ISSN 0189-0514
J. Anim. Prod. Res. (2016) 28(2):161-168

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EFFECTS OF MORINGA LEAF MEAL INCLUSION IN DAIRY CATTLE MEAL AMONG DAIRY FARMERS IN KUMBOTSO LOCAL GOVERNMENT AREA OF KANO STATE, NIGERIA

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ABSTRACT

The study was conducted in Kumbotso LGA of Kano State to examine the effects of moringa leaf meal inclusion in dairy cattle meal among dairy farmers in Kumbotso Local Government in Kano State, Nigeria. The specific objectives were: to compare the inputs and output levels of cow fed with exclusively no moringa leaf meal (MLM) and cows inclusively fed with MLM, compare the cost and returns in feeding cows with MLM and cows that were not fed with MLM, and examine the perceptions of the respondents of use of MLM as supplementary feed. Zawachiki village was purposively selection and a selection of 15 farmers who willingly accepted to participate in the study. Also, 4 white Fulani (Bunaji) breed with average body weight of 300+ or -22kg were selected for the study. The four cows were labeled cow 123and 4.Cow 1 and 2 were the experimental group and cow 3 and 4 were the control. Cow 1and 2 were fed with3kg of wheat ofal and 1 kg of Moringa Leaf Meal/day and cow3 and 4 were fed with4kg of wheat ofal only per day. Cow 1 and 2 were the experimental group and cow 3 and 4 were the control. Feeding systems lasted for 2 weeks within which milk collection commenced on the 4th day for 3 consecutive days. Descriptive statistics (percentage and mean) and gross margin technique were used for analysis. The results showed that cow 1 produced 5.82 litres of milk per day and cow 2 produced 4.51 litres mean yield per day while cow 3 produced 3.71litres mean yield and cow 4 produce 3.81 litre respectively. Also, the gross income for experimental (cow 1 and 2) group was ₦123,000.00 and the total variable cost was ₦35,000.00 while the gross margin was ₦88,000.00. The gross income for the control (cow 3 and 4) was ₦91,440.00 and the total cost was ₦26,000.00 while the gross margin was ₦65,440.00 and the total mean perception (2.4) of the use of MLM by the respondents was above the cut up point indicating that use of MLM to increase milk yield was perceived by the respondents as a management strategy to increase milk yield. Therefore the study recommends that livestock extension agents should use an effective participatory extension strategy to encourage dairy farmers to use moringa leaf meal to feed dairy cows to increase milk yield and livestock feed industries should include moringa leaf meal component in feeds formulation

Keywords*:* value addition; moringa leaf meal; milk production; dairy farmers.

INTRODUCTION

In Nigeria, efforts have been made by several governments and private institutions to improve the productivity of livestock sub-sector through research and extension services. These are done to solve the problems that posed serious threat to productivity of livestock and the efforts are achieved through adoption of improved livestock management technologies by farmers (Bernard, 2011). The technologies that were developed for livestock sub-sector are either aimed for increased meat, egg or milk production. Nigeria is endowed

with large herds of cattle of different breeds. However, the traditional dairy industry is dominated by indigenous cattle breeds such as the white Fulani (*Bunaji*) whose potential for milk production is underexploited as a result of poor quality and quantity of feeds, thus, responsible for low milk yield (Otchere, 2016).

The white Fulani cattle is the most common breed in Nigeria representing about 51% of the total cattle population in the country, providing the quantity of locally produced milk to the teeming population (Bajwa *et al.,* 2005). Milk production from white Fulani is low with lactating yield ranging from 295-650kg under extensive management and 850-1300kg high nutrient intake (Ngere, 1985; Otchere, 2016). However, the traditional management systems practiced by farmers is the extensive system where cattle are allowed to walk long distance to grazed on poorly-managed native pastures, that is, grasses of various kinds which are low in nutrients essential for enhancing milk yield in addition to lack of training on appropriate method of milk production and improved livestock management practices (Adamu *et al.,* 1991). Consequently, grazing cattle are unable to meet their protein and energy needs from grazing pastures, vulnerable to pest and disease infestations, energy loss and exposure to contaminated pastures through long walk which often results to infections of endemic or epidemic diseases. This affects the productivity of the cows, thus, milk yield from the lactating cows are grossly reduce. Therefore, the need for the use of locally supplementary feed that that has high protein content, readily available and affordable at low cost to the farmers under the extensive system of management would go a long way to increase the supply of milk and milk products to the people.

Recent studies (Fuglie, 2001; Sanchez *et al.,* 2005; Sarwatt *et al.,* 2006; Gakuya *et al.,* 2014) have shown that the tree "*moringa oleifera"* also known as horseradish or drumstich and commonly or traditionally called "*zogele*" in northern Nigeria, has high protein content essential for increased milk yield in dairy cows and weight gain in broiler birds. The plant contained the eight essential amino acids, that is, the building blocks of protein, which can not be synthesized by the body and must be obtained through dietary sources to provide a solid base for physical health, growth and productivity of the animal (Rajangaam, 2011). The leaf component of *moringa oleifera* plant has the highest crude protein (Gakuya, *et al.,* 2014). This excellent nutritional characteristic makes *moringa* leaves suitable for value addition in the feeding of dairy cattle to enhanced milk production. *Moringa oleifera* leaves fed to livestocks such as cattle and poultry have been found to increase egg laying in poultry birds and milk production, dry matter intake and digestibility of the diet in dairy cows (Sanchez, *et al,.* 2001; Nuhu, 2010). Thus, In northern Nigeria, Kano State in particular, *moringa oleifera* plants are commonly grown in the farm or around the family compound and leaves are readily eaten by cattle sheep and goat in addition to its delicacy uses (Fahey *et al.* 2001). The leaves are used to prepare traditional dishes of various types such as vegetable salad and soup. However, there is paucity of information on the knowledge of the use of *moringa* leave powder for milk production among livestock farmers in the traditional grazing system in the study area. Livestock farmers might have not been trained through participatory extension approach on the use of *moringa* leaf powder technology in dairy production in the study area. Therefore, the need to examine the use of *moringa* leave powder in the traditional feeding system of dairy cows to increase milk production among farmers is seen as time conscious.

The specific objectives were to:

compare the inputs and output levels of cows fed with exclusively no moringa leaf meal and cows inclusively fed with moringa leaf meal in the study area;

compare the cost and returns in feeding dairy cows with moringa leaf meal and the cows that were not fed with moringa supplement, and

examine the perceptions of the farmers on the use of moringa leaf meal as supplementary feed.

Review of related literatures

Literatures (Ojioko *et al*., 2011; Gakuya *et al*., 2014) have described *moringa* tree as one of the most useful multi-purpose plant where every part of the plant is edible by humans and livestocks. Its leaves and pods have been reported to be of great nutritional value. The leaves and the young green pods can be eaten like other vegetables. In livestock production, *moringa* leaves constituting the major components of the feed had been reported to produced good results in terms of weight gain in poultry birds (Gakuya *et al.*, 2014), digestibility, intake and increased milk yield (Sanchez *et al*,.2005) and weight gain in rabbits (Nuhu,2010). Several Studies have been conducted on the effects of *moringa* meal inclusion on the diet of dairy cows. Sanchez, *et al.* (2005) reported that milk production was higher from the cows supplemented with *moringa* than those offered with hay alone or sorghum silage basalt diet. Bajwa (2004) and Foidal (1999) reported that cows fed with *moringa* had about 13% and 30% increase in milk yield over the cows fed with *hyparenial rufa* grass or sorghum straw. The findings have proofed *moringa* leaves to be of immense importance in contributing to the growth of dairy industry particularly in developing countries that are characterized with poor quality feeds for milk yield. The nutritive attributes of *moringa* leaves has been given as being responsible for the increase in milk production by the lactating cows fed with it. Sanchez *et al.* (2005) stated that the lactating enhancing effects of *moringa* leaves increases the hormone that stimulate the mammary glands that produce milk. The present of other nutritive substance contained in the leaves and pods such as the high protein level, carotene, iron ascorbic acid vitamins and minerals make *moringa* leaves not only increase milk yield but improve the quality of milk from the cows fed with the plant (makkar and Becker, 1996; Robert and Paul, 2008; Nuhu, 2010).

MATERIAL AND METHODS

This study was conducted to examine the effects of *moringa* leaf meal (MLM) inclusion in dairy cattle meal among dairy farmers in Kumbotso local Government area (LGA) of Kano State. The first stage of sampling involved a purposive selection of Kumbotso LGA which has the largest herds of cattle in Kano State (KNARDA, 2009). Zawachiki village which has the largest number of livestock farmers in Kumbotso LGA was purposely selected. An enlightenment campaign was carried out, followed by several meetings of focused group discussion with interested farmers. Fifteen (15) dairy farmers were purposively selected because they offered to participate willingly in the use of *moringa* leaf meal feeding system from the total population of 36 pastoralists in the study area. The sampled size was made up of 13 male and 2 females. Four white Fulani (Bunaji breed) cows in their second time lactating period with average body weight of 300±22kg were selected from the herds of the farmers and used for the study. The selection was done with the farmers who have the pedigree information of the cows. The cows were labeled 1, 2, 3 and 4 respectively and each of them is a treatment in this study. The four cows were divided to experimental and control groups. Also, four farmers were assigned to each group and were responsible for mixing of *moringa* leaf with wheat ofal, feeding and collection and weighing of milk while the others were observing actively. The first two (1 and 2) cows were the experimental group and the last two (3 and 4) were the control. All the cows (treatments) were first of all dewormed with a broad spectrum drug (Albendazole) and ivomectrin injection for the control of external parasites and fed with wheat ofal supplement one week prior to commencement of feeding *moringa* leaf meal. *Moringa oleifera* leaves were harvested and dried in the shade to about

95% dry matter (DM) content and milled to powder form by the farmers. 1kg of *moringa* leaf meal and 3kg of wheat ofal were mixed properly and fed to cow 1 and 2 and only wheat ofal was fed to cow 3 and 4 continuously. This Feeding pattern was maintained for 2 weeks and feeding was done every morning and evening, that is, before and after the cows had returned from grazing. Milk collection started on the 4th day of feeding *moringa* leaf meal to 1 and 2 and the collections of milk were done from all the cows separately and weighed every morning and evening for 3 consecutive days. Primary data were used for the study and the data were obtained through observations and questionnaire to generate relevant information for the study. Information such as the quantity of wheat ofal and *moringa* leaf meal administered, cost of the variable inputs, quantity of milk yield per day for the two groups, income/amount obtained from the sales of milk, and the perceptions of farmers on the process of using moringa leaf on dairy cow were all recorded. Perception of the respondents on the used of moringa was measured by asking the respondents to react to a number of statements about their agreement and disagreement based on their observations using a 3 point type likert scale with 3 disagreed (DG), 2 undecided (UN) and agreed (AG) and the mean of the 3 point scale was determined by adding the 3 point scale (3+2+1=6) and divided by 3 equal to 2.0 to obtain the cut up point. Therefore, 2.0 was used as the mean threshold, meaning any mean perception from 2.0 to above indicates that the farmer perceived the statement as "agree" and any mean lower than 2.0 not perceived as "disagree". Data were analyzed by the use of descriptive statistics (percentage, mean and frequencies) and gross margin technique.

Gross margin is the difference between gross receipts or income and total variable cost of production and is expressed as: GM = TR – TVC…….(1)

Where;

GM = gross income from milk production in naira/cow÷

TR = Total returns from milk yield in naira (Total Output x Unit price)÷

TVC = Total variable cost (drugs,wheat ofal, moringa leaf meal and labour÷

RESULTS AND DISCUSSION

The results in Table 1 shows the mean milk yields of the cows fed with only wheat ofal supplement. It indicates that treatment 2 produced 2.3litres of milk followed by treatment 3 with 2.2 while treatment and treatment 1produced only 2litres of milk. The low milk yield is associated with poor quality and unavailability of tropical grazing pastures which have low amount of macro and micronutrients and essential amino acid, particularly during the dry season, as also expressed by Fahey (2009). This result is in consonance with findings of Sanchez *et al.* (2005) who reported that tropical dairy cows produce an average of 3.1kg of milk yield. Also Otchere (2016) made similar observation in the sub-humid zone of northen Nigeria that bunaji cows produced an average of less than 3kg of milk.

In Table 2 the results of the experimental group fed with 3kg of wheat ofal and 1kg of *moringa* leaf meal (MLM)/day is as follows: cow 2 produced 5.83 litres mean yield of milk per day and cow 4.51 litre mean while the control group that were fed with 4kg of wheat ofal only showed that cow 3 produced 3.71 litres mean yield and cow 4 yielded 3.81 litres respectively. This implies that the 1 kg inclusion of *moringa* meal in the diet of cow 1 and 2 has enhanced the quantity of milk yield of the cows because of the presence of high amount of important nutrient elements in *moringa* meal that aid more secretion of milk. This view is supported by Robert and Paul (2008) that the leaves of *moringa* are highly nutritious containing protein, vitamin A, B and C respectively.

Table 1: Distribution of the treatments according to their milk yield before MlM was fed

Treatment (cow)	Wheat ofal	Yield/Day 1	Day 2	Day 3	Total	Mean milk yield per day
1	2	1.99	2.00	2.01	6.0	2.0
2	2	2.4	2.2	2.3	6.9	2.3
3	2	2.3	2.1	2.2	6.6	2.2
4	2	2.0	2.2	2.1	6.3	2.1

Table 2: Distribution of the treatments fed with wheat ofal and MLM and those fed with wheat ofal only according to their milk yield

Trt (cow)	Input/day		Output (litre/Day)			Total (litre)	Mean (litre/day)
	Wheat ofal	MLM	1	2	3		
1	3	1	4.51	4.50	4.52	13.53	4.51
2	3	1	5.77	5.85	5.84	17.46	5.83
3	4	0	3.66	3.73	3.74	11.13	3.71
4	4	0	3.85	3.78	3.80	11.43	3.81

The result in Table 3 showed that experimental cows were fed with a total of 18kg of wheat ofal and 6kg of MLM for 3 days and produced about 58% of the total milk while the control were fed with 24kg of wheat ofal only for 3 days also and produced 42.1% of the total milk and the yield difference of experimental treatment over the control was 15.8% (8.53ltr). This implies that dairy cows that were fed with supplementary *moringa* leaves have the capacity to yield more than the cows that were fed with tropical pastures only. This results are in consonance with findings of Foidal et al. (1999) who reported that cows supplemented with *moringa* had 13% and 30% respectively higher milk production than cows fed with a basal diet of *hyparrenia rufa* grass of sorghum vulgare straw in Dakar. Also corroborated was findings of Sanchez *et al*. (2005) that MLM increased milk yield from 3.1 to 4.9 and 5.1 kg /day among small dairy farmers in Managua.

Table 3: Milk yield difference between the experimental and the control treatments

Trt and yield difference	wheat ofal (kg) 3 days	MLM (kg) 3 days	Milk yield (litre) 3 days	Percentage
Experimental	18	6	30.99	57.9
Control	24	0	22.56	42.1
Total	42	6	53.55	100.0
Yield difference			8.43	15.7

The results in Table 4 shows the gross margin for cows fed with wheat ofal supplement only and cows fed with ofal and MLM for milk yield. Results indicated that the gross income for experimental group fed with MLM (cows 1 and 2) was 123,000.00 and the total variable cost was ₦35,000.00 while the gross margin was ₦88,000.00. Similarly the gross income for the control treatment that had only wheat ofal was ₦91,440.00 and the total variable cost was ₦26,000.00 while the gross margin was ₦65,440.00. The implication shows that the tendency for high demand of MLM will lead to high profitability and increase in income of dairy farmers in the in the future, if a wide scale proportion of dairy farmers resort to use it.This view has also been expressed by Yisehak *et al.* (2011) on the nutritive influence of *moringa* plants for food security in southern Ethiopia.

Table 4: Results of gross margin for the experimental and control trts.

Item	**Experimental trt (cow 1&2)**	**Control trt (cow 3&4)**
	Cost value (₦)	Cost value (₦)
Variable cost		
Moringa leaves	9,000.00	Nil
Wheat ofal	21,000.00	21,000.00
Medication	2,000.00	2,000.00
labour	3,000.00	3,000.00
Total	35,000.00	26,000.00
Gross income		
Sales of milk	123,000.00	91,440.00
Gross margin	88,000.00	65,440.00

The result in table 5 showed a total mean score of 2.4 which is above the cut up point set for the study, implying that respondents agree with the perception statements on the use of MLM in dairy production. The results shows that the most perceived results of moringa inclusion was use of MLM increase milk yield with 3.0 mean perception of the respondents, followed by MLM does not change the colour of the milk had 2.8 mean and the leasts perceived moringa result were The practice can only be used by educated farmers and use of MLM produce different taste of milk with 1.3 and 1.6 mean perceptions of the respondents respectively. These results clearly showed that farmers observed that use of MLM enhances the capacity of the cow to produce more milk without reducing its milk quality. This result agree with findings of Sanchez et al. (2005) on the Creole Reyna breed in Managua. This implied that the moringa supplement might have had a medicinal effect in the cows and this had given the cows more strength and agility to restrain bulls that disturbed the cow.

Table 5: Distribution of farmers according to their perceived use of MLM supplement on dairy cow

Perception statement	AG	UN	DA	WT	MS	TMS
Use of MLM is the same with the use of other feed supplements	27	6	4	37	2.5	2.4
Use of MLM increases milk yield	45	0	0	45	3.0	
Use of MLM does not reduce the quality of milk	36	2	2	40	2.6	
Use of MLM does not change the colour of the milk	39	4	0	43	2.8	
The practice increases the income of dairy farmers	36	4	1	41	2.7	
The taste is good	39	4	0	43	2.8	
Use of MLM make the cows to eat more feed/grass	24	6	4	34	2.2	
Use of MLM produced different taste of the milk	6	10	8	24	1.6	
The practice can only be used by educated farmers	6	2	12	20	1.3	
The practice is too demanding	6	6	10	42	2.8	
There was a sign that the cow fed with MLM were stronger	21	10	3	34	2.2	

Multiple responses allowed

CONCLUDING REMARKS

Inclusion of *Moringa oleifera* meal in the feeding system of white Fulani (Bunaji) breed increased the milk yields especially during the dry season and this had improved the income of the farmers from the sale of milk. The study therefore recommends that livestock extension agents should devise an effective participatory extension strategy to encourage dairy farmers to use moringa leaf meal to feed dairy cows to increase milk yield, livestock feed industries should include MLM component in feed formulation and moringa tree planting campaign should be mounted by the Kano State government/KNARDA to encouraging farmers to plant moringa tree massively to make the crop available for livestock feed.

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