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Original Research Paper

Nutritive Value of Malted Millet Grains on Broiler Chicks Performance

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Abstract:

100 kilogram each of the three cultivars of pearl millet was purchased from Omdurman market. Their source is western Sudan, besides the other ingredients. The clean grains were steeped in water for 24 hours. Sprouting was allowed to take placed for 48 hours, 96 hours, and 144 hours respectively. Sprouted and non-sprouted samples were sun dried ground and oven dried for proximate analysis. Results showed dry matter percentage for white millet cultivar range from 94.2% to 94.6%, crude protein range from 15.8% to 17.1%, ether extracts ranged from 4.03% to 5.98%, crude fiber ranged from 2.29% to 4.64% and total ash was 1.8% - 2.0%. The dry matter percentage for the Red cultivar ranged from 92.05 to 93.05, crude protein ranged from 14.05 to 20.2%, ether extract range from 4.07% to 5.83%, crude fiber range from 3.6% to 5.18% while total ash range from 1.8% to 2.2%. While Black millet cultivar had a dry matter percentage range of 92.1% to 95.1%, crude protein range from 17.1% to 19.7%, ether extract range from 3.05% to 4.76%, and total ash range from1.2% to 1.6%. The proportion of the various protein fractions of the three millet cultivars (white, red and black) indicated that, Prolamin and Glutelin-dominted as major proteins. Whereas, Prolamin varied from 25.6(+0.387)% to 34.4(+0.050)%, Glutelin represented 23.6 (+0.02)% to 35.7 (+0.234)%, globulin range from 20.4 (+0.25)% to 13.3 (+0.806)%, whereas albumin varied from 3.7(+ 0.387)% to 10.2(+0.158)%. Effect of sprouting white millet cultivar for 0hrs, 48hrs, 96hrs, 144hrs showed that sprouting increased the albumin level from 10.2 (+0.158)% to 17.7 (+0.200)%. Globulin from 20.4 (+0.250) % to 27.5 (+0.700) %. Prolamin decreased from 34.4 (+0.050) % to 21.1 (+0.750) %, while Glutelin increased from 23.6 (+0.200) % to 29.0 (+1.200) %. For Red millet cultivar sprouting increased the albumin level from 6.0 (+0.150) % to 21.0(+0.387) %. Globulin increased from28.8 (+0.650)% to 39.5 (+0.00)%, Prolamin decreased from 31.0 (+0.003)% to 19.5 (+0.245)%, while Glutelin decreased from 25.8 (+0.250)% to 14.3 (+0.387)%. While Black showed an increase in albumin from 3.7 (+0.387)% to 12.7 (+0.387)%, globulin from 31.3 (+0.806)% to 36.8 (+0.316)%, Glubtelin increased from 35.7 (+0.224)% to 35.9 (+0.387)%.while Prolamin decreased from 25.6 (+0,224)% to 11.8 (+0.387)%. The effect of feeding sprouted levels of (0hrs, 48hrs, 96hrs and 144hrs) of (white black and red) millet cultivars on weight gain ,feed intake and feed conversion ratio on broilers chicks diet showed that: Broilers feed diet containing 48hrs and 96hrs sprouted white millet had reduction in weight gain, feed intake and feed conversion ratio as compared to un-sprouted control diet, while broilers fed sprouted white millet for 144hrs were heavier ($P<0.05$) at the end of 28 days experimental period, consumed more feed ($p<0.05$) than those feed white millet sprouted for 48hrs, 96hrs and un-sprouted control diets. Broilers fed red millet sprouted for 48hrs. 96hrs and 144hrs showed non-significant difference ($p<0.05$) in weight gain, but they showed an increase in feed intake and feed conversion ratio as compared to the un-sprouted control diet. Broilers feed Black millet sprouted for 48hrs, 96hrs, and 144hrs showed a decrease in weight gain and feed intake, but indicated a high feed conversion ratio in the 144hrs spouted diet as compared to the un-sprouted control diet. The overall performance (weight gain, feed intake and feed conversion ratio) among the three (3) millet cultivars was scored by the red millet cultivar followed by white millet cultivar and black millet cultivar ranged last. There was no mortality during the 28 days of experimental period. While sprouting (0hrs, 48hrs, 96hrs, and 144hrs) levels of three (3) millet cultivars (white, red and black) on in vitro protein digestibility showed an increase with increase in sprouting levels. The white millet cultivars ranged from 91.38(+0.071)% to 94.66(+0.212)%.Red millet cultivar ranged from 93.75 (+0.071)% to 94.66 (+0.071)%, and the black millet cultivar ranged from 92.11 (+0.283)% to 94.72 (+0.071)%.

Keywords: Proximate analysis, Protein Fractionalization, Sprouting, Millet Cultivars, Broilers.

I. INTRODUCTION

Pearl millet is one of the most important drought tolerant crops of the topical and sub- tropical regions of the world. It is able to produce good yields of the grain under conditions unfavorable to most other cereals. The crop is primarily grown for grain purposes while less than 5% is utilized as fodder. In Europe and North American it is chiefly cultivated for feed for livestock and poultry: it is grown extensively in Asia, Africa and countries of the former U.S.S.R. for human food on about 26 million hectares [1]. 9In Sudan pearl millet is grown in the rain-fed areas principally in western regions (Darfur and Kordofan), where it is the main food for western Sudanese, it is processed in several types of food stuffs such as fermented or unfermented breads, thin and thick porridges, alcoholics and non-alcoholics, cooked grains (bolila), aceda and kisra.As cereals of human food it contributes a great part of dietary nutrients for large segments of people of Africa and Asia, and is often considered highly palatable, good source of proteins, minerals and energy. Millet is not commonly used in poultry feed. Some studies on the use of millet in broiler feed were reported by [2], [3], [4], [5], [6]. They showed that millet improved broiler performance. While [7] found a significant reduction in broiler performance fed graded level of peal millet.

Although the nutritive value of pearl millet is comparable to other cereals [8] due to the presences of such anti-nutrients as phytic acid, polyphenol, [9], [10]; and amylase inhibitors [11]limit protein and starch digestibility, hinder mineral bioavailability, inhibit proteolytic and amylolytic enzymes [12]. The nutritional value of pearl millet may be effectively enhanced if contents of these anti-nutrients are reduced. Malting is known to be an effective method for decreasing the levels of anti-nutrients in food grains, besides that, malting grains improves their digestibility and nutritive value. However little has been done on the area of feeding poultry on malted grains. Hence the objective of the current study was to; evaluate some compositional changes and nutritive value of malted millet grains.

II. MATERIALS AND METHODS

A. EXPERIMENTAL SITE, HOUSING AND DURATION

The experiment was conducted in the premises of poultry research unit, faculty of animal production, university of Khartoum from October 22 to November 19 (1999).The experiment was carried out in an open sided poultry house with a concrete floor, iron post, corrugated iron sheet roof. The sites are wire netted. Cages raised above the floor were used as pens. Each cage was provided with a feeder and a drinker continuous lighting was provided throughout the 28 days of the experimental period.

B. INGREDIENT AND EXPERIMENTAL DIETS

100 kilogram each of the three cultivars of pearl millet was purchased from Omdurman market. Their source is western Sudan, besides the other ingredients (ground nut meal, sesame meal, vegetable oil, oyster shell, supper-concentrate, lysine, methionine, salt, vitamins, and minerals) each cultivar of millet was cleaned to remove dust, dirt and sand by sieving and lighter particles by winnowing. The clean grains were steeped in water for 24 hours, after which they were drained and rinsed with clean water. Grains were then placed on materials which allow air to circulate and covered with soaked sacks. Sprouting was allowed to take placed for 48 hours, 96 hours, and 144 hours respectively. Sprouted grains were sundried. Sprouted and non-sprouted samples were ground and oven dried for proximate analysis which was carried out according to the method of [13].

TABLE I. PROXIMATE ANALYSIS OF THE FEED

Millet and length of germination	Dry matter millet %	Crude protein (N*6.25)(%)	Ether extractives (%)	Crude fibre (%)	Total ash (%)
White variety Native	94.3	15.8	5.98	2.29	1.8
Germinated(h)					
48	94.6	16.2	5.88	3.31	1.8
96	94.2	15.8	5.91	3.12	2.1

144	94.5	17.1	4.03	4.64	2.0
Red variety Native	93.0	14.0	4.43	3.61	2.1
Germinated(h)					
48	92.6	20.2	5.83	3.92	2.2
96	92.1	19.0	5.38	4.62	1.8
144	92.0	17.1	4.07	5.18	2.1
Black variety Native	93.1	17.1	2.14	4.76	1.6
Germinated(h)					
48	94.5	19.7	3.46	3.85	1.2
96	94.7	18.8	3.58	3.05	1.5
144	95.1	19.4	2.84	4.48	1.6

C. DRY MATTER PERCENTAGE

One gram of sample was weighed using a sensitive balance, and then transferred to a pre-weighed clean crucible. The crucible, with it is contents were put in an oven adjusted to 105 degree Celsius and left overnight. Then the crucible was transferred to desiccators and allowed to cold then weighed. Dry matter percentage was calculated using the following formula.

D.M (%) = (W2-W1)-(W3-W1)*100^ W2-W1

Where:

DM = Dry Matter

W1 = wt. of empty crucible (g)

W2 = wt. of crucible with sample (g)

W3 = wt. after drying (g)

D. ASH CONTENT

A clean dry porcelain crucible was weighed and exactly 1gm of sample was transferred into it and placed in a furnace pre-heated to 600 degree Celsius for 3hrs. The crucible was the removed from furnace to a desiccators, allowed t cool and weighed. The ash content was calculated using the following formula.

A.C = W2-W1 *100^ Ws

Where:

A.C = Ash content

W1 = wt. of empty crucible (g)

W2 = wt. of crucible with ash (g)

Ws = wt. of sample (g)

D. ETHER EXTRACT

A dried sample of known weight was placed in sox let thimble plugged with cotton and dropped into the extractor of a: sox let apparatus. Sox let flask previously dried and weight after cooling in desiccators was fitted to the extractor. Petroleum ether was poured in to the extractor until it reached the level of siphon and siphoned over into the flask and the extractor was about half filled again with petroleum ether. A condenser was then fitted into the top of the extractor and heat was applied to the flask for about 7hrs. Heat was regulated to obtain at least 15 siphoning per hr. the thimble was then removed from the extractor and flask in an oven at 100 degree Celsius until a content weight was attained. The fat content of the sample was calculated by the following formula.

E.E. (%) =W1-W2 *100^WS

Where:

E.E. (%) =Ether Extract

W1= wt. of extraction flask (g)

W2= wt. of extraction flask +fat (g)

Ws=wt. of sample (g)

E. CRUDE FIBRE

Was carried out according to the method of white house et al 1945, whereby, One gram of dry de-fattened sample was weighed and transferred to a conical flask. 100ml of digestion reagent (450ml of distilled water+500ml of glacial acetic acid+20g.Trichloroacetic acid+50ml nitric acid) were added to the sample and properly shaken. The flask was attached to a cold finger condenser heated and left to boil for 40 min. The flask was left to cool to room temperature and the content were filtered through a filter paper no.40.The filtrate was transferred to a weighed dry crucible which was put in an oven at 105oc for overnight. The residue was weighed and transferred to a muffle furnace at 550oc then its ash content was determined by:

C.F=C-D *100^A

Where:

C.F = Crude Fibre

A= weight of dry sample (g)

C = weight of crucible + sample after drying

D = weight of crucible +ash

C – D (g) = weight of crude fibre

F. CRUDE PROTEIN

One gram of the dry sample was put in a kjeldahl flask, ¼ of selenium table was put in to the flask as catalyst. 25ml of concentrated sulphuric acid was added to the content. The content was digested by heating for 3hrs. The content was cooled and taken for distillation apparatus. The content was mixed with NaOH and nitrogen collected over boric acid at the level of 50ml.This content was titrated against 0.02M HCL using universal indicator(methyl red+ Bromo cresol green) three times.

Crude protein percentage was calculated by the following formula.

N% = volume of HCL*0.02*14*50ml*100^sample weight *1000

Crude protein percentage = N% *6.25

G. PROTEIN FRACTIONATION OF THE MILLET SAMPLES

The [14] technique for protein fractionation was used in this study. Duplicate 2.5 grams samples were taken in plastic bottle with screw caps. The sample was extracted twice with 50 ml of distilled water. The extraction was carried out for 30 minutes with con tenuous shaking on a shaker. The extract was separated from residue by centrifugation at 3000 * for 20min. the clear supernatant liquid were collected. The residue were then extracted successfully in a similar manner with 1.0 M NaCl solution, 70% ethanol and 0.2%NaOHsolution and the extract collected in the same way as described above.

The residues remaining after these successive extractions with the four solvents were the insoluble residues. The protein contents of the four extracts and the residue were determined by the micro-Kjeldahl method.

Fraction I contained the water soluble protein Albumins, fraction II contained the salt soluble protein Globulins fraction III contained the alcohol soluble protein prolamins fraction IV contained the NaOH soluble protein Glutelins. The following formula was applied.

Soluble protein (x) =T*N*TV *14*2.25*100^a*b*1000

Where;

T = Titration reading

N = Normality of the acid (HCL) 0.02

TV = Total volume of the liquid (50ml)

14 = each ml of HCL is equivalent to 14mg N

6.25 = Nitrogen factor

a = Number of ml of liquid taken for digestion (10ml)

b = number of grams of the sample extracted (2.5g)

Protein fraction percentage%= soluble protein(X) *100^ total protein of sample

H. IN VIRO PROTEIN DIGESTABILITY OF THE SAMPLE

The in vitro protein digestibility was carried out according to the method of[15]. In this method 0.2g of the sample was placed in to 50ml centrifuge tube, 15ml of 0.1MHCl containing 1.5mg pepsin were added; the tube was incubated at 37oc for 3hrs. The

sample was then centrifuge at 5000x for 20min. Nitrogen in the supernatant was estimated using Kjaldahl method. Digestibility was calculated using the formula.

Protein digestibility%=N in supernatant*100^N in sample

I. EXPERIMENTAL DIETS

Twelve (12) diets approximately iso-caloric and iso-nitrogenous containing un-sprouted millet as a control and sprouted millet(48hrs., 96hrs. and 144hrs.) as the main source of energy were formulated to meet the requirements for essential nutrients for broiler chicks as outlined by [16].

To balance energy levels vegetable oil was added to the experimental diets L=Lysine and DL-methonine were added to meet levels recommended by [16].

J. EXPERIMENTAL BIRDS

A total of seventy two (72) birds, one – day old commercial broiler chicks (Lohman) were purchased from Gabese Company. The chicks were transported to the experimental site, and fed on the experimental diets for a period of 28 days. Analysis was done on un-sprouted and sprouted millet and coverage of the three determinations reported.

Values expressed on dry weight basis.

TABLE2.SHOWS THE COMPOSITION OF THE DIET BASED ON THE SPROUTING LEVELS.

Ingredients	White variety sprouting levels (days)				Red Variety sprouting levels (days)				Black variety sprouting levels (days)			
Levels	0	2	4	6	0	2	4	6	0	2	4	6
millet	60	60	60	60	60	60	60	60	60	60	60	60
Sesame meal	14	14	14	13	15	12	13	14	14	12	12	12
G/nut meal	15	15	15	15	16	13	14	14	14	13	13	13
Super corn Concentrate	5	5	5	5	5	5	5	5	5	5	5	5
Vegetable oil	1	1	1	1	1	1	1	1	1	1	1	1
Oyster seed	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
Lysine	0.43	0.43	0.43	0.43.	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43

Methionine	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82
Salt	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Sand	2	2	2	2	-	6	4	3	3	6	6	6
premix	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25

K. CALCULATED CHEMICAL COMPOSITION

ME (MJ/Kg) 12.3 12.1 12.2 12.2 12.6 12.6 12.6 12.6 12.7 11.9 12.1 12.2

C.P. 22.89 22.89 22.74 23.13 22.65 22.91 22.64 22.60 22.34 22.28 23.21 22.78

Super concentrate* provided energy 8.37Kg^{-1}Lysine 6.5%,methionine 1.7%, crude protein 56%, phosphorus 4.9%, and calcium 8%

Premix * provided per Kg of diet, vit. A75000000Iu, vit. D 1500Iu vit.B 1000mg, vitB_2 2750mg, choline 6000mg, exhoxyguin 5000mg, Mn oxide 16100mg, Colbalt 280mg,zinc oxide 1300mg, faro-carbonate 2840mg.

L. MANAGEMENT

On arrival, the bird's initial weight were recorded and randomly assigned to each cage. The experimental diets were then assigned to each cage (6 cages/dietary treatment. Feed and water were provided to each cage.

Weight gain, feed intake and feed conversion ratio were recorded. On the 24^{th} 26^{th} and 28^{th} day of experiment, faces were collected from each bird from Nitrogen retention analysis.

M. STATISTICAL ANALYSIS AND EXPERIMENTAL DESIGN

A completely randomized design was used in the experiment. The data from the experiment was subjected to analysis of variance by the methods of [17], [18].

III RESULTS

Proximate analysis of three (3) millet cultivars (white, red and black) a affected by (0hrs, 48hrs, 96hrs, and 144hrs.)Levels of sprouting as presented in table.1.

The dry matter percentage for white millet cultivar range from 94.2%to 94.6%, crude protein range from 15.8% to 17.1%,ether extract range from 4.03% to 5.98%, crude fiber range from 2.29% to 4.64% and total ash range from 1.8% to 2.0%.

For the red millet cultivar, dry matter percentage range from 92.05 to 93.05,crude protein rang from14.05 to 20.2%, ether extract range from 4.07% to 5.83%, crude fiber range from3.6% to 5.18% while total ash range from 1.8% to 2.2%.Black millet cultivar had a dry matter percentage range of 92.1% to 95.1%, crude protein range from 17.1% to 19.7%, ether extract range

from 3.05% to 4.76%, and total ash range from1.2% to 1.6%.The proportion of the various protein fractions of the three millet cultivars (white, red and black) is shown in the table3. Of the four fractions, Prolamin and Glutelincodominted as major proteins. Whereas Prolamin varied from 25.6(+0.387)% to 34.4(+0.050)%, Glutelin represented 23.6 (+0.02)% to 35.7 (+0.234)%, globulin range from 20.4 (+0.25)% to 13.3 (+0.806)%, whereas albumin varied from 3.7(+ 0.387)% to 10.2(+0.158)%.Effect of sprouting white millet cultivar for 0hrs, 48hrs, 96hrs, and 144hrs is shown in the table 4. Sprouting increased the albumin level from 10.2 (+0.158) % to 17.7 (+0.200) %. Globulin from 20.4 (+0.250) % to 27.5 (+0.700) %. Prolamin decreased from 34.4 (+0.050) % to 21.1 (+ 0.750) %, while Glutelin increased from 23.6 (+0.200) % to 29.0 (+1.200) %.

Effect of sprouting red millet cultivar for 0hrs, 48hrs, 96hrs and 144hrs is shown in table 5. In the red cultivar, sprouting increased the albumin level from 6.0 (+0.150)% to 21.0(+0.387) %. Globulin increased from28.8 (+0.650)% to 39.5 (+0.00)%, Prolamin decreased from 31.0 (+0.003)% to 19.5 (+0.245)%, while Glutelin decreased from 25.8 (+0.250)% to 14.3 (+0.387)%.

Effect of sprouting on black millet cultivar for 0hrs, 48hrs, 96hrs and 144hrs is shown in table 6. The result shows an increased in albumin from 3.7 (+0.387)% to 12.7 (+0.387)%, globulin increased from 31.3 (+0.806)% to 36.8 (+0.316)%, Prolamin showed a decreased from 25.6 (+0,224)% to 11.8 (+0.387)%, while Glubtelin increased from 35.7 (+0.224)% to 35.9 (+0.387)%.

All the fractions showed an increase in their protein fractions as the level of sprouting increases, except prolamin which shows a decrease with increase in sprouting levels. The effect of feeding sprouted levels of (0hrs, 48hrs, 96hrs and 144hrs) of (white black and red) millet cultivars on weight gain ,feed intake and feed conversion ratio on broilers chicks diet is shown in the table 8, 9 and 10.Broilers feed diet containing 48hrs and 96hrs sprouted white millet (table8) showed reduction in weight gain, feed intake and feed conversion ratio as compared to un-sprouted control diet, while broilers fed sprouted white millet for 144hrs were heavier ($P<0.05$) at the end of 28 days experimental period, consumed more feed ($p<0.05$) than those feed white millet sprouted for 48hrs 96hrs and un-sprouted control diets.

Broilers fed red millet sprouted for 48hrs. 96hrs and 144hrs (table9) showed non-significant difference ($p<0.05$) in weight gain, but they showed an increase in feed intake and feed conversion ratio as compared to the un-sprouted control diet. Broilers feed Black millet sprouted for 48hrs, 96hrs, and 144hrs (table10) showed a decrease in weight gain and feed intake, but indicated a high feed conversion ratio in the 144hrs spouted diet as compared to the un-sprouted control diet. The overall performance (weight gain, feed intake and feed conversion ratio) among the three (3) millet cultivars was scored by the red millet cultivar followed by white millet cultivar and black millet cultivar ranged last.

There was no mortality during the 28 days of experimental period. Effect of sprouting (0hrs, 48hrs, 96hrs, and 144hrs) levels of three (3) millet cultivars (white, red and black) on in vitro protein digestibility is presented on table 7. In vitro protein digestibility showed an increase with increase in sprouting levels. The white millet cultivars ranged from 91.38(+0.071)% to 94.66(+0.212)%.Red millet cultivar ranged from 93.75 (+0.071)% to 94.66 (+0.071)%, while the black millet cultivar ranged from 92.11 (+0.283)% to 94.72 (+0.071)%.

Effect of sprouting on Nitrogen Retention is showed in table 11.The results indicate non-significant difference ($p\leq0.05$) among the three (3) millet cultivars. The red millet cultivars had the highest Nitrogen retention percentage, followed by the black millet cultivars and lastly the white millet cultivars with the lowest Nitrogen retention percentage. Their range is 2.94 (+0.34)% to 3.50 (+1.30)% in white millet diet, 3.67 (+0.44)% to 3.92 (+0.34)% in red millet diet and 3.19 (+0.28)% to 3.78 (+0.11)% in black millet diet.

TABLE 3.PROTEIN FRACTIONS BEFORE TREATMENT (SPROUTING)

Fractions	White cultivar (%)	Red cultivar (%)	Black cultivar (%)
Albumin I	10.2(+0.158)	6.0(+0.150)	3.7(+0.387)
Globulin II	20.4(+0.25)	28.8(+0.650)	31.3(+0.806)
Prolamin III	34.4(+0.050)	31.0(+0.003)	25.6(+0.387)
Glutelin IV	23.6(+0.20)	25.8(+0.250)	35.7(+0.224)
Residue V	11.5(+0387)	9.3(+0.224)	3.7(+0.316)
Actual protein	5.36(+0.187)	5.31(+0.224)	7.96(+0.141)
Extractable protein	88.6	92.6	100.0

Values are means of three titration (±)S.D

TABLE 4. EFFECT OF SPROUTING ON PROTEIN FRACTIONS OF WHITE MILLET CULTIVAR

Sprouting time (h)	Albumin(%)	Globulin(%)	Prolamin(%)	Glutelin(%)	Residue(%)
0	10. 2(+0.158)^{a}	20.4 (+0.250)^{a}	34.4 (+0.05)^{a}	23.6 (+0.200)^{a}	11.5 (+0.387)^{a}
48	13.1(+0.035)^{b}	19.3 (+0.200)^{b}	31.6 (+0.150)^{b}	29.2 (+0.40)^{b}	6.9 (+0.714)^{b}
96	19.7 (+0.300)^{c}	24.0 (+0.200)^{c}	16.5 (+0.400)^{c}	34.0 (+1.025)^{c}	6.0 (+0.316)^{c}
144	17.7 (+0.200)^{d}	27.5 (+0.700)^{d}	21.1 (+0.750)^{d}	29.0 (+1.200)^{d}	4.2 (+0.000)^{d}

Values are means of three titrations (±) standard deviation

Means not sharing a common superscript letter in a column are significantly different at $p<0.05$, as assessed by Duncan's Multiple range test.

TABLE 5. EFFECT OF SPROUTING ON PROTEIN FRACTIONS OF RED MILLET CULTIVAR

Sprouting time (h)	Albumin (%)	Globulin (%)	Prolamin(%)	Glutelin(%)	Residue (%)
0	6.0(+0.150)^{a}	28.8(+0.650)^{a}	31.0(+0.003)^{a}	25.8(+0.250)^{a}	9.3(+0.224)^{a}
48	9.6(+0.000)^{b}	33.6(+0.000)^{b}	27.9(+0.316)^{b}	24.0(0.000)^{b}	4.9(+0.224)^{b}
96	17.7(+0.400)^{c}	35.2(+0.800)^{c}	11.7(+0.224)^{c}	32.0(+0.224)^{c}	3.4(+0.387)^{c}
144	21.0(+0.387)^{d}	39.5(+0.000)^{d}	19.5(+0.245)^{d}	14.3(+0.387)^{d}	5.7(+0.000)^{d}

Values are means of three titrations (±) standard deviation.

Means not sharing a common superscript letter in a column are significantly different at p<0.05, as assessed by Duncan's Multiple range test.

TABLE 6. EFFECT OF SPROUTING ON PROTEIN FRACTIONS OF BLACK MILLET CULTIVAR

Sprouting time (h)	Albumin(%)	Globulin(%)	Prolamin(%)	Glutelin(%)	Residue(%)
0	3.7(+0.387)[a]	31.3(+0.806)[a]	25.6(+0.387)[a]	35.7(+0.224)[a]	3.5(+0.387)[a]
48	3.2(+0.387)[b]	33.4(+0.387)[b-]	28.0(+0.224)[b]	34.0(+0.224)[b]	1.4(+0.316)[b]
96	10.8(+0.500)[c]	29.4(+0.224)[c]	23.8(+0.387)[c]	32.0(+0.316)[c]	3.2(+0.224)[c]
144	12.7(+0.387)[d]	36.8(+0.316)[d]	11.8(+0.387)[d]	35.9(+0.387)[d]	2.7(+0.224)[d]

Values are means of three titrations (±) standard deviation.

Means not sharing a common superscript letter in a column are significantly different at p<0.05, as assessed by Duncan's Multiple range test.

TABLE 7.EFFECT OF SPROUTING ON PROTEIN IN VITRO DIGESTIBILITY OF THREE MILLET CULTIVARS

Millet sprouting length (hrs.)	White variety (%)	Red variety (%)	Black variety (%)
0	91.38(+0.071)[a]	93.71(+0.071)[a]	92.11(+0.283)[a]
48	91.82(+0.141)[a]	94.29(+0.212)[b]	93.09(+0.141)[c]
96	94.15(+0.071)[c]	94.40(+0.141)[b]	93.09(+0.354)[c]
144	94.66(+0212)[c]	94.66(+0.71)[b]	94.72(+0.71)[d]

Values are means of three titrations (±) standard deviation.

Means not sharing a common superscript letter in a column are significantly different at p<0.05, as assessed by Duncan's Multiple range tests.

TABLE 8.EFFECT OF FEEDING WHITE VARIETY OF SPROUTED MILLET CULTIVAR ON THE BROILER PERFORMANCE

White variety sprouting levels (hrs.)	Wt. gain (g) at day 28	Feed intake(g) at day 28	Feed conversion ratio at day 28
0	738	618	1.19
48	733	592	1.24
96	692	573	1.21
144	774	640	1.21
+SEM	14.6	12.7	0.02

Values are means of 6 birds/ dietary treatment + standard error of the treatment mean

None of the means is significantly different at (P≥ 0.05)

TABLE 9. EFFECT OF FEEDING RED VARIETY OF SPROUTED MILLET CULTIVAR ON THE BROILER PERFORMANCE

White variety sprouting levels (hrs.)	Wt. gain (g) at day 28	Feed intake(g) at day 28	Feed conversion ratio at day 28
0	806	612	1.32
48	794	593	1.34
96	806	587	1.37
144	757	638	1.19
+SEM	10.1	9.9	0.03

Values are means of 6 birds/ dietary treatment + standard error of the treatment mean.

None of the means is significantly different at (P> 0.05).

TABLE 10: EFFECT OF FEEDING BLACK VARIETY OF SPROUTED MILLET CULTIVAR ON THE BROILER PERFORMANCE

White variety sprouting levels (hrs.)	Wt. gain (g) at day 28	Feed intake(g) at day 28	Feed conversion ratio at day 28
0	725	587	1.24
48	719	593	1.21
96	673	550	1.22
144	658	575	1.14
+SEM	14.4	8.24	0.02

Values are means of 6 birds/ dietary treatment + standard error of the treatment mean.

None of the means is significantly different at (P$\underline{\geq}$ 0.05).

TABLE 11: FECAL ANALYSIS FOR NITROGEN RETENTION (%)

Millet sprouting length (hrs.)	White variety (%)	Red variety (%)	Black variety (%)
0	2.94(+0.057)^{a}	3.75(+0.050)^{a}	3.50(+0.35)^{a}
48	3.50(+1.03)^{b}	3.67(+0.44)^{b}	3.43(+0.15)^{b}
96	3.46(+0.07)^{c}	3.92(+0.34)^{c}	3.78(+0.11)^{c}
144	3.43(+0.26)^{d}	3.78(+0.45)^{d}	3.19(+0.28)^{d}

Values are means of three titrations ($\underline{+}$) standard deviation

Means not sharing a common superscript letter in a column are significantly different at $p \leq 0.05$, as assessed by Duncan's Multiple range tests.

A. DISCUSSION

The dry matter percentage of the three (3) pearl millet cultivar (white, red and black) sprouted and un-sprouted showed some variations in their percentage ranges. These variations may be partially attributed to the effect of sprouting at different levels or cultivar variations. These findings are in agreement with previous studies reported by[19], [20]for the local Sudanese varieties.

Crude protein values were found to show some variations for the three un-sprouted pearl millet cultivar (white, red and black). These results confirm the findings of [21] who gave a range of 8 to 20%, [19] who found out that crude protein range from 11.1 to 14.7%, while sprouted pearl millet cultivars showed an increase in their crude protein content. This increase was found to be attributed to loss of dry weight through respiration during germination. Thus, the germinated material on a unit weight base would contain more seeds and therefore more Nitrogen than the un-germinated samples. These results agree with the findings of[22] who reported that total protein as a percentage of the dry weight increased slightly in all cases during germination. Meanwhile, [23]working with corn found an increase in protein percentage in germinated corn as a result of dry weight loss during germination, while [24]reported that germination for 48hoursin pearl millet increased Lysine and Tryptophan levels. The above results don't support the findings of [25] who, showed that germination slightly lowers the levels of protein percentage in pearl millet. The Ether Extract for the un-sprouted three (3) millet cultivars (white, red and black) showed some variations in their ranges. This variation may be due to cultivar difference. These findings support the previous literature findings [26], [27], [28], [29] that reported values ranging from3.03 to 7.5%.

Sprouted levels for the three (3) pearl millet cultivars gave some variations with low ranges compared to un-sprouted. This low varying value may be due to variation in cultivars and sprouting time. These results are similar to findings of [25] working on finger millet reported that sprouting lowers Ether Extract percentage.

Crude fiber showed values with high varying ranges for the three (3) un-sprouted pearl millet cultivars. These high values may be attributed to cultivar variation and area of production. These values disagree with the results found by [30] who reported low average values of 1.6%.[1] reported 1.5 to 1.73% for different pearl millet lines. The results of this study confirm the findings of [20] who reported a range of 3.18 to 3.67% for the Sudanese local millet varieties.

Sprouted pearl millet cultivars (white, red and black) showed an increase in crude fiber content than un-sprouted samples. Observations of this nature have been reported by previous researchers [30]. Who attributed this increase to sprouting which enlarged the seed coat.

The ash content for both sprouted and un-sprouted three (3) pearl millet cultivars (white, red and black) showed ranges of low values with slight differences. This variation may be attributed to cultivar. These findings are similar to these observed by [30] who reported a range of 2.0% to 3.88%and [31] reported 1.93% for Sudanese varieties. [20] gave a figure of 1.75 to 1.87%, while [29] reported a high value of 4.19%.

Protein fractionation of un-sprouted three (3) pearl millet cultivars (white, red and black) showed prolamine and glutelins co-dominated as major proteins. These work also showed variation in ranges of the various protein fractions. This result confirm the variation of the previous work of[21] who reported a wide variation in protein fraction percentage and deduced that to storage protein prolamine and glutelin accounted for about 60% of the total protein and that albumin and globulin fraction contribute 15 and 9% respectively. On the other hand [32] found out a similar report, that of the four fractions prolamin and glutelin were the major co-dominating proteins, prolamin varied from 33.1 to 49.5%,, glutelin represented 30.6 to 45.3% of the total protein, globulin and albumin together made up 18 to 26%, globulin varying from 11.6 to 16.8% and Albumin from 6.4 to 9.6%.

Sprouted pearl millet cultivars showed a general trend of increase in albumin, globulin and glutelin with increase of sprouting levels (0hrs, 48hrs, 96hrs and 144hrs) respectively. Prolamin showed a decrease with increase of sprouting level. These findings

are similar to the work of [33], [23] who fractionated germinated sorghum proteins and found that sprouted sorghum had high albumin, lower prolamine with small increase in globulin and no definite trend for glutelin and residue fractions in germinating oats.

Broilers fed diets containing 48hrs and 96hrs. Sprouted white pearl millet cultivar showed a reduction in weight gain, feed intake and feed conversion ratio as compared to un-sprouted con troll diet, while those fed white pearl millet sprouted for 144hrs., were heavier at the end of the 28 days experimental period, consumed more feed than those fed white millet. Sprouted for 48hrs, 96hrs. and un-sprouted control diet. These results agree with the finding of[33], {34)who fed broiler on unknown pearl millet cultivar and reported a reduction in weight gain,feed intake and feed conservation ratio, while [35], [36], [37], [38] reported that sprouting for more than 96hrs.improves the nutritive value of pearl millet. This may be a reason for better performance of the 144hrs.sprouted white millet diet.

Broilers fed diet containing (48hrs, 96hrs and 144hrs.) level of red sprouted millet cultivar showed an overall better performance with increase in sprouting level. This work is similar to the result of [38], [35] who showed an improvement in nutritive value of pearl millet. This improvement may also be attributed to reduction of anti-nutrients in millet as a result of sprouting, palatability cultivar variation and increase in digestibility.

Broilers fed black pearl millet sprouted for 48hrs, 96hrs and 144 hrs. Showed a decrease in weight gain and feed intake, but indicated a high feed conservation ratio in the 144hrs. Sprouted diet as compared to un-sprouted control diet. These results are similar to the findings obtained from the white and red pearl millet cultivars. The difference here may be due to cultivar variation. In vitro protein digestibility showed an increase with increase in sprouting levels. These results may be the course for the better performance of broilers feed sprouted pearl millet cultivars. These results agree with the work of [8], [9], [38],who reported that sprouting increase protein digestibility, while [39] reported that germination increase significantly the in vitro protein digestibility of three sorghum varieties.

Nitrogen retention showed a non-significant difference among the three (3) pearl millet cultivars; for both un-sprouted and sprouted: these results indicate a uniform balance of Nitrogen distribution in the diet. Subsequent studies have reported improvements in nitrogen retention when diets were sufficient in amino acid [39].

B. CONCLUSION AND RECOMMENDATION

***1) CONCLUSION*:** Sprouting White millet cultivars increases albumin, Globulin and Glutamine levels while Prolamin decreases. For Red millet there was increase in albumin, Globulin while Promalin and Glutamine levels decreased. Black sprouted millet showed increase in albumin, Globulin and Glutamine. In terms of performance by broiler chicks Red sprouted pearl millet performed better compared to Black and White sprouted pearl millet cultivars respectively.

2) RECOMMENDATION: Sprouting millet for 144 hours is recommended for broiler feeding.

3) CONFLICT OF INTEREST: The Authors declares no conflict of interest.

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