Proc. 3rd All Africa Conf. Anim. Agric. & 11th Conf. Egyptian Soc. Anim. Prod., Alexandria, Egypt, 6-9 November 2000: 281-287

EFFECT OF AVOTAN® SUPPLEMENT TO DIETS OF LACTATING BUFFALOES ON COLOSTRUM, MILK PRODUCTION, MILK COMPOSITION AND SOME BIOCHEMICAL BLOOD METABOLITES

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SUMMARY

This trial was aimed to investigate the influence of Avotan® supplement in the diets of lactating buffaloes on their dry matter intake, nutrients digestibilities, colostrum, milk yield, milk composition and some blood metabolites.

Twenty lactating buffaloes aged 4-6 years, 4 weeks before calving, were divided into two equal groups. Animals in the experimental group received rations of 20% rice straw (RS) + 20% berseem hay (BH) + 60% concentrate feed mixture (CFM), supplemented with Avotan (150 mg avoparcin per head per day) daily from 4 weeks before calving to 26 weeks after parturition. The control group received the same basal ration without Avotan supplement. Dry matter intake was insignificantly ($P>0.05$) decreased in treated group being 15.20 and 14.65 kg/h /d for control and Avotan groups, respectively. Nutrients digestibilities were higher ($P<0.05$) in Avotan group than control group except DM and EE digestibilities which increased insignificantly ($P>0.05$). In the colostrum Avotan supplement for buffaloes increased total solids (TS), solids not fat (SNF), total protein (TP) and ash contents from the first milking after parturition; an increase of immunoglobulin concentration (IgG) in colostrum whey was also seen. However, lactose decreased ($P<0.05$) in Avotan group. The average daily milk yield and 4% FCM yield of experimental group were 9.65 and 14.19 kg, compared to 8.18 and 12.25 kg for control group, representing an increase of about 18% and 16%, respectively. The animals in the Avotan group used 5.42% less feed for producing 1.47 kg of milk than in the control group. Fat, protein, lactose and solids-not-fat yields were higher ($P<0.01$) in Avotan group. Percentage of protein ($P<0.05$) and lactose ($P<0.01$) were also higher with inclusion of Avotan in the diets, while fat and SNF were insignificantly higher ($P>0.05$) in treated group.

Efficiencies calculated as milk yield/DMI and 4% FCM yield/DMI and persistence were improved in Avotan group, representing a 23.08, 23.38 and 11.21% increase, respectively.

Plasma TP, albumin, globulin, glucose and immunoglobulin (IgG) were significantly higher in Avotan group. No differences among treatments were reported for other blood parameters.

Data showed that supplementing buffaloes rations with Avotan (150 mg avoparcin/head/day) improves nutrients digestibility, colostrum, immunoglobulin concentration (IgG), milk production, milk composition with no effect on general health of the treated animals compared to those fed a ration without Avotan.

Kaywords: Buffaloes, milk production, blood metabolites, avoparcin

INTRODUCTION

Avoparcin (a brand name : Avotan) is a new stimulator which isn't absorbed from alimentary canal and is excreted in unchanged structure. Avoparcin, a glycopeptide antibiotic produced by streptomyces candidus (Ali Haimoud *et al.*, 1995).

Avoparcin has a strong affinity to cell walls of Gram positive bacteria and disturbs peptide/glycan synthesis by inhibiting synthesis of N-acetyl glucosamine. It is a safe product which is not absorbed and is not found in milk, tissues or meat (Pape, 1993).

Avoparcin improves feed conversion efficiency by means of its effects on intestinal microflora. It prevents the development of Gram positive bacteria in the intestine (Szulc *et al.* 1992). Supplementation with apovarcin at a level of 100 mg/d. , a typical dose for dairy cows , has a localized effect on the intestinal microflora, and it also induces changes in the ruminal microflora (Pasierbski *et al.*, 1992). Apovarcin residues in milk have not been detected even when administrated to cows at levels ten times the recommended dose (Pape, 1993). Other European trials have also indicated that

supplementation with apovarcin improves reproductive performance and the general body conditions of animals, and its administration does not cause changes in the technological properties of milk for cheesemaking.(Minakowski *et al.*, 1990 and Pasierbski *et al.*, 1992).

The aim of this study is to define productive performance of lactating buffaloes that were given150 mg of Avoparcin daily.

MATERIALS AND METHODS

This study was conducted at the experimental farm Station of Milk Replacer Research Centre, Faculty of Agriculture, Ain Shams University at Shoubra El-Khema, and National Research Centre, Dairy and Food Tech. Dept., Dokki, Giza, Egypt.

Animals management and feeding regime

Twenty lactating buffaloes aged 4-6 years, 4 weeks before calving, were divided into two equal groups. Animals in the treated group (TG) received rations of 20% rice straw + 20% berseem hay + 60% concentrate feed mixture, supplemented with Avotan® (From Rovigyt Co. For Manufacturing Feed Products S. A. E. Tomouh Giza) (150 mg avoparcin/ head/day) daily from 4 weeks before calving to 26 weeks after parturition. The control group (C) received the same basal ration without Avotan supplement. The concentrate feed mixture had the following composition: 35% undecorticated cotton seed cake, 33% wheat bran, 22% yellow corn, 4% rice bran, 3% molasses, 2% limestone and 1% salt. The chemical composition of concentrate feed mixture, berseem hay and rice straw are presented in Table 1. Diets were formulated to meet the animals requirements (Shehata, 1971). The CFM for each animal was offered individually twice daily during the day at 6.00 and 16.00. Berseem hay and rice straw were offered at 9.00 and 12.00, respectively. The animals were offered water twice daily.

One digestibility trial was carried out on five animals/each treatment selected randomly during the last three months of the lactation period. Faecal grab samples of about 200 grams were taken from the rectum twice daily for 7-day collection period. Acid insoluble ash (AIA) was used as a natural marker to determine the neutrient digestibilities (Van Keulen and Young, 1977).

Table 1. Chemical composition of dietary ingredients% (DM basis)

Items	Ingredient		
	CFM*	BH**	RS***
Dry matter	92.70	91.34	91.00
Organic matter	90.90	88.20	85.80
Ash	9.10	11.80	14.20
Crude protein	14.00	13.22	2.84
Ether extract	4.29	3.21	1.30
Crude fiber	14.91	27.85	39.21
NDF[1]	22.31	37.25	66.40
ADF[2]	20.31	33.53	49.26
ADL[3]	9.67	5.27	10.46
Hemicellulose	2.00	3.72	17.14
Cellulose	10.64	28.26	38.80
Lignin	7.32	5.03	7.17
Nitrogen free extract	57.70	43.92	42.45

*CFM = Concentrate feed mixture
**BH = Berseem hay
***RS = Rice straw
[1]NDF = Neutral detergent fiber
[2]ADF = Acid detergent fiber
[3]ADL= Acid detergent Lignin

Analysis of feed and faeces samples

Samples of concentrate feed mixture, berseem hay and rice straw and faeces were analyzed for DM, OM, ash, crude protein, crude fiber, ether extract, nitrogen free extract and silica according to A.O.A.C. (1995). Fiber fractions were determined according to Goering and Van Soest (1970).

Sampling and analysis of colostrum and milk

Colostrum samples were collected from the experimental animals immediately postpartum. The first 200 ml of colostrum were stripped by hand from each quarter, pooled and aliquoted for subsequent analysis of fat, TS, SNF, TP and ash contents (Ling, 1963), lactose content (Barnett and Abd El-Tawab, 1957) and immunoglobulin (IgG) concentration (Erhard *et al.*, 1992).

Animals were machine milked twice daily and milk yield was recorded at each milking. The animals were weighed and milk samples were collected biweekly. Composite samples from morning and evening sampling were analyzed for milk fat, TS, SNF, TP, ash contents (Ling, 1963) and lactose content (Barnett and Abd El-Tawab, 1957).

Sampling and analysis of blood

Blood samples (from the jugular vein) were collected from the experimental animals immediately postpartum and analyzed for immunoglobulin (IgG) concentration according to Erhard *et al.*, (1992). Samples were taken biweekly along the experimental period after 4-5hr. of morning feeding. Blood plasma was analyzed for total protein (TP) (Armestrong and Carr, 1964), albumin (Doumas *et al.*, 1971), and plasma urea (< biblio >). Transaminase,GOT and GPT activites (Reitman and Frankel, 1957), alkaline phosphatase (Bessey *et al.*, 1946), cholesterol (Allain *et al.*, 1974), glucose (Siest *et al.*, 1981) and inorganic phosphorus (Troug and Meyer, 1939).

Statistical analysis

The ANOVA by a two-way classification design were used according to the general linear procedure.

$Y_{ijk} = u + T_i + e_{ik} + A_j + (TA)_{ij} + E_{ijk}$

Where

Y_{ijk} : Is the parameter under analysis of the ijk buffalo,
U : is the overall mean,
T_i : is the effect due to treatment,
e_{ik} is the effect due to the animals within treatments (treatment error)
A_j is the effect due to stage of lactation,
$(TA)_{ij}$: is the interaction (treatment x stage of lactation).
E_{ijk} : is the effect due to experimental error associated with the Y_{ijk} observation, according to Snedecor and Cochran, (1982). The Duncan's new multiple range test (Dunca, 1955) was used to test the significance between means.

RESULTS AND DISCUSSION

Dry matter intake and nutrients digestibilies

Data of dry matter intake and nutrients digestibilies for different experimental groups are shown in Table 2. Dry matter intake recorded for Avotan group was slightly ($P>0.05$) lower than that recorded for control group (14.65 vs. 15.20 kg/d). The same observation was detected in DM intake/kg $W^{0.75}$. These results are in agreement with those of Pape, (1993); Pasierbski *et al.*, (1992) and Korniewicz *et al.* (1990) who reported that the cows fed Avotan used 5% less feed to produce one litre milk than in the control group. Moreover, Johnson *et al.* (1979) demonstrated that avoparcin supplement to diets of dairy cows improves feed conversion as consequence of reduced feed intake with or without increased daily gain and reduces the acetate to propionate ratio when fed to beef cattle in a high barely diet.

Nutrients digestibilities of DM, OM, CP, EE, NFE, CF, NDF, hemicellulose and cellulose were increased with including Avotan in the diets. The differences between treatments were significant ($P<0.05$) except for DM, EE and NFE digestibility which increased insignificantly ($P>0.05$). The improvement in the nutreints digestibilities could be due to shifts in rumen fermentation and the effect of Avotan on the bacteria of the digestive tract which should enhance digestibility of nutrients and improve feed conversion as a consequence of reduced feed intake and reduced acetate/propionate ratio (Richardson *et al.*, 1976, Johnson *et al.*, 1979, and Bergeb and Bates, 1984). However, Ali Haimoud *et al.* (1995) detected no differences due to avoparcin in total tract digestion of OM, starch or N in beef cows fed a 70% concentrate diets.

Table 2. Mean of live body weight (LBW), dry matter intake and nutrients digestibility by lactating buffaloes fed diets supplemented with Avotan during the last three months of lactation period

Items	Control	Avotan	% Change
No. of animals	5	5	-
LBW (kg)	603	606	+0.50
Dry matter intake (DMI):			
Total (kg/d/h)	15.20	14.65	-3.75
From CFM	9.45	8.90	-6.20
From BH	3.00	3.00	-
From RS	2.75	2.75	-
Gram / kg $W^{0.75}$	124.90	119.95	-3.96
Nutrients digestibility:			
DM	68.00	69.35	+1.99
OM	70.00^{b}	75.40^{a}	+7.71
CP	71.33^{b}	76.77^{a}	+7.63
EE	65.10	65.31	+0.32
NFE	72.31	73.55	+1.71
CF	51.40^{b}	56.22^{a}	+9.38
NDF	57.30^{b}	61.61^{a}	+7.52
Hemicellulose	54.60^{b}	58.78^{a}	+7.66
Cellulose	49.60^{b}	53.51^{a}	+7.88

a,b values of different superscripts in the same row are significant different (P<0.05).

Chemical composition of colostrum

Data in Table 3 indicates the average changes in colostrum at first milking after parturition according to the supplement used for buffaloes in a period near calving. Addition of Avotan to diets before calving increased TS, SNF, ash (P<0.05) and TP (P<0.01) contents in colostrum during the first post-parturition milking. An increase of immunoglobulin concentration in colostrum whey was also detected (being 5.95 for control vs. 7.25g% for Avotan, representing 21.85% increase, respectively). However, lactose content in colostrum was higher (P<0.05) in control group compared to Avotan group. No significant influence of Avotan on fat content in colostrum was observed. Szulc *et al.* (1992) found that the addition of Avoparcin to diets before calving increased (P<0.05) total protein and DM contents in colostrum only from the first post-parturition milking; an increase of protein and immunoglobulin concentration (IgG) (g%) in colostrum whey was also seen.

Table 3. Changes in colostrum at first milking after parturition according to supplement used for buffaloes in period near calving

Colostrum components %	Control	Avotan	% Changes	±SE
Fat	5.10	5.23	+2.55	0.07
Total solids	21.65^{b}	23.00^{a}	+6.24	0.68
Solids-not-fat	16.55^{b}	17.77^{a}	+7.37	0.53
Total protein	11.60^{B}	13.38^{A}	+15.34	0.78
Lactose	3.54^{a}	3.31^{b}	-6.95	0.13
Ash	0.92^{b}	0.98^{a}	+6.52	0.04
Immunoglobulin (IgG) g%	5.95^{B}	7.25^{A}	+21.85	0.61

Averages of 10 samples each treatment. a.b means statistically differ (P<0.05).
A,B means statistically differ (P<0.01). ±SE = standard error.

Milk yield and composition

Data of milk yield and composition of the experimental animals are shown in Table (4). Milk yield and 4% fat-corrected milk (FCM) were significantly (P<0.01) higher in Avotan group compared to control group. The percent of increases were 17.97 and 15.84% for milk yield and 4% FCM, respectively. Milk fat, protein, lactose and solids-not-fat yields were also higher (P<0.01) in Avotan group.

Table 4. Effect of Avotan on milk performance (days 7 to 180)

Items	Control	Avotan	% Change	± SE
No. of animals	10	10	-	-
Dry matter intake (kg/d/h)	15.86	15.00	-5.42	0.40
Yield, kg/d:				
Milk	8.18^{B}	9.65^{A}	+17.97	0.71
4% FCM	12.25^{B}	14.19^{A}	+15.84	0.58
Fat	0.57^{B}	0.68^{A}	+19.30	0.04
Protein	0.30^{B}	0.38^{A}	+26.70	0.06
Lactose	0.34^{B}	0.46^{A}	+35.29	0.07
SNF	0.77^{B}	0.95^{A}	+23.38	0.08
Milk composition%:				
Fat	6.95	7.01	+0.86	0.22
Protein	3.67^{b}	3.91^{a}	+6.54	0.30
Lactose	4.10^{B}	4.76^{A}	+16.10	0.23
SNF	9.45	9.87	+4.44	0.41
Gross efficiency:				
Milk/ DMI	0.52^{B}	0.64^{A}	+23.08	0.04
FCM/ DMI	0.77^{B}	0.95^{A}	+23.38	0.04
Persistence[1]	1.07^{b}	1.19^{a}	+11.21	0.02

a,b Means statistically differ (P<0.05) A,B Means statistically differ (P<0.01)
(1) FCM at week 8: FCM at week 1 ±SE = Standard error

This improvement in milk production could be due to the improved nutrients digestibilities (Table 2) and consequently nutrients conversion effeciency (Korniewicz *et al.*, 1990). Similar results were reported by Abubakar (1988), Kraszewski *et al.* (1991); Blaziak *et al.* (1992) and Szulc *et al.* (1992). Pape (1993) reported that a high production of milk is a result of Avotan influence on the flora of alementary canal, that can find its documentary evidence in the improvement of protein diegestibility and a lower level of ammonia nitrogen in the rumen content.

Data of milk composition of the experimental buffaloes are summarized in Table (4). Milk fat and SNF contents were insignificantly (P>0.05) higher in Avotan group than the control group. Moreover, milk protein and lactose contents were significantly (P<0.05 and 0.01, respectively) higher in Avotan group. Similar results were reported by Abubakar (1988), Pres and Luczak (1990) , Kraszewski *et al.*, (1991); Blaziak *et al.* (1992), Wawrzynezak *et al.* (1992) and Pape (1993). Szulc *et al.* (1992) found that nutrients conversion into milk constituents was improved by about 5% in 31 trials and milk yield by 4.6% when cows were fed rations supplemented with 100 mg avoparcin/head/day. Results reflect improved energy and protein supply of the cows . However, Jamroz *et al.* (1990), Minakowski *et al.* (1990) and Cieslar *et al.* (1992) detected that there were no significant differences in milk constiteunts when cows were fed rations supplemented with 50 or 100 mg avoparcin/head/day.

The animals in the group with Avotan used 5.42% less feed for producing 1.47 kg milk than in the control group. Efficiency calculated as milk yield/DMI and 4% FCM yield/DMI and persistence were improved in Avotan group, representing a 23.08, 23.38 and 11.21% increase, respectively. Similar results were reported by Korniewicz *et al.* (1990) and Blaziak *et al.* (1992).

Blood plasma metabolites

Data of Table 5 indicated that plasma TP, albumin, globulin, glucose (P<0.05) and immunoglobulin (IgG) concentrations (P<0.01) were higher in Avotan group. No significant influence of Avotan on plasma A/G ratio, urea, GOT, GPT, alkaline phosphatase, cholesterol and inorganic phosphorus were observed.

Wawrzynczak *et al.* (1992) reported that the Avotan did not cause any changes in the biochemical blood indices for cows. Similar results were reported by Pasierbski *et al.* (1992) and Minakowski *et al.* (1990).

It could be concluded that supplementing buffaloes rations with Avotan (150 mg avoparcin/head/day) improves nutrients digestibility, colostrum, immunoglobulin concentration (IgG), milk production, milk composition with no effect on general health of the treated animals compared to those fed a ration without Avotan.

Table 5. Effect of supplementing rations with Avotan on some blood parameters of buffaloes, during 180 days of lactation period

Items		Control	Avotan	% Change	±SE
Total protein	g/dL	6.59^{b}	7.25^{a}	+10.02	0.53
Albumin	g/dL	3.17^{b}	3.45^{a}	+8.83	0.17
Globulin	g/dL	3.42^{b}	3.80^{a}	+11.11	0.24
A/G ratio		0.94	0.91	-3.30	0.02
Urea nitrogen	g/dL	33.01	33.87	+2.61	0.76
GOT	u/dL	33.88	34.12	+0.71	1.70
GPT	u/dL	22.65	23.10	+1.99	0.38
Alkaline phosphatase	u/dL	34.63	33.30	-3.84	0.67
Cholesterol	mg/dL	150.40	154.00	+2.39	4.41
Glucose	mg/dL	51.07^{b}	56.40^{a}	+10.44	3.83
Inorganic phosphorus	mg/dL	6.30	6.33	+0.48	0.06
Immunoglobulin (IgG)	g%	1.444^{B}	1.726^{A}	+19.53	0.04

a,b Means statistically differ (P<0.05) A,B Means statistically differ (P<0.01)
±SE = Standard error

ACKNOWLEDGMENT

Appreciation is expressed to Dr. Hany, M. Hassan Head of immunobiology and immunophamacology unit, Animal Reproduction Research Institute (ARRI), Giza, for assaying immunoglobulin IgG in colostrum and blood plasma of buffaloes used in this study.

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