Effect of adding different levels of commercial baker's yeast to concentrate diet of multiparous mid-lactation Holstein cows on some blood parameters

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Abstract
This study was conducted in the Taj Al-Nahrain company-Al-Qadisiya Province for 84 days to investigate the effect of adding different levels of commercial baker's yeast (BY) Saccharomyces cerevisiae, 0, 15 and 30 g/cow/day to concentrate diet offered to German Holstein Friesian lactating cows on some blood parameters. Nine multiparous Holstein cows in their mid-lactation were used. Daily feeding program applied in that station included 1 kg of concentrate diet per 3-4 kg milk produced divided into morning and evening meals, 10 kg of green forage, 10 kg of ensiled corn crop residue and free choice of rice straw. Results revealed that adding BY at level of 15 and 30 g/cow/day increased ($P<0.05$) serum concentrations of total protein (STP) from 7.65 to 8.79 and 7.97 g/100 ml, and triglyceride (STG) from 8.37 to 14.41 and 11.04 g/100 ml respectively. However, adding BY and increased its levels decreased ($P<0.05$) concentration of urea nitrogen (SUN) with no effect on glucose (SG) concentration .

Keywords: Holstein Friesian, Commercial baker's yeast, Blood parameters

Introduction

Undoubtedly animal production sector in Iraq faced a noticeable decline since eighties, number of farm animals including cow and buffalos were decreased as mentioned by the Arab Organization of Agriculture development, AOAD [2]. Due to abatement of arable lands and low production of forages, depending on low quality feed resources was increased leading to decrease animal production, particularly that of dairy cow .

For better production and composition of milk by cows, it is necessary to enhance the nutrient utilization from available feed resources, many feed supplements and additives like antibiotics, buffers and probiotic have been used to secure that goal. However, the increasing concern regarding the use antibiotics, the risk of using chemical additives on rumen microbial ecosystem and residues may left in milk led to increase interest in use of probiotics [22]. Therefore, probiotic feed additives including, yeast, bacteria and fungi have recently gained higher attention .

Yeast cells are known to increase rumen microbial activity due to be high vitamins, enzymes and some unidentified cofactors contents [7]. Mode of action of yeast on rumen metabolism includes stabilizing rumen pH by maintaining the reducing potential in the rumen, increasing fiber digestibility by

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supporting cellulolytic microbes, reducing lactic acid production by utilizing starch and sugars and releasing vitamins and growth factors to stimulate bacterial growth [21 .[

Since commercial baker's yeast of low prices are available in local markets, the current study was conducted to investigate the effect of adding these products in concentrate diets offered to dairy cow on blood parameters .

Materials and methods

This study was carried out at the Taj Al-Nahrain company-Al-Qadisiya station of dairy cow for 84 days including 14 days as a preliminary period to investigate the effect of adding commercial baker's yeast (BY), Saccharomyces cerevisia (Italian bakery, 3.1×108 cfu/g) available in local markets at levels of 0, 15 and 30 g/cow/day on blood parameters of German Holstein Frisian raised in local conditions. Nine cows in mid lactation period of its third season were selected according to daily milk production and randomly distributed into the experimental treatments. Feeding regime followed in that station involved offering concentrate diet, green forages, silage of corn crop residue and rice straw. Concentrate diet was prepared by mixing grain blend (manufactured by Egyptian nourishing company) with local yellow corn at ratio of 40:60 .

Commercial baker's yeast (BY) was locally added to the experimental concentrate diets, control diet was free of BY. Concentrates were offered at rate of 1 kg / 3-4 kg of daily produced milk with two equal morning and evening meals. Green forages were offered at 10 kg/cow/day (about 1.87 kg DM). Silage (Iranian production) was offered at 10 kg/cow/day (about 3.05 kg DM). Silage was characterized with accepted fermentation and quality characteristics, pH, ammonia nitrogen and total volatile fatty acids concentrations were 3.5, 0.98% of total nitrogen and 2.55 mEq/DM, respectively. Rice straw was offered ad libitum. Table 1 shows the chemical composition of experimental diets .

Table 1- chemical composition of experimental diets(%)

Diets	DM	% of DM				
		OM	CP	CF	EE	NFE
Concentrate	91.67	81.46	7.55	5.8	3.75	63.9
Green forages	18.70	89.45	4.40	16.25	3.19	65.61
Silage	30.50	89.45	3.03	29.76	2.78	53.88
Rice straw	92.25	77.22	2.73	35.13	1.45	37.91

Chemical analysis of concentrate, green forage, silage and rice straw were performed according to [3]. Blood samples were collected from milk vein (Subcutaneous abdominal vein) before the end of the study after the morning feeding to investigate the effect of adding BY on some blood parameters. Blood samples were collected using 10 ml sterilized syringes and transported to dried sterilized tubes free of anticoagulants. Serum was separated using centrifuge at 3000 rpm for 5 minute and divided into four portions; each was emptied in sterilized 1 ml Eppendorf tubes and kept frozen at -20℃ .

Concentrations of glucose (SG), total protein (STP), urea nitrogen (SUN) and triglycerides (STG) were determined using SP-3000 UV-Visible Spectrophotometer and commercial Kits. Concentrations were estimated by dividing absorption of the sample on that of

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standard solution and multiplying the result by the concentration of each parameter in the standard solutions. Table 2 shows the technical issues as described by manufacturer companies.

Table 2- Technical details concerning the determination of blood parameters

	Blood parameters			
	SG	STP	SUN	STG
Method	enzymatic colorimetric	Biuret	Berthelot reaction	GPO
Wave length	500 µm	550 µm	590 µm	500 µm
Concentration in standard	100 mg/100 ml	6 g/100 ml	50 mg/100 ml	200 mg/100 ml
Company	Biomaghreb	Biolabo	Biomaghreb	Biolabo

SG=serum glucose, STP=serum total protein, SUN=serum urea nitrogen, STG=serum triglycerides

Results and discussion

Table 3 shows the effect of adding different levels of commercial BY on blood parameters in Holstein Frisian dairy cow

-1Effect of adding different levels of commercial BY on SG concentration:

Results revealed that concentration of SG was not significantly affected by adding BY to concentrate diet and increasing its level. Means were 50.22, 53.99 and 51.21 mg/100 ml in blood samples collected from cows fed concentrate diet free of BY and those fed concentrate diet with addition of BY at level of 15 and 30 g/cow/day respectively .

Similar findings were obtained by [5, 17, 19]. However, values obtained in those studies were higher than that of a current study. Means ranged between 63-65, 59.4-59.8 and 69.6-73.1 mg/100 ml respectively. Since cows in a current study consumed similar amounts of diets, ingredients and accordingly similar level of energy, the insignificant effect of feeding BY on SG concentration may associated with the rate of energy utilization by cows which in turn may be improved by existence of BY due to its role in enhancing activity of rumen microbes, especially cellulolytic bacteria and the improvement of nutrients digestion.

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Table 3- Effect of adding different levels of commercial BY on blood parameters in Holstein Frisian dairy (means ± SE(

Blood parameters	level of baker's yeast (BY), g/cow/day			*P*
	0	15	30	
Glucose, SG, mg/100 ml	50.22 1.47±	53.99 2.02±	51.21 1.49±	NS
Total protein, STP, g/100 ml	7.65^{b} 0.42±	8.79^{a} 0.09±	7.97^{ab} 0.11±	*
Urea nitrogen, SUN, mg/100 ml	20.48^{a} 1.37±	14.42^{b} 0.43±	16.27^{ab} 1.63±	*
Triglycerides, STG, mg/100 ml	8.37^{b} 0.11±	14.41^{a} 1.95±	11.04^{ab} 0.23±	*

Means with different letters within each row are significantly differed at * (P<0.05), NS= not significant

Although SG concentration was not significantly affected in a current study, other studies reported that it was increased (P<0.01) due to addition of live BY to the diet from 66.50 to 76.60 [9], from 61.82 to 66.96 [4]. Moreover, [14] noticed that introducing live BY in the diet of Holstein Frisian cows decreased SG concentration from 48.3 to 43.37 mg/100 ml .

Variation in SG concentration as a response to inclusion BY in dairy cow diets may be due to many factors, some are related to the rumen [8], level of inclusion [20], species of yeast, number of live cells and growth media [10]. In a current study SG concentration took medial position between values which were higher than 50 and 40 mg/100 ml .

-2 Effect of adding different levels of commercial BY on STP concentration :

Results showed that adding BY to concentrate diet of Holstein Frisian cows at level of 15 g/cow/day significantly (P<0.05) increased STP as compared with that of cows consumed its diet without addition of BY. Mean values were 8.79 and 7.65 g/100 ml respectively. This result agrees with those obtained by [5, 15]. However, doubling the level of commercial BY to 30 g/cow/day did not lead to significant increase in STP concentration (7.97 g/100 ml) as compared with that of dairy cows in control treatment. No significant differences were shown in STP concentration between BY treatments.

The significant increase in STP concentration observed in a current study due to addition of BY may be attributed to the role of yeast in stimulating rumen microbial activity and increasing flow of microbial protein into small intestine [12]. Considering higher STP concentration as an indicator for protein deposits in the body [1]. Baker's yeast plays a role in protein creation in side animal body, particularly; there is a continuous need by dairy cow to supply protein for milk production. [13] emphasized that addition of yeast increased biosynthesis of protein as a result of increasing level of T3 and T4 hormones. A positive close relation between serum TP and albumin concentrations and the synthesized and absorbed protein was confirmed by [6 .[

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Despite of the significant increase in STP concentration observed in a current study and confirmed by many workers, this effect was not mentioned in other studies. Introducing BY in dairy cow diets decreased STP concentration from 8.44 to 7.78 [18], from 10.69 to 9.73 g/100 ml [9]. Differences in STP concentration as affected by level of BY added to the diets can be explained on basis of the role of BY in stimulating activity of ruminal cellulolytic bacteria which as proposed in a current study, its relative abundance has been associated with BY at the lower level [17]. Consequently, the probable increase in the syntheses of microbial protein.

The mentioned difference can also be related with the type of yeast. [19] fed two different commercial supplements containing Saccharomyces cerevisiae with concentrates at recommended amounts (groups B and L), results showed that a slight increase in STP concentration was obtained from 6.87 in control treatment to 7.03 and 6.68 g/100 ml in B and L treatments respectively .

-3 Effect of adding different levels of commercial BY on SUN concentration

Results showed that adding BY to the concentrate diet of Holstein Frisian cows at level of 15 g/cow/day led to a significant ($P<0.05$) decrease in SUN concentration from 20.48 to 14.42 mg/100 ml. This result is consistent with that obtained by [9] in which, supplementation diet of multiparous Holstein Frisian cows with BY (15×109 cfu/g) was associated with a significant ($P<0.05$) decrease in SUN from 18.75 to 16.6 mg/100 ml. In another study on Holstein Frisian cows, Bruno, et. al., [5] reported a decrease in SUN from 14.3 to 12.8 mg/100 ml due to adding 30 g/day of BY .

The significant effect of adding BY at a low level on SUN concentration observed in a current study as compared with the control was extended to the high level of BY, but the difference was insignificant (4.21 mg/100 ml). The decrease in SUN concentration in a current study due to introducing BY in concentrate diet offered to dairy cow may be associated with the increase of microbial activity in the rumen leading to incorporate more ammonia produced from degradation of protein into microbial protein. Similar conclusion was attained by [14 .[

[16] suggested that excess ammonia in the rumen may lead to increase SUN if ammonia was not efficiently utilized by ruminal bacteria. Hence, the significant ($P<0.01$) decrease in SUN observed in a current study from 18.14 to 13.92 and 14.21 mg/100 ml due to adding BY at 15 and 30 g/cow/day supports the conclusion that addition of BY enhances nitrogen utilization. The positive effect of addition of BY on nitrogen utilization is not limited to enhance the incorporation of ammonia into microbial protein and the flow and absorption of amino acids but to change nitrogen metabolism [11 .[

In spite of the beneficial role of addition of BY to dairy cows' diet on SUN concentration observed in a current study, a slight effect was shown by [17], SUN concentrations were, 12.3,11.9 and 12.4 due to inclusion of BY into Holstein cows at 5.7 × 107 and 6 × 108 cfu/g. Effect of adding BY on SUN concentration depends on many factors as rumen environment [8], dose and species [20], species, strains, number of live cells and growth media [10 .[

-4Effect of level of adding different levels of BY on STG concentration :

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Results revealed that adding commercial BY to the diet of Holstein Frisian cows at level of 15 g/cow/day significantly (P<0.05) increased STG concentration from 8.37 to 14.41 mg/100 ml. Habeeb, et. al., [13] observed that STG concentration was increased from 14 to 16 mg/100 ml as a result of inclusion BY in a diet. Similar trend was reported by [6, 24]. The increase in fat content of blood due to addition of BY to the diet in a current study may refer to the release fats from adipose tissue to meet increased demand for fat due to increase milk production. [24] emphasized that moderate doses of yeast culture enhanced the release of fat and synthesis of ketones in the liver and this was positively correlated with ratio and yield of milk fat.

When BY was added at level of 30 g/cow/day, insignificant increase in STG (11.04 mg/100 ml) was observed in a current study as compared with that in the blood samples collected from cows fed control diet. [9] reported insignificant increase in STG concentration from 6.73 to 8.07 mg/100 ml as a result of adding commercial BY (15 × 109 cfu/g) at 4 g/day to the diet of multiparous Holstein Frisian cows. However, other studies reported different responses; Heidari Khormizi, et. al., [14] stated that STG concentration was not affected (8.53-8.99 mg/100 ml) by introducing BY to the diet of Holstein cows. Moreover, [18] found that addition of BY at level of 10 g/day significantly decreased STG concentration by 4.42 mg/100 ml. It seems that the inconsistent response to introducing BY in diet of dairy cow on STG concentration may be related to lipid metabolism required to meet animal requirement for milk production [23 .[

Conclusion:

Introducing commercial baker's yeast into the diet of dairy cows has enhanced the efficiency of nitrogen utilization as evidenced by the increase in the concentration of total protein in blood synchronized with a decrease in the urea nitrogen concentration .

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