Effect of dietary rumen filtrate fermented wheat offal on nutrient digestibility, carcass characteristics and caecal microbiology of broiler chickens

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Abstract

Wheat offal is a feed resource with limited application in the diets of broiler chickens due to low nutritional value and bulkiness. Fermentation is expected to improve bioavailable nutrients and digestibility. This study evaluates the effect of dietary rumen filtrate fermented wheat offal (RUFFWO) on the nutrient digestibility, carcass characteristics and caecal microbiology of broiler chickens. A total of one hundred and eighty (180) broiler chicks were allotted to six (6) treatment groups of 30 birds each. Each treatment was sub-divided into three groups with 10 birds per replicate in a Completely Randomized Design (CRD). Six diets were formulated for the starter and finisher phases with the inclusion of RUFFWO at 0, 5, 10, 15, 20 and 25% of the diets. Feed and water were given ad-libtum. Data collected was subjected to analysis of variance, significant differences were separated using Duncans multiple range test (DMRT).The results of the experiment revealed significantly (P≤ 0.05) higher crude protein and energy digestibility in chickens fed the control diet. Chickens fed T_5 (20% RUFFWO diet had the highest (P≤0.05) crude fiber and ash digestibility. Groups fed 10% RUFFWO diets had higher dressing percent while breast percent was highest (p≤0.05) in chickens on T_5 (20%) RUFFWO. Chickens on T_2 (5% RUFFWO) had the highest drumstick (11.75%). The count of total bacteria, E-coli, staphylococcus, baccilus subtilis and conrybacta was significantly (P≤0.05) higher in chickens on T_6 (25%t RUFFWO) level compared to the control group which recorded the lowest value for all the bacteria. It was concluded that dietary RUFFWO can be included in the diet of broiler chickens up to 25% level without adverse effect on nutrient digestibility, carcass parameters and cecal microbiology of broiler chickens.

Keywords: fermented wheat offal, broiler chickens, digestibility, carcass cecal microbiology

Effet du filtrat de rumen de blé fermenté sur la digestibilité des nutriments, les caractéristiques de la carcasse et la microbiologie cécale des poulets de chair

Résumé

Les sous-produits de blé sont une ressource alimentaire dont l'application dans l'alimentation des poulets de chair est limitée en raison de leur faible valeur nutritionnelle et de leur voluminosité. La fermentation devrait améliorer la biodisponibilité des nutriments et la digestibilité. Cette étude évalue l'effet du filtrat de rumen de blé fermenté sur la digestibilité des nutriments, les caractéristiques de la carcasse et la microbiologie cécale des poulets de chair. Un total de cent quatre-vingts (180) poussins de poulets de chair ont été répartis en six (6) groupes de traitement de 30 oiseaux chacun. Chaque traitement a été subdivisé en trois groupes avec 10 oiseaux par réplique dans un plan complètement randomisé (PCR). Six régimes alimentaires ont été formulés pour les phases de démarrage et de finition avec l'inclusion du filtrat de rumen de blé fermenté à 0, 5, 10, 15, 20 et 25% des régimes. L'alimentation et l'eau étaient données ad libitum. Les données collectées ont été soumises à une analyse de variance, et les différences significatives ont été séparées à l'aide du test de multiple de Duncan (DMRT). Les résultats de l'expérience ont révélé une digestibilité significativement (P= 0,05) plus élevée des protéines brutes et de l'énergie chez les poulets nourris avec le régime témoin. Les poulets nourris avec le régime T_5 (20% du filtrat de rumen de blé fermenté) ont montré la digestibilité la plus élevée (P<0,05) des fibres brutes et de la cendre. Les groupes nourris avec un régime contenant 10% du filtrat de rumen de blé fermenté ont eu un pourcentage de carcasse plus élevé, tandis que le pourcentage de poitrine était le plus élevé (P<0,05) chez les poulets du régime T_5 (20% du filtrat de rumen de blé fermenté). Les poulets du régime T_2 (5% du filtrat de rumen de blé fermenté) ont eu la plus grande proportion de cuisse (11,75%). Le nombre de bactéries totales, d'Escherichia coli, de staphylocoques, de Bacillus subtilis et de Corynebacterium était significativement (P<0,05) plus élevé chez les poulets nourris avec le régime T_6 (25% du filtrat de rumen de blé fermenté) par rapport au groupe témoin, qui a enregistré la valeur la plus basse pour toutes les bactéries. Il a été

conclu que le filtrat de rumen de blé fermenté alimentaire peut être inclus dans le régime alimentaire des poulets de chair jusqu'à 25% sans effets indésirables sur la digestibilité des nutriments, les paramètres de la carcasse et la microbiologie cécale des poulets de chair.

Mots-clés : sous-produits de blé fermenté, poulets de chair, digestibilité, carcasse, microbiologie cécale

Introduction

Wheat offal (WO) is one of the most preferred and utilized AIBs used in poultry feed formulations as conventional source of dietary fibre in livestock feeds in Nigeria (Makinde, *et al*., 2017). It is reported to contain 14.80-17.60% CP, 8 - 10% crude fibre and 77.53 Kcal/kg metabolizable energy various essential amino acids and phytase (Lesson and Summers, 2005 Amaefule *et al*., 2009; Olomu, 2011). These reports have portrayed wheat offal as a product with a reasonable potential to replace a portion of maize in the diet of chicken. However, these nutrients are trapped by anti-nutritional factors called non-starch polysaccharides (NSPs). NSPs have been implicated as a factor depressing nutrient digestibility, absorption, availability and efficient utilization in monogastric animals (Alayande *et al.,* 2016). Nutritionists have identified various processing methods to enhance utilization of AIBs like WO; they include the use of exogenous enzymes and more recently, application of microbiological fermentation and biotechnology applications (Aro *et al*., 2013; Ereke *et al*., 2017). Fermentation is an effective means of breaking down anti-nutrients and increasing the nutritive value of AIBs**.** The works of Darwazeh (2010), Adesua and Onibi (2014) and (Elmasry *et al*., 2017) indicated the possibility of upgrading the feeding value of wheat offal through solid state fermentation. It is projected that simulating rumen fermentation of wheat offal with rumen liquor will perhaps reduce the fibre portion in the wheat bran and increase its nutritional quality such that portions of maize and soya bean which accounts for about 70% of the total feed ingredients can be cheaply replaced with nutrient enriched wheat offal. The objective of this study is to evaluate the effect of including rumen filtrate fermented wheat offal (RUFFWO) on the nutrient digestibility, carcass characteristics and cecal microbiology of broiler chickens.

Materials and methods

Study Area

This study was conducted at the poultry unit of the Teaching and Research Farm of the Department of Animal Science University of Maiduguri. Maiduguri is located between Latitude 11^0.85 and 12^0N and Longitude 13^0.16 and 14^0E, and at an altitude of 325m above sea level.

Experimental birds and their management

Total of one hundred and eighty (180) broiler chicks (Cobb 500) were used for the experiment. The chicks were brooded for one week and thereafter allotted to six (6) treatment groups of 30 birds each. Each treatment was sub-divided into three groups with 10 birds per replicate in a Completely Randomized Design (CRD). Feed and water were provided *adlibitum* throughout the experimental period of seven weeks.

Experimental diets and design

Fresh rumen content was collected from slaughtered cattle, it was immediately filtered through a sieve, the residue was discarded and the filtrate was used to inoculate wheat offal on weight to weight basis. The inoculated wheat offal was immediately compacted into fermentation vat and allowed to ferment for two weeks. The content was thereafter removed and sundried for three days and referred to as Rumen filtrate fermented wheat offal (RUFFWO). RUFFWO was used to formulate six (6) diets for the starter and finisher phases. During the phases, RUFFWO was included at 0, 5, 10, 15, 20 and 25 % of the diets. These were designated as T1 (0%RUFFWO), T2 (5% RUFFWO), T3 (10%RUFFWO), T4 (15% RUFFWO), T5 (20%) and T6 (25% RUFFWO), respectively. Gross and proximate composition of the experimental diets are presented in Tables 1 and 2.

Measurement of response criteria

At the end of sixth week of the experiment, three chickens were selected from each treatment for the digestibility trial at the end of which they were slaughtered following local ethical guidelines. The ceca from these chicken were collected for the cecal microbiology studies.

Parameters measured were as follows;

Nutrient digestibility;

The apparent nutrient digestibility was calculated as follows;

Nutrient digestibility coefficient = $\frac{(NF \times FI) - (Nf \times FO)}{(NF \times FI)} \times 100$

Where; NF = Amount of nutrients in feed (g) ; FI = Feed intake (g);

Nf =Amount of nutrient in faeces (g) FO = Faecal output (g)

Carcass characteristics were determined by measuring the live weight of each chicken using weighing scale followed by and then slaughtering and de-feathering. Each carcass was cut –up into

Table 1: Composition of experimental broiler starter diets

	Level of Rumen filtrate fermented wheat offal (RUFFWO) inclusion (%)					
Ingredients (%)	T_1(0)	T_2(5)	T_3(10)	T_4(15)	T_5(20)	T_6(25)
Maize	45.00	45.00	44.00	40.00	39.00	37.00
Groundnut cake	40.00	39.00	33.00	31.00	25.00	22.00
RUFFWO	00.00	05.00	10.00	15.00	20.00	25.00
Wheat offal	06.00	02.00	02.00	01.00	01.00	00.00
Fish meal	05.00	05.00	06.00	07.00	08.00	08.50
Bone meal	03.00	03.00	03.00	03.00	03.00	03.00
NaCl	00.30	00.30	00.30	00.30	00.30	00.30
Min- Vit premix*	00.40	00.40	00.40	00.40	00.40	00.40
Lysine	00.10	00.10	00.10	00.10	00.10	00.10
Methionine	00.20	00.20	00.20	00.20	00.20	00.20
Palm oil	00.00	00.00	01.00	02.00	03.00	03.50
Total (%)	100.00	100.00	100.00	100.00	100.00	100.00
Proxmate composition (%)						
Crude Protein	23.75	23.55	24.1	23.8	23.4	23.00
Ether extract	7.3	6.77	7.76	8	8.59	8.32
Crude Fiber	5.85	6.72	8.53	6.1	9.31	8.23
Ash	6.38	7.57	6.09	8.1	8.8	12.28
ME (kcal/kg)	3192.34	3136.08	3170.76	3184.25	3053.14	2978.03

ME = Metabolizable energy ; **1kg of starter premix contains: Vitamins A (5, 000, 000 I.U), Vitamin D3 (1000000 I.U), Vitamin E (16000mg), Vitamin K_3 (800mg), Vitamin B_1 (1200mg), Vitamin B_2 (22000mg), Niacin(22000mg), Calcium pontothenate (4600mg), Vitamin B_6 (200mg), Vitamin B_{12} (10mg)Folic acid (400mg), Biotin (32mg), Choline chloride (200000mg), Manganese (948000mg), Iron (40000mg), Zinc (32000mg), Copper (3400mg), Iodine (600mg), Cobalt (120mg), selenium (48mg), Anti-Oxidant (48000mg)*

Table 2: Composition of experimental broiler finisher diets

	Level of Rumen filtrate fermented wheat offal (RUFFWO) inclusion (%)					
Ingredients (%)	T_1(0)	T_2(5)	T_3(10)	T_4(15)	T_5(20)	T_6(25)
Maize	55.00	54.00	53.00	52.00	49.00	46.00
Groundnut cake	26.00	22.00	20.00	18.00	15.00	12.00
RUFFWO	00.00	05.00	10.00	15.00	20.00	25.00
Wheat offal	08.00	06.00	03.00	01.00	00.00	00.00
Fish meal	03.00	04.00	05.00	05.00	06.00	06.00
Bone meal	04.00	04.00	04.00	04.00	04.00	04.00
Blood-meal	02.00	02.00	02.00	02.00	02.00	02.00
NaCl	00.30	00.30	00.30	00.30	00.30	00.30
Min- Vit premix*	00.40	00.40	00.40	0.400	00.40	0.400
Lysine	00.10	00.10	00.10	00.10	00.10	00.10
Methionine	00.20	00.20	00.20	00.20	00.20	00.20
Palm oil	01.00	02.00	02.00	02.00	03.00	04.00
Total (%)	100.00	100.00	100.00	100.00	100.00	100.00

Proximate composition (%)						
Crude Protein	20.20	20.57	19.95	19.95	19.74	19.00
Ether extract	6.95	7.95	7.05	6.85	7.71	7.81
Crude Fiber	5.3	5.8	6.96	7.4	9.5	10.02
Ash	6.31	6.95	8.78	9	12.03	15.22
ME (kcal/kg)	3215.81	3117.99	3051.22	3045.86	2944.78	2973.61

ME = Metabolizable energy **1kg of finisher premix contains: Vitamins A (5, 000, 000 I.U), Vitamin D3 (1000000 I.U), Vitamin E (16000mg), Vitamin K_3 (800mg), Vitamin, B_1 (1200mg), Vitamin B_2 (22000mg), Niacin (22000mg), Calcium pontothenate (4600mg), Vitamin B_6 (200mg), Vitamin B_{12} (10mg),Folic acid (400mg), Biotin (32mg), Choline chloride (200000mg), Manganese (948000mg), Iron (40000mg), Zinc (32000mg), Copper(3400mg), Iodine (600mg), Cobalt (120mg), selenium (48mg), Anti-Oxidant (48000mg)*

shanks, drumsticks, thighs, back, thorax, wings, breast, neck and head. The visceral organs were separated. Cut-up parts and the visceral organs were weighed and expressed as percentage of live weight. Microbial studies were conducted at the Department of Veterinary Microbiology University of Maiduguri. Caeca from representative chickens in each replicate per treatment was obtained after slaughter. The content was emptied into sterile container and immediately taken to the laboratory for total bacteria count and microorganism identification according to Varghese and Joy (2014).

Statistical analysis

All data collected was subjected to analysis of variance, significant differences were separated using Duncans multiple range test (DMRT)

Results and discussion

Nutrient digestibility of broiler chickens fed dietary RUFFWO

The result of nutrient digestibility of broiler chickens fed various level of RUFFWO is presented in Table 3. Significant ($p \leq 0.05$) differences were observed among the treatments for dry matter, crude protein (CP), crude fiber (CF), ash and energy digestibility. There were however no significant ($p > 0.05$) differences in Nitrogen free extract (NFE) and ether extract, (EE) digestibilities.

Dry matter (DM) digestibility was lowest ($P \leq 0.05$) in chickens fed T_2 5% RUWWO diets. Other groups had values (69.52 - 79.58%) that were statistically similar. Crude protein digestibility was significantly ($P \leq 0.05$) higher in chickens fed the control diet (85.31%) although the value was similar to 83.65 – 84.14% obtained for chickens on T_2, T_3, T_4 and T_5 (5,10, 15 and 20% RUFFWO diets. The group fed T_6 (25% RUFFWO) diet had the least CP digestibility (78.05%). Chickens fed T_5 (20% RUFFWO diet had the highest ($P \leq 0.05$) CF and ash digestibility. The values were similar to values obtained 7 in chickens on T_3, T_4 and T_6 (10, 15 and 25% RUFFWO) diets. Similarly, values observed for the T_1control group (70.61%) was similar to values found in chickens on 10, 15 and 25% RUFFWO diets. The lowest ($P \leq 0.05$) energy digestibility (83.58%) was found in chickens on T_6 (25% RUFFWO) diets while the control group had the highest value. Both values were however, similar to the 87.19 – 89.43% found in chickens on $T_2 – T_5$ (5- 20% RUFFWO) diets. The findings of this study revealed better CF digestibility in chickens on 20% RUFFWO diet. The observation could be related to degradation of complex polysaccharides by microbial organism which secrete many enzymes such as cellulase, amylase and pectinase that enhance digestion (Zhang *et al*. 2021). It could also be related to effect of increased fiber content.

Table 3. Nutrient digestibility of broiler chickens fed diets containing RUFFWO

	Level of RUFFWO inclusion (%)						
Nutrients (%)	T1(0)	T2(5)	T3(10)	T4 (15)	T5 (20)	T6 (25)	SEM
Dry matter	72.88^{a}	57.38^{b}	71.55^{a}	79.58^{a}	75.39^{a}	69.52^{a}	1.55*
Crude protien	85.31^{a}	83.65^{a}	84.11^{a}	83.68^{a}	80.38^{ab}	78.05^{b}	1.15*
Ether extract	89.47	91.40	89.18	90.31	89.78	86.02	0.65^{ns}
Crude fiber	70.61^{b}	62.52^{c}	72.96^{ab}	73.92^{ab}	75.11^{a}	71.59^{ab}	0.52*
Ash	50.63^{c}	61.72^{bc}	68.37a^{b}	71.23^{ab}	80.92^{ab}	77.09^{b}	2.14*
Nitrogen free extract	89.01	86.27	83.78	82.66	83.03	81.19	2.08^{ns}
Metabolizable energy	89.98^{a}	88.34^{ab}	87.94^{ab}	89.43^{ab}	87.19^{ab}	83.58^{b}	0.76*

a,b, c Means on the same row having different superscripts are significantly different (P≤0.05)
SEM: Standard Error of Mean, ns = not significantly diierent (p>0.05)

in the diet which has a stimulating effect on gut development, GIT motility, feed retention and Secretion of pancreatic enzymes (Svihus *et al.,* 2004). The findings of this study is in consonance with the report of Abdulazeez *et al*.(2022) and Elmasry *et al*. (2017) who showed better nutrient digestibility in pullets and broiler chickens fed fermented wheat offal.

Effect of dietary rumen filtrate fermented wheat offal (RUFFWO) on carcass characteristics of broiler chickens.

The Effect of feeding RUFFWO carcass characteristics of broiler starter chickens is presented in Table 4. Significant (p≤0.05) differences were observed in plucked weight, chickens on T6 (25%RUFFWO) had the least plucked weight (2033.33g). The value was however, similar to values obtained for chickens fed T_1, T_2, T_4 and T_5 (0, 5, 15 and 20% RUFFWO) level. Chickens on T_1 and T_4 (control and 15% RUFFWO groups had the lowest dressing percent. The values were however, similar to 82.82 to 87.68% found in groups on T_2, T_5 and T_6 (5, 20 and 25% RUFFWO). Higher dressing percent in group on 10% RUFFWO diets may be as a result of better body weight and FCR of the chickens on these treatments. Breast percent was highest (p≤0.05) in chickens on T_5 (20%) RUFFWO. The T_1 (control) and T_2 (5%RUFFWO) groups had the lowest value. Values

Table 4. Effect of dietary rumen filtrate fermented wheat offal (RUFFWO) on carcass characteristics of broiler chickens

	Treatments/ Level of RUFFWO inclusion (%)						
Parameters	T_1 (0)	T_2 (5)	T_3 (10)	T_4 (15)	T_5(20)	T_6 (25)	SEM
Live weight (g)	2400	2400	2533.33	2466.67	2533.33	2166.67	56.38^{ns}
Plucked weight (g)	2350^{ab}	2133.33^{ab}	2400^{a}	2366.67^{ab}	2366.67^{ab}	2033.33^{b}	43.39*
Eviscerated weight	1683.66	1617.00	1891.66	1712.00	1765.67	1505.00	54.22^{ns}
Dressed weight (g)	1733.33	1800.00	2100.00	1866.67	1961.67	1683.33	50.68^{ns}
Dressing %	75.4^{b}	84.44^{ab}	87.68^{a}	78.37^{b}	82.82^{ab}	82.83^{ab}	1.38*
Cut up Parts (%) of live weight							
Head	2.67	2.46	2.65	2.25	2.91	2.78	0.11^{ns}
Neck	5.12^{ab}	5.25^{ab}	5.57^{a}	4.00^{ab}	4.84^{ab}	5.45^{a}	0.16*
Wings	6.95	7.05	7.76	6.93	6.57	7.48	0.19^{ns}
Breast	17.73^{b}	18.58^{b}	21.82^{ab}	20.35^{ab}	23.18^{a}	20.46^{ab}	0.62*
Thorax	7.98^{b}	8.28^{b}	8.73^{b}	11.79^{a}	7.42^{b}	7.70^{b}	0.27*
Back	9.90^{c}	11.97^{a}	11.28^{ab}	11.21^{ab}	11.31^{ab}	10.33^{bc}	0.22
Thigh	10.80^{a}	11.46^{a}	8.67^{b}	10.65^{a}	10.74^{a}	11.21^{a}	0.28*
Drumsticks	10.07^{ab}	11.75^{a}	10.28^{ab}	9.82^{b}	9.33^{b}	10.19^{ab}	0.24*
Shanks	4.34^{ab}	5.22^{a}	2.54^{bc}	1.35^{c}	3.74^{ab}	4.04^{ab}	0.27*
Organs weight (%) of live weight							
Crop	0.30	0.29	0.33	0.08	0.31	0.23	0.05
Empty gizzard	2.70	3.23	1.92	2.77	2.00	3.13	0.57

Proventriculus	0.40	0.55	0.43	0.41	0.38	0.50	0.16
Heart	0.37	0.51	0.51	0.48	1.934	0.46	0.25
Liver	1.74	2.18	2.09	2.11	1.611	2.20	0.01
Intestine	3.64	3.60	3.74	3.41	3.76	3.25	0.14

a,b, c Means on the same row having different superscripts are significantly different (P≤0.05), ns = not significantly different (p>0.05,)SEM: Standard Error of Mean,

obtained for groups on T_3, T_4 and T_6 (5, 15 and 25% RUFFWO) levels were similar to values obtained for groups on T_1 and T_5 (0 and 20% RUFFWO). Higher breast percent in groups on 20% RUFFWO could be as a result of better FCR and in turn resulted in higher degree of carcass meatiness in the 20% RUFFWO groups compared to the control group. Percent weight of the thorax was highest (p≤0.05) in chickens on T_4 (15% RUFFWO). The control (T_1) and groups fed T_2- T_6 (5, 10, 20 and 25% RUFFWO) had similar and lower weight compared to the 15% RUFFWO groups. Back weight (P≤0.05) was highest in chickens on T_2 (5% RUFFWO) (11.98%). The value is similar to values obtained for chickens on T_3, T_4 and T_5 (10, 15 and 20% groups. The lowest value was found in the control group (9.90%). Resnawati (2004) suggested that broiler backs contain more bone tissue, so that the mineral content of the feed has more effect on the back than its protein content. This could indicate that the treatment diets contained some minerals which encourage development of the bone especially that the RUFFWO based diet had higher ash content and ash digestibility (Table 1 and 3) than the control diet. Thigh weight was lowest in chickens on T_3 (10% RUFFWO) diets. Groups fed T_1, T_2, T_4 T_5 and T_6 (0, 5, 15, 20 and 25%) RUFFWO recorded values that were similar and higher (P≤0.05) than what was observed for the T_3 groups. Chickens on T_2 (5% RUFFWO) had the highest drumstick (11.75%) while those on T_4 had the lowest value (P≤0.05). Both groups had values that were similar to values obtained in groups fed T_1, T_3 and T_6. (control, 10, 15 and 25% RUFFWO).

Effect of dietary RUFFWO on caecal microbiology of broiler chickens

The effect of dietary rumen filtrate fermented wheat offal (RUFFWO) on caecal microbiology of broiler chickens is presented in Table 5. Significant (P≤0.05) effects were observed in the count of total bacteria, *E-coli, staphylococcus, baccilus subtilis and conrybacta*. There was however, no effect (P>0.05) on *streptococcus* and *salmonella*. The count of total bacteria, *E-coli, staphylococcus, baccilus subtilis and conrybacta* were significantly (P≤0.05) higher in chickens on T_6 (25%t RUFFWO) level compared to the control group which recorded the lowest value for all the mentioned bacteria. However, the values observed in chickens on T_2 - T_6 (5 to 20% RUFFWO) diets were statistically similar to the control and 20% RUFFWO group. According to Shamala, (2014) commensal bacteria can benefit their hosts by producing vitamin K_2 and preventing colonization of the intestine with pathogenic bacteria. Increased count of commensal

Table 5. Effect of dietary rumen filtrate fermented wheat offal (RUFFWO) on caecal microbiology of broiler chickens

		Treatments / Level of RUFFWO Inclusion (%)						
Bacteria (cfu x10^4)	Gram reaction	T_1 (0)	T_2(5)	T_3 (10)	T_4 (15)	T_5 (20)	T_6 (25)	SEM
Total bacteria		46.00^{c}	80.67^{bc}	101.33^{bc}	124.67^{abc}	147.33^{ab}	191.00^{ab}	10.05^{*}
E.coli	--	31.33^{c}	50.33^{bc}	62.33^{bc}	69.67^{bc}	92.67^{ab}	121.67^{a}	6.01^{*}
Staphylococcus	+	5.33^{c}	7.67^{bc}	13.00^{abc}	18.00^{abc}	20.67^{ab}	21.67^{a}	1.69^{*}
Streptococcus	+	7.67	10.33	16.67	23.33	17.67	22.00	2.19^{ns}
Salmonella	--	0.67	2.33	4.33	4.00	4.00	0.00	0.64^{ns}
Baccilus spp	+	1.00^{c}	5.00^{bc}	2.33^{bc}	7.67^{b}	5.67^{bc}	15.67^{a}	0.79^{*}
Corynebactaria	+	0.00^{b}	5.00^{ab}	3.67^{ab}	2.00^{b}	6.67^{ab}	10.00^{a}	0.81^{*}

a,b, c Means on the same row having different superscripts are significantly different (P≤0.05), ns = not significantly diierent (p>0.05) SEM: Standard Error of Mean, cfu = colony forming units

bacteria as level of RUFFWO increases could be related to better immune status and survival rates observed in the groups. The findings of this study in consonance with the reports of Elmasry *et al*. (2017) who revealed a significant an increase in the count of *Lactobacilli* and cellulolytic bacterial in broilers fed fermented wheat bran compared to the control groups. Also, Chu *et al*. (2016) reported a decrease in ileal and caecal count of *Clostridium perfringen* and *coliform* bacteria in broilers supplemented with 10% fermented wheat bran (FWB). Suggesting that fermented wheat bran stimulates the proliferation of gram + bacteria.

Conclusion

It was concluded from this study that dietary RUFFWO can be included in the diet of broiler chickens up to 25% level without adverse effect on nutrient digestibility, carcass parameters and caecal microbiology of broiler chickens

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