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Growth Performance and Carcass Characteristics of Broiler Chicks fed Graded Levels of Millet Processing Waste as Replacement for Dietary Maize

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ABSTRACT
Literature on the use of millet by-product as energy source for poultry appears to be very limited or absolutely scares in Sudan savannah zone of Nigeria. The replacement of expensive conventional feed ingredients with cheap, locally available and non-human competitive substitutes in feed formulation represents a suitable strategy at reducing the total feed cost of poultry production. In Nigeria, one of such by-products is millet processing waste which is a sievate of wet milling of millet after obtaining the flour (pap) which is prepared by milling and sieving millet soaked in water for 24 hours. The study which lasted for 28 days was conducted to determine the performance of broiler chickens fed varying levels of millet processing waste as replacement for dietary maize. A total of three hundred (300) day-old broiler chicks were purchased from a reputable farm in Kano. The birds were assigned in a completely randomized design (CRD) to five dietary treatments with three replicates of twenty birds each. Data generated was statistically analyzed using the General Linear Model Procedure of Statistical Analysis (SAS, 2002). Significant difference between treatments means were separated by Duncan Multiple Range Test (Steel and Torrie, 1980). Millet processing (reject) waste meal did not ($p>0.05$) affect the final live weight, weight gain and average daily gain. But feed intake, Feed Conversion Ratio (FCR) and mortality were ($p<0.05$) affected. There were no ($p>0.05$) differences in live weight, dressed weight, carcass weight, dressing percent, thigh, back and intestinal length across dietary treatments. Based on this study, it was concluded that millet processing waste can replace maize in the diets of broiler chicks up to 80% level without any adverse effect on growth performance and carcass characteristics and the increased revenue generated from birds fed replacement diets revealed a general financial gain to be accrued to the farmer with increasing millet processing waste in the diets for broiler chicken.
Keywords: Broiler, meal, millet, replacement, waste.

INTRODUCTION

In Nigeria, increasing cost of conventional feed ingredients such as maize, soybean, groundnut cake and fish meal has been recognized as the major factors affecting the development and expansion of poultry enterprise. This high cost particularly, of maize in Nigerian markets resulting from its competition with human diet has led to its scarcity (Fapohunda et al 2008; Agbabiaka et al 2013) which keeps affecting profitability of poultry production negatively and thus, resulted in inadequate protein intake among Nigerians (Nkwocha et al 2014) since it is one of the major source of bridging

the protein gap in Nigeria (Taburawa et al 2012). The cost of feed in poultry production constitute of about 70 to 80 percent of total production cost and out of these about 95 percent is meant for meeting the energy and protein requirement of the diet (Ravindran, 2014). Similarly, there has been a steady increase in the cost of conventional feed ingredients such as maize, groundnut cake, soybean meal and fish meal in the past years and this has led to increase in the prices of animal protein sources (Adejinmi et al 2007). The concomitant issue of climate change and global warming has also contributed to erratic rainfall pattern mostly in the North-west and North-eastern part of Nigeria which is located within the Sudan and Sahel savannah regions of the country. Several researchers have emphasized the need for utilizing alternative feed ingredients removed from human and industrial uses (Durunna et al 1999; Fanimo et al 2007; Nsa et al 2007; Kwari et al 2004; Okah, 2004).There is, therefore, a dire need for animal nutritionists to seek for alternatives to the inadequate and expensive conventional feedstuffs to forestall an impending serious food crisis. According to Ogundipe and Sanni (2002) and FAO (2006) reports poultry is considered to be a means of livelihood and a way of achieving certain level of economic independence by Nigerians. This is therefore imperative, since the major interest of the farmer is to reduce the feed cost, which constitute over 70% of the total cost of production (Bawa et al 2003; Ogundipe et al 2003, Tuluen and Igba, 2007). In view of this, there is increased interest by Nigerian livestock farmers on the search for nonconventional feed ingredients of comparable feed quality that are not competed for in man's dietary needs and are believed to be cost effective, non – toxic and readily available as energy sources. In Nigeria, one of such by-products is millet processing waste which is a sievate of wet milling of millet after obtaining the flour (pap) which is prepared by milling and sieving millet soaked in water for 24 hours. The sievate is relatively available in large quantities in both the rural and urban communities in Nigeria and often discarded as waste. This millet processing waste can be good alternative to replace maize in broiler diets. The proximate and energy composition of millet processing waste according to the findings of NRC (1994), indicates that dry matter (DM) is about 90%, crude protein (CP) 12.4 %, ME kcal/kg 2,896, ether extract (EE) 8.0 %, crude fibre 5.0 %, Ash 0.57 %, linoleic acid 3.28% and Nitrogen free extract (NFE) 74.03% Therefore their incorporation in place of maize can reduce the dependency on maize and also the cost of poultry production.

The study aimed to determine the effect of replacing maize with millet processing waste on the growth performance and carcass characteristics of broiler chickens.

MATERIALS AND METHODS

Experimental site

The experiment was carried out at the poultry unit of the Teaching and Research Farm, Department of Agricultural Science Education, Federal College of Education (Technical), Bichi, Kano. The State is located within the Northern Guinea Savannah Zone on the latitude 11^0 9' 45'' N and longitude 7^o 38' 8''E, at an altitude of 610 m above sea level (Ovimaps, 2012).

Sources of Ingredients

The Millet processing waste for the experiment was purchased from local market in Bichi, Kano State while other ingredients were sourced from feed mill, Kano, Kano State.

Laboratory Analysis

Chemical compositions of the millet processing waste and other samples of the ingredients used as well as the experimental diets were carried out at the Biochemical Laboratory of the Department of Animal Science, Ahmadu Bello University, Zaria. The proximate composition was determined according to the methods of AOAC (1990) and the following parameters were determined: % Dry Matter (DM), % Crude Protein (CP), % Crude Fiber (CF), % Ether Extract (EE), and Nitrogen Free Extractive (NFE). The haematological and serum analysis will be carried out at the Clinical Laboratory of the Pathology Department, Veterinary Teaching Hospital, Ahmadu Bello University, Zaria.

Design and Management of Experimental Birds

A total of three hundred (300) day-old broiler chicks were purchased from a reputable farm in Kano State. The birds were assigned in a completely randomized design (CRD) to five dietary treatments with three replicates. All necessary and routine management practices of sanitation, appropriate medication and vaccination were strictly observed. Feed and water will be provided *ad libitum.* The birds were weighed at the beginning of the trial and weekly thereafter. Weight gain, feed intake, feed conversion ratio, cost per kg gain was calculated. Mortality record was taken as it occurs. The experiment was carried out at the poultry unit of the Department of Agricultural Science Education, Federal College of Education (Technical), Bichi, Kano.

Experimental Diets

Five diets (23.5% CP; 2800 Kcal/kg ME) for the broilers was formulated to feed the experimental groups T_1, T_2, T_3, T_4 and T_5 at the starter phase:

Diet 1(Control) contain 100% of the maize component in the ration
Diet 2 contain 20% of the maize component replaced by millet processing waste
Diet 3 contain 40% of the maize component replaced by millet processing waste
Diet 4 contain 60% of the maize component replaced by millet processing waste
Diet 5 contain 80% of the maize component replaced by millet processing waste

The diets were formulated to meet the nutrient requirement standards (NRC, 1994). Samples of the dietary treatments were analysed for proximate composition using the appropriate method described by (AOAC, 1990).

Data Collection

The initial and final body weight (g/bird), average daily feed intake (g/bird), feed conversion ratio, feed cost per kilogram and the cost of feed per kilogram weight gain (₦/kg) was calculated. Mortality rate was also recorded as it occurs. The experiment lasted for a period of four (4) weeks.

Carcass Evaluation

At the end of the feeding trial, three birds were randomly selected from each replicate. They were starved overnight, weighed, slaughtered and eviscerated to record dressing weight, breast weight, thigh weight, liver, heart, gizzard and intestine (empty). The carcass evaluation was done at Animal Science laboratory, of the Department of Agricultural Science, Federal College of Education (Technical), Bichi, Kano State.

Statistical Analysis

Data generated was statistically analysed using the General Linear Model Procedure of Statistical Analysis (SAS, 2002). Significant difference between treatments means were separated by Duncan Multiple Range Test (Steel and Torrie, 1980).

The linear additive model for this design is as follows:

$Y_{ij} = \mu + t_i + e_{ij}$

Where Y_{ij} = any observation made in the experiment
μ = the population mean
t_i = Effect due to treatment added or treatment effect
e_{ij} = Experimental error

RESULTS AND DISCUSSION

The results of proximate analysis of millet reject waste meal and maize is presented in Table 1. Results revealed that maize had a higher dry matter and metabolizable energy than millet reject waste meal having 93.60% and 3519.69 kcal/kg compared to millet reject waste meal having 90.15% and 3333.10 kcal/kg. However, the crude protein content was found higher in millet reject waste meal than maize having 12.97% and 8.6% CP respectively. This agreed with the range of value for nutrient content in cereals as reported by Olomu (2011).

Performance: Millet processing waste meal did not ($p>0.05$) affect the final live weight, weight gain and average daily gain, but feed intake, Feed Conversion Ratio (FCR) and mortality were ($p<0.05$) affected (Table 2). Birds fed Maize diet replaced with millet reject meal at 20% had

($p<0.05$) higher feed intake as well as daily feed intake when compared with birds fed other diets. This finding agreed with the reports of Rama Rao et al (2002) who reported similar values of feed intake in birds fed millet and maize. This also indicated that the birds consumed more of T2 (20%) diet compared to other diets. The birds fed T5 diet had the lowest value (1792.5 and 64.02) respectively. The lower feed intake as well as daily feed intake observed in the birds fed millet reject waste meal at 80% (T5) agreed with the findings of Ibitoye et al (2012) who reported low feed intake in broilers fed diets containing guinea corn as replacement for maize. This resulted in ($p<0.05$) reduced feed conversion ratio (1.73) of the broilers more than that observed in other diets. It is however ($p>0.05$) similar to the control and T4 (60%) diet. This also means that millet reject waste meal was more digestible and properly utilized by the birds even at higher replacement levels. Birds fed T2 and T3 diets had similar ($p>0.05$) but ($p<0.05$) higher feed conversion ratio. This observation in birds fed T2 diet however recorded ($p<0.05$) reduced mortality rate (1.00). Mortality was recorded highest in the birds fed T3 diet which followed by the group fed with T5 and the control diets which were also similar ($p>0.05$) to that recorded for birds fed with T4 diet and the lowest was recorded in the groups fed with T2 (20%) level of replacement.

Cost: Feed cost in naira per kilogramme weight gain was lowest in birds fed 80% replacement of maize with millet waste meal (₦113.44). While those fed 60% (₦135.93) and 40% (₦142.64) have relatively lower feed cost per kg weight compared to the control (₦144.21). This means that the overall cost of producing 1kg of lean meat was minimal for birds fed diets high in millet reject waste meal as replacement for dietary maize as compared to birds fed low millet reject waste meal and the control. Although, the birds fed 20% had the highest feed cost per kilogramme weight gain (₦163.86) it is still economically viable as cost of producing a kilogramme of lean meat. The increase might also be as a result of the increased feed conversion ratio of the birds in the group. However, the increased revenue generated from birds fed replacement diets revealed a general financial gain to be accrued to the farmer with increasing millet reject waste meal in the diets for broiler chicken.

Carcass characteristics: The carcass characteristics of broilers fed millet waste meal as replacement for dietary maize is presented in Table 3. There were no ($p>0.05$) differences in live weight, dressed weight, carcass weight, dressing percent, thigh, back and intestinal length across dietary treatments. Drumstick and breast were ($p<0.05$) affected by the dietary treatments. Drumstick of birds fed T4 diet was ($p<0.05$) higher as compared to that observed in birds fed the control, T3 and T5 diets, while that of birds fed T2 had the lowest. However, from the observed, the major part that appeals to consumers such as breast in birds fed T4 diet had ($p<0.05$) higher breast weight as compared to those fed the control diet which was the lowest. This could be attributed to the fact that millet rejects waste meal with adequate fibre containing nutrient enhanced tissue accretion and reduced fat build up as reflected in increased breast weight. It is also a good indication that tissue synthesis for that part was at its best at that particular dietary level. The non-significant differences in live weight, dressed weight, carcass weight, dressing percent, and some cut up parts of birds fed experimental diets are in conformity with the reports of Medugu et al (2010) who reported that millets can be effectively utilized by broiler chickens for superior carcass quality as compared to other cereal based diets. This also agreed with the reports of Nwaigwe et al (2010) where no significant differences was recorded in the means of live weight and Abdullahi et al (2012) who reported no ($p<0.05$) differences in cut up parts except in drumstick and wings.

CONCLUSION

Based on this study, it was concluded that millet reject waste meal can replace maize in the diets of broiler chicks up to 80% level without any adverse effect on growth performance and carcass characteristics. The increased revenue generated from birds fed replacement diets revealed a general financial gain to be accrued to the farmer with increasing millet reject waste meal in the diets for broiler chicken.

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REFERENCES

Adegbola A J, Awagu E F, Kamaldeen O S and Kashetu R Q 2013 Sorghum: Most under-utilized grain of the semi-arid Africa. *Scholarly Journal of Agricultural Science,* Vol. 3(4), pp. 147-153.

Agbabiaka L A, Okorie K C and Ezeafulukwe C F 2013 Plantain peels as dietary supplement in practical diets for African Catfish (*Clarias gariepinus*) fingerlings. *Agric. Bio. J. North America* (ABJNA).4(2): 155-159.

Ani A O and Adiegwu L I 2005 The feeding value of velvet beans (*Mucuna pruriens*) to weaner rabbits. Proc.30th Ann. Conf. Nig. Soc. For Anim. Prod. (NSAP), March 20th-24th, 2005, Univ. Nigeria, Nsukka, Nigeria pp.186-189.

Association of Official Analytical Chemistry (AOAC) 1990. Official Method of Analysis, 15th Edn. Washington D.C., USA.

Atteh J O and Ologbenla F D 1993 Replacement of Fish Meal with Maggots in Broiler Diets. Effects on Performance and Nutrient Retention. *Nigerian Journal of Animal Production*. 20:44-49.

Bamgbose A M, Ogungbenrom S D, Obasoban E E, Aruna M B, Oteku I T, Igene U R, Otoikhian C S O and Imasuen J A 2004 Replacement value of maize offal/cashew nut for maize in broiler diet. *Proceedings of the 29th Annual Conference of the Nigerian Society for Animal Production,* 29:219-221.

Bawa G S, Tegbe T S B and Ogundipe S O 2003. Effect of feeding graded dietary levels of lablab seeds as a replacement for soyabean on performance characteristics of young pigs. Proc. 28 NSAP Conf., Ibadan, Nigeria Vol. 28 pp. 230-232.

Duncan D B 1955 New Multiple Range Test. Biometrics 11: 1-42.

Ezieshi E V and Olomu J M 2008 Biochemical evaluation of millet offal as feeds for broiler chickens. *Pakistan Journal of Nutrition*. 7 (3): 421-425.

Fapohunda J B Adejinmi O O, Okpeze A O, Owosilbo A O, Odunkoyo S O and Bamgbose, A M 2008 Effect of Replacing Maize with Biscuit Waste on the Performance of Growing Cockerels. In: Proceeding of the 13th Annual Conference of Animal Science Association of Nigeria (ASAN). Ahmadu Bello University, Zaria. Pp. 318-319.

Igwebuike J U, Kwari I D, Ubosi C O and Alade N K 2001 Replacement Value of Spent Sorghum Grains for Maize in Broiler Finisher Diets. *Journal of Sustainable Agricultural Environment;* 3:224-233.

National Research Council (NRC) 1994 Nutrient Requirements of Poultry. 9th Revised Edition, National Academy Press, Washington, D.C.

Nkwocha G A, Agbabiaka L A, Anukam K U and Beketin T O 2014 Growth response, Carcass and Blood characteristics of Finisher broilers fed Sorghum offal meal as dietary supplement. *International Journal of Agri Science Vol. 4(7): 392-398.*

Nwaigwe C O, Akwuobu C A and Kamalu T N 2010 Response of broiler chicks to diets with Bambara nut (Voandzeia subterranean) as protein source. *Arch. Zootec.* Vol.59, no. 225

Ogundipe S O, Abeke F O, Sekoni A A, Dafwang I I and Adeyinka A I 2003 Effect of duration of cooking on the utilization of lab lab purpureus by pullet chicks. In*: Proceedings of the 28th Annual conference of the Nigerian Society for Animal Production held at Ibadan, Nigeria.* Pp 233-235.

Olomu J M 2011 Monogastric Animal Nutrition. 2nd Edition Ajachem Publishers, University of Benin, Benin City, Nigeria. Pp 20-24.

Onuh S O 2005 Evaluation of the performance of broilers fed different Agro. Industrial by-products in Proc. of the 30th Annual Conference of Nigerian Society of Animal Production, 30: 169-171.

Ovimaps 2012 Ovi location map; Ovi earth imgery date; May 20th, 2012.

Pauzenga U 1985 Feeding parent stock. *Journal of Zoological Technology International,* December, Pp. 22-24.

Ravindran V 2014 Poultry Development Review: Poultry feed availability and nutrition in developing countries. Food and Agriculture Organization of the United Nations accessed via http://www.fao.org/docrep/013/al705e/al705e00.pdf on 10/11/2014.

SAS 2002 Statistical Analysis System Institute. Users Guide Version 9 for Windows. Cary North Carolina USA.

Serres H 1992 Manual of Pig Production in the Tropics. CAB International, Wellington Pp.14-50.

Smith A J 2001 Poultry. The Tropical Agriculturalist. Revised ed. Macmillan Education Ltd. London pp. 1-11.

Steel R G D and Torrie J H 1980 Principles and Procedures of Statistics. A Biometric Approach (2nd ed.). McGraw-Hill Publishers, New York, pp. 633.

Tamburawa M S, Ibrahim B A and Abdullahi A Y 2012 Growth Performance and Nutrient Digestibility of Broiler Chicks Fed Millet (*Pennisetum pedicellatum*) and Sorghum (Sorghum bicolor) Based Diet in Nothern Nigeria at Starter Phase. In: the Proceedings of the 46th Annual Conference of the Agricultural Society; 5th – 9th November, 2012. (Jibrin J.M., M.A. Hussaini, B.M. Auwalu, E.U. Essiet, I.R. Muhammad, S.G. Mohammed, M.I. Daneji, Y. Garba and S.A. Pantami (eds.)). Pp. 436-439.

Tuleun C D, Njike M C, Ikurior S A and Ehiobu N G 2005 Replacement of maize with cassava root meal/brewer's yeast slurry in the diets of broiler chickens. *Proceedings of the 30th Annual Conference of the Nigerian Association for Animal Production,* held at University of Nigeria, Nsukka. March, 20th-24th.

Tuleun C D and Igba F 2007 Growth and carcass characteristics of broiler chickens fed water soaked and cooked velvet beans (*Mucuna pruriens*) meal. Proc of the 32nd Ann. NSAP Conf. Calabar, Nigeria. pp. 240-243.

Table 1: Chemical composition of maize and millet processing wastes

Nutrients	Maize	Millet Processing Waste
Dry matter (%)	93.60	90.15
Crude protein (%)	8.6	12.97
Crude fibre (%)	3.2	6.20
Ether extract	3.8	0.95
Ash (%)	1.81	0.57
NFE (%)	82.59	79.31
ME (kcal/kg)	3519.69	3333.10

NFE determined by difference: NFE=100-(%CP+%CF+%EE+%Ash)

ME (kcal/kg) = 37 x %CP + 81.8 x % EE + 35.5 x %NFE (Pauzenga, 1985)

Table 2: Composition of the experimental broiler starter diets for Experiment 1 (0-4 weeks)

	Levels of maize replacement by millet processing waste				
Ingredients	**T1 (0%)**	**T2 (20%)**	**T3 (40%)**	**T4 (60%)**	**T5 (80%)**
Maize	51.35	41.08	30.81	20.54	10.27
MPW	0.00	10.27	20.54	30.81	41.08
GNC	24.36	23.25	22.10	20.98	19.85
Soya cake	14.00	14.00	14.00	14.00	14.00
Fish meal	4.00	4.00	4.00	4.00	4.00
Limestone	2.24	2.24	2.24	2.24	2.24
Bone meal	3.00	3.00	3.00	3.00	3.00
Palm oil	0.00	1.50	2.26	3.38	4.51
Common salt	0.25	0.25	0.25	0.25	0.25
Vit/M. Premix	0.30	0.30	0.30	0.30	0.30
L-lysine	0.25	0.25	0.25	0.25	0.25
Dl-methionine	0.25	0.25	0.25	0.25	0.25
Total	100	100	100	100	100
Calculated Analysis :					
ME(Kcal/kg)	2810	2811	2811	2812	2812
Crude protein (%)	23.50	23.50	23.50	23.50	23.50
Ether extract (%)	4.65	6.08	6.83	6.91	6.99
Crude fibre (%)	3.81	4.54	5.27	6.01	6.74
Calcium (%)	1.29	1.29	1.29	1.29	1.30
Avail. P (%)	0.63	0.63	0.63	0.63	0.64
Lysine (%)	1.28	1.28	1.28	1.28	1.27
Methionine (%)	0.46	0.46	0.46	0.46	0.46
Methionine +Cyst. (%)	0.95	0.96	0.96	0.96	0.97
Feed cost/kg (₦/kg)	76.30	75.86	70.97	68.65	65.57

*Bio Mix chicks provided the following per kg diet: Vit. A 2500i.u; Vit.D_3, 500i.u; Vit. E 5.75; Vit. K_3 0.5mg; Vit. B_1 0.45mg; Vit B_2 1.25mg; Niacin 6.875mg; Pantothenic acid 1.875mg; Vit. B6 0.75mg; Vit. B_{12} 0.00375mg; Folic acid 0.1875mg; Biotin H2 0.015mg; Choline chloride 75mg; Cobalt 0.05mg; Copper 0.75mg; Iodine 0.25mg; Iron 5mg; Manganese 10mg; Selenium 0.05mg; Zinc 7.5mg; Antioxidant 0.3125mg.

Table 3: Performance of Broiler Starter Chicks Fed Graded Levels of Millet Processing Waste as Replacement for Dietary Maize (0 – 4 weeks)

	Levels of Maize Replacement with Millet Processing Waste					
Parameters	T1 (0%)	T2 (20%)	T3 (40%)	T4 (60%)	T5 (80%)	SEM
Initial weight (g)	37.67^{a}	39.17^{a}	39.50^{a}	39.33^{a}	38.67^{a}	1.33
Final weight (g)	1050.4^{a}	1030.7^{a}	1053.3^{a}	1021.3^{a}	1080.3^{a}	65.28
Weight Gain (g)	1012.7^{a}	991.57^{a}	1013.3^{a}	981.97^{a}	1041.66^{a}	64.45
Ave daily gain (g)	36.17^{a}	35.41^{a}	36.20^{a}	35.07^{a}	37.20^{a}	2.30
Feed Intake (g)	1917.4^{ab}	2128.5^{a}	2035.2^{ab}	1940.0^{ab}	1792.5^{b}	82.17
Feed Intake (g/d/b)	68.48^{ab}	76.02^{a}	72.69^{ab}	69.29^{ab}	64.02^{b}	5.08
FCR	1.89^{a}	2.16^{b}	2.01^{b}	1.98^{a}	1.73^{a}	0.23
Feedcost/kg weight	144.21	163.86	142.64	135.93	113.44	
Mortality (%)	1.67^{ab}	1.00^{a}	2.00^{b}	1.33^{ab}	1.67^{ab}	0.45

^{abc}Means in the same row with different superscript are significantly different. FCR: Feed Conversion Ratio

Table 4: Carcass Characteristics of Broiler Starter Chicks Fed Graded Levels of Millet Processing Waste as Replacement for Dietary Maize (0 – 4 weeks)

	Levels of Maize Replacement with Millet Processing Waste					
Parameters	T1 (0%)	T2 (20%)	T3 (40%)	T4 (60%)	T5 (80%)	SEM
Live weight (g)	1495[a]	1520[a]	1500[a]	1310[a]	1425[a]	134.09
Dressed weight (g)	1375[a]	1410[a]	1365[a]	1165[a]	1305[a]	124.58
Carcass weight (g)	1110[a]	1155[a]	1080[a]	950[a]	1050[a]	119.87
Dressing %	74.30[a]	75.98[a]	71.98[a]	72.10[a]	73.67[a]	2.19
Thigh (%DW)	22.202[a]	21.316[a]	20.884[a]	20.575[a]	21.098[a]	1.46
Drumstick(%DW)	3.620[ab]	3.185[b]	4.041[ab]	5.283[a]	4.207[ab]	0.77
Breast(%DW)	19.295[b]	20.199[b]	20.508[b]	24.327[a]	22.259[ab]	1.23
Back(%DW)	17.802[a]	19.475[a]	16.805[a]	15.151[a]	17.617[a]	1.90
Intestinal length (cm)	10.664[a]	12.913[a]	14.432[a]	15.828[a]	14.697[a]	2.61

[abc]Means in the same row with different superscript are significantly different.