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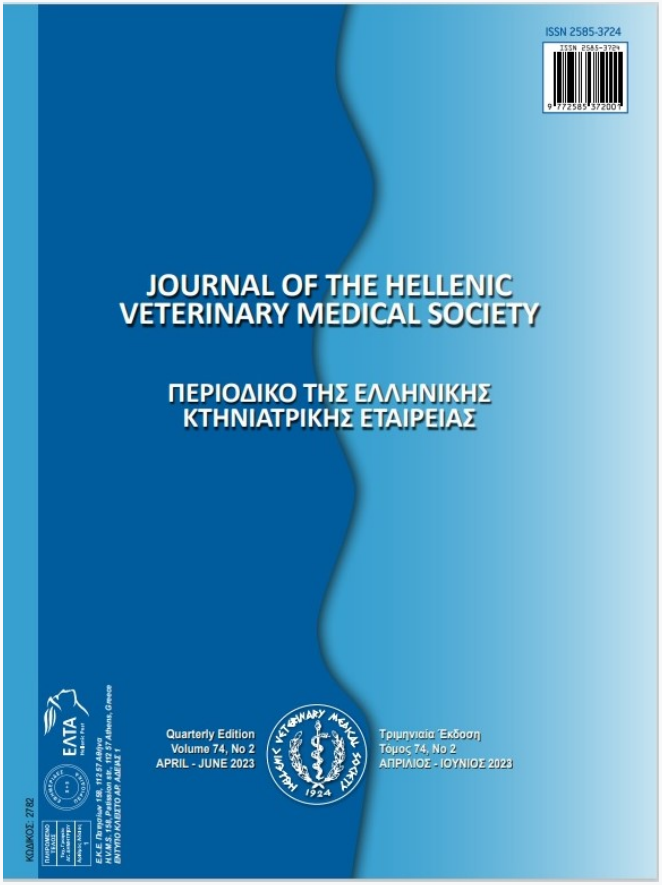

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Research article
Ερευνητικό άρθρο

Effect of dietary supplementation of seaweeds on growth and blood profiles of TANUVAS *Aseel* chicken

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ABSTRACT: The present study was conducted to evaluate the dietary effects of two seaweeds (*Sargassum wightii* and *Gracilaria corticata*) on different physiological parameters of TANUVAS *Aseel* chicken. A total of 30 TANUVAS *Aseel* chicks, day old were allocated into three groups (Each with 10 chicks) *viz.,* one control group (C1) and two treatment groups (T1 and T2). The control group (C1) were fed with commercial grower feed alone and the treatment group (T1) had control diet with 5% *Sargassum wightii* and the treatment group (T2) had control diet mixed with 5% *Gracilaria corticata*. Parameters were recorded for a continuous period of 16 weeks in 4 weeks interval. The growth performance was found to be non-significant ($P \geq 0.05$) during 0 day of feed trials and highly significant ($P \leq 0.01$) during 4th, 8th, 12th and 16th week of feed trails. Haematological parameters during 12th and 16th week of feed trials showed non-significant ($P \geq 0.05$) difference exist in lymphocyte, monocyte and eosinophil count and a highly significant ($P \leq 0.01$) difference exist in platelets count between the control (C1) and treatment groups (T1 and T2). Serum biochemical parameters during 12th and 16th week of feed trials showed non-significant ($P \geq 0.05$) difference in Uric acid, creatinine, ALT, calcium and cholesterol level and a highly significant ($P \leq 0.01$) difference in Total protein, albumin, AST, glucose, triglycerides, phosphorus, magnesium, potassium and chloride level between the control (C1) and treatment groups (T1 and T2). However non-significant ($P \geq 0.05$) difference exists in globulin and sodium content only during 16th week of feed trials. It could be noted that 5% inclusion of red seaweed, *Gracilaria corticata* in commercial grower feed as a feed supplement to TANUVAS *Aseel chicks* had a better body weight gain than 5% inclusion level of brown seaweed, *Sargassum wightii* in commercial grower feed. Based on the haematological and serum biochemical analysis, the supplementation of 5% inclusion level of seaweeds in this trial did not pose any threat to the physiological well-being of TANUVAS *Aseel* chicken.

Keywords: *Gracilaria corticata; Sargassum wightii*; TANUVAS *Aseel* chicken; Growth parameter; Blood profile

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INTRODUCTION

Modern intensive poultry production has achieved phenomenal gains in the efficient and economical production of high quality and safe chicken meat, eggs and poultry bio-products (Vijayalingam et al., 2020). At the same time as making gains in production and efficiency, the industry has to maximise the health and well-being of the birds with minimal expenditure (Holdt and Kraan, 2011). In any livestock / poultry units the feeding management costs the maximum. Hence, the use of certain industrial waste or unconventional stuff as feed additives or supplement may serve to enhance the farm economy. At the same time the environment can also be maintained free of pollutions arising out of such industrial waste products. Rearing of native chicken varieties is getting momentum in this district. Additives are primarily included in poultry to improve the growth or laying efficiency. This can also improve the immunity against disease. Additives also found to improve the feed efficiency or the FCR. Common feed additives used in poultry diets include antimicrobials, antioxidants, emulsifiers, binders, pH control agents and enzymes. Many additives are a normal part of a diet. More work is required to further identify the positive effects of additives and minimise the negative effects they may have if not used correctly or if they interact with other additives or feed ingredients. In particular, additives will play an essential role in maintaining the health of poultry in an era of no pharmaceuticals (Kulshreshtha et al., 2020). A detailed study may be essential to evaluate the impact of certain freely available unconventional materials like algae, seaweeds and other seafood by products in this district on the growth and production performance of improved chicken varieties. Considering the paucity of information on this aspect and the time being essentiality it was proposed to throw a little light on this aspect to use certain sea algae as a feed supplement for this study.

Seaweeds also called macroalgae, which include green (Chlorophyceae), brown (Phaeophyceae) and red algae (Rhodophyceae), are a naturally occurring source of the biomass that develops in variable environments (results also from eutrophication) and is easily cultivated (Cabrita et al., 2016). Seaweeds are the rich source of nutrients and bioactive compounds, including carotenoids, proteins, peptides, vitamins, minerals, oxylipins, phlorotannins, steroids, minerals, essential fatty acids, dietary fibers, polysaccharides, and sulphated polysaccharides (Vijayalingam et al., 2017; Venkatesan et al., 2019; Victor et al., 2022) and when included into feed can improve poultry health and performance as well as increase the quality of poultry products (eggs, meat) (Holdt and Kraan, 2011; Vijayalingam et al.. 2020). The nutritional value of seaweeds is highly variable and depends on many factors such as species, maturity, habitat, geographical origin, area of cultivation, season, harvest time, environmental and physiological variations, water temperature, etc. (Erum et al., 2017). Seaweeds applied at low inclusion levels can improve not only poultry growth performance and the quality of products, but also their health status (e.g., immune function) due to alteration of gut microbiome and antioxidant properties and can be considered an alternative to antibiotic growth promoters (AGP) used in poultry production (Evan and Critchley, 2014; Choi et al., 2018). Nowadays, seaweeds are fed as additives in low amounts, with inclusion rates being generally as low as 1-5% (Makkar et al., 2015). The rare combination of high nutritive value and rapid biomass production make seaweed as a potential and effective feed substitute for livestock, particularly poultry birds. Seaweed can play an important role as poultry stock feed and may serve as the cheapest source of feed supplement (Zahid et al., 2001). Most often, seaweeds are used as feed additives for hens and broilers, but there are also a few reports on their application in duck (El-Deekx et al., 2009; Frasiska et al., 2016), Japanese quail (Karu et al., 2018; Zeweil et al., 2019), cockerel (Ventura et al., 1994) and *Aseel* chicken (Vijayalingam et al., 2020) feeding.

Sargassum species is a brown macroalage live in a wide range of habitats, and many species have the ability to become free-floating and form large floating mats in open waters (Casas-Valdez et al., 2006) and are abundantly seen in mannar coast of Ramanathapuram district. In Tamil, it is called as Pattu pasi. *Sargassum* is a good source of minerals, carbohydrates and some essential amino acids like arginine, tryptophan and phenylalanine. It is also rich in beta-carotene and vitamins. Similarly, *Gracilaria* is a genus of red algae (Rhodophyta) notable for its economic importance as an agarophyte, as well as its use as a food for humans and various species of shellfish, livestock and poultry industry due to its higher protein content when compared to brown and green algae (Morais et al., 2020).

TANUVAS *Aseel* is a dual-purpose native variety of chicken breed evolved for table purpose with continuous selection and breeding for six generations to achieve 12th week body weight of 1.0 kg, with FCR at

3.5 and livability of 95 per cent. The breed has long and slender face with compact and bold look eyesight. Wattles and ear lobes are bright red and the beak is hard. The neck is long, uniformly thick but not fleshy. The general feathering is close. Predominantly reddish-brown plumage. Predominantly pea comb, occasionally rose comb seen. Elongated body length measuring 58.5 cm from head to tail and 60.25 cm head to toe. The tail is small and drooping. The legs are strong, straight and set well apart. Dark brown shelled eggs with thickness 0.33 mm. Reduced broodiness with resultant more egg number (160) and more chicks (112) per dam (Om Prakash et al., 2018).

In this study TANUVAS *Aseel* chicken was used as model for assessing the impact of seaweeds *Sargassum wightii* (*S. wightii*) and *Gracilaria corticata* (*G. corticata*) on growth performance and blood parameters.

MATERIALS AND METHODS

Seaweed

About 20 kg of seaweeds (*S. wightii* and *G. corticata*) were collected fresh from Gulf of Mannar coast (Ramanathapuram District, Tamil Nadu, India). The collected seaweeds were washed several times in freshwater to remove salts and were shade dried in normal room temperature. The dried seaweeds were finely powdered in a special pulveriser.

Chicks

A total of 30 TANUVAS *Aseel* chicks (one-day-old) with an average body weight (BW) of 35 to 45 gm were purchased from Regional Research and Educational Centre (RREC), Pudukottai, Tamil Nadu, India, a constituent unit of Tamil Nadu Veterinary and Animal Sciences University (TANUVAS) were used for this study. The procured birds were randomly distributed into two dietary treatment groups (T1 and T2) and one control group (C1) in three pens. Each pen measures 3.0 m length x 1.5 m breadth x 1.5 m height and holds 10 birds in each pen.

Experimental site

Being a On Farm Trial (OFT) study the work was carried out in a farmers poultry unit at Sathirakudi Village, Ramanathapuram district, Tamil Nadu, India, under the complete observation of the technocrats from Veterinary University Training and Research Centre (VUTRC), Ramanathapuram for a period of four months (June - September 2021).

Proximate analysis

A representative samples from the base diet (the commercial feed used in this study), trial diets (T1 - base diet with 5% *S.wightii* and T2 - base diet with 5% *G.corticata*) and samples from the individually ground sea weeds (*S.wightii* and *G.corticata*) were subjected for proximate analysis. The analysis was carried out at Animal Feed Analytical and Quality Assurance Laboratory (AFAQAL), Namakkal, a constituent unit of TANUVAS to estimate the dry matter, moisture, crude protein and fibre, ether extract, total ash, acid insoluble ash, calcium, phosphorus and gross energy content as per standards of Association of Official Agricultural Chemists (AOAC, 2000) and the results have been presented (Table 1).

Experimental feeding

The basal experimental diet was the commercial grower mash (Nutrikraft®) procured from a Local dealer at Ramanathapuram. The commercial mash without adding any supplement was used in the control group (C1). The trial diet was formed by adding 5.0% of *S. wightii* for T1 and 5.0% of *G. corticata* for T2 on DM basis in the basal diet. Different colour wing bands were used for identification of the birds in the (C1, T1 and T2) groups. All the experimental pens were checked regularly for sicknesses and mortalities. No mortalities were recorded during the study period. The average temperature (32°C) and humidity (60%) of the house was regularly monitored using a multi-meter device. Diets and clean water were offered to birds ad libitum and the birds were reared under natural lighting (12 h of daylight). The date of start of the feed trial is considered as day 0. The weight of individual birds in each group was recorded in an interval of 4 weeks (0^{th}, 4^{th}, 8^{th}, 12^{th} and 16^{th} week) to assess the growth performance. Blood samples were collected from wing vein of 3 birds from each group on 12^{th} and 16^{th} week of the trial for haematological and serum biochemical studies. No birds were vaccinated during the study period. The study does not involve killing of birds during the trial period and hence did not require animal ethical committee approval. After the successful completion of the study, the birds in the trial were sold by the farmer.

Haematology and serum biochemical analyses

Haematological parameters like haemoglobin (Hb), packed cell volume (PCV), red blood cell (RBC) count, white blood cell (WBC) count, platelets count and differential counts (heterophils, lymphocyte, monocyte

and eosinophil) were determined by using standard methods (Jain, 2000). Serum biochemical parameters like uric acid, creatinine, total protein, albumin, alanine transaminase (ALT), aspartate transaminase (AST), glucose, triglycerides, calcium, phosphorus, magnesium, cholesterol, sodium, potassium and chloride were estimated as per the procedure given in the commercial kits procured from Agappe Diagnostics Ltd., using CECIL CE 2021 UV spectrophotometer. Globulin concentration was obtained by deducting the albumin content from total protein. All the haematological and blood biochemical analysis were carried out at Centralised Clinical Laboratory, Madras Veterinary College, Chennai-7, Tamil Nadu, India.

Statistical analysis

The data were statistically analysed for normal distribution and homogeneity prior to the analysis of one-way ANOVA (analysis of variance) (SAS, 2004) to study the effect of treatment on various parameters. Software used was SPSS ver. 25.0.

RESULTS

Proximate analysis of feed samples

The chemical composition, *viz.* dry matter (%), moisture (%), crude protein (%), crude fibre (%), ether extract (%), total ash (%), calcium (%), phosphorus (%), and gross energy (Kcal/kg) of commercial feed, *S. wightii, G. corticata* and experimental diets (C1, T1 and T2) is given in Table 1.

Growth performance

The average body weight gains during the trial period were found to be highest in T2 group and least in T1 (Table 2). However, the weight gain in the control group was found to be lower than the treatment groups (T1 and T2). Highly significant difference ($P \leq 0.05$) in growth performance was recorded during 4th, 8th, 12th and 16th week of feed trials (Table 2).

Haematology and serum biochemistry

The effect of experimental diets on individual haematological and serum biochemical parameters during 12th and 16th week of feed trials is presented in Tables 3 and 4 respectively. Haematological analysis (Table 3) showed a high significant ($P \leq 0.01$) variation in platelets count and a non-significant difference ($P \geq 0.05$) in lymphocyte, monocyte and eosinophil count during 12th and 16th weeks of feed trials in all the three groups.

Table 1. Chemical composition of commercial feed, ***S. wightii, G. corticata*** and experimental diets

Parameters	Commercial feed	*S. wightii*	*G. corticata*	Commercial feed + 5% *S. wightii*	Commercial feed + 5% *G. corticata*
Moisture (%)	10.40	15.60	2.89	9.86	9.00
Crude Protein (%)	19.56	9.18	9.28	19.1	19.29
Crude Fibre (%)	3.98	8.32	7.3	4.68	3.79
Ether Extract (%)	5.04	1.57	1.55	5.18	4.82
Total Ash (%)	7.07	19.87	11.9	8.89	6.91
Acid insoluble Ash (%)	1.84	1.30	1.01	2.23	1.47
Calcium (%)	1.00	2.00	0.40	1.50	1.00
Phosphorus (%)	0.64	0.24	0.24	0.64	0.60
Salt (%)	0.36	1.03	0.57	0.45	0.34
Gross Energy (Kcal/kg)	3899	2818	3629	3847	3945

Table 2. Effect of *S. wightii* and *G. corticata* feed supplement on weight gain of *TANUVAS Aseel* chicken

Weight gain (in weeks)	Experimental diets		
	C1	**T1**	**T2**
0^{NS}	39.30 ± 1.033	40.00 ± 1.075	40.80 ± 0.998
4**	206.20 ± 5.412^{a}	250.20 ± 6.841^{b}	271.60 ± 6.072^{c}
8**	439.20 ± 6.660^{a}	593.50 ± 2.262^{b}	683.30 ± 4.457^{c}
12**	1008.60 ± 4.405^{a}	1040.40 ± 4.324^{b}	1180.90 ± 5.421^{c}
16**	1268.50 ± 4.214^{a}	1378.80 ± 6.653^{b}	1581.60 ± 4.965^{c}

C1 control diet alone, T1 control diet with 5% S. wightii, T2 control diet with 5% G. corticata
*NS = P ≥ 0.05; *P ≤ 0.05;**P ≤ 0.01*
^{a,b,c}Means within same row bearing different superscripts are highly significantly different at P ≤ 0.05

Serum biochemistry study (Table 4) revealed a non-significant difference ($P \geq 0.05$) in Uric acid, creatinine, ALT, calcium and cholesterol content and a highly significant ($P \leq 0.01$) variation in Total protein, albumin, AST, glucose, triglycerides, phosphorus, magnesium, potassium and chloride level in between the control (C1) and treatment groups (T1 and T2). However non-significant ($P \geq 0.05$) difference existed only during 16th week of feed trials in case of globulin and sodium content.

Table 3. Effect of *S. wightii* and *G. corticata* feed supplement on haematological parameters of TANUVAS *Aseel* chicken (n=3)

Haematological parameters (in weeks)		Experimental diets		
		C1	T1	T2
12	Hb (g/dL)**	9.23 ± 0.033^{b}	8.57 ± 0.088^{a}	9.07 ± 0.145^{b}
	PCV (%)**	26.13 ± 0.176^{b}	24.97 ± 0.186^{a}	25.50 ± 0.153^{a}
	RBC (m/µL)**	3.12 ± 0.058^{b}	2.94 ± 0.026^{a}	2.82 ± 0.035^{a}
	WBC/ cmm^{NS}	12366.67 ± 260.342^{a}	12640.00 ± 30.551^{a}	12850.00 ± 28.868^{a}
	Platelets (L/µL)**	67583.33 ± 294.863^{b}	69966.67 ± 554.777^{c}	58500.00 ± 288.675^{a}
	Heterophil (%)**	34.33 ± 0.882^{a}	39.00 ± 0.577^{b}	38.33 ± 0.882^{b}
	Lymphocyte (%)^{NS}	65.00 ± 1.732^{a}	60.00 ± 1.155^{a}	61.67 ± 1.202^{a}
	Monocyte (%)^{NS}	2.00 ± 0.577^{a}	1.67 ± 0.333^{a}	1.67 ± 0.333^{a}
	Eosinophil (%)^{NS}	1.33 ± 0.333^{a}	1.67 ± 0.333^{a}	1.33 ± 0.333^{a}
16	Hb (g/dL)*	9.00 ± 0.058^{ab}	8.80 ± 0.058^{a}	9.167 ± 0.067^{b}
	PCV (%)*	25.67 ± 0.240^{a}	25.70 ± 0.208^{a}	26.90 ± 0.289^{b}
	RBC (m/µL)^{NS}	2.99 ± 0.022^{a}	2.96 ± 0.067^{a}	2.96 ± 0.067^{a}
	WBC/ cmm**	12950.00 ± 76.376^{c}	11193.33 ± 209.868^{a}	12033.33 ± 185.592^{b}
	Platelets (L/µL)**	69433.33 ± 218.581^{b}	64233.33 ± 648.931^{a}	63033.33 ± 260.342^{a}
	Heterophil (%)^{NS}	36.00 ± 4.509^{a}	34.67 ± 0.882^{a}	34.33 ± 0.882^{a}
	Lymphocyte (%)^{NS}	65.00 ± 1.155^{a}	65.33 ± 1.453^{a}	65.33 ± 0.882^{a}
	Monocyte (%)^{NS}	2.67 ± 0.333^{a}	1.33 ± 0.333^{a}	1.67 ± 0.333^{a}
	Eosinophil (%)^{NS}	1.67 ± 0.333^{a}	1.33 ± 0.333^{a}	1.33 ± 0.333^{a}

C1 control diet alone, T1 control diet with 5% S. wightii, T2 control diet with 5% G. corticata
NS = $P \geq 0.05$; *$P \leq 0.05$; **$P \leq 0.01$
^{a,b,c,ab}Means within same row bearing different superscripts are significantly different at $P \leq 0.05$

Table 4. Effect of *S. wightii* and *G. corticata* feed supplement on serum biochemical parameters of TANUVAS *Aseel* chicken (n=3)

Serum biochemical parameters (in weeks)		Experimental diets		
		C1	T1	T2
12	Uric acid (mg/dL)^{NS}	15.07 ± 1.120^{a}	17.90 ± 1.153^{a}	18.30 ± 1.804^{a}
	Creatinine (mg/ dL)^{NS}	0.32 ± 0.030^{a}	0.36 ± 0.015^{a}	0.42 ± 0.030^{a}
	Total Protein (mg/dL)**	3.83 ± 0.033^{a}	3.77 ± 0.088^{a}	4.77 ± 0.033^{b}
	Albumin (mg/dL)**	1.97 ± 0.033^{a}	2.30 ± 0.058^{b}	2.40 ± 0.058^{b}
	Globulin (mg/dL)**	1.87 ± 0.067^{b}	1.47 ± 0.145^{a}	2.37 ± 0.033^{c}
	ALT (IU/L)^{NS}	33.33 ± 0.667^{a}	31.67 ± 0.333^{a}	32.67 ± 2.667^{a}
	AST (IU/L)**	274.67 ± 0.882^{c}	240.67 ± 0.882^{a}	269.33 ± 1.764^{b}
	Glucose (mg/dL)**	80.67 ± 1.453^{a}	96.67 ± 1.453^{b}	103.67 ± 2.028^{c}
	Triglycerides (mg/dL)**	222.33 ± 1.764^{a}	259.67 ± 2.028^{b}	285.33 ± 1.453^{c}
	Calcium (mg/dL)^{NS}	11.41 ± 0.236^{a}	11.93 ± 0.025^{a}	11.67 ± 0.248^{a}
	Phosphorus (mg/dL)**	6.83 ± 0.031^{a}	7.17 ± 0.029^{b}	6.98 ± 0.081^{a}
	Magnesium (mg/dL)**	2.36 ± 0.026^{a}	2.45 ± 0.023^{b}	3.14 ± 0.023^{c}
	Cholesterol (mg/dL)^{NS}	129.33 ± 8.848^{a}	117.33 ± 11.392^{a}	115.67 ± 2.333^{a}
	Sodium (mmol/L)**	154.20 ± 1.308^{b}	145.40 ± 1.222^{a}	146.67 ± 0.882^{a}
	Potassium (mmol/L)**	4.56 ± 0.151^{a}	5.77 ± 0.049^{b}	5.76 ± 0.062^{b}
	Chloride (mmol/L)**	114.33 ± 1.453^{b}	107.83 ± 0.921^{a}	110.97 ± 0.664^{ab}

16	**Uric acid (mg/dL)^{NS}**	17.77 ± 0.376^{a}	19.07 ± 0.962^{a}	19.40 ± 1.845^{a}
	Creatinine (mg/ dL)^{NS}	0.37 ± 0.023^{a}	0.41 ± 0.020^{a}	0.43 ± 0.007^{a}
	Total Protein (mg/dL)**	3.93 ± 0.145^{a}	4.03 ± 0.067^{a}	4.80 ± 0.100^{b}
	Albumin (mg/dL)**	2.03 ± 0.033^{a}	2.14 ± 0.033^{a}	2.57 ± 0.084^{b}
	Globulin (mg/dL)^{NS}	1.90 ± 0.116^{a}	1.89 ± 0.100^{a}	2.23 ± 0.120^{a}
	ALT (IU/L)^{NS}	37.67 ± 0.882^{a}	34.67 ± 0.333^{a}	33.67 ± 3.667^{a}
	AST (IU/L)**	245.67 ± 0.333^{b}	237.67 ± 2.404^{a}	260.67 ± 1.202^{c}
	Glucose (mg/dL)**	87.33 ± 1.202^{a}	94.33 ± 1.453^{b}	115.33 ± 1.667^{c}
	Triglycerides (mg/dL)**	210.67 ± 2.028^{a}	254.33 ± 2.906^{b}	268.67 ± 0.882^{c}
	Calcium (mg/dL)^{NS}	10.36 ± 0.246^{a}	10.75 ± 0.224^{a}	10.99 ± 0.054^{a}
	Phosphorus (mg/dL)**	6.52 ± 0.031^{a}	7.34 ± 0.056^{c}	6.99 ± 0.142^{b}
	Magnesium (mg/dL)**	2.31 ± 0.021^{a}	2.40 ± 0.020^{b}	3.26 ± 0.019^{c}
	Cholesterol (mg/dL)^{NS}	126.33 ± 9.821^{a}	116.33 ± 10.929^{a}	114.67 ± 2.848^{a}
	Sodium (mmol/L)^{NS}	143.27 ± 3.329^{a}	141.07 ± 1.507^{a}	143..50 ± 0.289^{a}
	Potassium (mmol/L)**	4.66 ± 0.108^{a}	5.46 ± 0.105^{b}	5.24 ± 0.112^{b}
	Chloride (mmol/L)**	119.67 ± 0.882^{c}	114.10 ± 0.900^{b}	106.00 ± 1.674^{a}

C1 control diet alone, T1 control diet with 5% S. wightii, T2 control diet with 5% G. corticata
NS = P ≥ 0.05; *P ≤ 0.05; **P ≤ 0.01
^{a,b,c,ab}Means within same row bearing different superscripts are significantly different at P ≤ 0.05

DISCUSSION

Growth performance

There was a highly significant difference from 4th to 16th week of feed trials among the control and treatment groups. The enhanced body weight gain in the treatment groups might be due to better availability of protein and micronutrients and lower level of fiber content and higher level of gross energy especially in the trial diet of T2 groups. Between the treatment groups the birds in T2 group showed higher growth convertibility than in the group T1 having supplemented with brown sea weed the *S. wightii*. Although the brown sea weed contained a range of bioactive compounds, it was proved to have lower nutritional value when compared to the red and green sea weeds (Misurcova 2011; Vijayalingam et al., 2020). The proximate analysis in the present study also showed a higher total protein, higher gross energy and lower fiber content in the red sea weed, *G. corticatta* when compared to the brown sea weed. Evan and Critchley (2014) opined that seaweeds in low inclusion levels can improve not only poultry growth performance and quality of the products, but also their health status. In the present s7tudy, an inclusion of 5% level of both seaweeds had shown no adverse side effects and mortality during the trial period. Vijayalingam et al. (2020) had also reported that 3% inclusion of green sea weed and 5% of azolla in TANUVAS *Aseel* birds' diet did not show any adverse effect in the health, instead had a better feed conversion ratio. However, a similar study conducted in Japanese quail with 3% dried seaweeds (*Chetomorpha antennina, Sargassum wightii* and *Gracilaria corticata*) by Karu et al. (2018) showed no significant differences in body weight gain.

Haematology and serum biochemistry

Blood parameters were an ideal tool for the assessment of health, nutritional and physiological status of animals during feed trials (Satheeshkumar et al., 2011). Platelet count showed a highly significant difference (P ≤0.01) between the control and treatment groups during 12th and 16th week of evaluation in this study. There was a highly significant change in RBC, heterophil, Hb and PCV (P ≤0.01) during 12th week and a significant variation in Hb and PCV (P ≤0.05) during 16th week of feed trials. A significant increase of heterophil and reduction in RBC and Hb during the 12th week of the trial and the vice versa during the 16th week of the trial period might be due to the causation and stabilisation of certain stressors in the initial and later stage of the trial respectively. This was in accordance with the earlier reports (Krams et al., 2012; Shima et al., 2020) made in broiler and layers birds.

The serum biochemical parameters of TANUVAS *Aseel* chicken were not influenced by dietary inclusion of *S. wightii* and *G. corticata,* which suggested intake of seaweeds, has no negative post-ingestive effect. The plasma levels of ALT and AST in birds reflect the integrity of hepatocytes (Ritchie et al., 1994; Jaensch et al., 2000). In this study, AST level showed a highly significant reduction in dietary treatment

group during 12th week when compared to the control group and suggested dietary inclusion of seaweed had better functioning of liver. According to Jiwuba et al. (2016) serum albumin concentration reflects liver functioning, thus, the higher albumin reported in this study compared to the findings by Albokhadaim (2012) and Sugiharto et al. (2018) indicates a better liver functioning of the birds in response to dietary seaweed. The higher level of AST in T2 group during 16th week of the trial might be due to higher total protein and calorific value of the diet and the older age of the birds.

The serum biochemical analysis showed elevated uric acid and creatinine level in all the treatment groups (T1 and T2) when compared to the control (C1) during 12th and 16th week of trial period. Knoph and Olsen (1994) and Madibana et al. (2017) reported similar changes in fishes affected with ammonia toxicity and in fishes fed with *U. lactuca.* The same changes had been reported by Vijayalingam et al. (2020) in TANUVAS *Aseel* chicken fed with *U. lactuca* and *Azolla* separately and in combination. The increase in uric acid might be due to the presence of a good amount of protein in the diet of treatment groups. This study also showed an elevated serum albumin, globulin, glucose, triglycerides and magnesium contents and lowered serum cholesterol in T2 group when compared to T1 and control group. Although, there were an elevated phosphorus and potassium levels and a reduction in globulin and sodium content in T1 group when compared to T2 and control group, the albumin content in T1 group was found to be higher than the control group. Athis Kumar (2018) had reported a reduction of blood plasma cholesterol and globulin contents and an elevated total serum protein, albumin, calcium, phosphorous and triglyceride in the broiler chicken supplemented with *S. wightii* at 1% and 2% levels.

In general, the dietary supplementation of *S. wightii* and *G. corticata* in TANUVAS *Aseel* grower chicken did not elicit much physiological alterations and the supplementation of *G. corticata was* found to be more effective in terms of weight gain.

CONCLUSIONS

It could be noted that 5% inclusion of *G. corticata* (T2 group) as feed supplement in TANUVAS *Aseel* birds had a better body weight gain when compared to 5% inclusion of *S. wightii*. Based on the haematological and serum biochemical analysis, the supplementation of both the seaweeds at 5% levels did not pose any threat to the physiological well-being of TANUVAS *Aseel* chicken.

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