RUN -19

Wafer As Dry Season Suppliment for Livestock Formulated With Different Sources of Binders and Levels of Inclusion in the Semi - Arid Region

H.B. Mohammed[1,2], I.R. Muhammad[2], Z.A. Aji, A.H. Abdullahi, U.I. Hassan and M. Baba
[1]Department of Animal Production, Dalanj University, Dalanj, Sudan; [2]Departments of Animal Science, Faculty of Agriculture, Bayero University, Kano
Corresponding author: H.B. Mohammed; E-mail: hamdenberima@yahoo.com+249 122650812;+234 7036698916

Abstract
A study was conducted in the semi-arid Kano; to investigate the effect of livestock feed binders and levels of inclusion on proximate and fiber composition of the resultant livestock wafers. Levels of inclusion revealed there were significant differences (p<0.05) amongst variables examined with the exception of DM. Inclusion of 28% levels of binders resulted in wafers with a higher amount of OM, CP, EE and NDF. Type of binders used in wafers prepared revealed significantly (<0.05) influence the variables evaluated. Cement significantly affected (p<0.05) the concentrate of ash. Similarly, Gum Arabic influenced (p<0.05), the values of CP in the wafer formulated while starch influenced (p< 0.05) OM, CF, EE, NDF and ADF. The 28% levels of wafers seem adequate since it was easy to handle and break by small ruminants, upon ingestion. The results from the current study show that 28% level of binder increase the components of the proximate composition, handling properly due to hardiness for ease of transportation and storage while the starch as binder produced wafer of better nutritive value relative to Gum Arabic or cement. It is therefore recommended that concentrate supplements as wafer for livestock can be produced using 28% level of starch inclusion.

Keyword: Wafers, Dry season, binders, proximate composition, semi-arid region

Introduction

Livestock production constitutes in part or whole of the livelihood of the great majority of populace either living in urban, peri-urban or rural areas of the semi-arid region of the world (Muhammad, 2008). The major production system is of low capital investment under the free-range systems. The free range system of livestock production is in the semi arid areas constrained by a variety of factors. One of the major factors are feed shortages during the dry season. Measures taken by some of the livestock farmers to address dry season feed shortage involves crop residues collection for conservation as fodder, haylage with few instance as hay and silage. The technology of making multi-nutrient blocks for dry and wet season feeding are available (Mubi *et al.,* 2013). Additionally, farmers in the semi arid zone of Nigeria realized the need to supplement their animals with minerals and energy sources in water as a supplement (Mohammed *et al.,* 2016).

It is therefore, the objective of this study was to investigate the effect of types of material to be used as livestock feed binders, their levels of inclusion on proximate and fiber composition, and the strength of the resultant binders in the formulation of livestock wafers.

Materials and Methods

The experiment was conducted at the Teaching and Research Farm, of Faculty of Agriculture, Bayero University Kano. Kano is located at (11059'N and 8026'E) in the semi-arid zone at an altitude of 460m above sea level. The area is characterized by tropical wet and dry climate; a dry season (Oct -April) and wet season (May-Sept.) with annual rain fall ranging between 787 – 960mm. The location has about 4-8 months of dry season with maximum and minimum temperatures of 33 and 15.2^{0}C, respectively. The temperature goes as low as 100C during harmattan (KNARDA, 2011).

The ingredients used in the formulation of wafer were categorized into four as: Energy sources constituting maize grain, rice straw and molasses; protein sources made up of cotton seed cake and granulated inorganic urea fertilizer; and mineral source which includes; salt (Nacl) and single super phosphate (SSP) as source of phosphorus (P), calcium (Ca), and Magnesium (Mg) along with the different sources of binders. The treatment examined were three sources of binders (starch, cement and gum Arabic) and six levels of inclusion (8, 12, 16, 20, 24 and 28) in the formulation of wafer for livestock. The 18 treatment combinations were replicated three times. The ingredients were weighed using a digital weighing scale according to the proportions indicated in Table 1.The urea, SSP, molasses and the binder were dissolved in 2 litre of water; it was then gradually sprinkled on the feed ingredients and thoroughly mixed. Thereafter, the mixture was transferred into 3 replicated cubic metal containers each measuring 25 x10 x 5 cm^3. The mixture was then compressed into the metal containers; and carefully oven dried at 60.50C for 3 days. Following oven drying, the wafers were carefully removed from the containers and samples taken for chemical analysis.

Table 1: Sources and levels of binder inclusion (%) in the formulation of livestock wafer

Variables	Levels of inclusion (%)					
Starch, cement or gum Arabic	8	12	16	20	24	28
Ingredients						
Energy Sources						
Maize	17	17	17	17	17	17
Maize bran	10	10	10	10	10	10
Rice straw	56	52	48	44	38	36
Molasses	1	1	1	1	1	1
Protein Sources						
Cotton seed cake	5	5	5	5	5	5
Granulated Urea	1	1	1	1	1	1
Mineral Sources						
Salt (Nacl)	1	1	1	1	1	1
Single Super Phosphate	1	1	1	1	1	1

Nitrogen (N) was determined using Kjeldahl method. Crude protein (CP) content was computed using N x 6.25. Crude fiber (CF), Ether Extract (EE), Nitrogen Free Extract (NFE), DM and Ash were determined according to the procedure outlined by AOAC (2016). Organic matter (OM) was calculated as the difference between DM and ash. Acid Detergent Fiber (ADF) and Neutral Detergent Fiber (NDF) were analyzed as outlined by vanSoest (2005).

Records of 3X6 treatments combinations of the poximate composition obtained from this research were analyzed using the general linear model of factorial experiment incompletely randomized design of SAS (2002). Differences between means were considered significant at a probability level of ($p<0.05$). Means were separated using Least Significance Difference (LSD).

Results and Discussion

The Table 2presents the effect of type of binders on proximate and fiber fractions of the wafers prepared, in Kano, semi arid, Nigeria. All the treatments examined significantly ($p<0.05$) influence the values obtained for the variables evaluated. Cement significantly affected ($p<0.05$) the content of ash and DM. Similarly, Gum Arabic influenced significantly ($p<0.05$), the values of CP and EE in the wafer formulated while starch influenced ($p<0.05$)OM, CF, EE, NDF, ADF and hemicellulose. The improvement in the ash content due to Cement as binder observed from this study suggests binders have some element of mineral which would likely add to the wafer diet formulated. For instance, reports by (Lelon *et al.,* 2010) revealed gum Arabic contain 2.94 to 3.16% ash while (Animashahun *et al.,* 2013) reported that starch contained 3.82% ash. The higher value of ash obtained from cement as a binder n the study in relation to Starch and Gum Arabic, may be due to source of cement being from limetone which could have a high proportion of minerals.

The value of ADF and NDF and of Starch as binder were significantly ($p<0.05$) higher than Cement and Gum Arabic. This may attributed to the high value of Carbohydrates and crude fiber in starch which could manifeste in high proportion of ADF and NDF. Finding from the present study revealed Gum Arabic had higher percent CP and NFE. Report by (Phillips, et al., 2001) indicated (2.41%) CP for Acacia Senegal, which could be higher than those obtained in either cement or starch. Animashahun *et al.* (2013) indicated that 2.39% CP for Starch. The results obtained revealed that Starch had a higher percent of OM, CF, EE, NDFand ADF. Either extract represents the oil content of the feed, which is a fraction of energy in the diet or when considered in conjunction with OM, the value is 91% suggesting the availability of substrate for energy from the formulated wafers. Table 3 presents the effect of levels of binder inclusion on proximate and fiber fractions of the wafers prepared, in Kano, semi-arid, Nigeria.

Composition of levels of inclusion revealed there were significant differences ($p< 0.05$) amongst variables examined with the exception of DM. The variations due to levels of inclusion manifested significant ($p< 0.05$), differences for the parameters examined. Finding of the present study revealed inclusion of 28% levels of binders resulted in wafers with higher amount of OM, CP, EE and NDF. The CP content of 20.1% indicates a diet high in nutrient that can serve as supplement for both growth and development for young animal as well as pregnant and lactating animals since NRC, (2001) recommended 12% and 16.5% as CP requirement for young and lactating animals, respectively.

Conclusion and recommendation

Inclusion of 28% level of binder increase the components of proximate composition, handling properly due to hardiness for ease of transportation and storage while the starch as binder producedwafer of better nutritive value related to

Gum Arabic or cement. It is therefore recommended that Starch is a good binder at 28% inclusion level in the formulation of livestock wafer.

Table 2: Effect of three binders (Cement, Gum Arabic or Starch) on the proximate composition of formulated livestock wafer

Treatments	Ash	DM	OM	CP	CF	EE	NFE	ADF	NDF
Cement	10.46^{a}*	93.40^{a}	82.95^{b}	18.70^{c}	30.92^{b}	2.41^{b}	36.49	28.78^{c}	45.34^{c}
Gum Arabic	8.20^{b}	91.58^{c}	83.38^{b}	20.19^{a}	32.9^{b}	2.66^{a}	37.29	29.54^{b}	48.96^{b}
Starch	7.09^{c}	92.27^{b}	85.18^{a}	19.49^{b}	34.69^{a}	2.77^{a}	36.84	35.62^{a}	55.29^{a}
SD+	1.717	0.919	1.1830	0.745	1.886	0.184	0.401	3.749	5.036

* Treatment means in the same column with different superscripts are significantly different ($p < 0.05$)

Table 3: The effect of levels of inclusion of binders on proximate and fiber fractions of the wafers prepared, in Kano, semi-arid, Nigeria

Trt	Ash	DM	OM	CP	CF	EE	NFE	NDF	ADF
8	7.2d*	91.6	82.9^{cd}	18.7^{c}	35.1^{a}	1.7^{d}	41.1^{a}	57.62^{b}	29.98^{e}
12	9.0^{bc}	91.6	82.2^{d}	19.8^{ab}	34.4^{ab}	2.1^{c}	34.1^{c}	58.64^{a}	34.00^{a}
16	8.7^{bc}	92.4	83.6^{bc}	19.3^{bc}	32.3^{c}	2.8^{bc}	35.7^{bc}	42.56^{f}	30.32^{d}
20	9.1^{b}	92.8	83.8^{bc}	19.7^{ab}	$33b^{c}$	3^{b}	35.6^{bc}	42.89^{e}	31.66^{c}
24	8.7^{c}	92.7	84.1^{b}	18.8^{c}	33.3^{bc}	2.6^{c}	36.6^{b}	49.88^{c}	33.01^{b}
28	9.4^{a}	92.8	86.3^{a}	20.1^{a}	28.4^{c}	3.6^{a}	35.9^{bc}	47.56^{d}	28.91^{f}
SD+	0.853	0.574	1.396	0.566	2.630	0.671	2.397	6.992	1.937

*Treatment means in the same colum with different superscripts are significantly different at ($p < 0.05$).

References

Animashahun, R.A., Omoikhoje, S.O., Edokpayi, M.I. and Adesina B.T. (2013).Nutrient Values of cassava residual pulp as affected by solid-state fermentation with Penicillium spp. International Journal of Applied Agricultural and Apicultural Research©(1&2): 42-47.

AOAC (2016) Association of Official Analytical Chemist Approved by AOAC Stakeholder Panel on Strategic Food Analytical Methods (SPSFAM). Final Version Date: March 31, 2016. Effective date March 2016; AOAC SMPR 2016.002

KNARDA, (2011). Kano Agricultural and rural development authority meteorological station reports: temperature record book and management unit, 11: 1-3

Lelon, J.K.., Jumba, J.K., Keter, W.C. and Oduor, F.D.(2010).Assessment of physical properties of gum Arabic from Acacia Senegal varieties in Baringo District, Kenya. *Africa Journal of Plant Sciences,*4(4): 95-98.

Mubi, A.A., Kibon, A. and Mohammed, I.D. (2013). Formulation and production of multinutrient blocks for ruminants in the guinea savanna region of Nigeria. *Agric. Biol. J. N. Am.,*4(3):205-215.

NRC (2001). Nutrient requirements of dairy cattle, 7th rev. ed. National Research Council, Natl. Acad. Sci., Washington, DC.

Phillips, G.O. and Williams, P.A. (2001). Tree exudate gums: natural and versatile food additives and ingredients. Food Ingredients and Analysis International, 23: 26- 28.

SAS (2002). Statistical Analysis System. Guide for personal computer version 9. SAS Institute, Inc. Carry, NC, USA