Original Research

Effect of Shellfish Industry Processing Waste Coated on Sunflower Extraction Replacing Soybean Meal on Performance of Broilers

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Abstract

A trial was conducted to evaluate the effect of feeding shellfish industry processing waste coated on sunflower extraction to replace soybean meal by part basis on the performance of broilers. 480 broilers of Cobb 400 strain were divided into eight groups of 60 chicks each with each group having six replicates of ten birds. Birds from groups A and B, were control receiving corn-soybean based diet without and with supplementation of enzyme, respectively. Birds from groups C, E and G received diets with coated sunflower extraction replacing soybean meal at 25, 50 and 75%, respectively, without supplementation of enzyme. Birds from groups D, F and H received diets same as groups C, E and G, respectively, with enzyme supplementation. Diet having coated sunflower extraction replacing soybean meal at 25% level with enzyme supplementation, helped in recording better live weights, gain in weights and feed consumption in broilers. Hence, it can be concluded that the use of coated sunflower extraction replacing soybean meal at 25% level with enzyme supplementation in the diet is useful in recording better production performance of broilers.

Key words: Broilers, Shellfish Industry Processing Waste, Sunflower Extraction

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Introduction

In broiler farming, feeding is the highest expense accounting up to 70% of the cost of rearing. Due to the rising prices of conventional ingredients used in poultry feeding viz. maize and soybean, there is a need to use other locally available by-products in poultry feed, Thirumalaisamy *et al.* (2016). The shrimp processing industry in India deals with more than 1.25 lakh tonnes of head and shell waste per annum. This causes enormous environmental pollution problems. India has a potential of producing 10,000 tonnes of

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chitin per annum from prawn shell itself. At present, the chitin industry in India is utilizing less than 20% of the shell waste with an earning of Rs. 100 crores annually, CIFT (2013). This prawn waste is used for manufacturing chitin, chitosan and glucosamine hydrochloride used in the pharmaceutical industry. During the process of extraction of chitin, the prawn shells are subjected to deproteinisation leading to formation of chitin precipitate and a protein slurry containing about 4-5% protein. This slurry can be coated on de-oiled rice bran (DORB) (Vichare, 2013; Subbarayadu, 2015) and used for feeding layers and broilers, respectively. However, use of the slurry coated on soybean meal (Purohit, 2013) in broiler rations did not show beneficial effect. Hence, a trial was designed to study the effect of sunflower extraction coated with protein from chitin industry to replace soybean meal in broiler diets. Sunflower extraction was chosen as an ingredient because of the absorbent nature of the ingredient and based on the previous studies carried out.

Material and Method

The trial was conducted on 480 day-old broiler birds of Cobb 400 strain. The birds were divided into eight equal groups of 60 birds each. Each group was further divided into six replicates of ten birds each. Each group was subjected to one of the following treatments-

Group A: Control diet

Group B: Control diet with enzyme*

Group C: Diet receiving coated sunflower extraction replacing 25% soybean meal in basal diet on part basis

Group D: Diet C with enzyme*

Group E: Diet receiving coated sunflower extraction replacing 50% soybean meal in basal diet on part basis

Group F: Diet E with enzyme*

Group G: Diet receiving coated sunflower extraction replacing 75% soybean meal in basal diet on part basis

Group H: Diet G with enzyme*

*Enzyme - Natuzyme @ 350 g/T of feed

The slurry for trial was prepared by carrying out deproteinization of prawn shells. This slurry was then coated onto sunflower extraction in 1:1 proportion in a steam jacketed vessel with turning process at temperature of 95-100^{o}C for one and half hours and then sun dried. The daily records for feed consumption and mortality were maintained. Weekly records of live weight, gain in weight, feed consumption, feed conversion ratio (FCR) and mortality were maintained. The economics of the production was calculated at the end of the trial. The feed formulations of the diets used in the trial are presented in Tables 1, 2 and 3.

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Table 1: Feed formulation of pre-starter diets

Ingredients	Control	Coated Sunflower extraction replacing soybean meal at 25% by part	Coated Sunflower extraction replacing soybean meal at 50% by part	Coated Sunflower extraction replacing soybean meal at 75% by part
	Groups A and B	Groups C and D	Groups E and F	Groups G and H
Maize	53.73	53.73	53.73	53.73
Bergafat	1.87	1.87	1.87	1.87
Soybean meal	40.36	30.27	20.18	10.09
Coated Sunflower extraction	0	10.09	20.18	30.27
Trace mineral mixture	0.1	0.1	0.1	0.1
Monocalcium phosphate	1.4	1.4	1.4	1.4
Limestone powder	1.8	1.8	1.8	1.8
Salt	0.3	0.3	0.3	0.3
Vitamin premix	0.02	0.02	0.02	0.02
Choline chloride	0.05	0.05	0.05	0.05
Anticoccidial	0.05	0.05	0.05	0.05
MHA	0.16	0.16	0.16	0.16
Lysine	0.06	0.06	0.06	0.06
Toxinbinder	0.1	0.1	0.1	0.1
TOTAL	**100**	**100**	**100**	**100**

Table 2: Feed formulation of starter diets

Ingredients	Control	Coated Sunflower extraction replacing soybean meal at 25% by part	Coated Sunflower extraction replacing soybean meal at 50% by part	Coated Sunflower extraction replacing soybean meal at 75% by part
	Groups A and B	Groups C and D	Groups E and F	Groups G and H
Maize	54.82	54.82	54.82	54.82
Bergafat	3.27	3.27	3.27	3.27
Soybean meal	37.93	28.45	18.965	9.48
Coated Sunflower extraction	0	9.48	18.965	28.45
Trace mineral mixture	0.1	0.1	0.1	0.1
Monocalcium phosphate	1.22	1.22	1.22	1.22
Limestone powder	1.9	1.9	1.9	1.9
Salt	0.3	0.3	0.3	0.3
Vitamin premix	0.02	0.02	0.02	0.02
Choline chloride	0.05	0.05	0.05	0.05
Anticoccidial	0.05	0.05	0.05	0.05
MHA	0.17	0.17	0.17	0.17
Lysine	0.07	0.07	0.07	0.07
Toxinbinder	0.1	0.1	0.1	0.1
TOTAL	**100**	**100**	**100**	**100**

Table 3: Feed formulation of finisher diets

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Ingredients	Control	Coated Sunflower extraction replacing soybean meal at 25% by part	Coated Sunflower extraction replacing soybean meal at 50% by part	Coated Sunflower extraction replacing soybean meal at 75% by part
	Groups A and B	Groups C and D	Groups E and F	Groups G and H
Maize	59.29	59.29	59.29	59.29
Bergafat	4.18	4.18	4.18	4.18
Soybean meal	32.6	24.45	16.3	8.15
Coated Sunflower extraction	0	8.15	16.3	24.45
Trace mineral mixture	0.1	0.1	0.1	0.1
Monocalcium phosphate	1.25	1.25	1.25	1.25
Limestone powder	1.92	1.92	1.92	1.92
Salt	0.3	0.3	0.3	0.3
Vitamin premix	0.02	0.02	0.02	0.02
Choline chloride	0.05	0.05	0.05	0.05
Anticoccidial	0.05	0.05	0.05	0.05
MHA	0.14	0.14	0.14	0.14
Lysine	0	0	0	0
Toxinbinder	0.1	0.1	0.1	0.1
TOTAL	**100**	**100**	**100**	**100**

Statistical Methods

The data collected pertaining to all the parameters were subjected to completely randomized design as per Snedecor and Cochran (1994).

Result and Discussion

Live Weights

The average live weights of birds at the end of six weeks were 2672.23, 2645.94, 2642.70, 2704.25, 2380.74, 2375.89, 1757.84 and 1807.65 g for groups A to H, respectively. From the data it is revealed that, the highest live weights were recorded by the birds from group D followed by the birds from group A, B, C, E, F, H and G, respectively.

The birds from group A recorded 1.12%, 12.24% and 52.02% higher live weights as compared to the birds from groups C, E and G, respectively. It was also noted that, the birds from group D recorded 2.20%, 13.82% and 49.60% higher body weights compared to the birds from groups B, F and H, respectively. Further, the birds from groups D and H receiving coated sunflower extraction replacing soybean meal at 25 and 75% levels with enzymes recorded 2.32% and 2.83% better live weights as compared to their respective non-enzyme supplemented counterparts. However, birds from group F recorded 0.2% lesser live weights as compared to the birds from group E. The statistical analysis revealed that, the differences in the weekly live weights of the birds from different groups were statistically non-significant. Ibrahim and El Zubeir (1990) reported no significant differences in the live weights of broiler birds receiving sunflower seed meal

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at 10, 20 and 30% in the diets. Gerendai *et al.* (1997) also reported similar results when broilers were fed sunflower meal with or without supplementation of enzymes. Similar results were noted in the present trial. Thus it can be concluded that, replacement of soybean meal with coated sunflower extraction at 25% on by part basis along with supplementation of enzyme results in recording 1.20% and 2.20% higher average live weight in broilers as compared to the birds from groups A and B, respectively, at the end of six weeks.

Gain in Weight

The average total gain in weights of birds were 2626.10, 2600.24, 2596.47, 2657.75, 2335.27, 2330.82, 1711.74 and 1762.12 for groups A to H, respectively. The corresponding average weekly gain in weights of birds from groups A to H were, 437.68, 433.37, 432.74, 442.96, 389.21, 388.47, 285.29 and 293.69, respectively. From the data it is revealed that, the birds from group D recorded the highest average weekly gain in weights followed by the birds from group A, B, C, E, F, H and G, respectively.

Comparison of birds from group A, C, E and G revealed that, birds from group A recorded 1.14%, 12.45% and 53.42% higher average weekly gain in weights as compared to the birds from groups C, E and G respectively. However, among the groups receiving supplementation of enzyme, the birds from group D, recorded 2.21%, 14.03% and 50.83% better average weekly gain in weights than birds from groups B, F and H, respectively. Further, birds from groups D and H receiving coated sunflower extraction replacing soybean meal at 25 and 75% levels with enzymes recorded 2.36% and 2.94% higher gain in weights as compared to their respective non-enzyme supplemented counterparts. However, in groups E and F, it was noted that birds from group E, provided with diet without enzyme recorded 0.19% higher gain in weights as compared to birds from group F, receiving enzyme supplementation. The statistical analysis of the data revealed that, differences among the average weekly gain in weights of the birds from different groups were statistically non-significant. Rad and Keshavarz (1976) and Ologhobo (2016) reported non-significant differences in gain in body weights for the birds receiving diets with sunflower meal replacing soybean meal at 25, 50 and 70% levels. However, the birds receiving sunflower meal recorded lesser gain in body weights as compared to birds from control group. Similar results were reported by Cheva-Isarakul and Tangtaweewipat (1991) when soybean meal was replaced by sunflower meal at 15, 30 and 45%. These results corroborate with the results of the present trial.

Thus, it can be concluded that, the use of diet with soybean meal replaced with coated sunflower extraction at 25% level along with supplementation of enzyme helps in recording 1.20% and 2.21% higher average gain in weights as compared to the birds from groups A and B, respectively.

Feed Consumption

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The total feed consumption per bird during the entire trial period for groups A to H was 4309.17, 4312.52, 4448.10, 4490.29, 4292.38, 4177.17, 3416.80 and 3614.31 g, respectively. It was noticed that the highest feed consumption was recorded by the birds from group D receiving diet with soybean meal replaced with coated sunflower extraction at 25% on by part basis, supplemented with enzyme followed by the birds from groups C, B, A, E, F, H and G, respectively. The birds from group C, recorded 3.22%, 3.63% and 30.18% higher feed consumption compared to the birds from groups A, E and G, respectively. It was also noted that, the birds from group D recorded 4.12%, 7.50% and 23.32% higher feed consumption than the birds from groups B, F and H, respectively. Further, groups D and H receiving coated sunflower extraction replacing soybean meal at 25 and 75% levels with enzymes recorded 0.95% and 6.57% higher feed consumption as compared to their respective non-enzyme supplemented counterparts. However, the birds from group F recorded 2.68% less feed consumption as compared to the birds from group E. The statistical analysis of the data revealed that, the differences among the average weekly feed consumption of the birds from different groups were statistically non-significant. Ologhobo (2016) reported non-significant feed consumption in the birds receiving diets with sunflower meal replacing soybean meal up to 75% level. Cheva-Isarakul and Tangtaweewipat (1991) recorded non-significant feed intake in birds receiving diet containing sunflower meal up to 30% level. Similar results were obtained in the present trial as birds receiving sunflower extraction have recorded lesser feed consumption.

Thus, it can be concluded that, the use of diet with soybean meal replaced with coated sunflower extraction at 25% level along with supplementation of enzyme helps in recording 4.20% and 4.12% higher average feed consumption by the birds as compared to the birds from groups A and B, respectively.

Feed Conversion Ratio (FCR)

The average feed conversion ratio (FCR) was 1.54, 1.56, 1.61, 1.57, 1.72, 1.68, 1.88 and 1.94 for the birds from groups A to H, respectively. The corresponding cumulative FCR for the birds at the end of six weeks were 1.60, 1.63, 1.68, 1.65, 1.77, 1.74, 1.94 and 2.01. It was noted that, the birds from groups C, E and G recorded 4.55%, 11.69% and 22.08% poorer FCR as compared to the birds from group A, respectively. Similarly, the birds from groups D, F and H recorded 0.64%, 7.69% an 24.36% poorer FCR as compared to birds from group B, respectively. It was also noted that, the birds from group C recorded 2.55% poorer FCR as compared to birds from group D. However, birds from group F and group H recorded 2.38% and 3.19% poorer FCR than birds from group E and group G, respectively. The analysis of the data revealed that the differences in the FCR of the birds from different groups were statistically non-significant. Rad and Keshavarz (1976) and Ologhobo (2016) reported non-significant FCR for birds receiving diets with sunflower meal replacing soybean meal up to 70%. However, Ologhobo (2016) reported significantly

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poorer (P<0.05) FCR in birds receiving sunflower meal at 75% replacement level. Similar results were obtained in this trial.

Thus, it can be concluded that, the supplementation of enzyme helped in recording better FCR when the birds received diets with soybean meal replaced with coated sunflower extraction at 25% and 50% on part basis.

Economics of Production

The economics of broiler production from different groups was calculated considering feed cost as the only variable. The birds from group A recorded highest net profit per kg. However, amongst the groups receiving replacement of soybean meal with coated sunflower extraction, the group D recorded highest profits per kg as compared to all other treatment groups.

Overall Performance

The overall performance of broilers from different groups during the trial is presented in Table 4.

Table 4: Overall performance

Parameters	Groups							
	A	B	C	D	E	F	G	H
	Control	Control plus enzyme	Coated Sunflower extraction replacing soybean meal at 25% by part	Coated Sunflower extraction replacing soybean meal at 25% by part plus enzyme	Coated Sunflower extraction replacing soybean meal at 50% by part	Coated Sunflower extraction replacing soybean meal at 50% by part plus enzyme	Coated Sunflower extraction replacing soybean meal at 75% by part	Coated Sunflower extraction replacing soybean meal at 75% by part plus enzyme
Initial body weight (g)	46.13	45.7	46.23	46.5	45.47	45.07	46.1	45.53
Final body weight (g)	2672.23	2645.94	2642.7	2704.25	2380.74	2375.89	1757.84	1807.65
Total gain in weight (g)	2626.1	2600.24	2596.47	2657.75	2335.27	2330.82	1711.74	1762.12
Total feed consumption (g)	4309.17	4312.52	4448.1	4490.29	4292.38	4177.17	3416.8	3641.31
Average FCR	1.54	1.56	1.61	1.57	1.72	1.68	1.88	1.94
Cumulative FCR	1.6	1.63	1.68	1.65	1.77	1.74	1.94	2.01
Mortality %	0	0	0	6.67	3.33	0	6.67	3.33
Net profit per bird (Rs.)	44.32	38.84	30.54	34.22	9.38	11.54	-19.63	-22.63
Net profit per kg (Rs.)	16.58	14.68	11.56	12.66	3.94	4.86	-11.17	-12.52

It is observed from the table that, providing diet with replacement soybean meal by sunflower extraction at 25% along with supplementation of enzyme, helped the birds to record higher feed consumption and better live weights at the end of six weeks along with better gain in weights. The birds from group D could not

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record higher profit margin compared to birds from control group with or without enzyme supplementation, due to the higher cost of the slurry.

Conclusion

It can be concluded that, the use of shellfish industry processing waste coated on sunflower extraction replacing soybean meal at 25% level with enzyme supplementation in broiler diets is useful in recording better live weights, higher gain in weights and comparable feed conversion ratio. In areas where slurry is available at lower cost, more economic benefit will be obtained by using the coated sunflower extraction in the diet of broilers.

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