

## Performance of Broiler Starter Chickens fed High Fibre Diets Supplemented with Probiotics

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### Abstract

Poultry are Monogastric and therefore unable to efficiently digest crude fibre as they do not have innate ability to digest high crude fibre materials excepts they require exogenous sources of essential amino acids and enzymes or additives to improve their nutritional requirements. Dietary crude fibre level has effect on diet digestion in chickens. Fibre in the diet is essential for optimization of nutrient digestibility and feed efficiency. That is why the researcher has to examined, the performance of broilers fed high fibre diets supplemented with probiotics at the starter phase using a total number of one hundred and eighty (180) day old Cobb 500 breed of broilers. The birds were randomly assigned to six (6) dietary treatments replicated three (3) times. Each replicate comprises of ten (10) birds. The experiment was a 2x3 factorial laid in complete randomized designed, which comprised of 2 levels (0 and 2mL) of essential microbes (Lactic acid bacterial, Yeast, Actinomycetes bacterial, Photosynthetic bacteria and Fermenting fungi) and 3 levels (2.5, 5 and 7.5%) of fibre at starter phase. Birds were given the same quantity of feed measured in grams, for the treatments combination T1,T2,T3,T4,T5 and T6, respectively. The result for the effect of main and interactive effect of probiotics and fibre on growth performance of broiler starter birds indicate that Effective Microorganism Activated Solution (EMAS) did not show significant ( $P<0.05$ ) differences on Initial Weight(IW),Final Weight(FW),Weight Gain per day(WG/D),Average Feed Intake(AFI),Feed Conversion Ratio(FCR),Protein Intake(PI),Protein Efficiency Ratio(PER) and Energy Efficiency Ratio(EER), except that of fibre that indicates significant ( $P<0.05$ ) increase in the AFI (41.2, 43.4 and 42.0g/birds) and FCR (1.53, 1.62 and 1.67). The main and interactive effect of essential microbes and fibre on economic production of broiler starter, indicated significant ( $P<0.05$ ) increase in the total cost of production (TCP) for EMAS and fibre. It was concluded and recommended that 7.5% fibre with 2mL essential microbes be administered into broiler starter chicken diets as it improves total well-being of birds.

**Keywords:** Performance, Microbes, High fibre, Broiler Chickens, Probiotics

## Performance Des Poulets De Chair En Elevage Alimentés Avec Des Diètes Riche En Fibres Supplémentées En Probiotiques



### Résumé

Les volailles sont des monogastriques et ne peuvent donc pas digérer efficacement la fibre brute, car elles n'ont pas la capacité innée de digérer des matériaux riches en fibres brutes, sauf si elles nécessitent des sources exogènes d'acides aminés essentiels et d'enzymes ou d'additifs pour améliorer leurs besoins nutritionnels. Le niveau de fibre brute dans l'alimentation affecte la digestion des aliments chez les poules. La fibre dans l'alimentation est essentielle pour optimiser la digestibilité des nutriments et l'efficacité alimentaire. C'est pourquoi le chercheur a examiné la performance des poulets de chair alimentés avec des régimes riches en fibres, supplémentés en probiotiques à la phase de démarrage, en utilisant un total de cent quatre-vingts (180) poussins Cobb 500 âgés d'un jour. Les oiseaux ont été répartis aléatoirement en six (6) traitements diététiques, chacun répété trois (3) fois. Chaque répétition comprend dix (10) oiseaux. L'expérience était un plan factoriel 2x3 en bloc complet randomisé, qui comprenait 2 niveaux (0 et 2 ml)

de microbes essentiels (bactéries lactiques, levure, bactéries actinomycètes, bactéries photosynthétiques et champignons fermentaires) et 3 niveaux (2,5 %, 5 % et 7,5 %) de fibre à la phase de démarrage. Les oiseaux ont reçu la même quantité de nourriture mesurée en grammes pour les combinaisons de traitements T1, T2, T3, T4, T5 et T6, respectivement. Les résultats concernant l'effet principal et l'effet interactif des probiotiques et de la fibre sur la performance de croissance des poussins de chair indiquent que la Solution Microbienne Activée (SMA) n'a pas montré de différences significatives ( $P < 0,05$ ) sur le poids initial (PI), le poids final (PF), le gain de poids par jour (GP/J), la consommation alimentaire moyenne (AFI), le rapport de conversion alimentaire (RCA), l'apport en protéines (PI), le rapport d'efficacité protéique (PER) et le rapport d'efficacité énergétique (REE), sauf pour la fibre qui indique une augmentation significative ( $P < 0,05$ ) de l'AFI (41,2, 43,4 et 42,0 g/oiseaux) et du FCR (1,53, 1,62 et 1,67). L'effet principal et interactif des microbes essentiels et de la fibre sur la production économique des poussins de chair a montré une augmentation significative ( $P < 0,05$ ) du coût total de production (TCP) pour la SMA et la fibre. Il a été conclu et recommandé que 7,5 % de fibre avec 2 ml de microbes essentiels soient administrés dans les régimes des poussins de chair, car cela améliore le bien-être total des oiseaux.

**Mots-clés :** Performance, Microbes, Fibres élevées, Poules de chair, Probiotiques

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## **Introduction**

Poultry are Monogastric and therefore unable to efficiently digest crude fibre as they do not have innate ability to digest high crude fibre materials excepts they require exogenous sources of essential amino acids and enzymes or additives to improve their nutritional requirements. Dietary crude fibre level has effect on diet digestion in chickens. Fibre in the diet is essential for optimization of nutrient digestibility and feed efficiency.

The poultry industry in the developing countries like Nigeria is faced with the challenges of meeting the demand of animal protein for the consumption of a geometrically rising population. Yakubu *et al.* (2010) suggested that the quickest potential for bridging protein supply-demand gap lies in the production of highly prolific animals that are efficient converters of feed to flesh and have short generation interval such as broiler chickens. In the light of this and the inherent challenges faced by the industry in the area of meeting critical needs of feeds which constitute over 70% of production cost and legislation against the use of antibiotics (Casewell *et al.*, 2003). Many advances in poultry production have been made through the use of nutritional supplements and that of probiotics compound into poultry feeds and water.

The use of probiotics is one methods receiving considerable recent attention as a natural alternative to use of synthetic chemicals in enhancing animal productivity and improving product safety as well as feeding of viable microorganisms (Brashears *et al.*, 2005). Similarly, the advantages of direct fed microbial consumption in humans have been documented (Mackowiak, 2013). However, their applications and efficiency in livestock operations have only recently been pursued (Alu *et al.*, 2012).

The influence of probiotics in fibre digestion has also been documented (Pérez-Burillo *et al.*, 2019). The essence of this study therefore was to see the viability of supporting farmers who usually mix the concentrate feeds with high fibre materials in an attempt to reduce cost of feeds supplied. Therefore, this study seeks to evaluate the effect of probiotics in the digestion of high fibre diets by broilers.

## **Materials and Methods**

### **Study Location**

The study was conducted in the Poultry Unit IBAS Farm Keffi along Nasarawa road. IBAS farm is located in the Guinea Savanna zone of the North Central Nigeria. It is found in latitude  $08^{\circ} 51'$  North of the equator and longitude  $07^{\circ} 51'$  East of the Greenwich meridian. IBAS farm is located at an average altitude of 850 meters above sea level. The mean monthly maximum and

minimum temperature is 35.06°C and 20.16°C respectively while the mean monthly relative humidity and rainfall is 74.6% and 168.9mm respectively (NIMET, 2019).

#### **Experimental Birds and Management**

A total 180 1 day old Cobb 500 breed of broilers from Hatchery Kaduna, Kaduna State were used for this experiment. The birds were randomly assigned to 6 dietary treatments replicated 3 times. Each replicate comprises of 10 birds. The pens were disinfected prior to the arrival of the birds. All the experimental birds were weighed (to determine the initial weight) and they were provided with feed and water *ad-libitum*. Routine management practices were carryout throughout the period of the experiment. And at the age of 2 and 3 weeks the chicks were vaccinated against Gumboro and New-castle diseases (NCD) respectively.

#### **Source of experimental materials**

The essential microbes (EM) were procured from Songhai Farm Port Novo, Bénin Republic. All others ingredients such as Maize, Soybeans,

Wheat Offals, fish meal, bone meal, premix, methionine, salt and lysine were procured from Star Mega Feed Mill Limited, Karu Local Government Area of Nasarawa State Nigeria.

#### **Experimental design and diets**

The experiment was a 2 x 3 factorial laid in Completely Randomized Design. The design comprises of 2 levels (0 and 2mL) of Essential Microbes (Lactic acid bacterial, Yeast, Actinomycetes bacterial, Photosynthetic bacteria and Fermenting fungi) and 3 levels (2.5, 5, and 7.5%) of fibre at starter phase. The birds were given the same quantity of feed measured in grams; water was given *ad-libitum*. Records of feed consumption, weight gain and feed conversion ratio were taken. The starter diets were fed for 4 weeks (1 – 28days). Experimental diets were formulated to be isocaloric and isonitrogenous having 2850 kcal ME and 22% crude protein (CP). The experimental feed were formulated using least cost feed formulation software (feed win).

**Table 1. Gross composition of experimental diet for broiler starter**

Ingredients	T1(2.5%cf)	T2 (2.5%cf)	T3 (5%cf)	T4 (5%cf)	T5 (7.5%cf)	T6 (7.5%cf)
Aflatoxin binder	4.85	4.85	0.05	0.05	0.05	0.05
Blood meal	6.00	6.00	1.00	1.00	3.00	3.00
Bone meal	2.50	2.50	3.50	3.50	1.60	1.60
Fish meal	5.50	5.50	4.00	4.00	5.00	5.00
Ground nut cake	0.00	0.00	4.00	4.00	5.00	5.00
Limestone	0.00	0.00	0.22	0.22	0.50	0.50
Lysine	0.00	0.00	0.00	0.00	0.00	0.00
Maize	52.00	52.00	41.90	41.90	37.00	37.00
Maize bran	0.00	0.00	5.55	5.55	0.15	0.15
Methionine	0.15	0.15	0.13	0.13	6.00	6.00
Molasses	0.50	0.50	0.00	0.00	0.20	0.20
Palm kernel cake	0.00	0.00	3.00	3.00	6.00	6.00
Palm oil	1.00	1.00	0.70	0.70	1.60	1.60
Premix	0.20	0.20	0.25	0.25	0.25	0.25
Rice bran	0.00	0.00	2.06	2.06	10.00	10.00
Common salt	0.30	0.30	0.30	0.30	0.25	0.25
Sorghum	11.00	11.00	0.00	0.00	1.00	1.00
Soya beans toasted	16.00	16.00	26.64	26.64	15.00	15.00
Soya oil	0.00	0.00	0.00	0.00	0.00	0.00
Wheat bran	0.00	0.00	6.70	6.70	7.00	7.00

TOTAL	100	100	100	100	100	100
Essential microbe (mL)	0	2	0	2	0	2
<b>Nutrient and Energy composition</b>						
ME/Kcal/Kg	3000.20	3000.20	3000.80	3000.80	3000.00	3000.00
Crude protein (%)	21.45	21.45	22.00	22.00	21.50	21.50
Crude fibre (%)	2.50	2.50	5.00	5.00	7.50	7.50
Ether extract (%)	7.70	7.70	8.45	8.45	8.25	8.25
M+C (%)	0.91	0.91	0.89	0.89	0.90	0.90
Calcium (%)	1.20	1.20	1.00	1.00	0.82	0.82
Phosphorus (%)	0.81	0.81	0.80	0.80	0.77	0.77
Lysine (%)	1.30	1.30	1.20	1.20	1.16	1.16
Methionine (%)	0.53	0.53	0.51	0.51	0.52	0.52

CF= crude fibre. mL= mill. The vitamin- mineral premix supplied the following per 100kg of diet: vitamin A15,000 I.U, vitamin D3 300,000 I.U., vitamin E 3,000 I.U., vitamin K 2.50mg, vitamin B<sub>1</sub> (thiamin) 200mg, Riboflavin (B<sub>2</sub>) 600mg, pyridoxine (B<sub>6</sub>), Niacin 40.0mg, vitamin B<sub>12</sub> 2mg, Pantothenic acid 10.0mg, folic acid 100mg, Biotin 8mg, choline chloride 50mg, anti-oxidant 12.5mg, manganese 96mg, zinc 6mg, Iron 24mg, Copper 0.6mg, Iodine 0.14mg, Selenium 24mg, cobalt 214mg. Using Feedwin software version 1.0

### **Results and Discussions**

Main and interactive effect of essential microbes and fibre on growth performance and economic of production of broiler starter birds. The results for the main and interactive effect of essential microbes and fibre on growth performance of broiler starter birds are presented in Table 2. The result indicated that effective microorganism activated solution (EMAS) did not show significant ( $P>0.05$ ) differences on the growth performance of broilers starter for initial weight, final weight, weight gain per day, average feed intake, feed conversion ratio, protein intake, protein efficiency ratio and energy efficiency ratio. The result for the effect of fibre indicates significant ( $P<0.05$ ) increase in the average feed intake (41.2, 43.4 and 42.0g/bird) and feed conversion ratio (1.53, 1.62 and 1.67). Birds fed on 5% fibre (43.4g/bird) had the highest feed intake values followed by 7.5% fibre birds than the 2.5% fibre birds. However the resultant feed conversion ratio was lower at 2.5% fibre compared with 5 and 7.5% fibre. The interaction effect did not show significant ( $P>0.05$ )

difference in the all the growth performance parameters.

The non-variation observed by bird's fed probiotics on the growth performance of broilers starter indicates that the mixture is safe for broiler production. This observation contradicts the previous work of Wondmeneh *et al.* (2014) who studied the effect of effective microorganisms (EM) on growth parameters and serum cholesterol levels in broilers and reported significant increase in the Weight gain when EM was supplemented in water. The significant increase in the average feed intake for birds fed 5% fibre (43.4g/bird) and the lower feed conversion ratio observed at 2.5% birds were due to inclusion of fibre in the diets which makes the birds to eat more to compensate the needed energy for growth. This disagreed with Agbabiaka *et al.* (2013) reported reduction the feed intake of broiler chicks when Feeding of high fibre feedstuff such as Tigernut might have resulted in gut filling in birds. However, Sundu *et al.* (2005) reports that voluntary feed intake of chickens or monogastrics have been established to be a function of dietary fibre characteristics.

This is also in NAPRI (1985) who reported that replacing maize with wheat offal beyond 50% in broilers has also been reported to reduce chicken feed intake but disagreed the present research. Interaction of essential micros and fibre were in support of Sundu *et al.* (2005).

The results for the main and interactive effect of essential microbes and fibre on economic of production of broiler starter chickens is shown in Table 3. The result for the effect of EMAS indicates significant (P<0.05) increase in the total cost of production (₦634.69 vs. 574.71/bird).

Birds fed on 2ml EMAS diets had the highest cost of production than the 0ml based birds. Effect of fibre on economics also indicated significant (P<0.05) increase in the TCP (₦601.79, 610.68 and 603.83/bird). Birds on 5% fibre (₦610.68/bird) had higher total cost of production than 2.5 and 7.5% fibre. Similarly the interactive effect indicated significant (P<0.05) increase in the TCP at T5 (₦642.73/bird) followed by control birds T1 (₦640.79/bird) compared with other treatment diets.

**Table 2. Main and interactive effect of essential microbes and fibre on growth performance of broiler starter birds.**

PARAMETERS		IW	FW	WG/D	AFI	FCR	PI	PER	EER
EMAS	0mL	44.52	782.96	26.38	42.16	1.62	9.31	2.83	24.61
	2mL	44.52	789.37	26.60	42.17	1.59	9.31	2.86	24.88
	SEM	0.00	27.57	0.99	0.35	0.06	0.08	0.11	0.93
FIBRE	2.5%	44.53	806.83	27.23	41.2 <sup>b</sup>	1.53 <sup>c</sup>	9.11	2.99	25.41
	5%	44.54	795.33	26.81	43.4 <sup>a</sup>	1.62 <sup>b</sup>	9.57	2.81	25.03
	7.5%	44.51	756.33	25.44	42.0 <sup>b</sup>	1.67 <sup>a</sup>	9.25	2.75	23.81
	SEM	0.00	33.77	1.21	0.43	0.07	0.10	0.13	1.14
EMAS* FIBRE	T1	44.55	860.10	29.10	42.64	1.49	9.45	3.08	27.18
	T2	44.55	817.30	27.60	42.17	1.53	9.34	2.96	25.76
	T3	44.50	715.40	23.90	39.25	1.67	8.67	2.76	22.36
	T4	44.50	753.60	25.30	39.67	1.57	8.76	2.89	23.64
	T5	44.52	773.30	26.00	44.58	1.72	9.81	2.65	24.29
	T6	44.52	797.20	26.80	44.67	1.68	9.83	2.74	25.25
	SEM	0.01	19.84	0.71	0.56	0.04	0.12	0.07	1.85
SOURCES OF VARIATION									
Emas		NS	NS	NS	NS	NS	NS	NS	NS
Fibre		NS	NS	NS	*	*	NS	NS	NS
Emas * fibre		NS	NS	NS	NS	NS	NS	NS	NS

EMAS= effective microorganism activated solution, IW= initial weight, FW= final weight, WG/D= weight gain per day (WG/D), AFI= average feed intake, FCR= feed conversion ratio, PI= protein intake, PER= protein efficiency ratio, EER= energy efficiency ratio (EER), AFI= average feed intake, \*= Significant, NS= Non-significant.

abc= Means on the same row bearing different superscript differ significantly (p>0.05).

**Table 3. Main and interactive effect of essential microbes and fibre on economic production of broiler starter**

PARAMETERS		FC/kg	FC/WG	TCP	REV	GM
EMAS	0mL	156.44	253.72	574.71 <sup>b</sup>	754.79	120.10

	2mL	156.44	249.13	634.69 <sup>a</sup>	763.54	184.65
	SEM	0.00	9.43	1.54	28.24	27.76
FIBRE	2.5%	157.46	240.81	601.58 <sup>b</sup>	762.66	154.84
	5%	157.07	254.47	610.68 <sup>a</sup>	753.12	142.44
	7.5%	154.77	258.99	603.83 <sup>b</sup>	761.71	159.86
	SEM	0.00	11.55	1.88	34.59	34.00
EMAS* FIBRE	T1	159.76	237.51	640.79 <sup>a</sup>	766.62	125.84
	T2	159.76	243.90	578.64 <sup>c</sup>	726.41	147.78
	T3	155.16	258.60	620.54 <sup>b</sup>	717.91	97.37
	T4	155.16	244.12	562.36 <sup>d</sup>	758.69	183.84
	T5	154.39	265.03	642.73 <sup>a</sup>	779.83	137.10
	T6	154.39	259.38	583.12 <sup>c</sup>	805.51	222.34
	SEM	0.58	6.11	7.68	18.25	19.20
SOURCES OF VARIATION						
Emas		NS	NS	*	NS	NS
Fibre		NS	NS	*	NS	NS
Emas * fibre		NS	NS	*	NS	NS

FG/kg= feed cost per kilogram, FC/WG= feed cost per weight gain, TCP= total cost of production, REV= revenue, GM= gross margin, NS= no significant, \* =significant.

abc means with the different superscripts on the same row are significantly different (p<0.05).

### Conclusion

The results in this present research revealed no effect of probiotics and fibre in most of the parameters of growth performance in starter phase except on the feeding intake at 2.5 and 5% inclusion of fibre. However the resultant feed conversion ratio was lower at 2.5% fibre compared with 5 and 7.5% fibre. The supplementation of essential microbes at 2mL and fibre at 5% increased total cost of production (TCP) due to increase in prices of commodity in the market. This indicates that the mixture is safe for broiler production.

### Recommendation

Further research should be carryout to ascertain the effects of probiotics and dietary fibre on growth performance for both starter and finisher phase on battery cage system of production.

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