

Effects of some probiotics during its use as a growth promoter in calves

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ABSTRACT

This study was performed on to evaluate the effect of some probiotic strains (*Pediococcus acidophilus* and *Pediococcus pentosaceus*) on performance, blood picture and some biochemical parameters in serum of treated calves (10 weaned calves 90-115 kg). Calves were classified into 2 equal groups (each of 5 calves). The 1st group was served as the control group while the second group was given Maxboost® (20gm/head/day) in drinking water (after fermentation for 2-3 hours) for five months. Calves were weighed monthly to calculate the body weight gain till the end of the experiment whole blood weight and serum were collected from both groups at 1st, 2nd, 3rd, 4th and 5th month. Results revealed a significant increase in total body weight, body gain, total erythrocytes count, hemoglobin content, total leucocytes count, total protein and mean corpuscular hemoglobin. On the other hand, there were a significant decrease in serum aspartate transaminase (AST), serum alanine transaminase (ALT) and urea in *Pediococcus* treated group compared to the control one.

1. INTRODUCTION

Probiotics as growth promoter are a culture (either mono or mixed) of living microorganisms. They produce a beneficial effect on the host by improving the properties of the indigenous micro- flora (Ghadban, G., 2002. Good features of good probiotic must be a strain, which is capable of exerting a beneficial effect on animals, by increasing the performance. Also it should be non-pathogenic, non-toxic, and capable of surviving and metabolizing in gut environment and should be capable of remaining viable for periods under storage and field conditions (Fuller, 1989).

The alimentary bacterial probiotics play an important role in improving the general health conditions of the animals (Fuller, 1992). Such beneficial effects of the probiotic depending many factors as the chosen strain, duration and frequency of exposure, and the physiological status of the animal. (Koop-Hoolihan, 2001).

Probiotics have several beneficial effects on the host animal such as: increasing milk yield, fat and protein contents (Yu et al, 1997), growth promotion (Change et al, 2001), synthesis off nutrients as vitamin B complex and amino acids (Koop-Hoolihan,2001), immunostimulant by increasing phagocyte activity and immunoglobulin levels (Aattor et al,2002), production of the animal from the intestinal infection (Oyetayo et al.,2003), increasing the carcass output and output and water holding capacity and decreasing the meat hardness (Ceslovas et al.,2005) and reducing morbidity and mortality of the growing animals (Paulius et al.,2006).

The available probiotics mainly belong to the genera *Lactobacillus* and *Bifidobacterium*. *Pediococcus* is a Grampositive LAB of the family *Lactobacillaceae*. The genus *Pediococcus* is comprised of *P. acidilactici*, *P. pentosaceus*, *P. damnosus*, *P. parvulus*, *P. inopinatus*, *P. halophilus*, *P. dextrinicus* and *P. urinaeequi* (Garvie 1986).

This work aimed to study the effects of the used preparation as a growth promoter on performance, hemogram and some biochemical parameters of treated calves.

2. MATERIALS AND METHODS

3-Drug and chemical composition

- (Maxboost ®)
- *Pediococcus acidilactici* 1×10⁶ cfu/g
- *Pediococcus pentosaceus* 1.3×10⁶ cfu/g
- Dextrose as carrier.

Manufactured & explored by DVS Biolife limited – India purchase
Experimental animals and grouping:

Ten apparently healthy male cow calves of cross breed (5-6 months of age) With average body weight 90-115 kg. They were reared in special farm in Dakahlia Governorate and fed on concentrated ration of 18% protein (by 1% of body weight) and water was provided ad-libitum.

Calves were classified into 2 equal groups, each of 5 calves as the following:

G1: control group (without treatment)

G2: calves given *Pediococcus* mix at 20gm/head/day for 5 months.

Body weight was determined in the beginning of the experiment and monthly, moreover the general health conditions were observed.

4-Sampling

Two blood samples (the first was collected on heparinized test tubes used for hematological studies and the second was collected into a Temperature for 45 minute) were collected from each animal at zero day, 1st, 2nd, 3rd, 4th and 5th month after drug administration.

5. Hematological studies:

Were carried out using fully automated cell counter R.B.Cs, W.B.Cs count, Hb concentration, PCV% and blood platelets were determined according to Colos (1986).

6. Serum Biochemical Analysis:

(A) Liver function tests:

- Determination of Total Protein level according to Doumas, (1975)
- Determination of Albumin level according to Doumas, (1975)

dry sterile centrifuge tube and allowed to clot at room

- Serum globulin calculation as described by Doumas and Biggs, (1972)
- Determination of serum Transaminases (ALT) and (AST) activities according to Reitman and Frankel, (1957).
- Determination of serum Alkaline phosphatase (ALP) activity according to Rosalki, (1993).

(B) Kidney function tests:

- Determination of serum Creatinine: according to (Henry, 1974)
 - Determination of Urea: according to (Patton and Crouch, 1977)
- Statistical analysis: as described by Snedecor and Cochran, (1981)

3. RESULTS

Ten calves at Dakahlia governorate were observed and weighted for five months to evaluate the body performance as mentioned in Table (1).

Table(1): The effect of oral administration of *Pedicoccus* (23×10^6 CFU/calf/day) in ration once daily for five months on body weight, body gain, food intake and food conversion rate in cow calves . (Mean \pm S.E) (n=5)

Item	Group	Zero	1 st	2 nd	3 rd	4 th	5 th
Body weight (kg)	Control	100 \pm 6.52	117.8 \pm 6.46	138 \pm 3.82	150.6 \pm 3.59	172.8 \pm 1.32	209.4 \pm 2.58
	Treated	100.6 \pm 3.79	125.2 \pm 3.97	152 \pm 3.35 *	177.6 \pm 2.7 *	209.6 \pm 3.04 *	244.8 \pm 6.15 *
Body gain (kg)	Control	17.8 \pm 1.8	20.2 \pm 3.47	12.6 \pm 1.63	22.2 \pm 3.24	36.6 \pm 3.65	109.4 \pm 8.58
	Treated	24.6 \pm 1.96 *	26.8 \pm 2.13 *	25.6 \pm 3.23 *	32 \pm 2.24 *	34.8 \pm 3.34	144.2 \pm 8.5 *
Feed intake (kg)	Control	1.88 \pm .014	2.36 \pm 0.13	2.76 \pm 0.07	3.01 \pm 0.07	3.46 \pm 0.02	4.19 \pm 0.05
	Treated	1.95 \pm 0.06	2.5 \pm 0.07	3.04 \pm 0.06	3.55 \pm 0.05	4.19 \pm 0.06	4.89 \pm 0.12
Conversion rate	Control	3.32 \pm 0.49	3.96 \pm 0.72	6.95 \pm 0.79	4.48 \pm 0.74	2.95 \pm 0.35	5.06 \pm 0.56
	Treated	2.42 \pm 0.18	2.87 \pm 0.26	3.47 \pm 0.39	3.51 \pm 0.27	3.75 \pm 0.38	4.25 \pm 0.27

* means significant at (p< 0.05)

Table (2): The effect of oral administration of *Pedicoccus* (23×10^6 CFU/calf/day) in ration once daily for five months on total erythrocytes count, hemoglobin content and packed cell volume (PCV), MCV, MCH, MCHC and total and differential leucocytes count in cow calves .

(Mean \pm S.E) .

Item	Group	Zero	1 st	2 nd	3 rd	4 th	5 th
RBCs($n \times 10^6$ /ML)	Control	6.57 \pm 0.31	6.46 \pm 0.20	5.98 \pm 0.07	6.04 \pm 0.12	5.64 \pm .014	5.56 \pm 0.33
	Treated	6.77 \pm 0.32	7.46 \pm 0.22 *	7.4 \pm 0.18 *	7.64 \pm 0.22 *	7.36 \pm 0.43 *	7.52 \pm .047 *
HB (gm./dl)	Control	8.6 \pm 0.41	7.4 \pm 0.4	7.4 \pm 0.51	7.4 \pm 0.68	6.6 \pm 0.51	7.4 \pm 0.24
	Treated	8.58 \pm 0.29	10.6 \pm 0.51*	11 \pm 0.45*	11.6 \pm 0.68*	10.6 \pm 0.24*	11 \pm 0.32*
PCV (%)	Control	24.08 \pm 0.87	45.2 \pm 2.24	34.4 \pm 3.68	43.8 \pm 3.73	38.8 \pm 0.66	37.7 \pm 2.1
	Treated	25.02 \pm 0.54	37.1 \pm 2.23 * \downarrow	38.1 \pm 2.58 * \uparrow	41.26 \pm 3.69	38.74 \pm 3.68	37.78 \pm 3.73
MCV (fl)	Control	36.82 \pm 0.59	36.54 \pm 0.5	36.18 \pm 0.28	36.04 \pm 0.15	35.9 \pm 0.32	36.12 \pm 0.54
	Treated	35.92 \pm 0.52	35.78 \pm 0.33	35.92 \pm 0.22	35.9 \pm 0.23	35.8 \pm 0.27	35.78 \pm 0.41
MCH (pg)	Control	13.02 \pm 0.11	8.6 \pm 0.4	8.4 \pm 0.24	7.8 \pm 0.49	8.4 \pm 1.86	11.9 \pm 0.46
	Treated	12.94 \pm 0.34	12.2 \pm 1.22 *	11.44 \pm 0.53 *	11.38 \pm 1.16 *	10.3 \pm 0.80 *	11.94 \pm 0.52
MCHC(%)	Control	35.6 \pm 0.61	32.2 \pm 1.16	32.2 \pm 0.86	30.6 \pm 0.93	31 \pm 0.55	34.2 \pm 0.73
	Treated	36.14 \pm 0.64	33.2 \pm 1.32	32.6 \pm 1.29	24.64 \pm 4.30	33.06 \pm 1.13	33.24 \pm 1.18
WBCs ($n \times 10^3$ /ml)	Control	11.05 \pm 0.61	11.4 \pm 0.51	8.6 \pm 0.4	8.2 \pm 0.37	8.2 \pm 0.37	7.8 \pm 0.37
	Treated	10.97 \pm 0.55	11.8 \pm 0.2	11.6 \pm 0.24 *	12.6 \pm 0.75 *	13 \pm 0.45 *	12 \pm 0.55 *
Neutrophil %	Control	35.72 \pm 0.81	35.6 \pm 0.68	37.2 \pm 0.73	36.4 \pm 0.75	38 \pm 1.14	35.8 \pm 1.60
	Treated	35.18 \pm 0.58	35.8 \pm 0.2	41.8 \pm 1.9 *	44.2 \pm 1.8 *	53 \pm 2.55 *	44.2 \pm 1.16 *
Lymphocyte %	Control	42.77 \pm 1.53	41.2 \pm 0.37	40.8 \pm 0.37	42 \pm 0.45	45.4 \pm 2.30	49.6 \pm 2.7
	Treated	53.2 \pm 1.94 *	52.2 \pm 0.58 *	52.8 \pm 0.8 *	51.4 \pm 0.51 *	51.2 \pm 3.88 *	48 \pm 7.91
Basophil %	Control	0.25 \pm 0.11	0.6 \pm 0.24	0.2 \pm 0.2	0.0 \pm 0.0	0.2 \pm 0.2	0.6 \pm 0.24
	Treated	0.30 \pm 0.08	2.2 \pm 0.58	0.0 \pm 0.0	0.8 \pm 0.49	0.0 \pm 0.0	0.6 \pm 0.24
Eosinophil %	Control	0.2 \pm 0.2	0.0 \pm 0.0	0.8 \pm 0.2	0.6 \pm 0.4	0.2 \pm 0.2	0.2 \pm 0.2
	Treated	0.57 \pm 0.04	2.2 \pm 0.37	0.6 \pm 0.24	0.8 \pm 0.37	0.2 \pm 0.2	0.8 \pm 0.37
Monocyte %	Control	0.29 \pm 0.09	1.8 \pm 0.49	2 \pm 0.0	2.4 \pm 0.24	2.4 \pm 0.51	3.8 \pm 0.58
	Treated	0.5 \pm 0.03	1.8 \pm 0.58	3 \pm 0.32 *	4.2 \pm 0.58 *	4 \pm 0.55 *	4.2 \pm 0.58
Platelets (n $\times 10^3$ /ml)	Control	270.2 \pm 21.38	352.8 \pm 7.7	344.6 \pm 9.80	362.2 \pm 5.6	338 \pm 6.27	560.4 \pm 23.5
	Treated	262.8 \pm 21.16	390 \pm 17.85	520.6 \pm 13.66	451.4 \pm 1.3	547.4 \pm 4.2	559.6 \pm 25.21

* means significant at (p< 0.05).

Table (3): The effect of oral administration of *Pedococcus* (23×10^6 U/calf/day) in ration once daily for five months on total protein, albumin, globulin, spartate transaminase (AST), alanine transaminase (ALT) and alkaline phosphatase (ALP), urea and creatinine in cow calves .

(Mean \pm S.E) .

Item	Group	Zero	1 st	2 nd	3 rd	4 th	5 th
TP (g/dl)	Control	6.7 \pm 0.17	5.76 \pm 0.24	6.24 \pm 0.24	5.1 \pm 0.25	5.24 \pm 0.21	6.74 \pm 0.18
	Treated	6.84 \pm 0.16	7.74 \pm 0.50 *	6.4 \pm 0.24	6.9 \pm 0.16 *	7.1 \pm 0.12 *	6.9 \pm 0.2
ALB(g/dl)	Control	3.15 \pm 0.10	2.86 \pm 0.21	2.76 \pm 0.16	2.84 \pm 0.28	3.36 \pm 0.25	2.92 \pm 0.15
	Treated	3.26 \pm 0.05	2.74 \pm 0.17	3.24 \pm 0.21 *	2.92 \pm 0.32	3.36 \pm 0.34	3.24 \pm 0.14
globulin (g/dl)	Control	3.57 \pm 0.08	2.9 \pm 0.36	3.48 \pm 0.32	2.26 \pm 0.44	1.88 \pm 0.42	3.66 \pm 0.12
	Treated	3.59 \pm 0.12	5 \pm 0.44 *	3.12 \pm 0.36	3.98 \pm 0.28 *	3.74 \pm 0.15 *	3.66 \pm 0.11
ALT (IU/L)	Control	26.6 \pm 5.03	30.8 \pm 1.53	31 \pm 2.66	33.2 \pm 4.72	32.4 \pm 3.14	17.2 \pm 2.13
	Treated	29 \pm 1.87	27 \pm 2.11	17.8 \pm 1.59 *	18.6 \pm 1.6 *	20.2 \pm 2.00 *	19.4 \pm 2.2 *
AST (IU/L)	Control	171.6 \pm 7.2	181.4 \pm 11.40	173 \pm 8.46	166.6 \pm 6.66	176 \pm 8.38	150 \pm 19.47
	Treated	167.2 \pm 4.50	120.2 \pm 12.20 *	93.4 \pm 6.18 *	91 \pm 5.8 *	94 \pm 9.08 *	80.2 \pm 3.43 *
AIP(IU/L)	Control	3.9 \pm 0.13	2.84 \pm 0.22	2.84 \pm 0.18	3.9 \pm 0.25	3.22 \pm 0.29	4.12 \pm 0.25
	Treated	4.14 \pm 0.49	2.48 \pm 0.05	2.88 \pm 0.24	3.72 \pm 0.27	3.46 \pm 0.28	4.1 \pm 0.46
Urea(mg/dl)	Control	1.42 \pm 0.17	1.14 \pm 0.13	1.14 \pm 0.13	1.1 \pm 0.07	0.62 \pm 0.11	0.62 \pm 0.11
	Treated	1.22 \pm 0.19	0.82 \pm 0.19 *	0.94 \pm 0.17 *	0.9 \pm 0.18 *	0.62 \pm 0.11	0.62 \pm 0.11
Creatinine(mg/dl)	Control	0.97 \pm 0.03	1.3 \pm 0.28	1.8 \pm 0.2	1.6 \pm 0.10	1.84 \pm 0.10	0.72 \pm 0.04
	Treated	1.14 \pm 0.04 *	1.28 \pm 0.09	1.36 \pm 0.26 *	1.3 \pm 0.23	1.54 \pm 0.21 *	0.76 \pm 0.04

* means significant at (p< 0.05).

4. DISCUSSION

In the digestive system of the newborn calves, the digestive tracts are sterile in the womb of their mothers. Upon birth, this alimentary tract is naturally colonized by a certain of microorganisms from the environment (**Savage, 1987**). Under normal conditions, useful micro-organisms colonize in the rumen and lower part of intestine in a synbiotic relationship with the host.

Due to the intensive rearing and systems of calves, make them very susceptible to enteric bacterial imbalance. *Pedococcus* is a G+ve bacteria that belongs to a group of homofermentative lactic acid bacteria (LAB). It is the best-known major member of probiotic bacteria (Gibson and Fuller, 2000; Rolfe, 2000), which can prevent harmful pathogens from affecting the gastrointestinal mucosa (Rinkinen et al., 2003;

Duggan et al., 2002) and provoke immune reaction (Ouwehand et al., 2003 ;Vinderola et al., 2005).

The present study showed a significant increase in body weight and body gain in 2nd, 3rd and 5th month post treatment in treated groups compared with the control group, while there was no significant change in feed intake of all groups. (Table 1).

The obtained data was in agreement with that of Dimova et al. (2013) who stated that there was no difference in feed intake. Calves fed with probiotic were healthier than control calves. In addition, probiotic had positive effect on average daily gain in calves.

The obtained results showed a significant increase in total erythrocyte count in hemoglobin content in 1st, 2nd, 3rd, 4th

and 5th month post treatment in treated groups compared to the control one.

Also a significant increase in total protein in 1st, 3rd and 4th month in treated groups compared to control group

Our results agreed with Cetin et al. (2005) who observed that the probiotics supplementation caused statistically significant increase in the erythrocyte count and hemoglobin concentration of Turkeys.

But on the other side, Dimova et al. (2013) concluded that the hematology parameters were normal in experimental and control groups of White and Black breed with also a no significant change in total protein.

Moreover there is a significant increase in mean corpuscular hemoglobin in 1st, 2nd, 3rd and 4th month of the treated group compared to control groups (Table2).

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- The significant increase in total leucocyte count in treated groups compared to the control one at 2nd, 3rd, 4th and 5th month was in agreement with Shaimaa, (2018) who found a significant increase in total leucocyte count in treated female calf group with *Pediococcus pentosaceus* and *Pediococcus acidilactici*. But this result doesn't agree with Dimova et al. (2013) who stated that the level of leucocytes in the experimental calf group was lower than the control.
- The results recorded in Table(3): Data showed a significant decrease in Aspartate transaminase (AST), alanine transaminase (ALT) at 2nd ,3rd, 4th and 5th month in treated group compared to control one. And also showed a significant decrease in Urea at 1st, 2nd and 3rd month in treated groups compared to control one.
- This data is agreed Antunovic et al. (2005) who reported that probiotic supplementation to growing lambs resulted in slight activation.