

EFFECT OF PROBIOTICS SUPPLEMENTATION ON GROWTH AND PHYSIOLOGICAL PERFORMANCE OF MAGHATIR CAMEL-CALVES

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*Biotechnology Department, Faculty of Science (Al-Khumrah), Taif University; KSA,*** Animal Production Department, Faculty of Agriculture, Ain Shams University Cairo, Egypt***SUMMARY**

This study was conducted to investigate the effect of probiotics inclusion on growth traits, hematological profile and thyroid hormones (T_3 and T_4) concentration at monthly intervals for six months period. 22 early weaned camel-calves of Maghatir breed (12 males and 10 females) aged 6-7 months and weighing 186.6 ± 0.3 and 173.2 ± 0.5 kg for males and females, respectively were used. Calves were allotted into two main groups according to their gender and each gender was assigned into two equal groups had approximately similar body weight. The first group fed concentrate feed mixtures (CFM) without probiotics and served as control group (C), whereas, the second group fed CFM plus 20g/h/d of probiotics and served as treated group (P). Live body weight (BW) and hematological parameters (hemoglobin concentration, Hb; packed cell volume, PCV; erythrocyte count, RBC's; and total leukocytes count, WBC's) were determined monthly. In addition derived erythrocyte indices (mean corpuscular volume, MCV, fl; mean corpuscular hemoglobin, MCH, pg and mean corpuscular hemoglobin concentration, MCHC %) were calculated in addition to plasma thyroid hormones concentration.

Results indicated that males of (P) group gained more body weight (+5.39%) compared with the corresponding females' one. Probiotics supplementation improved ADG for males (18.5%) and females (4.9%), respectively than control groups. Probiotics supplementation had no effect ($P > 0.05$) on plasma T_3 and T_4 concentrations in both genders. Hb, PCV, RBC's and WBC's values significantly ($P < 0.05$) affected in both gender calves supplemented probiotics compared with control calves.

Gender had significant effects on body weight, hematological parameters and T_3 and T_4 where females had higher values ($P < 0.05$) of Hb, PCV and RBC's count, while male calves had higher ($P < 0.05$) values of BW, WBC's count, T_4 and T_3 levels than females. Daily gain of control groups showed that male calves had higher ($P < 0.01$) daily gain than the female calves. In addition, plasma T_3 concentrations increased ($P < 0.001$) over time in both genders and tended to be more related to body weight gain, while T_4 behaved the opposite trend.

It could be concluded that probiotics supplementation (20g/h/d) in ration of post-weaning camel calves improving weight gain and physiological status.

Keywords: camel-calves, probiotics, body weight, hematological traits, thyroid hormones

INTRODUCTION

One of the best feed additives for ruminant rations is the probiotics or direct fed microbial (DFM). DFM are viable microbial cultures and enzyme preparations that improve intestine microbial balance (Fuller, 1989). Manipulating rumen digestion system through the addition of DFM and a fibrolytic enzymes to ruminant rations enhance cellulose digestion and improve the animal performance Fadel and Abusamra (2007); Musa *et al.* (2009) and Mandour *et al.* (2009).

Live yeast supplements release essential enzymes, vitamins and aminoacids during digestion, which have a positive effect on the performance of ruminants (Newbold, 1995) in general and on average daily gain and feed efficiency in particular (El-Ashry *et al.*, 2003; Salama *et al.*, 2005 and Fadel and Abusamra, 2007).

Aro and Akinmoegun (2012) and Aro *et al.* (2013) reported that hematological parameters are used in routine screening for the health and physiological status of livestock. Mean values of corpuscular volume; corpuscular hemoglobin and corpuscular hemoglobin concentration have a considerable

importance in determination of health status of flock (Saddiqi *et al.*, 2011).

Hematological parameters are influenced by many factors like genotype, age, gender, seasonal variations, lactation, pregnancy, health and nutrition status (Aengwanich, 2002; Al-Shami, 2007; Gupta *et al.*, 2007, Mohammed *et al.*, 2007 and Mohri *et al.*, 2007). During calves' weaning time, total leukocytes count increased significantly as observed by Mohri *et al.* (2007).

Huska *et al.* (2002) and Jukna *et al.* (2003) reported in their studies that calves received probiotic had a good health status as indicated by hematological parameters.

Thyroxine and tri-iodothyronine hormones are involved in the regulation of metabolic process at body tissues, growth and development, reproduction, and adaptation in farm animals (Kahl and Bitman, 1983 and Todini, 2007).

The objective of this study was to evaluate the effect of probiotics supplementation on growth indices, hematological parameters and thyroid hormones concentrations in both male and female Maghatir camel-calves during post-weaning period.

MATERIALS AND METHODS

Animals and experimental procedure:

A total of 22 early weaned camel-calves of Maghatir breed (12 males and 10 females) were used in this study. Calves had age of 6-7 months and weighing 186.6 ± 0.3 and 173.2 ± 0.5 kg for males and females, respectively. Calves were divided into two equal groups/gender. The first group in each gender served as control and fed concentrates feed mixture (CFM) without probiotics, while the second group was fed CFM containing probiotics as growth promoter and housed in 4 separated pens. The study lasted six months period. CFM was offered once a day in the morning (at 08:00 am) and was adjusted monthly to meet the changes of body weight as

reported by Kearn (1982). All the calves fed clover hay (CH) *ad libitum* as roughage throughout the experiment. The CFM consisted of 67% whole yellow corn, 13% wheat bran, 15% soybean meal, 1.2% premix, 0.8% common salt and 3% limestone. Fresh water was offered once daily. All calves were provided free-choice access to a salt-based trace mineral mix that contained 12.0% Ca, 9.0% B, 9.0% Na, 0.30% Zn, 0.15% Cu, 0.05% Mn, 0.02% I, 0.005% Co, and 0.004% Se; in a blocks form (3kg each).

The chemical composition of CFM and CH (on DM basis %) are presented in Table (1). Proximate analyses were determined by the standard AOAC (1995), while nitrogen-free extract (NFE) was determined by the calculated difference.

Table 1. The chemical composition (on DM basis, %) of concentrate feed mixture (CFM) and clover hay (CH)

Item	DM	OM	CP	CF	EE	Ash	NEF
CFM*	90.43	92.79	16.97	10.61	4.37	8.24	61.21
CH	89.96	90.00	13.76	36.20	1.28	10.03	38.76

*CFM; concentrate feed mixture contained; 67% whole yellow, 13% wheat bran, 15% soybean meal, 1.2% premix, 0.8% common salt and 3% limestone.

The dried commercial probiotics (Biyoteksin™ L, Novartis) was added in a powder form at a level of 20g/h/d (Abdel-Fattah *et al.*, 2011). According to the supplier each kg probiotics contains variety of microbial species; with lactose as a carrier compound plus numerous of minerals, amino acids and vitamins. Calves were weighed at monthly using an aviary weighing-machine to the nearest 100 grams (at 08:00 a.m.). The average daily weight gain (ADG), total gain (TG) and growth rate (GR) was calculated as follows:

Total weight gain, kg = final weight – initial weight

Average daily gain, g = (final weight, g – initial weight, g) / experimental period in days

Growth rate, % = (final weight, kg – initial weight, kg) / initial weight, kg * 100

Blood sampling and analyses:

Blood samples were collected from the jugular vein of the calves. Monthly, approximately 10 ml of blood was taken of each animal at early morning (just before feeding and drinking) intest tubes containing Lithium heparin as anticoagulant. Hemoglobin concentration (Hb, g/dl) was determined in blood according to Drabkin and Austin (1932), while packed cells volume (PCV %) was estimated according to Chyrel *et al.* (1992). Erythrocytes count (RBC's $\times 10^6$ cells/ μ l) was made by diluting whole blood, 1:200 in physiological saline solution, while total leukocytes (WBC's $\times 10^3$ cells/ μ l) was count in blood diluted 1:50 according to Chyrel *et al.* (1992). Erythrocyte indices in terms of the mean corpuscular volume (MCV, fl), mean corpuscular hemoglobin (MCH, pg) and mean corpuscular hemoglobin concentration (MCHC, %) were calculated according to Chyrel *et al.* (1992) as follows:

MCV, fl = (Ht, % / RBC's, $\times 10^6$ /mm³)*100

MCH, pg = (Hb, g/dl / RBC's, $\times 10^6$ /mm³)*10

MCHC, % = (Hb, g/dl / Ht, %)*100

Hormonal assays:

Plasma concentrations of T₃ and T₄ were determined by using Dia Sorin CLIA kits (Stradaper Crescentino-13040 Saluggia (Vercelli) – Italy) with the LIAISON analyzer. The validation for these hormones assays assessed the limits of detection, precision of standard curve following sample dilution and intra-and inter-assay coefficient of variation of the results.

Statistical analysis:

Statistical analysis was conducted using the general linear model (GLM) procedures of SAS (2003). A repeated measurement model was used. Distributed Duncan's tests (1955) were used to compare the treatment means. Dead calves were subtracted from the total number (22) and statistical analysis was done on raw data of 20 camel-calves for six months period.

$$Y_{ijke} = \mu + T_i + S_j + P_k + (T*S)_{ij} + (S*P)_{jk} + e_{ijke}$$

Where:

μ = Average; T_i = treatment effect (i = 1,2)

S_j = Sex effect (j = 1,2)

P_k = Time effect (k = 1,2)

(T*S)_{ij} = The effect of treatment and sex interaction

(S*P)_{jk} = The effect of sex and time interaction

e_{ijke} = Error

RESULTS AND DISCUSSION

1. Productive performance:

Clinical observations:

Severe diarrhea was reported in two males and died at the end of the second month of study. The main cause of this death was diarrhea. Etiologically, the disease was caused by mixed infection with numerous microbes, notably *Salmonella* spp. and *E. coli* (Abbas *et al.*, 1992a and Bengoumi *et al.*, 1998). The mortality rate reported in this study (9.10%) is within the expected range and is comparable to the rate recorded previously by Abbas *et al.* (1992a).

Effect of treatment

Body weight changes:

1. Effect of probiotics

Results in Table (2) indicated that BW of the treated calves was higher in both genders throughout the study. On the other hand, ADG, TG and GR was more distinctive in treated calves compared with control. The present results are in accordance with the findings of Ismaiel *et al.* (2010) and Adel and EL-Metwaly (2012) who reported that final weight gain; ADG and TG were significantly higher in treated supplemented groups than control group of camel calves. Similar trends were observed on Najdi lambs (Hussein, 2014) and Nubian goats (Fadel and Abusamra, 2007). They attributed the improvement in daily gain as a result of adding *Saccharomyces cerevisiae* and its effect on microbial efficiency and organic matter, crude protein and crude fiber digestibility's. These results are supported by the results of Gado *et al.* (2009) and Adel and El -Metwaly (2012) who reported that dry matter and organic matter digestibility was significantly lower

($P < 0.05$) in dairy cows fed control ration than rations with ZADO supplementation.

On the other hand, this is in disagreement with the findings of Titi *et al.* (2008) who reported that yeast supplementation had no effect on growth rate in lambs and kids. Whitley *et al.* (2009) found that growth performance of goats remained unaltered with probiotics supplementation, except in one growth trial in which weight gain and feed conversion ratio was higher in probiotics supplemented group compared with the control.

2. Effect of gender

Results in Table (2) indicated that gender had a significant effect ($P < 0.05$) where male calves had the heavier BW than females by about 8.74%. Similar results were reported by Abbas *et al.* (2010); Saddiqi *et al.* (2011); Abdel-Fattah *et al.* (2013) and Wielgosz-Groth *et al.* (2015).

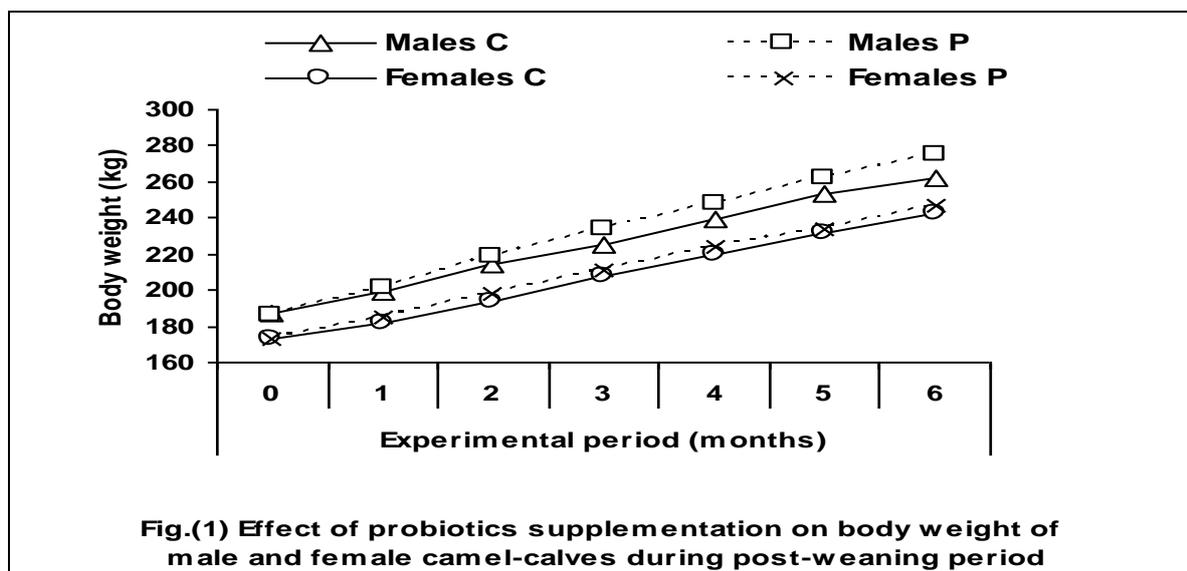
Abbas *et al.* (2010) demonstrated that gender had significant effect on BW with advance of age in camel's calves. This may be due to the secretion of sex testosterone, which enhances growth in males. As shown in Table (2) and Fig.(1), Male-calves had higher ($P < 0.01$) final body weights than female-calves. In the present study.

Kadim *et al.* (2008) and Asadzadeh *et al.* (2010) found that sex has no effect on live weights of camel at early ages of one humped camels but at the later ages, males had significantly heavier live body weights than females. Asadzadeh *et al.* (2010) reported that live weight for the fattened males was higher (376.7 ± 18.6) compared with fattened females (342.0 ± 18.6) kg at 21 months of age.

Table 2. Means \pm SE of body weight, average daily gain, total gain and growth rate of weaned camel-calves fed diet with or without probiotics during post-weaning period

Trait	Sex	Groups		Average
		C	P	
IBW (KG)	Males	186.75 ^a	185.95 ^a	186.35A
	Females	172.78 ^a	173.50 ^a	173.14 ^B
\pm SE			± 0.79	
FBW (KG)	Males	261.52 ^b	274.52 ^a	268.02A
	Females	242.56 ^b	246.79 ^a	244.70 ^B
\pm SE			± 0.77	
ADG (g/h/d)	Males	415.40	492.05	453.72
	Females	387.70	407	397.35
TG (Kg)	Males	74.77	88.57	81.67
	Females	69.78	73.29	71.53
GR(%)	Males	40.04	47.63	43.83
	Females	40.34	42.24	41.29
\pm SE			± 3.94	

IBW= initial body weight; FBW= final body weight; ADG= average daily gain; TG= total gain; GR= growth rate; ^{a, b} in the same row bearing significant different at ($P < 0.05$); ^{A, B} in the same column bearing significant different at ($P < 0.01$); C= control group; P= probiotics group



2. Physiological performance:

2.1. Hematological responses

Effect of probiotics

Supplementing rations with probiotics indicated that Hb, PCV, RBC's and WBC's values were higher ($P < 0.05$) in the treated group compared with the control (Table 3). These findings agree with the findings of Milewski and Sobiech (2009) who reported that natural feed additives increased ($P < 0.05$) Hb, PCV, RBC's, WBC's and MCVs compared with control group of ewes.

Contrariwise, Sarker *et al.* (2010) reported that there were no significant differences ($P > 0.05$) in blood Hb, RBC's and WBC's among the feed additive groups compared to control group during post-weaning period of the Korean native calves (Hanwoo), Hanwoo is a pure breed maintained by the Korean national breeding system (Kee *et al.*, 2008) and the phylogenetic tree based mitochondrial DNA sequence homology shows that Hanwoo belongs to the humpless *Taurine species*, *Bos Taurus* (Kikkawa *et al.*, 2003). Ali-Arab *et al.* (2014) reported that lambs received 0.5 and/or 1.0 g Bioplus/kg of feed caused a significant ($P < 0.05$) decrease in the values of Hb, PCV and RBC's. Riddell *et al.* (2010) reported no differences were observed in packed cell volume between control and treated Holstein calves with probiotics. Adams *et al.* (2008) also found no variation between probiotic treated calves and their control counterparts in overall hematocrit. Dimova *et al.* (2013) reported that there was no significant differences ($P > 0.05$) in hematological parameters between probiotic treated group (12 g/h/d) and control one at the beginning and the end of the study.

Effect of Gender

The obtained results indicated that Hb, PCV and RBC's values were higher in females than males throughout the study (Figures 2, 3 and 4) but male calves had the higher value of WBC's (Fig. 5) than females. In accordance, Tibbo *et al.* (2004) on goats; Saddiqi *et al.* (2011) on Kajli lambs; Opara *et al.*

(2010) on West African Dwarf (WAD) goats and Abdel-Fattah *et al.* (2013) on Barki lambs reported that blood values of Hb, PCV, RBC's were higher ($P < 0.01$) in females than males.

This observation is in contrast with values obtained for Red Sokoto goats in Nigeria (Tambuwal *et al.*, 2002) in which male animals have higher values than females. Hussein *et al.* (2012) reported that no significant effect of gender on Hb, PCV, RBC's, MCHC and WBC's, while MCV and MCH were higher ($P < 0.05$) in female compared to male camels for Majahim and Maghatir dromedary camels. Likewise, Olayemi *et al.* (2006) on Gudali and Kuri cattle, Awolaja *et al.* (1997) on Keteku cattle reported that there was no gender difference in the RBC's values.

The obtained results revealed that, in both genders, hematological traits improved linearly with weight gain but calves supplemented probiotics has the better improvement compared with control calves (8.5, 8.6, 4.02 and 4.30 vs. 4.5, 3.1, 0.82 and 0.54 %) for males. The corresponding values for females recorded (10.61, 6.62, 6.4, and 6.63 vs. 5.06, 1.42, 2.3 and -0.34 %) for Hb, PCV, RBC's and WBC's, respectively. In agreement, Thomas *et al.* (1994) and Chang'a *et al.* (2012) reported that there was a significant correlation between blood Hb level and BW gain in calves.

2.2. Erythrocyte indices:

Results in Table (4) indicated that probiotics caused a significant increase in MCHC (42.13%) compared with control group (40.72%), but MCH values tended to be decreased. Supplementing rations with the probiotics had no effect on MCV values of female calves. On the other hand, probiotics supplementation had no significant effect on MCV, MCH and MCHC values of male calves. Mandour *et al.* (2009) reported that probiotics supplementation caused a significant decrease of MCH in weaned Najdi lambs and significant increase on MCHC in weaned Awassi lambs relative to control groups.

Ali-Arab *et al.* (2014) reported that lambs received 0.5 and/or 1.0 g Bioplus/kg of feed caused an ($P < 0.05$) in MCV and MCH levels.

The present results indicated that, no interaction between gender and treatment on MCV and MCH.

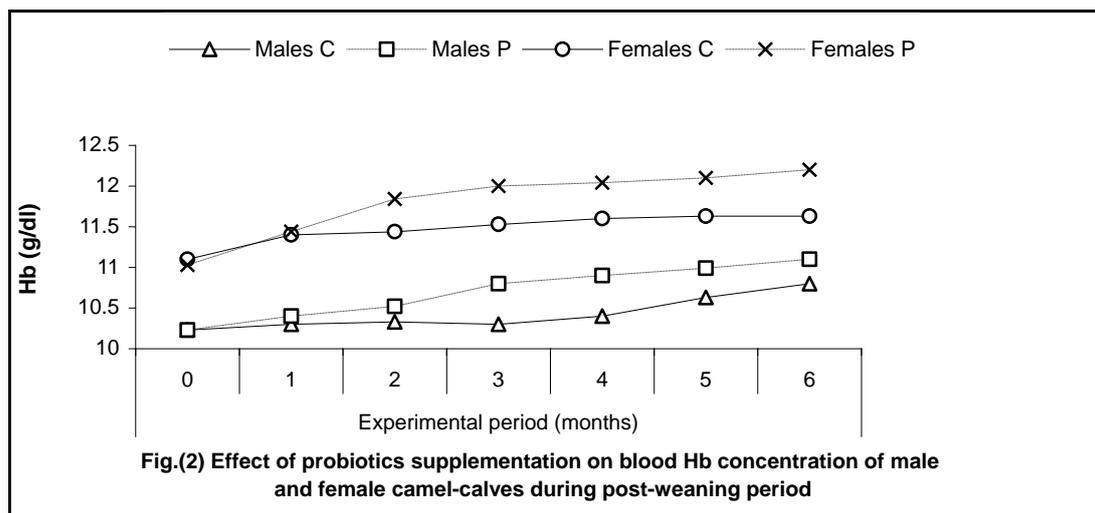
Unlike, Sarker *et al.* (2010) found that, there were no significant differences ($P > 0.05$) in MCV, MCH, MCHC among the feed additive groups of Hanwoo calves. Kunavue and Lien (2012) reported that folic acid and probiotics supplementation with diets did not show any significant difference compared with the control group of pigs.

Concerning the effect of sex, results in Table (4) indicated that the averages of MCV and MCHC were higher by 3.8 and 2.0%, respectively in females than males. Meanwhile MCH was higher by 2.0% in males than females. Therefore, it could be explain the increase of MCH level in males was attributed to the decrease in MCV value. Mirzadeh *et al.* (2010) reported that MCH were significantly ($P < 0.05$) higher in males than females of Iranian cattle. Finally, AL-Busadah. (2007) reported that no significant effect due to breed or sex on erythrocytic indices and leukocytic series of Majahim, Maghatir and Awarike camel breeds in Saudi Arabia.

Table 3. Means \pm SE of blood hemoglobin, packed cell volume, erythrocytes and leukocytes counts of weaned camel-calves fed diet with or without probiotics during post-weaning period

Trait	Sex	Initial		Average	Final		Average	Change %	
		C	P		C	P		C	P
Hb (g/dl)	Males	10.23 ^b	10.23 ^b	10.23 ^B	10.69 ^b	11.10 ^b	10.90 ^B	4.5	8.5
	Females	11.07 ^a	11.03 ^a	11.05 ^A	11.63 ^a	12.20 ^a	11.92 ^A	5.06	10.61
					± 0.10				
PCV (%)	Males	26.0 ^b	25.6 ^b	25.8 ^B	26.8 ^b	27.8 ^b	27.3 ^B	3.1	8.6
	Females	28.2 ^a	27.2 ^a	27.7 ^A	28.6 ^a	29.0 ^a	28.8 ^A	1.42	6.62
					± 0.40				
RBC's	Males	7.30 ^b	7.21 ^b	7.24 ^B	7.36 ^b	7.50 ^b	7.32 ^B	0.82	4.02
	Females	7.64 ^a	7.65 ^a	7.44 ^A	7.82 ^a	8.14 ^a	7.62 ^A	2.3	6.40
					± 0.09				
WBC's	Males	9.30 ^a	9.32 ^a	9.31 ^A	9.35 ^a	9.72 ^a	9.54 ^A	0.54	4.30
	Females	8.70 ^b	8.60 ^b	8.65 ^B	8.67 ^b	9.17 ^b	8.92 ^B	- 0.34	6.63
					± 0.10				

C= control group; P= probiotics group; Hb =hemoglobin, PCV = packed cell volume; RBC's = erythrocytes count ($\times 10^6$ cells/ μ l); WBC's = total leucocyte count ($\times 10^3$ cells/ μ l); ^{a, b} in the same row bearing significant different at ($P < 0.05$); ^{A, B} in the same column bearing significant different at ($P < 0.01$)



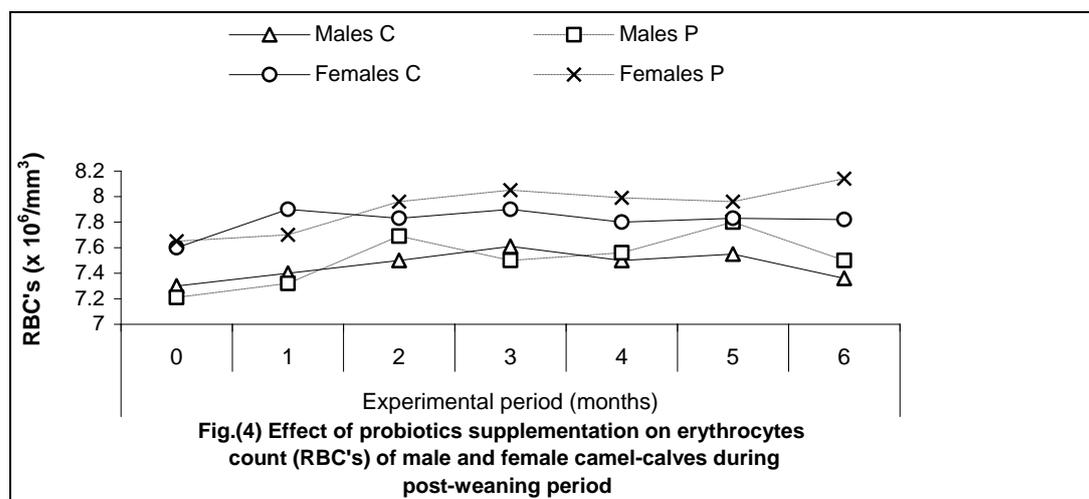
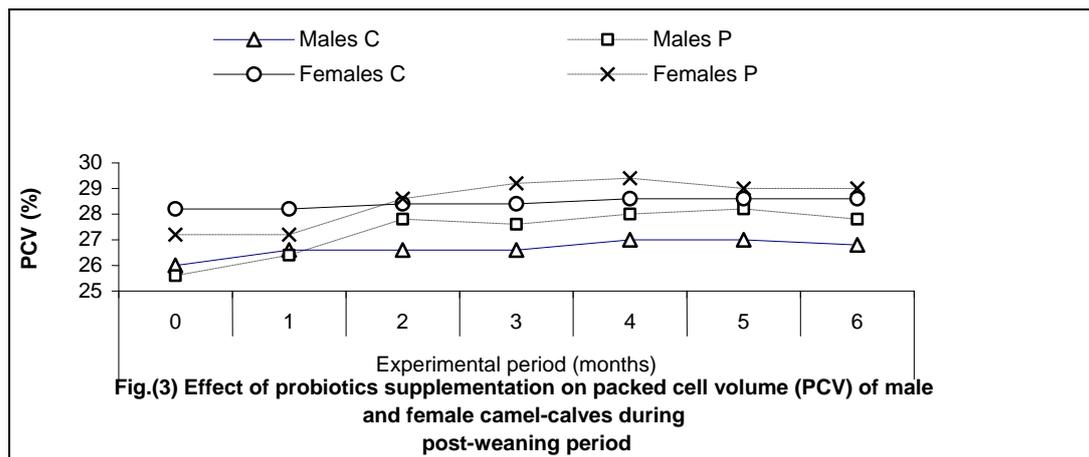


Table 4. Means \pm SE of derived erythrocyte indices (MCV, MCH and MCHC) of weaned camel-calves fed diet with or without probiotics during post-weaning period

Trait	Sex	Initial		Average	Final		Average	
		C	P		C	P		
MCV (fl)	Males	14.06 ^a	14.19 ^a	14.13^B	14.68 ^a	14.83 ^a	14.92^B	
	Females	14.58 ^a	14.42 ^a		14.89 ^a	15.10 ^a		
		\pm SE				\pm 0.20		
MCH (pg)	Males	25.4 ^a	24.01 ^b	25.2^A	24.82 ^a	25.04 ^a	25.02^A	
	Females	25.48 ^a	24.66 ^b		24.58 ^a	23.79 ^b		
		\pm SE				\pm 0.50		
MCHC (%)	Males	39.41 ^a	40.15 ^a	39.78^B	40.38 ^a	40.03 ^a	40.07^B	
	Females	39.33 ^b	40.74 ^a		40.72 ^b	42.13 ^a		
		\pm SE				\pm 0.80		

C= control group; P= probiotics group; MCV = mean corpuscular volume, MCH = mean corpuscular hemoglobin, MCHC = mean corpuscular hemoglobin concentration; ^{a, b} in the same row bearing significant different at (P<0.05); ^{A, B} in the same column bearing significant different at (P<0.01)

2.3. Thyroid hormones:

Regarding the effect of probiotics, as shown in Table 5 results indicated that there were no significant effects on plasma concentrations of T₄ or T₃ among treated and control calves in both genders. As shown in Figs. 6 and 7, the determined thyroid hormones (T₃ and T₄) concentrations did not differ

and remained almost the same from initial till the third month of study in both control and treated groups of each gender, after that plasma concentration of T₃ began to be increased (P<0.05) from the 4th month till the end of the study, the opposite trend was observed for T₄ concentration in all calves. This result may be due to that T₄

transformed to T₃ in tissues before it becomes biologically active (Boonnamsiri *et al*,1979).Therefore, in both genders, the highest T₃ concentration was recorded at the end of study while

the lowest T₄ concentration was recorded at the end of study, In addition, there was no significant differences between control and treated groups along the study in both genders.

Table 5. Means±SE of thyroid hormones (tri-iodothyronine, T₃ and thyroxine T₄) concentrations of weaned camel-calves fed diet with or without probiotics during post-weaning period

Trait	Sex	Initial		Average	Final		Average
		C	P		C	P	
T ₃ (ng/ml)	Males	2.65 ^a	2.67 ^a	2.70 ^A	3.39 ^a	3.42 ^a	3.40 ^A
	Females	2.23 ^a	2.25 ^a		2.76 ^a	2.78 ^a	
				±SE			
				±0.01			
T ₄ (µg/dl)	Males	153.5 ^a	153.7 ^a	153.58 ^A	140.7 ^a	140.3 ^a	140.52 ^A
	Females	149.3 ^a	148.4 ^a		138.7 ^a	138.3 ^a	
				±SE			
				±0.90			

C= control group; P= probiotics group; ^{a, b} in the same row bearing significant different at (P<0.05); ^{A, B} in the same column bearing significant different at (P<0.01)

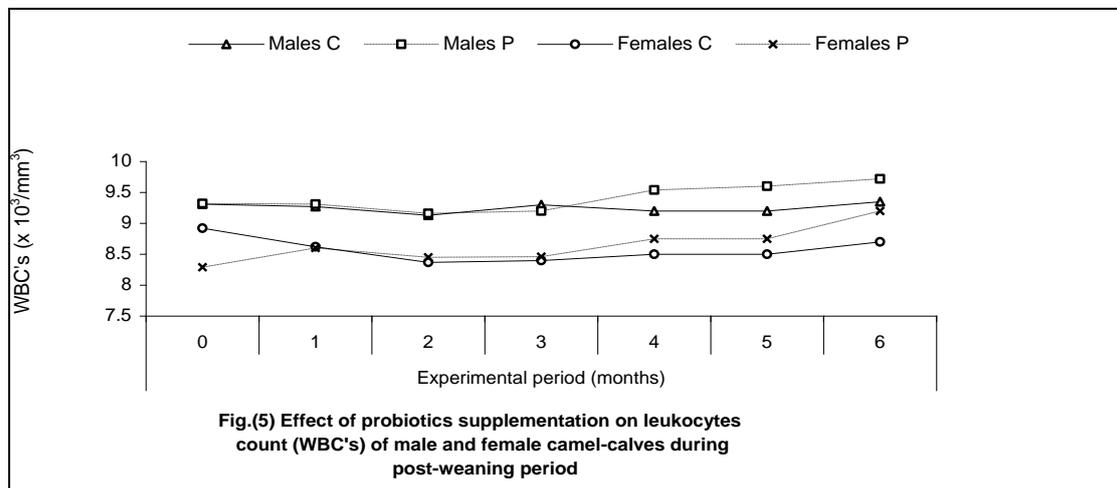
In accordance, Estell *et al.* (1993) found that no effect (P>0.10) of supplementing Se yeast on thyroid hormones levels of the calf during post-weaning. Le-Dividich and Seve (2000) observed that levels of T₃ and T₄ after weaning but measured a decline of those two hormones after a change in the diet. The present results show that no interaction between treatment and gender for plasma T₃ and T₄ levels.

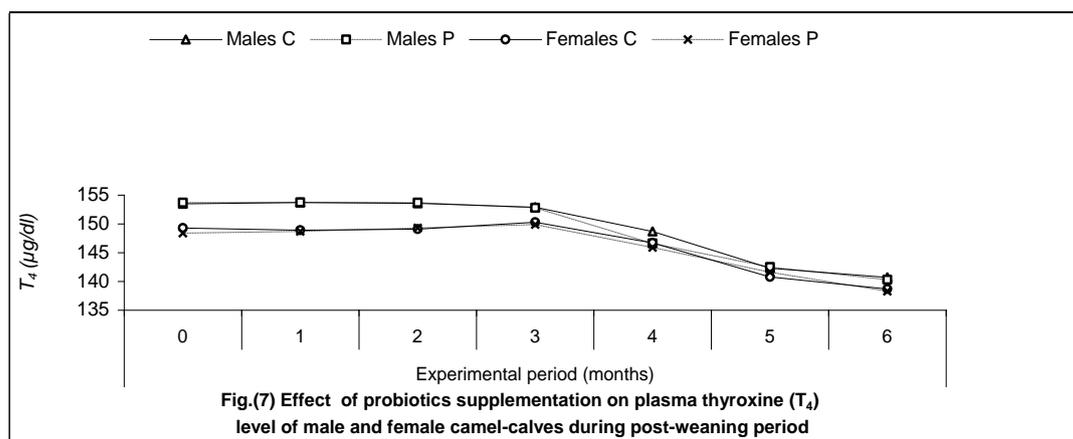
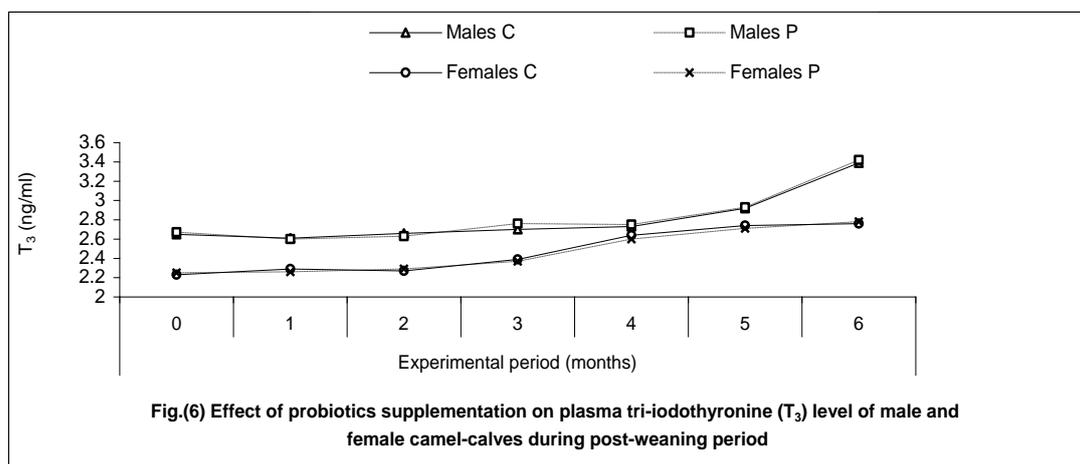
Similarly, in rams and ewes subcutaneously implanted with trenbolone acetate (TBA), Kahl *et al.* (1992) found a decrease in plasma thyroxine and hepatic 5'-deiodinase activity. This enzyme, 5'-deiodinase, converts thyroxine to 3,5,3'- triiodothyronine, which was the metabolically active thyroid hormone. Donaldson *et al.* (1981) also noted

a decrease in plasma thyroxine of growing withers implanted with 140 mg of TBA. This might suggest a decrease in lipid metabolism and (or) turnover of lipid in the lambs implanted with TBA.

Effect of gender

Results presented in Table (5) indicated that male calves had slightly higher overall means of T₃ and T₄ concentrations compared with females. This is in agreement with the findings of Kahl and Bitman. (1983) who found that average concentrations of T₄ and T₃ were 53.3 and 1.21 ng/ml for males and 39.9 and 1.06 ng/ml for females in growing Holstein cattle.





From the present results, the decrease of the circulating T₃ and T₄ levels in female calves might explain their lower ADG than males being 397.35 vs. 453.72 g/h/d, respectively. As shown in Figs. (1) and (6), plasma T₃ behaved the same trend for body weight in both genders along the study. Therefore, T₃ may play the main role in metabolic rate. Sharma (1996) reported positive relationship between circulatory levels of thyroid hormones and body weight during growth in pre-pubertal and pubertal heifers.

Contrariwise, Eshratkhan *et al.* (2010 a) reported that no gender-dependent significant differences between two sexes in plasma thyroid hormones concentrations of Sarabi calves. Also, Todini (2007) on goats and Eshratkhan *et al.* (2010 b) on Moghani sheep observed the same trend.

CONCLUSION

It could be concluded that, the inclusion of probiotics in feeding camel-calves during post-weaning period improved growth and physiological performance of both sexes.

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تأثير البروبيوتك على وزن الجسم والصفات الهيماتولوجية ومستويات هرموني الغدة الدرقية لحيران المغاير المفطومة

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أجريت هذه الدراسة بهدف تقليل بعض التأثيرات السلبية التي تحدث نتيجة تعرض حيران الإبل للظلم المبكر. حيث تم استخدام البروبيوتك كإضافات بيولوجية بالعليقة بمعدل ٢٠ جم/رأس/اليوم. وقد أجريت الدراسة على عدد ٢٢ من حيران الإبل من سلالة المغاير (١٢ ذكر & ١٠ إناث) مفطومة مبكراً (عند عمر ٦-٧ شهور) وبمتوسط وزن ١٨٦,٦٠ ± ٠,٢٦٠ & ١٧٣,١٨ ± ٠,٥٠٠ كجم لكل من الذكور والإناث على التوالي ولمدة ستة أشهر تم خلالها تسجيل وزن الجسم وعمل صورة دم وتقدير مستوى هرموني الثيروكسين والتراي أيدوثيرونين في بلازما الدم شهرياً. قُسمت الحيوانات في كل جنس إلى مجموعتين متساويتين إحداهما تُمثل المجموعة الضابطة بينما تُمثل الأخرى مجموعة المُعاملة أوضحت النتائج أن للمعاملة بالبروبيوتك عند مستوى ٢٠ جم/رأس/اليوم تأثيراً معنوياً ($P < 0.05$) على وزن الجسم الحي ومعدل الزيادة اليومية في كلا الجنسين ولكن كانت الذكور أكثر تفوقاً عن الإناث طوال فترة الدراسة، كما أظهرت النتائج أن حيوانات المجموعة المُعاملة بالبروبيوتك تميزت بالقيم الأعلى معنوياً ($P < 0.05$) في كل من تركيز هيموجلوبين الدم وكذلك العدد الكلي لخلايا الدم البيضاء مقارنة بحيوانات المجموعة الضابطة في كل من الذكور والإناث، إلا أن المُعاملة بالبروبيوتك عند مستوى ٢٠ جم/الرأس/اليوم لم يؤثر معنوياً ($P > 0.05$) على مستوى تركيزات بلازما الدم من هرموني الغدة الدرقية في كلا الجنسين.

بصرف النظر عن المُعاملة فقد كان للجنس تأثيراً معنوياً ($P < 0.05$) على وزن الجسم والقياسات الهيماتولوجية ومستوى هرموني الغدة الدرقية في بلازما الدم حيث تميزت الذكور عن الإناث بالقيم الأعلى في وزن الجسم الحي والعدد الكلي لخلايا الدم البيضاء وكذلك تركيز بلازما الدم من هرموني الغدة الدرقية. بينما تميزت الإناث عن الذكور في قيم كل من تركيز هيموجلوبين الدم والهيماتوكريت وعدد خلايا الدم الحمراء يتضح من هذه الدراسة أن إضافة البروبيوتك عند مستوى ٢٠ جم/الرأس/اليوم في عليقة حيران الإبل المفطومة مبكراً كان له تأثيراً إيجابياً على وزن الجسم وصورة الدم وبالتالي يكون هناك أداء إنتاجي جيد خلال فترة مابعد الفطام لتفادي الآثار السلبية التي من الممكن حدوثها نتيجة صدمة الفطام.