 4).

Feed intake of the birds is affected by many factors, one of them is the bird's weight. The smaller the bird the less they eat. This is not peculiar since they need less to maintain the smaller body size. Feed intake was affected by the interaction between period and levels of hasawi rice hulls (Fig. 1). Birds which remained longer under 50% rice hulls treatment consumed the lowest amount of feed which consequently affected their body weight later in life. Feed conversion, on the other hand, was not optimum (Table 4) which could be due to the relatively lower egg production of the birds. However, feed conversion value of the birds fed the diet containing 50% rice hulls was in close proximity to that of the control. Birds, fed 50 % rice hulls diet had significantly ($P<0.5$) lower survival rate compared to birds on other treatments (Table 4). Whether, the higher mortality was due to the treatment is open for speculation as no specific signs were observed on the dead birds.

The effect of interaction between hasawi rice hulls levels and period of inclusion was significant ($P<0.05$) pertaining to cumulative livability and haugh unit of the eggs (Fig 2 & 3).

Tabel (4) : The effect of Hasawi Rice Hull inclusion in the grower diet on production traits of S. C. White Leghorn layers during 26 weeks of laying

Variation	FI	TEG	FC	EW	HD	WLIV	CLIV	SPG	HU	WT20	W36	WG
Among periods	NS	**	**	NS	**	NS	**	NS	**	*	NS	NS
G1 (5-8 weeks)	127.4	24.0^{a}	3.29^{a}	55.5	70.1^{b}	99.8	94.7^{a}	1.09	100.2^{a}	1301^{b}	1626	325
G2 (5-10 weeks)	125.2	24.8^{ab}	3.09^{b}	55.9	73.1^{a}	99.7	97.1^{b}	1.09	99.5^{b}	348^{a}	1662	313
G3 (5-12 weeks)	126.9	25.7^{b}	3.11^{b}	55.7	74.4^{a}	99.8	99.0^{c}	1.09	99.5^{b}	1319^{b}	1641	322
P>F	0.1900	0.0009	0.0209	0.5875	0.0091	0.5009	0.0001	0.5387	0.0081	0.8911	0.5193	0.9177
Among levels of rice hull, %												
	**	**	*	*	**	NS	**	NS	*	**	**	NS
0	129.1^{a}	25.7^{a}	3.16^{ab}	55.8^{ab}	74.4^{a}	99.9	97.6^{a}	1.09	99.9^{ab}	1378^{a}	1702^{a}	325
15	130.4^{a}	24.6^{a}	3.30^{a}	56.3^{a}	71.4^{ab}	99.9	97.3^{a}	1.09	100.0^{a}	1344^{a}	1639^{ab}	295
30	124.5^{b}	25.5^{a}	3.07^{b}	55.6^{ab}	74.7^{a}	99.6	97.2^{a}	1.09	99.8^{ab}	1338^{a}	1641^{ab}	303
50	122.0^{b}	23.5^{b}	3.13^{ab}	55.1^{b}	69.7^{b}	99.6	95.8^{b}	1.09	99.3^{b}	1232^{b}	1589^{b}	357
P>F	0.0001	0.0002	0.0827	0.0565	0.0046	0.0792	0.0424	0.2106	0.0812	0.0001	0.0239	0.2542
Period X levels	**	NS	NS	NS	NS	NS	*	NS	**	NA	NA	NA

FI : Feed intake, gm/b/d; TEG: Total number of eggs produced by the hen per period; FC : Feed conversion, Kg/Kg; EW : Egg weight, gm; HD : Hen-day egg production; WLIV: Weekly livability, %; CLIV: Cumulative livability, %; SPG: Specific gravity of the eggs; HU: Haugh unit (Albumin height)
WT20: Bird's weight at 20 weeks of age; Wt36: Bird's weight at 36 weeks of age; WG : Weight gain of the birds
** Significant, P<0.01; * Significant, P<0.05; NS Not significant, P>0.05; NA Not applicabale

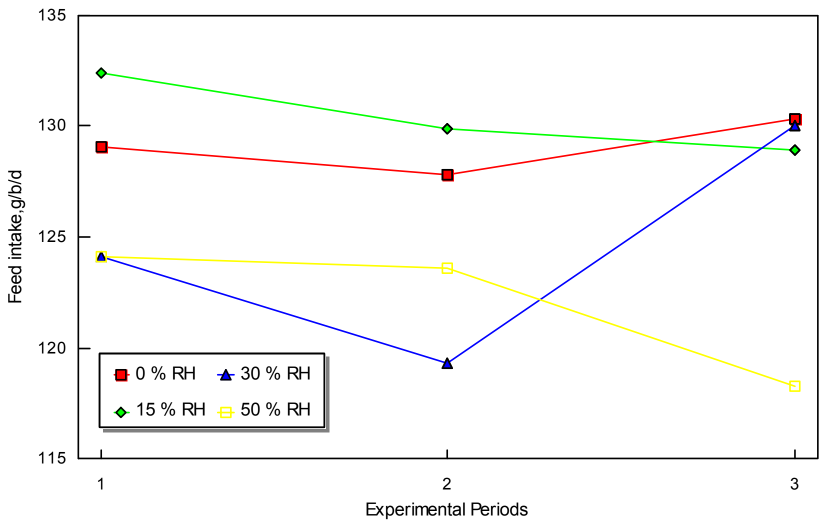

Fig. 1 The effect of treatment X period interaction
on daily feed intake

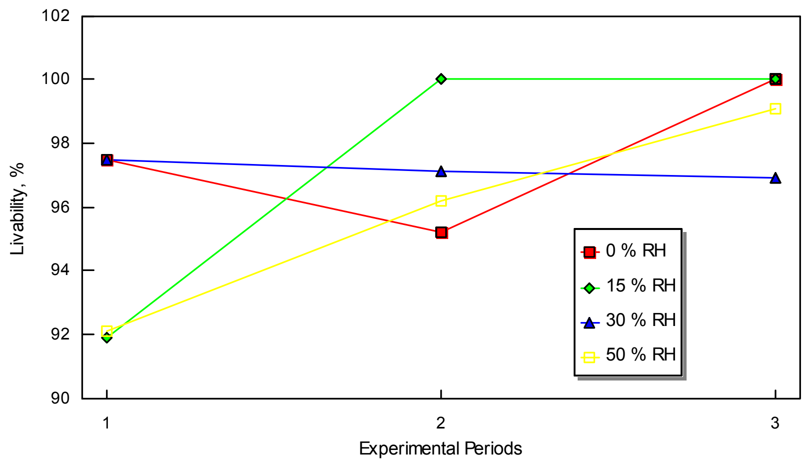

Fig 2. The effect of treatment X period interaction
on cumulative livability

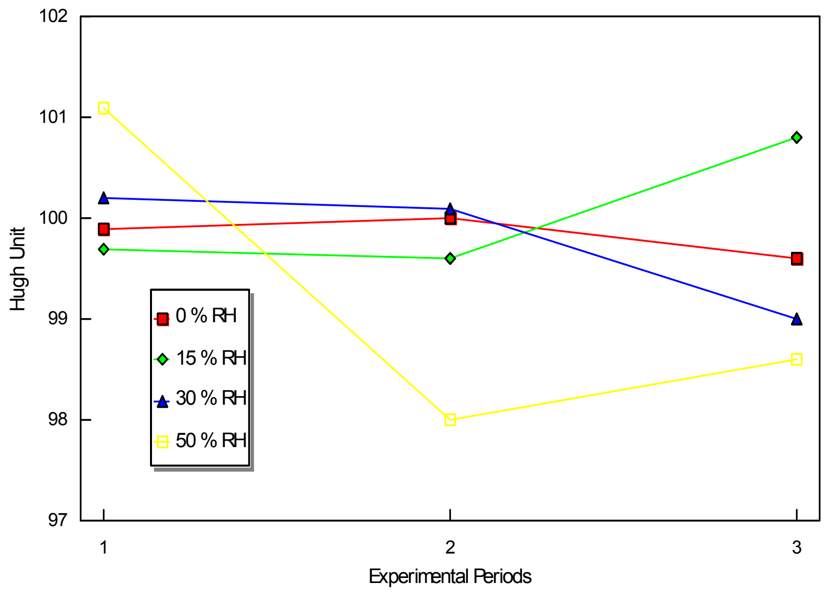

Fig 3. The effect of treatment X period interaction
on Haugh Unit

The inclusion of rice hulls in the grower diet had some effect on delaying sexual maturity which resulted in numerically larger eggs. This result was observed when 50 % rice hulls were incorporated in the diets.

Table (5) : The analyzed levels of protein and fiber in the experimental diets*

Treatments	**Protein level %**	**Fiber level %**
% Rice Hulls		
0	16.40	5.03
15	14.29	9.74
30	13.71	13.21
50	11.76	19.95

*Obtained by chemical analysis of the diets

The other treatment levels had no significant effect on this trait. This could be due to the higher levels of protein contained in these treatments

(Table 5) caused by possible contamination of the hulls with the other constituents of the rice. The highest level of fiber (20%) was observed in the diet containing 50% Rice hulls. This could probably assist in decreasing the growth rate of the birds, fed this diet. However, diluting the diet with 50% rice hulls decreased the level of protein to about 12% suggesting the sufficiency of protein needed for optimum growth of the pullets during the growing period. This indeed would minimize the cost of the grower diet to half. Cost of hulls is very low compared to the conventional diet in countries where rice production is abundant.

CONCLUSION :

Under the circumstances of this experiment and based upon the type of rice hulls used, it was concluded that if less production is acceptable, then inclusion of 50 % rice hulls in grower diet could be beneficial in delaying sexual maturity and obtaining relatively larger egg size. This is especially true if low production is compensated for, by the low cost of feed during the growing period.

Acknowledgment

The authors wish to thank The Scientific Council of King Faisal University for providing the fund of this research, and Al-Hasa Regional Agricultural Research Center for their cooperation in providing the rice hulls .

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تأثير إضافة مستويات مختلفة من قشور الأرز الحساوي في علائق دجاج البيض على النمو والنضوج الجنسي

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ا لمخص :

استخدمت عدة طرق لتأخ النضج ا نسي دجاج البيض للحصول على بيض كب ا جم عند بداية الإنتاج. وقد تدرجت هذه الطرق من منع كامل للعلف إ تقليل كثافة بعض العناصر الغذائية العلف.

أجريت هذه الدراسة لبحث تأث فيف علف النمو بقشور الأرز ا ساوي على معدل النمو والنضوج ا نسي لدجاج الليجهورن الأبيض ذو العرف ا فرد وكذلك لتقدير التركيب الكيميائي لقشور الأرز ا ساوي. وقد خلط أربعة مستويات من الأرز ا ساوي : صفر ، ١٥ ، ٣٠ و ٥٠ % مع علف النمو وأطعمت هذه العلائق لـ ٣٦٠ فرخة الفترات من ٥ – ٨ و ٥ – ١٠ و ٥ – ١٢ أسبوع من العمر. كما ليل الأرز ا ساوي كيميائيا.

وقد أظهرت نتائج هذه الدراسة أن إضافة ٥٠ % من قشور الأرز ا ساوي أخرت معنويا النضوج ا نسي ونادت إ زيادة غ معنوية حجم البيض الأو . إلا ان معدل الإنتاج اللاحق أ فض الطيور ا غذاة على علائق توية على ٥٠ % قشور أرز حساوي مقارنة بالعلائق ا الية منه. كما أظهرت نتائج التحليل الكيميائي أن قشور الأرز ا ساوي توي على ٩٣,٣ % مادة جافة، ٤٠,٥ % ألياف خام ، ١٥,٣ % رماد ٣,٩ % مستخلص الإيثر و ٧,٤٥ % بروت خام.

هذا وقد اقترح انه ت ظروف هذه التجربة فإن فيف علائق النمو بـ ٥٠ % شور الأرز ا ساوي كن ان يكون ذو فائدة تأخ النضج ا نسي والتبك ا صول على بيض كب ا جم نسبيا والتقليل من تكاليف الإنتاج.