Effect of layer chicken litter and yellow maize meal on mineral status of bovine.

T. P. Ateba[1*] and D. E. Beighle[1]

[1]Dale Beighle Centre for Animal Health Studies, School of Agricultural Sciences, North-West University-Mafikeng Campus, P. Bag X 2046 Mmabatho 2735, South Africa.
tshepna77@hotmail.com

Abstract: Twelve Friesian calves were blocked according to sex and age and assigned to treatment and control groups (six calves in each group). The aim of this research was to compare the value of layer chicken litter and yellow maize meal as a source of Phosphorus (P) in cattle by determining their concentration in faeces, blood and bone. To find an inexpensive and useful supplement that can be used by communal farmers as a feed to improve the mineral status of their cattle or to supply their phosphorus (P) needs. The licks were given so that an equal amount of concentrate was given to both the treatment and the control animals. Faecal, blood, bone samples and the licks were collected and analysed for P concentration. Data was collected for P concentration in mg% for blood and in mg/g for bone, faeces and lick consumption. The serum inorganic phosphorus (SIP) concentration was significantly ($P<0.05$) higher at all sampling periods for the animals that received layer chicken litter (TCL) than those that received yellow maize meal (CNT) only. The mean faecal P concentration was significantly ($P<0.05$) higher for the TCL animals at all sampling periods on a fresh, dry and ash weight basis when compared to the CNT animals.
[T. P. Ateba and D. E. Beighle: **Effect of layer chicken litter and yellow maize meal on mineral status of bovine;** Life Science Journal. 2011;8(S2):8-11] (ISSN: 1097 – 8135). http://www.lifesciencesite.com.

Keywords: Layer chicken litter, yellow maize meal, faecal P and serum inorganic P.

1. Introduction

The livestock industry in the Republic of South Africa is almost entirely dependent on the native pasture for satisfying their nutritional needs. Unfortunately several nutritional deficiencies put a limit on animal production in most pastoral areas covered mainly by grass. In this regard the well-known P deficiency was discovered in some classic research during the early part of the century (Theiler, 1927).

A major constraint to livestock production in communal areas is a lack of proper nutrition. Cattle that are kept in communal areas are dependent mainly on grazing and browsing with little or no supplementary feeding. As a result of poor grazing management systems, grazing is normally scanty and this is particularly so in areas where livestock numbers are high. This situation is worse during the dry (winter) period when, besides total feed scarcity, forage quality is also low (Undi, 2003).

To meet the nutritional requirements of calves for growth and development, supplementation with macrominerals including Calcium (Ca), P and Magnesium (Mg) is recommended (Odenya et al., 1992).

In spite of the potential benefit from the use of supplementary feeds during the dry period, the majority of livestock farmers in Africa do not make full use of this knowledge and as a result suffer major losses in production. During the dry season, the grasses that are standing in the rangeland lose nutritive value. In addition, the soils are lacking in mineral content so supplementary feeding becomes a necessity if one is to get good returns from the animals (Raats, 2004).

According to (Carter and Poore., 1995) of all the alternative feeds available chicken litter has the greatest value for its cost. Farmers should consider using chicken litter in winter-feeding programs. It is an economical and safe source of protein, minerals and energy for beef cattle. Litter also makes an economical substitute for hay especially during drought years when hay supplies are short.

2. Material and Methods

2.1 Area of the study

The research was conducted at the North-West University Farm (Molelwane) Mafikeng in the North-West Province, South Africa.

2.2. Animals used in the research

Twelve Friesian calves between 1 and 3 years were blocked according to sex and age. Animals were randomly assigned into two groups containing six animals each.

2.3. Licks given to the animals

The first group was fed layer chicken litter (TCL) supplement plus yellow maize meal and the second group of animals was the control group and was fed only yellow maize meal.

Animals in treatment group (TCL) were given a lick of 200 g layer chicken litter and 1.2 kg yellow maize meal and 1.4 kg yellow maize meal to the control group (CNT) so that an equal amount of P was given to both the treatment and control groups of animals. All animals were given buffalo grass hay ad libitum as roughage.

2.4. Collection of samples

Faecal and blood samples were collected on day 0 before the beginning of feeding supplements and days 1, 2, 3, 4, 7, 8, 9, 10, 11, 14, and 15 after feeding supplements and bone samples were collected on day 0 before the beginning of feeding supplements and days 4, 9, and 14 after feeding supplements.

Blood samples were collected from the jugular vein (Beighle et al., 1995) faecal samples were collected as grab samples from the rectum and bone sample were surgically collected from the 9^{th}, 10^{th}, 11^{th} and 12^{th} ribs using a trephine (Beighle, 1999).

Buffalo grass hay was collected four times from the feeding trough and kept in a clean plastic container.

Layer chicken litter was collected from under the layer cages at the North West University Farm (Molelwane).

2.5. Digestion and analysis of samples

Faecal and bone samples and the feed were digested as described by (Beighle et al., 1995). The samples were analysed for P through the Bran & Luebbe Auto-Analyser II: Technicon Industrial System, Tarytown NY 10591. An Aquamate UV-Visible Spectrophotometer (Thermo Spectronic, Mercers Row, Cambridge CB5 8HY UK) was used to determine blood P concentration.

2.6. Statistical analysis

Data was analysed using Minitab (version13.13). Analysis of Variance (ANOVA) was performed to compare the value of layer chicken litter and yellow maize meal in improving the mineral status (P) in the bovine through the faeces, bone and blood. Analysis of variance (ANOVA) was also done to test the effects of treatment, time and their interactions using SPSS Windows 14.0 Data for repeated measures.

3. Results

Table 3.1: Nutrient and concentrate composition of experimental diets fed to calves.

Supplements	**Amount consumed/day**	**P (%)**	**Ca (%)**	**Mg (%)**
LCL	200 g	15	21	1.77
YMM	1.4 kg	0.4	0.48	0.57
GH	Ad libitum	0.3	1.13	0.41

LCL (layer chicken litter); YMM (yellow maize meal) and GH (buffalo grass hay).

Table 3.2: Serum inorganic phosphorus concentration (mg %) by days

DAYS	TCL	CNT
0	$3.62^{a,y}$	2.82^{b}
1	$2.82^{a,w}$	2.79^{a}
2	$3.62^{a,y}$	3.15^{b}
3	$3.90^{a,z}$	3.61^{a}
4	$3.29^{a,x}$	3.14^{a}
7	$3.27^{a,x}$	3.12^{a}
8	$3.26^{a,x}$	3.11^{a}
9	$2.97^{a,w}$	2.68^{c}
10	$2.48^{a,v}$	2.39^{a}
11	$2.35^{a,v}$	2.29^{a}
14	$2.82^{a,w}$	2.44^{c}
15	$2.54^{a,v}$	2.24^{b}

TCL: Layer chicken litter (Treatment), CNT: Control.

$^{a, b, c}$ Means in a row carrying different letters are significantly different between the treatment and control groups ($P<0.05$).

$^{v, w, x, y, z}$ Means in a column carrying the same letter are not significantly different within treatment groups ($P<0.05$).

Table 3.3: The mean faecal P concentrations by days (mg/g fresh weight).

DAYS	TCL	CNT
0	1.87^{a}	2.59^{b}
1	2.96^{a}	2.41^{a}
2	3.45^{a}	4.13^{c}
3	4.34^{a}	2.85^{c}
4	4.49^{a}	2.89^{b}
7	4.40^{a}	2.83^{b}
8	3.58^{a}	3.80^{a}
9	2.57^{a}	2.48^{a}
10	5.15^{a}	2.51^{c}
11	2.57^{a}	2.48^{a}
14	4.09^{a}	1.55^{c}
15	4.98^{a}	1.46^{c}

TCL: Layer chicken litter (Treatment), CNT (Control)

$^{a, b, c}$ Means in a row carrying different letters are significantly different between the treatment and control groups ($P<0.05$)

Table 3.4: The mean bone P concentrations mg/g (fresh weight) by days.

DAYS	TCL	CNT
0	116.65[a]	114.71[a]
4	106.07[a]	117.21[b]
9	97.18[a]	126.55[b]
14	99.07[a]	140.17[b]

TCL: Layer chicken litter (Treatment), CNT (Control)
[a, b] Means in a row carrying different letters are significantly different between the treatment and control groups (P<0.05)

4. Discussions

Livestock producers are becoming increasingly aware of the challenges associated with nutrient management. Moreover the largest challenge is managing Phosphorus (P) inputs and outputs in the livestock feeding operations. (Erickson et al., 2002.) This situation is even more common in communal settings. One method to help alleviate P mismanagement is decreasing dietary P to meet and not exceed requirements. (Erickson et al., 2002.)The aim of this research was to compare the value of layer chicken litter and yellow maize meal as a source of P in cattle and to find a cheap supplement that can be used by communal farmers to improve the mineral status of their cattle.

4.1 The effect of layer chicken litter compared with yellow maize meal on serum inorganic phosphorus.

Animals receiving layer chicken litter had a higher concentration of P in the serum at every sampling period compared to animals receiving only maize. At days 2, 9 and 14 SIP concentration was significantly (P<0.05) higher for the TCL group as compared to the CNT group. At day 1 there was no significant difference for both the two groups of animals (2.82 mg % P versus 2.79 mg % P).

4.2 Comparison of layer chicken litter and yellow maize meal (Bone P)

The mean bone P concentration was higher for the CNT animals at days 4 and 9 as compared to the TCL animals. At day 14 the mean bone P concentration was significantly (P<0.05) higher for the CNT group when compared to the TCL group.

4.3 Layer chicken litter as compared to yellow maize meal (faecal P)

The mean faecal P concentration was significantly (P<0.05) higher for the TCL group of animals at all days except days 1, 2, 8, 9 and 11 when compared to those in the CNT group.

Conclusion

(Zinn et al., 1996) and (Cooke and Fontenot, 1990) indicated that poultry manure is an excellent source of Calcium and Magnesium, respectively for ruminants and that Mg is well utilised from the waste diet. Layer chicken litter could be used as a supplement by communal farmers to avoid cases of Mg deficiency that can lead to decreased productivity and economic losses to the livestock industry (Hurley et al., 1990). Communal farmers should vaccinate their animals for botulism before feeding layer chicken litter. According to the results obtained animals receiving the layer chicken litter had significantly (P<0.05) more faecal P than the animals receiving yellow maize meal at all sampling periods except days 1, 2, 8, 9 and 11 on a fresh weight basis. The higher concentration of P in the faeces of animals receiving layer chicken litter may have resulted from the diet fed to animals. (Weiss and Wyatt, 2004) and (Knowlton and Herbein, 2002) also reported that there is a direct relationship between dietary P and faecal P. (Wu et al., 2001) also reported that decreasing dietary P reduces faecal P excreted. Most communal farmers can consider using layer chicken litter as a feed to their cattle this is motivated by the fact that layer chicken litter is easy to find or inexpensive but farmers should vaccinate their animal for botulism before feeding. As reported in the previous studies that poultry manure is an excellent source of calcium and magnesium his research has showed that layer chicken litter is a good source of phosphorus.

However, the P concentration in the bone for animals that received layer chicken litter was lower at days 9 and 14. This could have resulted from the fact that TCL animals were pulling P out of the bone and putting it in the blood and faeces which was reflected by their concentrations.

Since layer chicken litter does not improve bone P status of animals in the short term, this requires more research in which sampling should be conducted on a long term to clearly evaluate the effect of layer chicken litter in improving the P status of the animals.

Acknowledgements:

The authors would like to thank GOD Almighty for his wonderful blessings, the International mission board, North West University – Mafikeng Campus and the Centre for Animal Health studies for financial support.

Corresponding Author:
Mrs. T. P. Ateba
Centre for Animal Health Studies

North West University – Mafikeng Campus
Private BagX2046, Mmabatho, South Africa
E-mail: tshepna77@hotmail.com

References

1. Beighle D.E., Boyazoglu P.A., Hemken R.W., and Serumaga-Zake P.A. Determination of calcium, phosphorus and magnesium values in rib bones from clinically normal cattle. American Journal of Veterinary Research 1994:55:85-89.
2. Beighle D.E., Boyazoglu P.A., and Hemken R.W. Short term effects of dietary cation-anion balance on bone minerals homeostasis in the bovine. Journal of South African Veterinary Association 1995: 66(2):56-60.
3. Beighle D.E. The effect of gestation and lactation on bone calcium, phosphorus and magnesium in dairy cows. Journal of South African Veterinary Association 1999: 70(4):142-146.
4. Carter T.A., and Poore M. Deep stacking broiler litter as a feed for beef cattle. Department of Poultry and Animal Science. North Carolina Cooperative Extension 1995. Service Bulletin No: AG-515-2.
5. Cohen R.D.H. Phosphorus nutrition of beef cattle. 2. Relation of pasture phosphorus to phosphorus content of blood, hair and bone of grazing steers. Australian Journal of Experimental Agriculture and Animal Husbandry 1973:13:625-628.
6. Cooke J.A. and Fontenot J.P. Utilization of phosphorus and certain other minerals from swine wastes and broiler litter. Journal of Animal Science 1990:68:2852-2863.
7. Erickson G.E., Klopfestein T.J., Milton CT., Brink O., Orth M.W., and Whittet K.M., Phosphorus requirements of finishing feedlot calves. Journal of Animal Science 2002: 80:1690-1695.
8. Hurley L.A., Greene L.W., Byers F.M. and Carstens G.E. Site and extent of apparent magnesium absorption by lambs fed different sources of magnesium. Journal of Animal Science 1990:68:2181-2187.
9. Knowlton K.F. and Herbein J.H. Phosphorus partitioning during early lactation in dairy cows fed diets varying in phosphorus content. Journal of Dairy Science 2002:85:1227-1236.
10. Odenya W.O., Elzo M.A., Manrique C., McDowell L.R., and Wakeman D.L. Genetic and environmental factors affecting serum macrominerals and weight in an Angus-Brahman multibreed herd. 1. Additive and non-additive group, genetic effects of serum calcium, phosphorus and magnesium and weight at weaning. Journal of Animal Science 1992:70:2065-2071.
11. Raats J.G. Strategies for feeding animals during the dry period. University of Fort-Hare. Department of livestock and Pasture Science. South Africa. www.fao.org/Doc 2004. REP/004/Bulletin No: AC 152E.
12. Undi M., Training communal farmers in Namibia: The role of the university in rural development. University of Namibia. Department of Animal Science pgs 1-6.
13. Weiss W.P., and Wyatt D.J. Macromineral digestion by lactating dairy cows: Estimating phosphorus excretion via manure. Journal of Dairy Science 2004: 87:2158-2166.
14. Wu Z., Satter L.D., Blohowiak A.J., Stauffacher R.H., and Wilson J.H. Milk production, estimated phosphorus excretion and bone characteristics of dairy cows fed different amounts of phosphorus for 2-3 years. Journal of Dairy Science 2001:84:1738-1748.
15. Zinn R.A., Barajas R., Montano M., and Shen Y. Protein and energy value of dehydrated poultry excreta in diets for feedlot cattle. Journal of Animal Science 1996:74:2331-2335.

5/21/2011