

EFFECT OF FEEDING SHRIMP WASTE MEAL REPLACING FISH MEAL AT DIFFERENT LEVELS ON SERUM BIOCHEMICAL PROFILE OF COMMERCIAL BROILERS

S. Dhamotharan¹ and K. Premavalli^{2*}

Department of Poultry Science
Madras Veterinary College
Tamil Nadu Veterinary and Animal Sciences University
Chennai - 600 007

ABSTRACT

An experiment was conducted to evaluate the effect of feeding steam processed shrimp waste meal as a replacement for fish meal on serum biochemical parameters in broilers. A total of 300 day old commercial broiler chicks were randomly allotted into five treatment groups with three replicates having twenty chicks per replicate. The five treatment groups were fed with the diets containing SWM gradually replacing FM at 0, 2.5, 5, 7.5 and 10% level. There were no significant difference in serum glucose and serum protein profile among different treatments. The mean HDL: LDL ratio was significantly ($P < 0.05$) highest (3.40) in the birds fed with FM0%+SWM10% (T5) than other treatments. It is inferred from the study that the replacement of FM with SWM at different levels in broiler feed did not influence serum biochemical parameters significantly ($P > 0.05$), however significantly ($P < 0.05$) higher mean HDL: LDL ratio and lower cholesterol: HDL ratio indicates better health status of birds. Therefore, processed SWM may be used as a complete alternate animal protein source up to 10% level with supplementation of lysine and methionine amino acids replacing fish meal in commercial broiler ration without any adverse effects on serum biochemical indices of the broilers.

Keywords: Shrimp waste meal, fish meal, serum biochemical profile, broilers.

Received : 08.07.2026

Revised : 22.07.2026

Accepted : 06.08.2026

INTRODUCTION

Indian broiler farming is growing at an annual growth rate of 11%, faster than the other livestock sectors. Feed cost accounts for more than 70% of the total cost of production of commercial broilers. In general, feed cost is determined by protein content of the feed.

Plant protein and animal protein sources are being included in the ration to meet out the protein requirements of commercial broilers. Among the animal protein sources, Fish meal (FM) is mostly preferred in poultry feed formulations because of its high biological value, better amino acids profile, as a source of nucleotides, essential fatty acids, phospholipids, minerals, fat and water soluble vitamins with improved palatability and digestibility. However, due to the lack of availability of fishmeal, variation in

¹M.V.Sc. Scholar

²Professor

*Corresponding author: drpremavalli@gmail.com

This is Thesis article

its nutrient composition according to fish varieties, possibility of adulteration, hazards of pathogenic salmonella contamination and escalated cost causes limited usage of it in commercial broiler diets nowadays. Therefore, constant search for economical alternate unconventional protein source to partial or total replacement of fish meal is warranted. Shrimp Waste Meal (SWM) is a by-product of shrimp processing industry consisting of mainly the head, guts and exoskeleton of shrimps processed for export and local consumption (Fanimo *et al.*, 1999). The high CP content and reasonably good balance of essential amino acids make shrimp waste a useful potential alternative to fish meal in diets for monogastric animals (Ngoan *et al.*, 2000).

Serum biochemical profile is usually estimated to assess the health status of birds. Serum biochemical constituents are positively correlated with the quality of the diet (Adeyemi *et al.*, 2000). A readily available and fast means of assessing clinical and nutritional health status of animals on feeding trials may be the use of blood analysis, because ingestion of dietary components has measurable effects on blood composition (Maxwell *et al.*, 1990). It is accepted that serum protein profile and the absolute values of individual fractions are an excellent basis for a tentative diagnosis (Kaneko, 1997). On the other hand, the available literature information on the effect of shrimp waste meal as an alternate animal protein source in the place of fish meal on the serum biochemical profile of commercial broilers under Indian climatic conditions are very scanty. Hence, the present study

was proposed to investigate the effect of shrimp waste meal by replacing fish meal at different levels on serum biochemical profile of commercial broiler.

MATERIALS AND METHODS

A total of 300 day old commercial Cobb broiler chicks were procured for this study. The chicks were randomly allotted into five treatment groups with three replicates having twenty chicks per replicate. Three phases of experimental diets (broiler pre-starter, broiler starter and broiler finisher) were formulated as per BIS (2007) specifications with locally available feed ingredients. The rations for the five treatment groups were iso-caloric and iso-nitrogenous corn soya bean based diets with the addition of 10% animal protein source. The groups were fed with the diets containing steam processed SWM gradually replacing FM and the treatment diets of T1, T2, T3, T4 and T5 groups consisted of basal diet with 10% FM + 0% SWM, 7.5% FM + 2.5% SWM, 5% FM + 5% SWM, 2.5% FM + 7.5% SWM and 0% FM + 10% SWM, respectively. All the birds were reared under the standard management conditions and fed *ad libitum* till 35 days of age. Ingredient and nutrient composition (%) of the experimental broiler pre-starter, starter and finisher feed are furnished in Table: 1- 3.

- **Poultry Mineral Mixture (MMP)** contains Calcium-23 per cent, Phosphorus -12 per cent, Magnesium-6.5 per cent, Iron - 0.5 per cent, Iodine - 0.026 per cent, Copper-0.077 per cent, Manganese-0.12 per cent, Cobalt-0.012

per cent, Zinc -0.38 per cent, Sulphur - 0.5 per cent, Fluorine - 0.07 per cent and Selenium - 0.3 ppm.

- **Ultravite M** Each 2.5 kg contains Vitamin A- 1,25,00,000 IU, Vitamin D3- 25,00,000 IU, Vitamin B2 - 5 gm, Vitamin B6- 0.4 gm, Vitamin B12- 15 mg, Vitamin E - 800 IU, Vitamin K - 2 gm, Niacinamide - 10 gm, Calcium d-Pantothenate - 4 gm, Choline chloride - 300 gm, Calcium- 760gm, Copper-2 gm, Iodine-2 gm, Iron - 20 gm, Manganese - 55 gm, Zinc - 52 gm and Cobalt - 100 mg.

At the end of 35 days of experimental period, a total of 30 birds comprising of one male and one female from each replicate with a total of six birds from each treatment group were randomly selected, blood samples were collected and serum was separated for biochemical analysis. The biochemical parameters such as glucose, total protein (TP), albumin, globulin, triglycerides, total cholesterol, high density lipoprotein (HDL) and low density lipoprotein (LDL) were estimated by A15 Biosystem auto analyzer, using the commercial kits that were purchased from AGAPPE, Radiant specialty diagnostics and Stepstone chemicals, Chennai. The ratios of Albumin: Globulin, HDL: LDL and TC: HDL were calculated. Data recorded in this biological experiment were subjected to one way analysis of Variance (ANOVA) as per the procedures of statistical analysis system (SPSS, version 20.0). Post hoc test was carried out to compare means by Duncan multiple range comparison test with level

of significance ($P < 0.05$). The results of the analysis were interpreted accordingly.

RESULTS AND DISCUSSION

The mean ($\pm$ S.E) serum biochemical profile of broilers as influenced by different levels of SWM replacing FM is presented in Table 4.

Serum glucose profile

Analysis of variance of data on mean serum glucose (mg/dl) level revealed no significant ($P > 0.05$) difference among different levels of SWM replacing FM in broiler diet. Similar observation was also made by Olayemi, (2001) and Mounica *et al.* (2020) in feeding Shrimp waste meal based diet for broilers.

The mean serum glucose levels recorded (118-187 mg/dl) in the present study falls within the range (110-350 mg/dl) stated by Sturkie (1986) and was lower than those recorded by Mounica *et al.* (2020) in broilers at the end of 6 weeks of age (373.75 – 386.36mg/dl) by replacing fish meal protein by shrimp waste meal protein at different levels with or without amino acids.

Serum protein profile

Statistically non-significant ($P > 0.05$) differences existed for serum protein profile parameters (g/dl) namely total protein, albumin, globulin levels and albumin: globulin ratio (A: G ratio) between different treatment groups of this study. This implies that the replacement of fishmeal with various levels of shrimp waste meal

in broiler diet had identical dietary qualities with each other. The non-significant ($P>0.05$) differences on serum protein profile parameters (g/dl) observed between different treatment groups of this study is in agreement with the results of Mounica *et al.* (2019) who also recorded the same outcome in finisher phase of broilers that there were no significant difference in levels of serum total protein (g/dl), albumin (g/dl) and glucose (mg/dl) among treatments, except globulin levels (g/dl) which was found to be significantly ($p < 0.01$) higher (1.41 g/dl) in birds fed T1(0% SWM) diet than birds fed other diets T2(50% SWM), T3(100% SWM), T4 (50% SWM+ synthetic lysine and methionine) and T5(100% SWM + synthetic lysine and methionine SWM). The mean values of total protein, albumin, and globulin levels between different treatment groups ranged from 3.08 – 3.35 g/dl recorded in this study which was lower than those (4.04 to 5.15g/dl) recorded by Mounica *et al.* (2019) which might be attributed to variations in experiment, birds, diet and environment.

Serum lipid profile

The mean values of serum lipid profile parameters namely total cholesterol, triglycerides, LDL and HDL values did not differ significantly ($P>0.05$) between different treatments such as 10% FM +0% SWM (T1), 7.5% FM + 2.5% SWM (T2), 5% FM + 5% SWM (T3), 2.5% FM + 7.5% SWM (T4) and 0% FM + 10% SWM (T5), respectively.

The inclusion of SWM at various levels replacing FM in broiler diets had non-significant effect on mean serum total cholesterol levels recorded in this study indicates better health status of broilers. The mean HDL: LDL ratio calculated for T1, T2, T3, T4 and T5 groups fed with different level of SWM replacing FM were 3.10 ± 0.44 , 2.20 ± 0.21 , 2.45 ± 0.12 , 2.92 ± 0.23 and 3.40 ± 0.31 , respectively. The mean HDL: LDL ratio was significantly ($P<0.05$) influenced by different level of SWM replacing FM in broilers in this study and it was highest in T5(FM0%+SWM10%) and lowest in T2(FM2.5%+SWM7.5%) birds. The T1(FM10%+SWM0%), T4 (FM2.5%+SWM7.5%) and T3(FM5%+SWM5%) birds were intermediary to T5 and T2. In the present study significantly ($P<0.05$) higher HDL: LDL ratio (3.40) was found in the birds (T5) fed with (FM0%+SWM10%).

The present biological trial findings on serum lipid profile of broilers fed with different levels of SWM by replacing FM is in agreement with the results of Nuengjamnong and Angkanaporn (2017) who stated that chitosan supplementation in broiler group of 3 and 4 (1 and 2 g/kg respectively) had no effect on serum cholesterol (127 & 122 mg/dl) and triglyceride (78 & 81 mg/dl) on d 39, compared with groups 1 and 2 (control and supplemented with 200 ppm amoxicillin respectively).

In contrast to the findings of the present study, Adeyeye *et al.* (2014) reported that the levels of serum cholesterol increased as the level of SWM substitution increased

in turkey poults. Mounica *et al.* (2019) also found significant ($P<0.01$) reduction in the level of cholesterol (111.26 mg/dl) during finisher phase of broilers fed with increasing levels of SWM (T3) replacing FM protein. The mean total cholesterol: HDL ratio for treatment groups fed with SWM replacing FM at different levels in T1, T2, T3, T4 and T5 groups were 1.25 ± 0.04 , 1.45 ± 0.03 , 1.37 ± 0.07 , 1.29 ± 0.05 and 1.26 ± 0.04 , respectively. The mean of mean total cholesterol: HDL ratio differed significantly ($P<0.05$) between the treatments. The control (T1- 10% FM +0% SWM) group recorded lowest ratio (1.25 ± 0.04) and comparable to T5 (0% FM +10% SWM) and T4 (2.5% FM +7.5% SWM) followed by T3 (5% FM +5% SWM) and T2 (7.5% FM +2.5% SWM) groups. The ideal total cholesterol: HDL ratio should be below 4. In this study, the birds fed with 10% FM +0% SWM (T1), 0% FM +10% SWM (T5) and 2.5% FM +7.5% SWM (T4) had lowest ratio, which indicates better health status of broilers. Several factors including physiological conditions, environmental conditions, diet composition and age affect the blood profiles of healthy birds (Seiser *et al.*, 2000; Vecerek *et al.*, 2002).

CONCLUSION

It is inferred from the present study that the replacement of FM with SWM at 0, 2.5, 5.0, 7.5 and 10% levels in broiler feed did not influence serum biochemical parameters significantly ($P>0.05$), however significantly ($P<0.05$) higher mean HDL: LDL ratio and lower total cholesterol: HDL ratios was recorded for the birds fed with 0% FM +10% SWM (T5). Therefore steam processed SWM may be used as a complete alternate animal protein source up to 10% level with supplementation of lysine and methionine amino acids replacing fish meal in commercial broiler ration without any adverse effects on serum biochemical indices of the broilers.

ACKNOWLEDGEMENTS

The authors are very much thankful to the Tamil Nadu Veterinary and Animal Sciences University, Chennai for the facilities provided to carry out the present work.

Table.1. Ingredient and nutrient composition (%) of the experimental broiler pre-starter feed

Name of the Ingredients	T1	T2	T3	T4	T5
Maize	54.46	55.01	55.67	55.00	55.23
Soyabean meal	31.00	30.75	30.50	30.70	30.40
Fish meal	10.0	7.5	5.0	2.5	0.0
Shrimp waste	0.0	2.5	5.0	7.5	10.0
Oil (palmolein)	2.00	1.75	1.30	1.40	1.20
Poultry mineral mixture	1.00	0.83	0.40	0.28	0.20
Di-calcium phosphate	0.08	0.20	0.60	1.00	1.27
Salt	0.50	0.50	0.50	0.50	0.50
Feed additives #	0.86	0.86	0.86	0.86	0.86
Lysine	0.00	0.00	0.05	0.11	0.18
Methionine	0.10	0.10	0.12	0.15	0.16
Total	100	100	100	100	100
Nutrient composition of the experimental broiler pre-starter feed					
Crude protein (%)	23.05	23.05	23.00	23.00	23.00
Metabolizable energy (Kcal/kg)	3005	3008	3000	3001	3007
Calcium (%)	1.16	1.16	1.15	1.11	1.21
Av. phosphorus (%)	0.53	0.49	0.47	0.45	0.46
Lysine (%)	1.37	1.31	1.30	1.30	1.33
Methionine (%)	0.51	0.50	0.49	0.51	0.50

- Feed additives includes Ultravite – M, Toxin binder, Synercox, Oxinex, Choline chloride, Spectra DFM and Ultra – B12.

T1-FM10/SWM0, T2-FM7.5/SWM2.5, T3-FM5/SWM5, T4-FM2.5/SWM7.5, T5-FM0/SWM10

Table.2. Ingredient and nutrient composition (%) of the experimental Broiler starter feed

Name of the Ingredients	T1	T2	T3	T4	T5
Maize	55.48	56.00	56.30	56.50	56.30
Soyabean meal	28.50	28.25	28.10	28.00	27.87
Fish meal	10.0	7.5	5.0	2.5	0.0
Shrimp waste	0.0	2.5	5.0	7.5	10.0
Oil (palmolein)	3.56	3.25	3.00	2.80	2.76
Poultry mineral mixture	1.00	0.80	0.47	0.10	0.07
Di-calcium phosphate	0.00	0.21	0.60	1.01	1.33
Salt	0.5	0.5	0.5	0.5	0.5
Feed additives #	0.86	0.86	0.86	0.86	0.86
Lysine	0.00	0.00	0.02	0.08	0.14

Methionine	0.10	0.13	0.15	0.15	0.17
Total	100	100	100	100	100
Nutrient composition of the experimental broiler pre-starter feed					
Crude protein (%)	22.04	22.02	22.02	22.04	22.01
Metabolizable energy (Kcal/kg)	3102	3103	3103	3101	3100
Calcium (%)	1.15	1.15	1.15	1.17	1.14
Av. phosphorus (%)	0.52	0.48	0.46	0.45	0.45
Lysine (%)	1.31	1.24	1.21	1.21	1.21
Methionine (%)	0.5	0.51	0.51	0.51	0.5

- Feed additives includes Ultravite – M, Toxin binder, Synercox, Oxinex, Choline chloride, Spectra DFM and Ultra – B12.

T1-FM10/SWM0, T2-FM7.5/SWM2.5, T3-FM5/SWM5, T4-FM2.5/SWM7.5, T5-FM0/SWM10

Table.3. Ingredient and nutrient composition (%) of the experimental broiler finisher feed

Name of the Ingredients	T1	T2	T3	T4	T5
Maize	59.51	59.80	60.00	59.82	59.50
Soyabean meal	23.30	23.16	23.00	23.00	23.00
Fish meal	10.0	7.5	5.0	2.5	0.0
Shrimp waste	0.0	2.5	5.0	7.5	10.0
Oil (palmolein)	4.75	4.50	4.27	4.28	4.22
Poultry mineral mixture	1.22	1.12	1.00	0.70	0.70
Di-calcium phosphate	0.0	0.2	0.5	0.9	1.2
Salt	0.5	0.5	0.5	0.5	0.5
Feed additives #	0.62	0.62	0.62	0.62	0.62
Lysine	0.00	0.00	0.00	0.05	0.10
Methionine	0.10	0.10	0.11	0.13	0.16
Total	100	100	100	100	100
Nutrient composition of the experimental broiler pre-starter feed					
Crude protein (%)	20.11	20.16	20.13	20.15	20.08
Metabolizable energy (Kcal/kg)	3206	3208	3214	3216	3219
Calcium (%)	1.16	1.16	1.18	1.2	1.23
Av. phosphorus (%)	0.53	0.49	0.49	0.48	0.49
Lysine (%)	1.17	1.11	1.05	1.05	1.03
Methionine (%)	0.47	0.46	0.44	0.45	0.46

- Feed additives includes Ultravite – M, Toxin binder, Synercox, Oxinex, Choline chloride, Spectra DFM and Ultra – B12.

T1-FM10/SWM0, T2-FM7.5/SWM2.5, T3-FM5/SWM5, T4-FM2.5/SWM7.5, T5-FM0/SWM10

Table.4. Effect of SWM replacing FM at different levels on serum biochemical profile of broilers (Mean $\pm$ SE).

Serum Biochemical Parameters		Treatments					F value
		T1 FM10/SWM0	T2 FM7.5/SWM2.5	T3 FM5/SWM5	T4 FM2.5/SWM7.5	T5 FM0/SWM10	
Serum Protein (g/dl)	Serum Glucose (mg/dl)	118.82 $\pm$ 24.73	187.33 $\pm$ 7.35	180.50 $\pm$ 6.10	146.67 $\pm$ 28.37	166.50 $\pm$ 8.41	2.44 ^{NS}
	Total Protein	3.08 $\pm$ 0.07	3.22 $\pm$ 0.12	3.35 $\pm$ 0.16	3.12 $\pm$ 0.14	3.25 $\pm$ 0.25	0.45 ^{NS}
	Albumin	1.75 $\pm$ 0.10	1.78 $\pm$ 0.03	1.81 $\pm$ 0.05	1.90 $\pm$ 0.11	1.87 $\pm$ 0.10	0.54 ^{NS}
	Globulin	1.33 $\pm$ 0.12	1.43 $\pm$ 0.14	1.53 $\pm$ 0.19	1.22 $\pm$ 0.07	1.38 $\pm$ 0.20	0.59 ^{NS}
	A:G ratio	1.38 $\pm$ 0.16	1.30 $\pm$ 0.12	1.29 $\pm$ 0.18	1.58 $\pm$ 0.11	1.48 $\pm$ 0.20	0.60 ^{NS}
Serum Lipid (mg/dl)	Total Cholesterol	119.33 $\pm$ 7.89	143.17 $\pm$ 6.78	138.67 $\pm$ 11.71	138.00 $\pm$ 6.10	141.00 $\pm$ 5.86	1.44 ^{NS}
	HDL	95.37 $\pm$ 6.40	98.90 $\pm$ 4.92	100.75 $\pm$ 5.70	107.57 $\pm$ 6.52	111.90 $\pm$ 2.52	1.54 ^{NS}
	LDL	33.17 $\pm$ 3.62	46.50 $\pm$ 4.34	42.00 $\pm$ 3.98	37.50 $\pm$ 2.50	34.33 $\pm$ 3.24	2.38 ^{NS}
	HDL: LDL ratio	3.10ab $\pm$ 0.44	2.20c $\pm$ 0.21	2.45bc $\pm$ 0.12	2.92ab $\pm$ 0.23	3.40a $\pm$ 0.31	2.95*
	TC:HDL ratio	1.25a $\pm$ 0.04	1.45b $\pm$ 0.03b	1.37ab $\pm$ 0.07	1.29a $\pm$ 0.05	1.26a $\pm$ 0.04	3.12*
	Triglyceride	96.50 $\pm$ 4.06	91.50 $\pm$ 5.27	86.50 $\pm$ 5.35	92.00 $\pm$ 6.18	94.50 $\pm$ 2.36	0.61 ^{NS}

n= 6, NS - Not significant ($P \geq 0.05$), * - Significant ($P < 0.05$), ** - Highly significant ($P < 0.01$)
Mean values within each row bearing common superscript do not differ significantly ($P > 0.05$).

REFERENCES

- Adeyemi O.A., Fashina, O.E. and Balogun, M.O. (2000). Utilization of full-fat jatropha seed in broiler diet: effect on haematological parameters and blood chemistry. In: *Proceeding of 25th Annual Conference Nigeria Society for Animal Production (NSAP)*19th–23rd March, Umudike.pp.108-09.
- Adeyeye, A., Oduguwa, O., Oso, O., Sudekum, K., Pirgozliev, V. and Abebayo, J. (2014). Haematology and serum biochemistry of turkey poult fed shrimp waste meal based diet. *Proceedings of Tropentag*, September 17-19, Prague, Czech Republic. pp.167.
- BIS, (Bureau of Indian Standards), (2007). Indian Standard Poultry Feeds - Specification. 5th edn.New Delhi.
- Fanimio A.O., Odugawa, O.O., Onifade, A.O. and Olutunde, T.O. (1999). Protein quality of shrimp waste meal. *Bioresource Technology*, **72** : 185-188.
- Kaneko, J.J. (1997). Serum Proteins and the Dysproteinemias. In: *Clinical Biochemistry of Domestic Animals*, 5th edn, (eds J.Kaneko, J. Harvey and M. Bruss). Academic Press, San Diego, CA, pp: 117 -138.
- Maxwell, M.H., Robertson, G.W., Spence, S. and McCorquodate, C.C. (1990). Comparison of haematological values of restricted and ad libitum feeding in domestic fowl, blood characteristics. *British Poultry Science*. **31**(3): 407 - 413.
- Mounica, N., Ramana, J.V, Rao, Srinivasa, D., Suresh, J. and Kavitha, R.(2020). Effect of replacing fish meal protein by shrimp waste meal protein with or without supplementation of amino acids on performance and cost economics of broilers. *Indian Journal of Poultry Science*, **55**(2): 129-132.
- Ngoan, L.D., Lindberg, J.E., Ogle, B. and Thomke, S.(2000). Anatomical proportions and chemical and amino acid composition of common shrimp species in central Vietnam. *Asian-Australasian Journal of Animal Sciences*, **13**(10), pp.1422-1428.
- Nuengjamnong, C. and Angkanaporn, K.(2018). Efficacy of dietary chitosan on growth performance, haematological parameters and gut function in broilers. *Italian Journal of Animal Science*. **17**(2):428-435.
- Olayemi Olugbenga Victor. (2001).The feeding value of shrimp waste meal based diet for finisher broilers. A project report submitted to the college of Animal science and Livestock production. University of Agriculture Abeokuta, Ogun State -Nigeria.
- Seiser, P. E., Duffy, L. K., McGuire, A. D., Roby, D. D., Gole, G. H., and Litzow, M. A. (2000). Comparison of pigeon

guillemot, *Cepphus columba*, blood parameters from oiled and unoiled areas of Alaska eight years after the Exxon Valdez oil spill. *Marine Pollution Bulletin*, **40**: 152-164.

Sturkie P.D.(1986). Avian physiology. Springer, Berlin, Heidelberg, New York, pp 102-120.

Vecerek,V., Strakova, E., Suchy, P. and Voslarova, E.(2002). Influence of high environmental temperature on production and haematological and biochemical. *Czech Journal of Animal Science*. **47**: 176-182.