

Effects of Substituting Some Components of Broilers' Feed with Crude Aquous Extract of Fresh Leaves of *Mucuna Poggei*

A. O. Oko (Correspondence author)

Department of Biotechnology, Ebonyi State University

P.M.B. 053 Abakaliki, Ebonyi State, Nigeria

Tel: 234-803-261-3614 E-mail: austineok@yahoo.co.uk

S. T. Nwoba

Department of Biotechnology, Ebonyi State University

P.M.B. 053 Abakaliki, Ebonyi State, Nigeria

J. N. Idenyi

Department of Biotechnology, Ebonyi State University

P.M.B. 053 Abakaliki, Ebonyi State, Nigeria

O. Ogah

Department of Biotechnology, Ebonyi State University

P.M.B. 053 Abakaliki, Ebonyi State, Nigeria

O. O. Ugwu, & L. U. Ehihia

Department of Biochemistry, Ebonyi State University

P.M.B. 053 Abakaliki, Ebonyi State, Nigeria

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Abstract

We studied the effects of substitution of Palm kernel cake (PKC), Fishmeal and Soyabean Cake (SBC) with crude extract of *Mucuna poggei* on the performances of broilers. A total of forty broiler chicks of a day old each were bought and shared into four groups of ten broilers each, allowed to acclimatize for two weeks and then reared for eight weeks. Palm kernel Cake (PKC), Fishmeal and Soyabean Cake (SBC) were given to broilers in groups 1, 2 and 3 respectively with similar quantities of crude extract of *Mucuna poggei* fresh leaves. The fourth group served as a control and was fed normal feed (Fishmeal and Soyabean Cake). The weekly body weights of the broilers were taken for eight weeks, after which they were slaughtered for the determination of their carcass characteristics, breast meats' drip loss and cook loss. The results showed significant differences ($P < 0.05$) in the weights of the broilers at the end of the experiment. The "control" had the highest mean body weight of 1233.33 ± 76.38 g followed by "group 2" with mean body weight of 1150.00 ± 50.00 g while "group 3" had the least mean body weight of 950 ± 40.82 g followed by "group 1" with mean body weight of 1000.00 ± 40.82 g. There was no significant variation ($P < 0.05$) in the cooking losses among the breast meats of the four groups. However, the results showed significant variation ($P < 0.05$) in the drip losses among the breast meats of the broilers. On the whole, the results revealed that the control which had no crude extract of *Mucuna poggei* fresh leaves performed better than other groups which were given the extract as feed substitute. The crude extract should therefore be given to broilers as feed supplement not as feed substitute for optimal performance.

Keywords: Palm kernel cake, Fishmeal, Soyabean cake, Broilers, *Mucuna poggei*, Carcass, Drip and Cook loss

1. Introduction

Poultry is a category of birds reared in homes for the purpose of provision of proteins to humans. The demand for poultry products have been increasing over the years. The poultry industry over the years has grown into a large commercial venture providing means of livelihood and employment for both skilled and unskilled workers (Esonu, 1996). The industry provides poultry birds either as source of meat (broilers) or as egg producers (layers), these serve as source of proteins for many people around the world. Poultry accounts for about 30% of meat production worldwide (Rallof and Janet, 2003). Broilers are the meat types of poultry. They usually have high feed conversion efficiency and are bred specifically for marketing at early age. They are usually sold when they attain the live weight of 1500g, which occurs between 4-8 weeks of age depending on their production efficiency (Egbo *et al.*, 2000).

However, in Nigeria the major factor militating against poultry production in general and broilers in particular is the high cost of feeds. Feed cost constitutes the highest proportion of the capital required in running poultry farms. In developing countries including Nigeria, cost of feeds constitute as much as 70-80% of the total cost of poultry production as against 50-70% in most developed countries (Olomu, 1979). This is further compounded by scarcity of feed ingredients, inadequate knowledge of cheap ingredients, dearth of

information on the use of agro-industrial by-products, over dependence on the importation of certain items like cereals and root crops (Olomu, 1979). Hence, it is necessary to resort to incorporation of local agro-by-products such as wheat offals, rice husks, groundnut cake, palm kernel cake, maize chaffs in poultry feeds, since they do not qualify for direct human consumption. There is need to also substitute some of these feed components due to their increasing scarcity with natural crops such as legumes.

Interestingly, there are a number of underutilized legumes such as the African yam beans (*Shenostylis stenoscarpa*), *Mucuna conchinchinesis*, *Mucuna pruriens*, *Mucuna flagellipes* *Mucuna poggei* etc. For instance, *Mucuna poggei* is increasingly becoming popular and much has been said about its nutritional and medicinal potentials. In most villages in Eastern Nigeria predominantly occupied by the “Igbos”, *Mucuna* species such as *Mucuna flagellipes* and *poggei* leaves are squeezed in water and taken orally to boost blood levels (Ihedioha and Okoye, 2011). A study of the proximate and mineral composition of *Mucuna poggei* seeds reveals that it has about 3.58% crude fiber, 89.7% dry matter, 3.9% ash, 27.9% crude protein, 45.8% Nitrogen free extract and green energy of 4.13 Kcal/g (Tuleun *et al.*, 2008). The high mineral content of the leaves such as Calcium, Magnesium, Potassium, Iron, Phosphorous, Zinc, Sodium etc is also interesting.

A critical assessment of the nutritional potentials of *Mucuna poggei* in the livestock industry has become very imperative. It is in this premise that we assessed the possibility of substituting this legume (*Mucuna poggei*) with some components of the broiler feeds by determining the effects of substituting palm kernel cake, fishmeal and soya bean cake with crude extracts of *Mucuna poggei* on the growth performances, carcass characteristics and meat quality of broilers.

2. Materials and Method

Preparation of crude extract of *Mucuna poggei* leaves: Fresh leaves of *Mucuna poggei* leaves were obtained from a local farm at the PRESCO Campus of Ebonyi State University, Abakaliki, Nigeria. The leaves were pounded and weighed using mortar and pestle and sensitive weighing balance respectively. About 50g of the leaves were squeezed in 1000ml of water, mixed properly and filtered to obtain the crude extract. The crude extract were stored in bottles, covered and preserved in a refrigerator and then added to the water given to the broilers on daily basis.

Formulation of the broiler feeds: The feeds were formulated using conventional broiler feed formulas to meet the broilers’ nutritional needs. The ratio used in the formulation of the feeds were soyabean cake 25%, palm kernel cake 10%, maize 50%, rice offals 10%, fishmeal 5%, lysine 0.25%, methionine 0.25% and salt 0.5%. Soyabean cake and palm kernel cake were bought from Abakpa market in Abakaliki, Nigeria. Rice offals were obtained from Abakaliki rice Mill industry while fishmeal and maize were bought from dried fish and maize dealers. All the feed components were then milled and mixed together.

The amount of each component used for the feed formulation was determined thus:

Formula = $\%IR \times \%DM \times WNV / 100$

Where IR=Incorporated rate in %

DM=Dry matter content in %

WNV=Wanted Nutritive value in %

Experimental Layout: The experiment was carried out using forty broiler chicks of a day old each. The experimental birds were allowed to acclimatize, during which they were fed with commercial starter feeds bought in a market in Abakaliki, Nigeria and then shared into four groups of ten broilers each. Each group was put in a single cage. The “control” was fed with all the eight ingredients used in the feed formulation and the crude extract of *Mucuna poggei* was not included in its diets. The other three groups were fed as follows; “group 1” feed had palm kernel cake substituted with crude extract of *Mucuna poggei*, “group 2” feed had the fishmeal component substituted with *Mucuna poggei* leaves crude extract and soya bean cake was substituted with crude extract of *Mucuna poggei* in feed given to “group 3”. The broilers were fed as described above for eight the weeks of the experiment.

Carcass Characteristics and Meat Quality Determination: At the end of the experiment, the birds were slaughtered for carcass characteristics and meat quality determination. The birds were fasted overnight and their weights obtained before slaughtering. They were bled and killed by cutting their jugular veins, scalded in warm water (about 60°C) and the feathers were manually removed. The legs and heads were cut at tibio-metatarsus and atlanto-occipital joints respectively. The weights of carcass, head, legs, hearts, livers and gizzards were obtained using a weighing balance. After which, carcasses were preserved in a refrigerator at 4°C for twenty four hours and then reweighed. And weight gains of the carcasses were obtained. Carcasses were then carved out and weights of breasts, thigh-drumsticks, wings, necks and back-cut were determined. The breast samples of the carcasses were used for drip loss determination. Meat samples of the breasts were placed in plastic bags and freely hanged up to a hook at 4°C during forty hours. The samples were then removed, mopped up and weighed for drip loss determination. Samples were placed in a hot water at 75°C during thirty minutes, cooled during forty minutes and then mopped. The differences in weights of the samples before and after cooking were used to determine the cook loss.

Statistical Analysis: All data obtained were analyzed by the Analysis of Variance (ANOVA) procedure using SAS software (SAS Institute, 1999). Differences were declared statistically significant at $P \leq 0.05$. Where significant differences were detected, the means were separated by least significant difference (LSD) at 5% probability.

3. Results

Variation in Weekly Growth among the Broilers: The result of the weekly weight gained by the four groups of broilers used in the experiment is as shown in table 1. The mean weights of the broilers in the first week ranged from 280.00±32.59g to 317.50±31.23g, the group 2 broilers had the highest mean weight of 317.50±31.23 followed by group 1 with the mean weight of 310.00±28.50g. The group 3 broilers had the least mean weight of 280.00±32.59g followed by the “Control” with the mean weight of 305.00±32.59g. There was an observable numerical increase in the weights of the broilers in the second week of the

experiment, though there was no significant difference in the mean weights of the broilers ($P > 0.1781$) and an average weight of 400.00g was observed. However, there was a significant difference in the mean weights of the broilers during the third week ($P < 0.0014$). The mean value of the means of the weights of the four groups of broilers was 530.00g; the mean weights for groups 1, 2, 3 and control were 550.00 ± 20.41 g, 550.00 ± 25.00 g, 450.00 ± 20.00 g and 575.00 ± 54.01 g respectively. While there was significant variation among the mean weights of the broilers in the fourth week ($P < 0.0002$), there was only numerical difference among the weights of the broilers in the four groups in both the fifth and sixth week of the experiment. Also table 1 show significant differences in the mean weights observed among the four groups in the seventh week of the experiment, suggesting variation bin the sizes of broilers in different groups. The mean weight of the broilers ranged from 812.50 ± 32.00 g to 1116.67 ± 104.08 g. The broilers in the “Control” were the heaviest with the mean weight of 1116.67 ± 104.08 g followed by group 2 with the mean weight of 1033.33 ± 20.41 g while group 3 had the least mean weight of 812.50 ± 32.00 g followed by group 1 with the mean weight of 900.00 ± 20.41 g. Similarly, during the eighth week, significant differences were observed among the mean weights of the broilers in the different groups ($P < 0.0001$). The mean weight of the broilers for the eighth week was 1067.85g. The “control” had the highest mean weight of 1233.33 ± 76.37 g followed by group 2 with the mean weight of 1150.00 ± 50.00 g. Group 3 had the least mean weight of 950.00 ± 40.82 followed by group 1 with the mean weight of 1000.00 ± 40.82 g.

Variation in the carcass sizes and weight lost of the broilers after slaughtering and removal of feathers: The table 2 below shows the mean weight of their carcass after removal of feathers and their net weight loss. The four groups of broilers showed significant differences ($P < 0.0015$) in their weights before their feathers were plucked out. This indicates wide variation in the weights of the broilers used for the experiment. The $LSD_{0.05}$ values show that no real differences existed between the weights of broilers in group 2 (1200g) and the control (1233.33g). On the other hand, real difference existed between weight of broilers in group 2 and the control and that of groups 1 and 3. The initial mean weight of the broilers was 1104.167g, which ranged from 966.67g to 1233.33g. However, significant differences ($P < 0.0009$) existed among the weights of the carcasses after plucking out their feathers, suggesting a wide variation. The mean weight was 768.75g and the values ranged from 833.33g to 1091.67g. Group 3 had the least mean weight (833.33g) followed by group 1 (866.67g), while the control had the highest mean weight of 1091.67g followed by group 2 with the mean weight of 1083.33g. Table 3 also shows the mean net weight of the broilers’ carcasses after removal of their feathers and it showed no significant difference ($P > 0.3463$). The mean net weight loss of the carcasses was 135.42g. The values ranged from 116.67g to 150.00g with group 1 having the highest value while group 2 had the least value.

Cook and drip losses of the broilers’ breast meat sample: Table 4 shows the mean cook and mean drip loss of the breast meat of the broilers. The result showed no significant difference among the mean cooking losses of the breast meat of the four groups of broilers. The mean cook loss ranged from 46.67g to 50.00g. The $LSD_{0.05}$ reveals no statistical differences among the mean values of the cook loss of the broilers’ breast meat. The table

also shows that there is a significant difference ($P < 0.00115$) in the drip loss of the broilers' breast meat. The drip losses of groups 1, 2 and the "control" had no statistical difference as shown by the $LSD_{0.05}$ in table 4, while group 3 differed statistically. The mean drip loss ranged from 15g to 25g. Group 3 had the least mean drip loss of 15g while group 2 and "Control" had the highest mean drip loss of 25g each followed by group 1 with mean drip loss of 20g.

4. Discussion

The observed variations in the weights of the broilers could be attributed to the nutritional content of the feeds given to the broilers in the individual groups. The "control" must have performed better than the other groups because its feeds were made up of all the major ingredients used in the feed formulation unlike the other groups where one of its feed ingredients was substituted with crude extract of *Mucuna poggei* leaves. A lot of workers have reported that fishmeal and soya bean cake contain high proteins necessary for the growth of animals and broilers inclusive, unlike 1.16% protein content of certain *Mucuna species* leaves as reported by Ihedioha and Okoye (2011), this is far lower than 20% protein content of certain *Mucuna* seeds reported by Enwere (1998).

Besides, certain anti-nutrient factors and toxic metals have been identified in *Mucuna* species by a lot of workers (Siddhuraju *et al.*, 2000 and Delcarmen *et al.*, 1996). They reported that *Mucuna* reduces feed palatability and digestibility of diets particularly proteins. Acamovie (2002) has reported that presence of tannin in *Mucuna* species reduces its palatability by binding with proteins. Similarly, Udensi *et al.*, 2008, reported that seeds of non-heat treated *Mucuna* reduces the palatability of broiler feeds; this may also be true for its crude extract. The low palatability of crude extract of *Mucuna poggei* leaves to the broilers in groups 1, 2 and 3 and also its low protein content and presence of anti-nutrients could have caused the broilers in groups 1, 2 and 3 not to grow and gain as much weights as the broilers placed in the "control" which were not given the crude extract as feed substitute. The control maintained the highest mean weight through out the eight weeks of the experiment. This could be due to the soyabean cake, fishmeal and palm kernel cake which were present in the feeds given to the broilers in the control, unlike other groups that had one of the three feed components substituted with crude extract of *Mucuna poggei* leaves. The growth performance and weight gained by broilers under the control explains the impacts of certain anti-nutrients contained in crude extract of *Mucuna poggei* leaves coupled with its low palatability as already reported. Lack of soya bean cake in the diets of group 3 broiler chicks might have contributed to their low average weight. This because heat treated soya bean cake contains up to 9% proteins and 80% calories responsible for the growth, weight gain and energy in animals including broilers as reported by the WHO in 1990. The low weight gain and growth of the group 3 broilers is therefore attributable to lower nutritional value of the crude extract of *Mucuna poggei* than in soya bean cake. Similarly, the absence of palm kernel cake and fish meal in the diets of group 1 broilers and group 2 broilers respectively may have affected their growth and weight, hence the "the control" performed more than the two groups due to the inclusion of the two ingredients in their diets.

In the eighth week of the experiment, there was significant variation ($P < 0.0002$) in the live weights of the broilers as shown by the analysis of variance. The mean live weights of the broilers in the “control” was 1233.3 ± 76.37 g which was below the minimum marketable size of 1500g and below the live weights of 1550g reported by Narayangswamy and Santosh (2004) for six months old broilers. The broilers in the “control” were not as heavy as other broilers fed with crude extract of *Mucuna poggei* supplement and commercially blended feeds under the same conditions reported by other workers. It could be that there are other feed ingredients in those commercial feeds that were lacking in the formulated feeds used in this experiment. As a result improved nutrient content in the feeds might help to improve weight gain and growth rate of broilers fed with crude extract of *Mucuna poggei* leaves. Also, broilers fed with commercial feeds with out the extract appear to have higher feed conversion efficiency, growth rate and weight. This could be as result of absence of certain anti-nutrients in such feeds but contained in the crude extract of *Mucuna poggei*. Tuleun *et al.* (2008) reported the presence of 5.86% L-Dopa, 0.25% tannin, 0.22% phytate, 0.74% saponin, 0.03% oxalate, 2.3% alkaloids in seeds of *Mucuna poggei* seeds as well as high amount of HCN (13.14%) and trypsin inhibitor (31.4%). Phytate is an anti-nutrient known to increase mineral requirement in animals especially phosphorous, as it forms insoluble complexes with phytic acid. Prolonged intake of HCN even at low level as happens when the carrier is a staple food, results to damage to the central nervous system and the thyroid gland, which manifests as ataxia and goiter (Makkar and Becker, 1997 and Ekpechi, 1967). This level of certain phytochemicals in *Mucuna poggei* must have contributed to poor performance by the broilers it was fed with.

The carcasses of the broilers of the four groups showed significant variations before and after the removal of feathers from them as shown in table 2, but no significant variation in the net loss of weight among the broilers existed after plucking out their feathers. The significant variations could be attributed to the wide differences in the sizes of the broilers of the different groups. The carcasses of broilers of the control weighed highest before and after plucking out their feathers (1233.33 ± 76.37 and 1091.67 ± 62.92 respectively) followed by the carcass of the group 2 broilers which weighed 1200 ± 50 g and 1083.33 ± 57.74 before and after the plucking out of their feathers respectively. The group 3 broilers had the least mean carcass weight followed by the group 1 broilers. The trend of the results indicated highest yield by the control followed by group 2, group 3 and then group 1, these could be attributed to their individual initial live weights. The broilers of groups 1, 2 and 3 had lower carcass weight. This result was similar with that of Dahouda *et al* (2003); Toleu and Igba (2008) and Ferrira *et al* (2003). They similarly reported lower carcass weight and dressing percentage of broilers fed with 20% raw *Mucuna* seed meal diets as a result of smaller live weight. In other words, carcass weight and size of broilers are dependent on their live weight. According to them, cut-parts of the chicks were improved when fed with processed seed of *Mucuna*.

The organ sizes of the broilers revealed that the broilers of the control had the highest weights for all the organs studied. The $LSD_{0.05}$ showed that there was no real difference between the weights of the hearts of broilers in group 1, group 2 and the control but differed only with the weight of the hearts of broilers of group 3. These mean that the over all weight of the

carcasses of the broilers did not have much effect on the size of the heads of the broilers. Similar observations were made for the sizes and weights of the broilers in all the groups. The $LSD_{0.05}$ for the gizzard showed real differences among the four groups. Expectedly, the gizzard of broilers in the control had the highest mean weight of $30 \pm 2.0g$, this supports the previous results which showed that the “control” were better than other groups in terms of overall size. The gizzard of broilers in group 3 had the least mean weight of $15 \pm 0g$, which may be attributed to their carcass weight which were the least from other groups. Real differences between the sizes of legs and livers of broilers in the control and those of other groups were observed in the course of the study. These further indicate better performance of the broilers in the control than the ones in the other groups. This is in line with the previous report by Narayangswamy and Santosh (2004).

The drip loss and cook loss were used to determine the quality of the broilers. There were no significant variations ($P > 0.8592$) in the cook losses of the breast meat of the broilers. The $LSD_{0.05}$ also showed no real differences among the broilers in all the groups. This could be attributed to the proportion of the breast meat lost into the water and by implication, the result of the cook loss of the broilers means that the cooking qualities of the breast meat do not differ significantly. There was low proportion of meat lost into the water by the breast meat which agrees with the report of Allen, (2007) that low cook loss occur as a result of water holding capacity which prevents lost to water. There were significant variations in the drip loss of the broilers ($P < 0.0015$). Group with higher cook loss had lower drip loss while group 3 with the lowest cook loss had the lowest drip loss. These indicate a correlation between the drip loss and the cook loss of the broilers’ breast meat. The drip loss and cook loss of the broilers’ breast meat were higher than the values obtained in local guinea fowl meat (Dahouda *et al.*, 2009). Such differences might be due to factors such as rate and extent of pH decline, meat fat content, proteolysis and protein oxidation (Siddhuraju *et al.*, 1996). Omojola and Adesehinwa, (2007) observed that the lower the cook loss of a meat the more juicy the meat. The low cook loss of the meat of broilers in groups 1, 2 and 3 can be attributed to their juiciness and high quality.

5. Conclusion

The outcome of the study showed that the broiler chicks could not really perform optimally largely due to the composition of the feeds given to them. The formulated feeds used for the study which composed of basically Palm kernel cake, Fish meal, Rice offals, Soya bean cake and 50% maize appeared not to be as nutritious as some commercially blended broiler feeds, as shown by the sizes and live weights of the broilers. We therefore suggest inclusion of other protein and calorie sources in locally prepared feeds and each of the feed ingredients should be included in adequate proportion to provide maximum nutrients for poultry animals and broilers in particular. There should be better processing of the crude extract of *Mucuna poggei* leaves and adequate research into the nutrients and anti-nutrients composition of the crude extract in order to ascertain its real potentials in serving as feed supplements or substitute not only in broilers but in other related livestock. It is expected that the findings of the experiment will go a long way in reducing the increasing problem of livestock feed scarcity and its attendant high price in the local market.

Table 1. Variation in Weekly Weights (in grams) of the Broilers

Week	Group 1	Group 2	Group 3	Control	Mean	Prob.
First week	310.00±28.50	317.00±31.23	280.00±32.59	305.00±32.59	301.1	0.3394
Second week	412.50±32.27	425.00±25.00	362.50±32.27	406.25±51.54	400.00	0.1781
Third week	550.00±20.41	550.00±25.00	450.00±20.41	575.00±54.01	530.00	0.0014
Fourth week	643.75±31.46	650.00±25.00	550.00±20.41	693.75±37.50	633.33	0.0002
Fifth week	725.00±35.36	733.33±38.19	650.00±20.41	815.00±37.75	676.00	0.8391
Sixth week	826.25±33.01	891.67±38.19	717.50±23.63	916.67±38.19	795.00	0.5255
Seventh week	900.00±20.41	1033.33±20.41	812.50±32.27	1116.67±104.08	950.00	0.0001
Eighth week	1000.00±40.82	1150.00±50.00	950.00±40.82	1233.33±76.38	1067.00	0.0001

Table 2. Variation in mean weight of the broilers and net weight loss after slaughtering and removal of feathers

Group	Group1	Group 2	Group3	Control	Mean	Prob.	LSD _{0.05}
Weight of Broilers	1016.67±28.87 ^b	1200.00±50.00 ^a	966.67±76.38 ^b	1233.33±76.38 ^a	1104.10	0.0015	115.30
Net weight loss	150.00±0.00 ^a	116.67±28.87 ^a	133.33±28.87 ^a	141.67±14.43 ^a	135.42	0.3406	40.77

*Means followed with the same letter in each column are not significantly different.

Table 3. Variation in weight gain of some organs of the broilers after preservation at 4°C for 24 hours

Organ	Group1	Group2	Group3	Group4	LSD _{0.05}	Mean
Heart	4.00±1.00 ^a	5.00±1.00 ^a	3.00±1.00 ^b	5.00±1.00 ^a	1.87	4.25
Head	15.00±1.00 ^{ba}	20.00±1.00 ^a	13.00±1.00 ^b	25.00±1.00 ^a	5.17	18.25
Gizzard	20.0±2.00 ^b	20.00±2.00 ^b	15.00±0.00 ^c	30.00±2.00 ^a	2.74	21.25
Leg	15.00±0.00 ^b	20.00±2.00 ^a	15.00±1.00 ^b	20.00±1.00 ^a	1.87	17.25
Liver	5.00±1.00 ^b	5.00±0.00 ^a	5.00±0.00 ^b	10.00±0.00 ^a	2.50	7.00

*Means followed with the same letter in each column are not significantly different.

Table 4. The mean cooking loss and drip loss of breast meat sample of the broilers after cooking in hot water at 75°C for 30 minutes.

Group	Group 1	Group2	Group3	Control	Mean	Prob.	LSD _{0.05}
Cooking loss	50.00±5.00 ^a	50.00±5.00 ^a	46.67±7.64 ^a	50.00±5.00 ^a	49.17	0.859	10.87
Drip loss	20.00±2.00 ^{ba}	25.00±0.00 ^a	15.00±3.00 ^b	25.00±5.00 ^a	21.25	0.012	5.80

*Means followed with the same letter in each column are not significantly different.

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