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Effect of different additive sources on milk yield and composition of lactating buffaloes

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ABSTRACT

In-vitro study was conducted to evaluate the effect of dried yeast (*Saccharomyces cervisiae*[1026]) and yeast selenium as biological additives, sodium acetate and sodium succinate as chemical additives and chamomile flower, garlic and fenugreek seeds as natural additives on dry matter (IVDMD) and organic matter (IVOMD) disappearances. Results clearly indicated that combination of yeast and chemical mixture and combination of chamomile and chemical mixture supplementation recorded the highest rate of IVDMD and IVOMD. Sixteen lactating buffaloes after two weeks of calving were divided into 4 groups (four animals each) using complete random block design to evaluate the effect of chemical mixture (as second control), yeast and chemical mixture and chamomile and chemical mixture on the productivity of lactating buffaloes. Animals were fed on 60% concentrate feed mixture (CFM), 20% rice straw and 20% berseem clover (control group), control ration + chemical mixture (sodium acetate 100 g/head/day + sodium succinate 3.5 g/head/day)(T_1); control ration + chemical mixture + dry yeast 10 g/head/day (T_2) and control ration + chemical mixture + chamomile flower 10 g/head/day (T_3). Dry matter intake (DMI) was slightly increased for animals fed on T_1, T_2 and T_3 rations compared with control. Apparent nutrients digestibility and total digestible nutrients (TDN) were significantly improved by treatments. Milk yield, 4% fat corrected milk (FCM), milk protein, fat, lactose, total solids, ash contents, feed efficiency (Milk yield/DMI and FCM/DMI) and economic efficiency were significantly higher for animals fed T_3 followed by T_1 and T_2 and then control. Serum total protein, albumin, globulin and glucose contents were higher in animals received experimental additives than those received control. It may be concluded that adding the combination of chamomile, sodium acetate and sodium succinate to rations improved the productivity of lactating buffaloes with no deleterious effects on general health.

1. Introduction

One of the most successful attempts accomplished in the last decade is using feed additives such as biological additives (yeast cultures), natural additives (medicinal plants as its seeds) and chemical additives (sodium acetate and sodium succinate). These additives help in improving animal productivity and increasing milk production. Incorporation of microbial additives such as a culture of *Saccharomyces cerevisiae* to the diet has become a common practice in ruminant nutrition. Various *S. cerevisiae* based products have been shown to affect dry matter intake (DMI), rumen pH, and nutrient digestibility (Campanile et al., 2008; Wang et al., 2009), however, most studies have been conducted with lactating cows. In-vitro and in vivo studies have shown that yeast cultures stimulate growth of rumen cellulolytic bacteria (Erasmus et al., 2005). The dietary supplementation with *S. cerevisiae* increase organic matter digestibility and guarantee higher energy availability led to higher milk yield and lower fat mobilization (Campanile et al., 2008).

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In the last decade, natural additives such as fenugreek seeds, *Carum carvi*, *Nigella sativa* and chamomile flower have been increased the central concern of scientists as useful resource for treating diseases and improving animal productivity (Abo El-Nor, 2000 and Kholif and Abd El-Gawad, 2001). Medicinal plant seeds improved the productivity of lactating animals and its hormonal alert effect on animals is resulting from increasing prolactin and growth hormone release, in addition to activating udder tissues in line with increasing glucose concentration with a reduction in cholesterol concentration in blood (Abo El-Nor et al., 2007).

Chemical additives have been used to improve animal productivity from milk that depends on direct manipulation in rumen environment. The remarkable effect is increasing propionate level in the rumen with maintaining the acetate to propionate ratio to be constant in order to maintain fat concentration in milk. Several investigators indicated that adding 7 mg/kg live body weight/d from sodium succinate to lactating buffalo's ration before milking increased milk production to more than 20% of control animals (Abo El-Nor, 2000). Addition of sodium acetate, succinate, propionate and bicarbonate as buffers resulted in improving milk production (El-Sayed, 2002).The aim of the present work is to study the effect of chemical, biological and natural additives either alone or combination on milk yield and composition of lactating buffaloes.

2. Material and methods

This study was conducted at the Experimental Farm in Shalakan, Faculty of Agriculture, Ain Shams University and Dairy Science Department, National Research Center, Dokki, Cairo, Egypt during January to April 2009.

2.1. Material

Natural additives as garlic (*Allium sativum* L.), fenugreek and chamomile (*Matricaria chamomile*) were obtained from El Harraz Market, Cairo, Egypt. The cultures of yeast (*S. cerevisiae*^{c}) and selenized yeast^{1026} (with organic selenium) were maintained on Malt agar medium and obtained from Microbial Chemistry Lab. while, sodium acetate and sodium succinate were obtained from Dairy Lab. National Research Center, Dokki, Cairo, Egypt.

2.2. In-vitro study

Seven feed additives either alone and or six of their combinations were tested to determine in-vitro dry matter and organic matter disappearances using two stages technique according to method of Norris (1976). The feed additives used were, garlic, fenugreek, chamomile flower (natural), dried yeast, selenium yeast (biological), sodium acetate, sodium succinate (chemical). Concentrate feed mixture was added to all tested additives.Rumen contents samples were collected after 4 h after morning feeding from three adult Baladi bucks fed on concentrate feed mixture (60%), berseem hay (20%) and rice straw (20%) diet. Rumen contents were transferred directly to the laboratory in separate warmed oxygen free plastic jugs. Then strained through two layers of cheese cloth and the obtained liquor was used for the in-vitro study.

2.3. Lactation trial

According to results of in-vitro trial, the proper dry matter and organic matter disappearances of different additives, combinations of yeast and chemical mixture and chamomile and chemical mixture were chosen to be used in the lactation trial.

2.4. Feeding and management

Sixteen lactating buffaloes after two weeks of calving, aged 5–6 years and weighting on average of 555 ± 35 kg at the 3rd–4th season of lactation) were randomly assigned into four groups (four each) using complete random block design. The experimental period was extended to 12 weeks. The animals were introduced to the following treatments; 1) control group fed on 60% concentrate feed mixture (CFM), 20% rice straw and 20% berseem clover (control), 2) control ration + chemical mixture (sodium acetate 100 g + sodium succinate 3.5 g/head/day (T_1, second control), 3) control ration + chemical mixture + dry yeast 10 g/head/day (T_2) and 4) control ration + chemical mixture + chamomile flower 10 g/head/day (T_3). Experimental additives were mixed with 1 kg of CFM and introduced to animals before the daily morning meal. Diet was formulated to meet the animal's requirements (A.R.C., 1983). Animals were fed individually and concentrates were offered twice daily during milking time at 6:00 a.m. and 4:00 p.m. while, berseem and rice straw were offered at 8 and 11 a.m., respectively. Dry matter intake (DMI) was recorded every two weeks by weighing feeds offered and refused by the animals. Fresh water was available to the animals all time. Chemical composition of ingredients and calculated total mixed ration are shown in Table 1.

2.5. Apparent digestibility

Three digestibility trials were applied during the last three days every month using three animals from each group. Silica

Table 1
Chemical composition (on dry matter basis %) of the experimental CFM and feed additives.

Item	CFM	BC	RS	YC	CF	FS	GS	TMR
Dry matter	92.30	13.10	91.80	89.69	89.01	91.0	15.11	76.36
Organic matter	90.60	88.40	85.20	88.20	94.3	97.0	95.35	89.08
Ash	9.40	11.60	14.80	11.80	5.7	93.0	4.65	10.92
Crude protein	14.10	13.80	3.50	20.3	18	26.0	3.35	11.92
Ether extract	4.08	2.60	1.40	4.30	4.6	8.0	0.60	3.25
Crude fiber	15.23	27.40	34.20	8.25	36.5	48.0	2.1	21.46
Nitrogen free extract	57.19	44.60	46.10	55.35	35.2	25	89.3	52.45
NDF	35.26	45.87	62.70	19.3	25.65	28.0	–	42.87
ADF	20.21	38.72	37.70	8.7	18.34	15.3	–	27.41
Hemicellulose	15.05	7.15	25.0	10.6	7.31	16.7	–	15.46
Cellulose	11.5	25.09	33.1	5.4	12.36	7.2	–	18.54
lignin	3.5	8.33	4.07	–	3.5	1.2	–	4.58

CFM: Concentrate feed mixture consisted of 35% yellow corn, 25 % wheat bran, 23% decorticated cotton seed meal, 15% rice bran, 1.5% ground limestone and 0.5% Mineral and vitamin mix contained 42 ppm Co, 3500 ppm Cu, 20,000 ppm Fe, 12,000 ppm Mn, 12,00 ppm Zn, 1200 ppm I, 3800 IU/g of vitamin A, 1200 IU/g of vitamin D, and 3 IU/g of vitamin E.
BC: berseem clover, RS: rice straw, YC: yeast culture^{1026}. CF: chamomile flower, FS: fenugreek seeds, GS: garlic seeds, TMR: total mixed ration (calculated).