TECHNICAL BULLETIN

No. 42, 2023

Value Addition to Feeds and Fodder for Safe Livestock Production

In animal nutrition, feed additives are used for the purposes of improving the quality of feeds, animal health, animal production performance, quality of animal products with the ultimate aim of consumer health and mitigating undesirable environmental impacts of animal production. During the last five decades, chemical feed additives, especially antibiotics, had been widely used as growth promoters. Residues from antibiotics in animal products and growing resistance to antimicrobial agents in humans have led to the banning of the use of antibiotics as growth promoters in animal feeds on January 1, 2006 by EU. This ban accelerated the search for alternative, safe animal feed additives. A major cause of low livestock productivity in Bangladesh is feed deficit. In animal feeds, there are a 20% dry matter and 71% digestible crude protein shortages in the country which hinder sustainable livestock rearing. Feed additives are used for the purposes of improving animal health and production performance.

Fig. 1. Moringa leaves as a cattle feed

Natural herbs (Fig. 1) are a very good alternative being biologically beneficial for animals in many ways. There are many natural herbs in Bangladesh, which have a century-old history of being used as traditional medicines in treating both humans and livestock. Plant extracts, such as, saponins, tannins and essential oils derived from yucca, chestnut, garlic, ginger, etc. have been used in ruminant feeds to modulate rumen fermentation. A growing awareness among people to consume antioxidant-rich foods necessitates production of antioxidant-rich milk and meat for human consumption. This KGF sponsored study was designed to determine and characterize bioactive components of natural herbs available in Bangladesh, and to study their impacts on the milk fatty acid profiles in ruminants under local conditions.

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Methodology

The 2,2-diphenyl-1-picryl hydrazyl (DPPH), Vitamin C contents and mineral contents of 11 herb species using thin layer chromatography (TLC) and biomass yields of feed herbs were studied. On the basis of these studies, 8 herbs including moringa, pineapple, ivy-gourd, spear-mint, garlic, neem, plantain, and lemon grass were selected to determine the total flavonoids, total flavonoids, total phenolic and vitamin E contents. Proximate components, (dry matter (DM), crude protein (CP), crude fiber (CF), ether extract (EE), nitrogen-free extract (NFE) and ash contents of the selected herbs were determined. The samples were freeze- and shade-dried. Total phenolic, flavonoids and Vitamin E contents were determined in the fresh, freeze-dried and shade-dried samples. Neem was later on excluded due to the bitter taste and coarseness. Specific bioactive components from the remaining 7 herbs were determined using high performance liquid chromatography (HPLC) and gas chromatography-mass spectrometry (GC-MS) in Japan.

Fig. 2. Herb mixture feed developed using four herbs (pineapple waste, moringa leaves, ivy gourd and lemon grass)

In addition to biomass productivity, the herb plants were chosen for their bioactive components and availability. Garlic and spearmint were also excluded later due to low biomass availability. The shade dried forms were chosen over freeze dried forms for less loss of bioactive components, sustainability, and convenience.

A herb mixture (Fig. 2) was prepared using moringa, pineapple waste, ivy-gourd and lemon grass selected on the basis of biomass yield and availability (40%), level of bioactive components (40%), minerals profiles (10%), others (cows preference, milk volatility) (10%). Pineapple waste was collected from Modhupur, Tangail. Finally, a feeding trial was conducted at the BLRI Regional Station, Baghabari Ghat, Sirajganj using 20 mid-lactating cows and 5 cows/treatment. The duration of feeding trial was 63 days and all samples including milk, blood, feces and feed were stored at -200C pending analysis.

Results and Outputs

In the phytochemical profiling of the herbs (Table 1), novel bioactive components like total phenolic, flavonoid and Vitamin-E contents were determined in fresh, shade dried and freeze dried samples. The nutritive values of the herbs used to prepare the herb mixture are given in Table 1.

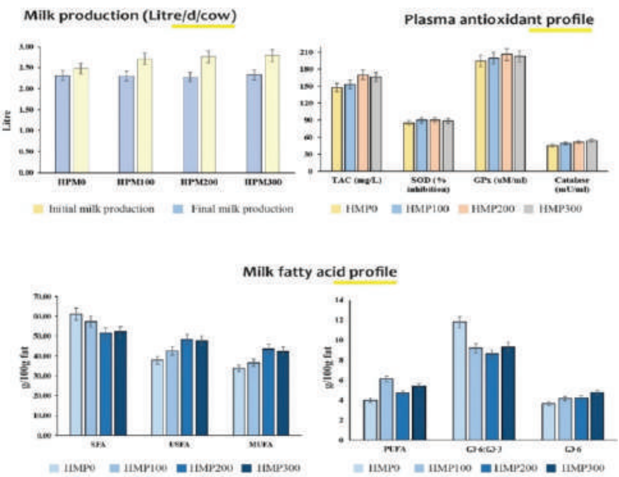
Table 1. Nutritive value of selected forage herbs

Herb	*DM	CP	CF	EE	NFE	Ash	ADF	NDF	dO	ME (MJ/kg DM)
		(g/100g DM)								
Pineapple waste	15.9	6.5	22.0	3.5	64	4.5	28	52	54	8.5
Moringa	26.5	23.7	11.8	3.8	52	9.0	18	19	68	9.6
Ivy-gourd	15.5	28.5	14.2	2.6	38	16.4	32	44	57	7.8
Lemongrass	27.2	5.4	26.5	5.2	8.8	54.1	45	51	58	8.0

DM: Dry matter, CP: crude protein, CF: Crude fiber, EE: ether extract, NFE: nitrogen free extract, ADF: acid detergent fiber, NDF: neutral detergent fiber, dO: In vitro organic matter digestibility, ME: metabolizable energy

*g/100g of fresh herbs

Incorporation of the herbs powder mixture with the total mixed ration (TMR) diet increased milk yield by 20% compared with the control diet (TMR). The herbs mixture improved the level of secondary metabolites in poor quality ration which enhanced the blood antioxidants status and milk antioxidants level especially fatty acid profile (Fig. 3). It significantly improved the milk yield and decreased the cost of feed through reducing the feed conversion ratio (FCR) resulting in enhanced farmers' income. The antioxidant status of dairy cows was improved due to incorporation of herbs mixture. As a result, milk antioxidants especially the zinc level increased which would help boost immunity in human consumers.



HPMO= Total Mixed Ration (TMR); HPM100= TMR+100gHPM/animal; HPM200= TMR+200gHPM/animal; HPM300= TMR+300gHPM/animal

Fig. 3. Influence of herbs powder mixture (HPM) on milk yield, plasma antioxidant level and milk fatty acid profile of dairy cow

Expected Impact

The herb powder mixture developed by this project expected to boost milk supply and improve milk quality. This will help increase the national milk yield and at the same time enhance growth of the antioxidant fortified milk chain market. As a result, the dairy farmers' income and socioeconomic conditions will improve. Antioxidants in milk will immunity in consumers to fight infectious and non-contagious diseases and anti-microbial resistance (AMR).

Recommendations

The promising findings of the laboratory trials under this project call for trials at farmers' level for modification, validation, scaling up and finally technology dissemination in collaboration with the collaboration with the Dept of Livestock Services and cattle feed entrepreneurs.

This Technical Bulletin has been prepared on the basis of technical information available from a completed BKGET-KGF Funded CGP Project, the details of which are given below:

Project Code and Title: TF-47-L/17. Value Addition to Feeds and Fodder through Bioactive Component-Rice Herbs for Safe Livestock Production

Principal Investigator: Dr. Al Mamun, Professor, Dept of Animal Nutrition, BAU, Mymensingh, Cell: 01715051093, e-mail: mamunshimu@yahoo.com

Project duration: February 2018 - January 2023

Edited by:
Nasrin Akter, GM Panaullah and Nathu Ram Sarker
Krishi Gobeshona Foundation (KGF)

Published by:
Krishi Gobeshona Foundation, AIC Building, 3rd Floor, BARC Campus, Farmgate, Dhaka-1215, Bangladesh, Cell: 01729 480988, Website: www.kgf.org.bd, e-mail: kgf-bd@kgf.org.bd