EFFECT OF LOCALLY SOURCED ALGAE AS DIETARY SUPPLEMENTATION ON BEHAVIOUR OF BROILER CHICKENS AT STARTER PHASE

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ABSTRACT
Studies on the use of algae in animal diets have explored commercially manufactured algae biomass. However, there is dearth of information on the use of algae population found in the Nigerian waterways. Therefore, this study was carried out to investigate the effect of dietary supplementation of locally sourced and heat-processed freshwater algae (Enteromorpha sp.) on the behaviour of broiler chickens at the starter phase. A total of 150 Arbor Acres strain of broiler chickens were used for this study. Birds were assigned to five dietary treatments in a completely randomized design. The treatments were replicated three times to contain 10 birds each. The treatments were T1- Control without algae biomass, T2 and T3- dehydrated algae biomass at 60^0 and 80^{0}C, respectively, T4 and T5- oven dried algae biomass at 60^0 and 80^{0}C, respectively. The algae biomass was incorporated into the diet at 0.5% inclusion rate. Feeding of birds with algae-supplemented diet began during brooding and continued throughout the starter phase. During the 2nd, 3rd and 4th week of age, the behaviour of the chickens was observed and recorded via CCTV cameras, after which the frequency of occurrence of the feeding, drinking, walking, dustbathing and wing flapping behaviour were extracted. Data were subjected to statistical analysis using Tukey's test. Among the behaviours observed, only the dustbathing behaviour was significantly ($p<0.05$) affected by algae supplementation. The behaviour was highest in broilers offered dehydrated algae biomass at 60^{0}C. It was concluded from this study that heat-processing and supplementation of algae from Nigeria freshwater in broiler chickens' diet did not have a negative impact on their behaviours.
Keywords: Broiler chickens, Algae biomass, Polyunsaturated fatty acids, heat processing, Behaviour

INTRODUCTION

Algae are eukaryotic photoautotrophic organisms that have existed in marine settings for billions of years (Ferrara, 2020). They contain proteins, essential amino acids, vitamins, minerals, both soluble and insoluble dietary fibres and bioactive compounds. They are a good source of omega-3 and omega-6 polyunsaturated fatty acids (Babich *et al*., 2022). Fatty acids are components of energy giving food that are essential because they cannot be manufactured by the body and must come from foods. They are needed for brain and eye development of the growing foetus during pregnancy, and for the maintenance and promoting of health and normal growth and development throughout life (Harris *et al*., 2009). Fatty acids can be classified into saturated and unsaturated. In general, algae are characterized by a fatty acid composition that is quite advantageous for human and animal health, with amounts of unsaturated fatty acids usually higher than the amounts of saturated fatty acids (Kumari *et al*., 2010; Pereira *et al*., 2012).

Higher intakes of long fatty acids in the diet of animals have been reported to improve the functions of immune, nervous, and cardiovascular systems, the reproductive performance and carcass quality in animals (Ponnampalam *et al.,* 2006). Similarly, it has been demonstrated that adding algae to feed can boost the development rates and productivity of a variety of animals (Yaakob *et al*., 2014). Rhymer *et al.* (2010) reported no significant effect on growth parameters of broiler chicken fed microalgae rich in docosahexaenoic acid (DHA) - a form of omega-3 fatty acid and concluded that microalgae supplementation has no adverse effects on bird performance. Algae are indispensable to brain health, cognitive skills and to the prevention and mitigation of brain disorders (Sorrenti *et al*., 2021). There exists a link between nutrition and behaviour. As opined by Han and Dingemanse (2015), diet affects morphology and physiology, and consequently the behaviour. Franchi *et al*. (2023) explored the effects of nutritional measure on play behaviour in pigs and found a complimentary effect of good nourishment in the exhibition of play behaviour. Previous researches have established a close relationship among feeding and drinking behaviour and performance traits (Yan *et al*., 2019; Pires *et* *al*., 2022). The health status of an animal could also be reflected through its behavioural expressions, such as changes in feeding, drinking, social and locomotory behaviours (Matthews *et al*., 2016). Hence, it can be said that behavioural observation seeks to corroborate findings on growth performance and health status.

Studies on the use of algae in animal diets have explored commercially manufactured algae biomass, however, there is dearth of information on the use of algae population found in the Nigerian waterways. Fakoya *et al*. (2011) opined that algae could become an important economic niche for Nigeria if adequate research is undertaken in studying them. Hence, this study aimed to investigate the use of locally sourced and processed algae biomass in broiler production, with the aim of evaluating the behaviour (as a welfare indicator) of broiler chickens, as there is a dearth of information on the behavioural impact of algal-meal in broiler production.

MATERIALS AND METHODS

The experiment was carried out at the Poultry Experimental House, Directorate of University Farm, Federal university of Agriculture, Abeokuta, Ogun State. Freshwater algae (*Enteromorpha species*) were gotten within the premises of Federal University of Agriculture, Abeokuta. These were properly washed under running tap to remove adhering dirt. The fresh algae were dried using two heat treatments (oven drying and dehydration) at two different temperatures (60^0 and 80^0C). After drying to a constant weight, the algae were milled to powdery form using a household blender. A total of 150 Arbor Acre strain of broiler chickens were used for this study. Birds were assigned to five dietary treatments consisting of three replicates of 10 birds each in a completely randomized design. The dietary treatments include; T1- Control diet without algae biomass, T2 and T3- diet containing dehydrated algae biomass at 60^0 and 80^0C, respectively, T4 and T5- diet containing oven dried algae biomass at 60^0 and 80^0C respectively. The algae biomass was incorporated into the birds' diet (commercial starter diet containing 2900Kcal/KgME and 23% crude protein) at 0.5% inclusion rate. The feeding of the birds with the algae biomass began at the 5^{th} day of brooding and spanned throughout the starter phase. The feed and water were supplied *ad libitum*. Vaccination and medication programs were strictly adhered to as applicable. Data were collected on the behaviour of the chickens through CCTV cameras which were installed across the treatments to capture two replicates per treatment. The behaviours of interest are; the frequency of occurrence of feeding, drinking, walking, dustbathing and wing flapping behaviour. The behaviours were recorded for a period of eight hours per day three times a week, starting from the second week of brooding. Data generated were subjected to One-way analysis of variance using the general linear model procedure of MINITAB 17 and means were separated using Tukey's test of the same statistical package.

RESULTS AND DISCUSSION

Effect of dietary supplementation of locally produced algae powder on the behaviour of broiler chickens at starter phase is presented in Table 1. The inclusion of algae powder in broiler chickens' diet did not significantly ($P>0.05$) affect the frequency of occurrence of feeding, drinking, wing flapping and walking behaviour, however, there was a significant ($P<0.05$) influence in the occurrence of dustbathing behaviour. Highest occurrence of the behaviour was observed in chickens given diet supplemented with algae dehydrated at 60^oC.

Table 1: Effect of local algae as dietary supplementation on behaviour of broiler chickens at starter phase

	Dietary algae treatments						
PARAMETERS	**T1**	**T2**	**T3**	**T4**	**T5**	**SEM**	**P-VALUE**
Feeding	18.36	16.75	12.40	15.65	17.09	3.32	0.763
Drinking	14.28	14.13	10.05	12.68	12.09	2.68	0.796
Dustbathing	1.63^{ab}	3.78^{a}	0.49^{b}	3.20^{ab}	1.67^{ab}	0.67	0.010
Wing flapping	6.52	5.72	3.75	5.48	7.02	2.01	0.816
Walking	21.96	26.43	18.39	26.84	28.69	4.88	0.571

^{a,b} Means with different superscripts along the same row are significantly ($P<0.05$) different
SEM – Standard Error Mean
T1-Control; T2-Dehydrator 60^oC; T3-Dehydrator 80 ^oC; T4-Oven 60 ^oC; T5-Oven 80 ^oC

An important non-invasive tool for welfare assessment is animal's behavioural expressions (Dawkins, 1999). Nutrition has been found to be a contributory factor to the expression of behaviour in animals (Han and Dingemanse, 2015). According to Costa *et al*. (2012), broiler behaviour can be categorized as consummatory, comfort/maintenance, locomotory, social, inactive, aggressive, exploratory/foraging and reproductive behaviours. In this experiment, the supplementation of broiler chickens' diet with algal biomass influenced only the frequency of expression of dustbathing behaviour. Birds in the dietary group of dehydrated algae at 60^{o}C performed the dustbathing behaviour most, while those in the group of dehydrated algae at 80^{o}C exhibited the behaviour least. Dustbathing and wing flapping are part of the maintenance or comfort behaviour (Van Liere and Bokma, 1987). These comfort behaviours are those behaviours performed after the completion of basic needs such as drinking, feeding and resting (Duncan and Mench, 1993). As opined by Hoeks *et al*. (2011), the ability to perform natural behaviour, especially foraging, preening and dustbathing helps to prevent frustration. The expression of wing flapping behaviour by the chickens were similar across all treatments in this study.

A change in the drinking or feeding behaviour can indicate a health or welfare problem (Gaillard *et al*., 2021). From this study, both consummatory behaviours were expressed in similar pattern by the chickens in both the algae-supplemented groups and the non-supplemented group. This could imply that the use of the locally processed algae is nutritionally safe and does not have a deleterious effect on the health and wellbeing of the animals. Generally, many species of macroalgae (including the *Enteromorpha sp*. used in this study) have been reported to be nutritionally beneficial to the survival, growth and well-being of livestock due to the high concentration of polyunsaturated fatty acid (omega-6 and omega-3), carbohydrates, protein, essential amino acid, chlorophylls, vitamins, macro and micro minerals, dietary fibres (agarose and carrageenan), and phytochemicals (Xie *et al*., 2020; Babich *et al*., 2022). The similarity in the frequency of expression of walking behaviour across all treatment could be further evidence of the good state of health of the birds. According to Dawkins (2023) active or sustained walking is a universally agreed sign of a healthy birds and it is linked to many other components of good welfare.

CONCLUSION

Study showed that dietary inclusion of locally heat-processed algae biomass (*Enteromorpha sp.*) obtained from freshwater source in Nigeria did not pose a negative effect on broiler chicken welfare.

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