USING A DIGESTAMIN AS A FEED ADDITIVE IN EGYPTIAN BUFFALO COWS (*Bubalus bubalis*) DIETS

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SUMMARY

This current work was performed to estimate the milk production and composition, blood parameters and some reproductive properties of Egyptian buffalo cows (*Bubalus bubalis*) fed a digestamin as feed additive. A total of 27 Egyptian buffalo cows were used in this study. The experimental buffaloes aged 4-8 years between the 2nd and 5th parity at late pregnancy (one month pre partum). Three main experimental basal diets were formulated from corn silage, berseem hay, rice straw and concentrate feed mixture containing 14 % CP and digestsmin was added at 0, 0.1, and 0.5% of DM, respectively. The current study showed that, increasing digestamin supplementation in buffalo cows diets increased significantly ($P<0.01$) average milk yield, total solids, fat, lactose, protein. On the other hand, there was a significant decrease ($P<0.01$) in milk total solid not fat, ash and somatic cells count by increasing digestamin supplementation to 0.5% level. Increasing digestamin levels also, significant increased ($P<0.01$) blood total protein, albumin and total lipids. Oppositely, there was a significant decrease ($P<0.01$) blood plasma globulin, glucose, AST and ALT concentration with increasing digestamin levels. The experimental diets with digestamin recorded the higher ($P<0.01$) calf birth, calf birth at weaning, daily weight gain compared to other experimental diets, while the higher body weight and placenta weight of buffalo cows were obtained by control buffalo cows. Generally, there was a significant improved ($P<0.01$) in reproduction parameters of the experimental buffalo cows by digestamin supplementation. It could be concluded that, digestamin as a feed additive can improve the growth, productive and reproductive performance of Egyptian buffalo cows (*Bubalus bubalis*). So, it could be used in diets of Egyptian buffalo (*Bubalus bubalis*) especially with 0.5% of DM.

Keywords: *Digestamine, Growth, Reproduction, Blood parameters and Egyptian buffalo cows (Bubalus bubalis).*

INTRODUCTION

The scarcity of animal feeds particularly protein sources is a serious problem faces the animal breeders which result in low productivity and reproductive performance of farm animals. Soybean meal (SBM) is most widely used as a protein source for ruminants feeding. Soybean meal has many beneficial prosperities such as high crude protein (44% to 49%), rich source of lysine, tryptophan, threonine, isoleucine, and valine which are seriously deficient in cereal grains. The presence of raw SBM in ruminants feeding in high quantities had been restricted because many of the anti-nutritional factors contains anti-nutritional factors such as antigens, oligosaccharides, lectins, and trypsin inhibitors that decrease nutrient availability and reduce growth performance of farm animals especially young one (Li et al., 1991; Hong et al., 2004). So, it is believed that, using fermented soybean meal (FSBM) which devoid the pervious anti-nutritional factors is more efficient in ruminants feeds without inhabiting growth performance (Jones et al., 2010).

Digestamin is one of natural feed additives which include Lactic acid fermented soybean, lactic acid fermented dried grass from natural pastures rich in herbs, dried horse radish roots, and Lactic acid fermented oak bark shavings. The high quality dietary fiber from the fermented grass contained in digestamin is very important for the digestive hygiene of the animals and very helpful for young animals to build up an optimal working digestive system. Soya, used as a fermentation substrate, is converted by the fermentation and additionally different metabolites, like short chain peptides, which are known to enhance mucosal immunity and thereby the general health, are produced. The horseradish also contained in digestamin has a positive influence on the immune- and digestive system, and it is also a very effective agent against respiratory diseases (Piro, 2000) of animals. In the meantime, buffalo is the second global milk-producing animal all over the world. It could produce about 90 million tons in 2009 which contributing about 13% of the total world milk production with an annual growth rate of 3.1% as compared to 1.3% for cow milk (CM) production (IDF 2010). Additionally**,** buffalo milk is richer in almost all the main milk nutrients compared to cow milk (CM). Also, some milk products such as Mozarrella cheese and ghee are the specialties of buffalo milk. So, the main aims of this study is estimating the effect of digestamin as feed additive on milk production and composition, blood parameters and some reproductive properties of Egyptian buffalo (*Bubalus bubalis*).

MATERIALS AND METHODS

The experimental work of this study was carried out at El-Gemmizah Research Station, Gharbia Governorate, belonging to the Animal Production Research Institute (APRI), Agricultural Research Center, Ministry of Agriculture in participation with Department of Animal Production Faculty of Agriculture, Tanta University, during the period from 1 May 2014 to 30 of April 2015.

Experimental animals and diets:

A total of 27 Egyptian buffalo cows aged 4-8 years between the 2nd and 5th parity. Were at late pregnancy (one month prepartum) were assigned to three groups balanced for live body weight (LBW), milk yield; parity and age. Three main experimental basal diets were formulated from corn silage (CS), berseem hay (BH), rice straw (RS) and concentrate feed mixture (CFM) containing 14 % CP. The experimental diets were fed to experimental animals according to NRC (1985) for Egyptian buffaloes nutritional requirements. Digestamin was obtained from Produktionsgemeinschaft F.U.H. Egger GmbH Company; Austria was added to the CFM of ration of the D1, D2 and D3 groups at 0, 0.1 and 0.5% of DM , respectively. Buffalo cows in all groups were fed the experimental rations for about month prepartum on the basis of their expected birth date till 4 months lactation period. Animals were housed in open pens and fed in groups. Fresh and clean drinking water was available at all times The animals were fed on the following tested diets

1- The control group (D1): CS + BH + RS + CFM.
2- The 1st treated group (D2): CS + BH + RS + CFM plus 0.1% digestamin.
3- The 2nd treated group (G3): CS + BH + RS + CFM plus0.5% digestamin.

Chemical compositions of the experimental feed stuffs are shown in table (1). Animals were housed in open pens and fed in groups. Fresh and clean drinking water was available at all times. At the start of the experiment, the quantity of CFM, BH, RS and CS were fed in restricted amounts being 6, 4, 4 and 9 kg DM/h /d, respectively. The CFM was offered twice daily just before milking at 6 a.m. and before the second milking at 4 p.m. The amount of RS was divided into two equal parts and given at 7 a.m. and 4 p.m. The amount of CS was divided into two equal parts and offered at 8 a.m. and 5 p.m. All buffalo cows were allowed to nurse their calves for the first four days postpartum (period of colostrum intake). Thereafter, they were milked in the absence of their calves' twice-daily at.6 a.m. and 5 p.m. throughout the lactation period. Buffalo cows in all groups were fed the experimental rations for about month pre-partum on the basis of their expected birth date till 4 months lactation period.

Experimental procedure:

Body condition score and milk production:

Throughout the feeding period, body condition score (BCS) as changes in live body weight was monthly recorded for each animal. Milk yield was individually recorded twice daily at 6 a.m. and afternoon at 5 p.m. throughout lactation period of 4 months. Representative monthly samples from milk were taken from evening and morning milk for determination of fat protein, lactose and total solids. The 4% fat corrected milk (4% FCM) for each buffalo cow was calculated from milk yield according to the following formula: 4% FCM = Actual milk yield (kg) x 0.4 + 0.15 x fat yield (kg) Geans equation, (cited by Abou-Raya, 1967).

Blood sampling:

Blood samples through postpartum period up to pregnancy were collected twice weekly immediately before feeding at 3 days interval via jugular vein from all buffalo cows. However, biochemical parameters in blood plasma were determined in monthly samples. Sampling started from 10 days postpartum for four months (experimental period). Within an hour after collection, samples were centrifuged for 15 minutes at 3000 rpm for plasma separation, which was stored at –20oC until analysis.

Placental drop and uterine involution:

The time required for complete placental drop in each animal was immediately calculated. The reproductive tract of each animal was rectally palpated once /two day till 21 day postpartum and once/three days after that, to assess the uterine involution according to El-Fadaly (1978). Live body weight of calves at birth was recorded individually after parturition.

Observation of oestrus:

Buffaloes in all groups were visually observed for oestrus behavior using teaser bull introduced for 3 times /day at 6:00, 12.00 and 4.00 h. The teaser bull was allowed to run with females for 30 minutes on each occasion. The following symptoms were used as indicators for oestrus, including response to teaser bull, bellowing, segregation and restlessness, standing female, frequent urination, response to finger massage and vaginal mucous discharge. The following signs were recorded for male behavior sniffing the vulva following the female, resting chin on female rump, mounting the females and standing for mounting by bull.

Reproductive parameters:

Postpartum first ovulation interval (PPFVI) was determined by subtracting four days from the time at which plasma progesterone concentration reached the level of <0.5 ng/ml that was sustained for two consecutive samples. This was based on the finding on changes in P4 concentration to oestrus and ovulation as reported by Aboul-Ela (1992) and Avenell et al. (1985). Time of the 1st occurrence of standing postpartum oestrus was recorded as postpartum first oestrus interval (PPFOI). Buffaloes that were detected in standing oestrus were served naturally by a fertile bull and then postpartum first service interval (PPFSI) was recorded. Rectal palpation was performed 60 d after date of service for pregnancy diagnosis, thereafter length of days open (DO), service period (SP), and number of service per conception (NS/C) were recorded. Conception rate was determined as percentage of buffaloes diagnosed pregnant proportional to the total number of buffaloes served. This was recorded for the 1st, 2nd and 3rd service. Gestation period (GP) was recorded as an interval from conception date to parturition date. Yet, calving interval (CI) was computed as gestation period length plus days open.

Biochemical parameters:

Concentration of total protein (g/dl), albumin (g/dl), glucose (mg/dl) and total lipids (g/dl) in plasma were photometrically determined using spectrophotometer (6405 UV/VIS) and commercial kits. According to Gornall *et al*. (1949), Weichselaum (1946), Trinder (1969) and Zollner and Kirch (1962), respectively. However, concentration of globulin was computed by subtracting concentration of total protein from albumin., Activity of glutamic oxaloacetic (ALT) and glutamic pyruvic transaminase (AST) were estimated according to Varoly (1976).

Statistical analysis:

All data were subjected to statistical analysis according to the procedures reported by Sendector and Cochran (1982) using computerized analysis system (SAS 2004), Significant differences among means were set at P<0.05 using Duncan's multiple range test (Duncan, 1955) .

RESULTS AND DISCUSSION

Milk production and composition:

The current study showed that, increasing digestamin level supplementation in buffalo cows diets increased significantly (P<0.01) average milk yield, total solids, fat, lactose and protein (Table 2). On the other hand, there was a significant decrease (P<0.01) in milk total solid not fat, and somatic cells count by increasing digestamin level supplementation to 0.5% level. However, there no significant effect (P<0.01) was detected by digestamin supplementation on milk ash.

Digestamin is one of natural feed additives which include Lactic acid fermented soybean, lactic acid fermented dried grass from natural pastures rich in herbs, dried horse radish roots, and Lactic acid fermented oak bark shavings. Wanapat et al. (2011b) explained that milk yield was remarkably improved when yeast-fermented cassava chip (YEFECAP) was fed at 16–28% DM in concentrate during early lactation period (30 DIM) of dairy cows. While, no differences were obtained in milk production (Wanapat et al., 2011a) when YEFECAP was used during the early lactation period (18 DIM).

Blood parameters:

Results in table (3) explained that, increasing digestamin levels increased ($P<0.01$) blood total protein, albumin and total lipids (Table 3). On the other hand, there was a significant decrease ($P<0.01$) in blood, glucose, AST and ALT concentration with increasing digestamin levels. Kwon *et al*. (2011) showed that, total serum Ig A and IgM levels significantly increased in both FSBM groups compared to un supplemented one. It could be suggest that, FSBM may have lower concentrations of allergenic and anti nutritional factors than the soybean meal which improve kidney and liver function of experimental animals (Wolfswinke, 2009). The presence of micro-organisms in fermented soybean meal may helper factor to enhance intestinal tract and liver health in digestion and absorption which reflex on normal blood components of experimental buffalo cows.

Growth performance:

Results of Table (4) clearly indicated that, the addition of digestamin recorded the highest ($P<0.01$) calf birth, calf birth at weaning, daily weight gain compared to the control with 0.5% levels (41.1kg, 119.0 and 742.16 g/day, respectively, While the lowest were obtained by control buffalo cows (30.83, 69.50 and 621.89 kg, respectively). Fermentation by bacteria such as lactobacillus could be decreases peptide size by releasing proteases and peptidases during fermentation that aid in the breakdown of complex nutrients in soy protein which accompanied with more nutrients utilization and enhancing growth performance of experimental calves (Hong et al., 2004). In the meantime, Min et al. (2009) reported that, FSBM maybe work as a growth promoter through its higher supply of essential amino acids and possibly vitamins synthesized during the fermentation. Also, Kim et al. (2009) reported that, fermented soybean meal can be used as replacer for animal-derived protein sources containing plasma protein and dried skim milk in piglet nursery diets without hazards effects on growth performance of the piglets.

Reproduction indices:

Results in Table (5) showed, a significant decrease ($P<0.01$) in the lested reproduction parameters of the experimental buffalo cows by digestamin supplementation. The supplemented diet with 0.5% of digestamin had the lowest value of uterine horns symmetry, uterine involution, first post-partum estrus days open period and time of placenta dropping (28.33, 18.17, 32.67, 47.17 days and 3.50 hr, respectively, Sapbamrer et al. (2013) explained that, the dietary fermented soybean amount might be an important factor for enhancing the reproductive hormones, lipids, and glucose. They found remarkable and a significant increase of progesterone in the experimental group supplemented with fermented soybean. Also, Cederroth et al. (2012) reported that, in humans there is a modest suppressant influence of soy and iso- flavone exposure on the hypothalamic–pituitary–gonadal axis.

CONCLUSION

It could be concluded that, digestamin as a feed additive can improve the growth, productive and reproductive performance of Egyptian buffalo cows (*Bubalus bubalis*). So, it could be used in diets of Egyptian buffalo (*Bubalus bubalis*) especially with 0.5% of DM.

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استخدام الديجستامين كاضافة غذائية لعلائق ابقار الجاموس المصرى

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اجريت الدراسة الحالية بهدف معرفة تاثير اضافة الديجستامين الى علائق ابقار الجاموس المصرى على انتاج ومكونات اللبن وبعض مكونات الدم وايضا الاداء التناسلى لاناث الجاموس المصرى استخدم فى هذه الدراسة عدد ٢٧ جاموسة يتراوح اعمارها من ٤-٨ سنوات وموسم حليب ٢-٥ فى المرحلة الخيرة من الحمل قبل الولادة يشهر العليقة الاساسية المستخدمة فى التغذية مكونة من سيلاج الدرة ودريس البرسيم وقش الارز ومخلوط علف مركز ١٤% بروتين خام تم تقسيم العليقة الى ثلاثة اجزاء وتم اضافة الديجستامين بنسبة ٠- ١و٠ – ٥و٠ % من المادة الجافة . اظهرت الدراسة النتائج التالية:- حسنت اضافة الديجستامين من متوسط انتاج اللبن اليومى وكذلك الجوامد الكلية الغير دهنية للبن وايضا مستوى الخلايا الجسدية فى اللبن كما كان لها تاثيرا ايجابيا على بعض مكونات الدم مثل البروتين الكلى والالبيومين ولم يكن لها اى اثار ضارة على وظائف الكبد كما ادت المعاملة بالديجستامين الى زيادة وزن الخلفى عند الميلاد والفطام وايضا حسنت من كثير من الاداء التناسلى لابقار الجاموس المصرى . توصى هذه الدراسة بان استخدام الديجستامين بمعدل ٥و٠ % من المادة الجافة للعليقة يحسن من الاداء الانتاجى والتناسلى لابقار الجاموس المصرى.

Table (1): Chemical analysis of the experimental feed stuffs (on DM basis).

Item	DM%	Chemical composition on DM basis (%)					
		OM	CP	CF	EE	NFE	Ash
Feedstuffs:							
Rice straw (RS)	88.40	78.36	2.96	35.83	2.23	37.34	21.64
Berseem hay 3^{rd} cut (BH)	86.70	87.10	15.50	30.93	2.13	38.54	12.90
Whole corn silage (WCS)	36.06	87.58	9.43	26.64	2.73	48.87	12.42
Conc. Feed Mix. (CFM)	90.00	91.20	16.50	13.40	3.00	58.30	8.80

Table (2): Effect of digestamin supplementation on total milk yield and milk component of buffalo cows after the 1^{st} week postpartum till 120^{th} day postpartum

Treatment group	Average milk yield and milk component							
	Average milk yield(kg)	Total solid %	Fat %	lactose %	Total solid not fat %	Protein %	Ash %	Somatic Cells account
Control (D1)[1]	9.965 ±0.05^{c}	16.473 ±0.01^{c}	6.516 ±0.030^{c}	5.350 ±0.057^{a}	9.956 ±0.02	4.006 ±0.05^{b}	0.600 ±0.002	58.800 ±5.2^{a}
(0.1%) Digestamin (D2)[2]	10.882 ±0.02^{b}	16.768 ±0.016^{b}	6.733 ±0.03^{b}	5.226 ±0.023^{b}	10.035 ±0.01	4.213 ±0.02^{a}	0.595 ±0.004	45.500 ±2.3^{b}
(0.5%) Digestamin (D3)[3]	11.608 ±0.006^{a}	16.970 ±0.017^{a}	6.900 ±0.036^{a}	5.133 ±0.022^{b}	10.070 ±0.03	4.335 ±0.03^{a}	0.601 ±0.003	32.650 ±2.6^{c}

a, b and c: Means within the same row with different superscripts are significantly different at P<0.01.

Table (3): Effect of digestamin supplementation on blood component of buffalo cows after the 1^{st} week postpartum till 120^{th} day postpartum

Treatment group	blood component concentrations (g/100 ml)						
	Total protein	Albumin	Globulin	Glucose	Total lipids	AST	ALT
Control (D1)[1]	7.630 ±0.01^{c}	4.065 ±0.01^{c}	3.565 ±0.01^{b}	59.788 ±0.1^{a}	0.588 ±0.03^{c}	29.950 ±0.2^{a}	1.615 ±0.02^{b}
(0.1%) Digestamin (D2)[2]	7.916 ±0.01^{b}	4.238 ±0.01^{b}	3.658 ±0.02^{a}	57.805 ±0.02^{c}	0.773 ±0.004^{b}	23.166 ±0.07^{b}	2.128 ±0.01^{a}
(0.5%) Digestamin (D3)[3]	8.051 ±0.01^{a}	4.470 ±0.01^{a}	3.581 ±0.04^{b}	57.128 ±0.01^{b}	0.940 ±0.008^{a}	17.116 ±0.1^{c}	2.076 ±0.02^{a}

a, b and c: Means within the same row with different superscripts are significantly different at P<0.01.

Table (4): Effect of digestamin supplementation on body weight, calf weight, daily weight gain of calves and placenta weight of buffalo cows.

Treatment group	Body Weight of cow ,calves and placenta weight (kg)			
	Body weight (kg)	Calf birth weight (kg)	Calf birth weight at weaning (kg)	Daily weight gain (g/day)
Control (D1)[1]	615..66±3.5	30.83 ± 0.8^{c}	96.50 ± 1.2^{c}	621.83 ± 5.6^{c}
(0.1%) Digestamin (D2)[2]	614.16±5.6	35.67 ± 0.06^{b}	108.50 ± 1.3^{b}	693.17 ± 3.6^{b}
(0.5%) Digestamin (D3)[3]	614.33±7.4	$41.\ 0 \pm 0.09^{a}$	119.00 ± 0.6^{b}	742.17 ± 3.8^{a}

a, b and c: Means within the same row with different superscripts are significantly different at P<0.01.

Table (5): Effect of digestamin supplementation on reproduction indices of buffalo cows after the 1st week postpartum till 120th day postpartum

Treatment group	Reproduction parameters					
	uterine horns symmetry (day)	uterine involution (day)	first post partum estrus (day)	days open period (day)	time of placenta dropping (hours)	Placenta weight (kg)
Control (D1)[1]	38.333 ± 0.4^{a}	29.500 ± 0.3^{a}	53.166 ± 2.3^{a}	102.833 ± 3.8^{a}	7.000 ± 0.5^{a}	5.108 ± 0.04^{a}
(0.1%) Digestamin (D2)[2]	30.666 ± 0.6^{b}	21.333 ± 0.3^{b}	41.500 ± 0.9^{b}	73.833 ± 2.8^{b}	4.083 ± 0.3^{b}	4.641 ± 0.01^{b}
(0.5%) Digestamin (D3)[3]	28.333 ± 0.4^{c}	18.166 ± 0.5^{c}	32.666 ± 1.1^{c}	47.166 ± 3.3^{c}	3.500 ± 0.1^{b}	4.825 ± 0.08^{b}

a, b and c: Means within the same row with different superscripts are significantly different at P<0.01.