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EFFECT OF PTEROYLMONOGLUTAMIC ACID ON GOATS MILK YIELD AND COMPOSITION

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ABSTRACT

Twenty-multiparous homoparity Zaraibi goats at late month of pregnancy were randomly assigned to two equal groups: (control and tested group). All animals were fed on berseem hay (BH) and concentrate feed mixture (CFM). The BH and CFM represented 48 and 52% of the total ration (on dry matter basis), respectively. Each animal in tested group was injected intravenously with 4 ml saline solution containing 40 mg pteroylmonoglutamic acid (P.G.A.) weekly. The experimental period extended from late month of pregnancy until the 12th week of lactation. The obtained results illustrated that P.G.A. administration significantly increased ($p < .05$) birth weight of kids by 11% comparing with the control group. Moreover, animals in tested group significantly consumed ($p < .05$) more feed and yielded ($p < .05$) more milk by 8.6 and 25.6% respectively. Furthermore, the results showed that no remarkable differences ($p > .05$) were detected between the two groups for milk fat, protein, TS and ash contents. Data of blood haemoglobulin, total protein, urea-nitrogen and glutamic – pyruvate – transaminase did not show significant differences between the control and tested groups. However, serum glutamic – oxaloacetic transaminase increased in tested group by 11 and 7% during gestation and lactation, respectively. The present study concluded that injected Zaraibi does with 40mg P.G.A weekly produced more milk ($p < .05$) without any adverse effects on milk or blood constituents.

Key words: Pteroylmonoglutamic acid goats – Milk yield – Milk composition – Blood constituents

INTRODUCTION

Pteroylmonoglutamic acid (P.G.A.) is a combination of the pteridine nucleus, para-aminobenzoic acid and glutamic acid. Ruminal microorganisms synthesize the crude form of P.G.A. under the name of vitamin B_9 even diets are free from it (**Lardinois *et al* 1944**). The active form of P.G.A. is responsible for several biological processes such as: methionine synthesis, conversion of glycine to serine and fetal growth (**Marks, 1975 and Leonard, 1984**).

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Recently, few studies towarded at adding P.G.A. to dairy cattle diets inparticular at late stage of gestation (**Girard *et al* 1989 & 1995 and Girard and Matte 1995, 1998 & 1999**). The dietary supplements of P.G.A. to dairy cows increased both milk yield and milk protein content by 14 and 10% respectively (**Girard and Matte 1998**).

The present work was carried out to determine the effect of P.G.A. on feed intake, milk yield, milk composition and some blood parameters of Zaraibi goats.

MATERIAL AND METHODS

The experiment started with twenty pregnant (at late month) Zaraibi goats in their third or fourth season. The goats were randomly divided into two equal groups: control and tested group. Each animal in the tested group was injected with 40mg pteroylmonoglutamic acid (P.G.A.) weekly after the morning milking and before feeding. The experimental period extended from one month prepartum until the first three months of lactation season.

All experimental animals were individually fed twice daily on concentrate feed mixture (CFM) (at 7 a.m. and 2p.m.) and berseem hay (BH) (at 9 a.m. and 4 p.m.). The ratio of BH to CFM was 48 and 52% of the total ration (on DM basis). Water was available ***ad. lib***.. Energy and protein requirements were estimated as recommended by **NRC (1981)**. Components of concentrate feed mixture (CFM) and the chemical composition of CFM, berseem hay (BH) and the ration are shown in Table (1). The chemical analysis was done by the methods of **A.O.A.C. (1995)**.

At partum day, kids and dams were weighed, then only dams were weighed monthly. Dams were milked twice daily (at 7 a.m. and 2 p.m.). Milk yield was recorded biweekly. Composite samples (morning and evening) of each goat were taken for analysis. Milk fat, total solids (TS) and protein contents were determined by the methods of **Ling (1963)**. Lactose and ash contents were determined according to **Barnett and Abd El-Tawab (1957)** and **A.O.A.C. (1995)** respectively. Solid not fat (SNF) was calculated by difference.

Blood samples were taken via the jugular vein at 4 hr. after the morning feeding at the end of gestation (three days prepartum) and at the end of the 12^{th} week of lactation period. Blood haemoglobulin (Hb) was estimated immediately after blood samples collection. The serum samples were stored at – 20°C until analysis for total protein (**Armstrong and Carr 1964**), urea-nitrogen (urea – N) (**Patton and Crouch 1977**) and transaminases: glutamic – pyruvate – transaminase (GPT) and glutamic – oxaloacetic – transaminase (**GOT**) (**Reitman and Frankel, 1957**).

The obtained data were statistically analyzed using variance two-way classification according to **Snedecor and Cochran (1982)**.

RESULTS AND DISCUSSION

Feed intake

Data presented in Table (2), clearly indicated that P.G.A. injection increased ($P < .05$) total DM intake by 8.6% comparing with the control. Both intaked of BH and CFM as DM increased by 7.14% ($P > .05$) and 10% ($p < .05$) respectively.

Table 1. The CFM[1] constituents and the chemical composition of CFM, BH[2] and total ration

Item			%		
CFM constituents (g/100g)					
Undecorticated cotton seeds			30		
Yellow corn			37		
Wheat bran			20		
Rice bran			6.5		
Molasses			3		
Lime stone			2.5		
Common salt			1		
Chemical composition			**CFM**	**BH**	**Total ration***
Dry matter (DM) (%)			89.5	88.3	88.9
Crude protein			14.72	10.71	12.65
Ether extract			3.05	2.5	2.79
Crude fiber		on DM	16.78	27.03	21.70
Nitrogen free extract		Basis (%)	56.95	46.26	51.96
Ash			8.5	13.5	10.90

[1]CFM = Concentrate feed mixture.
[2]BH = Berseem hay.
*calculated

In the light of this result and with regard to scarcity work on using P.G.A. for ruminants in the literature, it may be expected that P.G.A. increased animal appetite by any way. The present result is in line with that obtained by **Girard and Matte (1995)** who found that when cows were injected weekly with 160mg folic acid (P.G.A), they ingested 12% more forage than control cows during the first 6 week of lactation.

Milk yield

It is of interest to report that goats injected with P.G.A. significantly yielded more milk (2.06kg/ h/ d) comparing with the control group (1.64 kg/ h/ d). Obviously, the overall mean of daily milk yield increased by 25.6% during the first three months of lactation (Table, 2). It could be noticed that the increase in milk yield was three times approximately of

Table 2. Effect of pteroylmonoglutamic acid (P.G.A.) on feed intake, milk yield and milk composition

Item	Control group	Tested group	SE
Dry matter of feed intake (g/h/d):			
BH	840	900	22.6
CFM	900[b]	990[a]	28.1
Total	1740[b]	1890[a]	36.3
Milk yield (kg/h/d)	1.64[b]	2.06[a]	0.029
Milk composition (%):			
Fat	4.26	4.22	0.06
Protein	2.98	2.99	0.03
Lactose	4.50	4.46	0.04
TS	12.40	12.33	0.099
SNF	8.14	8.10	0.09
Ash	0.64	0.66	0.024

[a&b] Means having unlike superscript letters differed significantly at ($p<.05$).

that in total feed intake, (Table, 2). The present result is in line with that obtained by **Girard and Matte (1995)** who suggested that milk production tended to be increased (from 11 to 12.5 kg/ cow/ day) by intramascular (i.m.) injection of P.G.A. (folic acid).

Milk composition

With regard to the effect of P.G.A. on milk components, it could be observed that the overall means of milk fat, protein, lactose, TS, SNF and ash contents were unmodified by the P.G.A injection. However, **Girard and Matte, (1995)** showed that milk protein percentage in multiparous cows increased by intramascular injection of folic acid during the first 6 wks of lactation.

Blood parameters

Inspection of the data concerning blood parameters, Table (3) showed no remarkable differences between the two groups for serum total protein urea – nitrogen and GPT either during late gestation or early lactation. However, the GOT activity in the tested group increased by 11% ($p < .05$) and 7% ($p > .05$) during late gestation and early lactation, respectively comparing with the control group.

This finding may possibly be explained on the basis that P.G.A. serves as an acceptor and donor of single carbon units in a wide variety of reactions involved amino acids metabolism (**Brody *et al* 1984**).

Table 3. Effect of pterolymonoglutamic acid (P.G.A.) on blood serum parameters during late gestation and lactation periods

Item	Late gestation		SE	Lactation		SE
	Control group	Tested group		Control group	Tested group	
Serum total protein (g/dl)	6.9	6.8	.33	6.63	6.57	.11
Serum urea-N (mg/dl)	16.3	16.77	.48	15.4	15.67	.61
Serum GOT (u/l)	48.13[b]	53.67[a]	4.4	42.83	46	4.9
Serum GPT (u/l)	14.17	14.50	.53	13.73	14.03	.75
Blood Hb (g/dl)	7.9	7.6	.26	8.33	8.20	.21

[a&b] Means having unlike superscrpit letters differed significantly at ($p < .05$).

Moreover, Table (3) indicated that P.Ç.A. had no effect on blood Hb. Similar trend was observed by **Girard and Matte (1995).**

Body weight

Data of Table (4) showed that birth weight of kids was significantly ($p < .05$) affected by P.G.A. (folic acid) injected to the dams at prepartum. The overall means were 1.59 and 1.77 kg for the control and tested groups, respectively. This result might reflect that the folate status of the control dams was low, and their kids were in need to folic acid to sustain new tissue synthesis. However, **Girard and Matte (1995) and (1998)** noticed that birth weight of calves was not modified by the supplement of folic acid (P.G.A.) given to the cows. The conflicting results may be possibly related to manipulation method (injection or supplement) and / or animal type.

Moreover, data of Table (4) indicated that no significant differences were detected between the two groups for dams body weights at partum day or at 4,8 and 12 wk after parturition. This finding may possibly illustrate that P.G.A. was towarded to milk production not to meat production during early lactation. The present results agree with those reported by **Girard and Matte (1995) and (1998)** for dairy cows.

Economic efficiency

Data of Table (5) clearly showed that goats injected with P.G.A., gave better relative economic efficiency (134.8%) than the uninjected goats.

It is possible therefore to conclude that weekly intravenous injection with 40mg pteroylmonoglutamic acid (P.G.A.) or (folic acid) was beneficial to increase both daily feed intake and milk yield by 8.6 and 25.6%, respectively for Zaraibi goats during the early lactation.

Table 4. Effect of pteroylmonoglutamic acid (P.G.A.) on bodyweight of kids and dams

Item	Control group	Tested group	SE
Body weight of kids of birth day (kg)	1.59[b]	1.77[a]	0.05
Body weight of dams(kg)at:			
parturition	44.8	43.6	1.8
4 wk after parturition	39.6	40.0	1.01
8 wk after parturition	37.2	38.4	1.2
12 wk after parturition	37.4	37.6	0.12

[a&b] means having unlike superscrpit letters differed significantly at ($p < .05$).

Table 5. Economic efficiency of pteroylmonoglutamic acid (P.G.A)

Item	Control group	Tested group
Economic:		
Milk value[1] PT./h/d	205	257.5
Feed cost[2] PT./h/d	73.5	79.8
P.G.A. cost[3] PT./h/d	00.0	00.46
Return PT./h/d	131.5	177.24
Relative economic efficiency	100	134.8

[1]On the basis of a price of 125 P.T./ kg milk
[2]On the basis of a price of 0.500 L.E/kg CFM and a price of 0.350 L.E./kg BH.
[3]On the basis of a price of 8 L.E./ 10 g P.G.A.
[4]Assuming that economic efficiency of the control equals 100.

REFERENCES

A.O.A.C. (1995). ***Official Methods of Analysis.*** 16th Edition. Association of Official Analytical Chemists, Washington, D.C.

Armstrong. W.D. and C.W. Carr (1964). ***Physiological Chemistry: Laboratory Direction, 3rd Ed.*** **p. 75,** Burges Publishing Co. Minneapolis, Minnesota, USA.

Barnett, A.J.G. and G. Abd El-Tawab, (1957). Determination of lactose and cheese. ***J. Sci. Food Agric., 8: 437-441.***

Brody, T.; B. Shane and E.L.R. Stokstad (1984). Folic acid. **Page 459** In: ***Handbook of Vitamins. Nutritional, Biochemical, and Clinical Aspects.*** Machlin, L.J. ed. Marcel Dekker. Inc. New York.

Girard, C.L. and J.J. Matte (1995). Serum clearance and urinary excretion of pteroylmonoglutamic acid in gestating and lactating dairy cows. ***Br. J. Nutr. 74: 857-865.***

Girard, C.L. and J.J. Matte (1998). Dietary supplements of folic acid during lactation: Effects on the performance of dairy cows. ***J. Dairy Sci., 81: 1412-1419.***

Girard, C.L. and J.J. Matte (1999). Changes in serum concentrations of folates, pyridoxal, pyridoxal – 5 – phosphate and vitamin B_{12} during lactation of dairy cows fed dietary supplements of folic acid. ***Can. J. Anim. Sci., 79: 107-113.***

Girard, C.L.; J.J. Matte and G.F. Tremblay (1989). Serum folates in gestationg and lactating dairy cows. ***J. Dairy Sci., 72: 3240-3246.***

Girard, C.L.; J.J. Matte and G.F. Tremblay (1995). Gestation and lactation of dairy cows: A role for folic acid. ***J. Dairy Sci., 78: 404-411.***

Lardinois, C.C.; R.C. Mills; C.A. Elvejem and E.B. Hart (1944). Rumen sythesis of the vitamin B complex as influenced by ration composition. ***J. Dairy Sci., 27: 579 – 583.***

Leonard, M. (1984). ***The Dictionary of Vitamins. 1st Ed.*** **pp. 96-97.** Thorsons Publishers Limited Wellingborough, Northamptonshire. UK

Ling, E.R. (1963). ***A Text Book of Dairy Chemistry.*** Vol. 2. (Practical). 3rd Ed. Chapman and Hall, L.T.D. London.

Marks, J. (1975). ***A Guide to the Vitamins.*** **1st Ed.. pp. 111-116.** Published by MTP (Medical and Technical Publishing COLTD), St Leonard's House Lancaster. England.

NRC (1981). ***Nutrient Requirement of Goats.,*** **p. 15.** National Research Council. National Academy of Sciences, Washington, DC.

Patton, C.J. and S.R. Crouch (1977). Spectrophotomitric and kinetics investigation of the berthelot reaction for the determination of ammonia. ***Anal. Chem., 49: 464–469.***

Reitman, S. and S. Frankel (1957). Colorimetric method for the determination of serum glutamic – oxaloacetic and glutamic – pyrovate transaminase. ***An. J. Clin. Path., 28 : 56.***

Snedecor, G.W. and W.G. Cochran (1982). ***Statistical Methods.*** 7th Ed. Iowa State Univ. Press Ames, Iowa, USA.

مجلة حوليات العلوم الزراعية ، كلية الزراعة ، جامعة عين شمس ، القاهرة ، م٤٨ ، ع(١) ، ٩٩-١٠٦ ، ٢٠٠٣

تأثير حمض بترويل مونوجلوتامك على كمية وتركيب لبن الماعز

[٧]

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قسمت عشرة إناث من الماعز الزرايبي في الشهر الأخير من الحمل إلى مجموعتين غذيت المجموعة الأولى على عليقة الكنترول المكونة من دريس برسيم وعلف مركز بنسبة ٤٨ : ٥٢ أما المجموعة الثانية فغذيت على نفس العليفة مع حقنها أسبوعياً بـ ٤ مل محلول ملحي به ٤٠ ملليجرام من حمض بترويل مونوجلوتامك (P.G.A.) .

استمر الحقن ابتداءً من الشهر الأخير للحمل إلى نهاية الأسبوع الثاني عشر من الحليب.

أوضحت النتائج أن الحقن بـ ٤٠ ملليجرام من P.G.A أسبوعياً تسبب في زيادة وزن الحملان عند الميلاد بنسبة ١١% وبالنسبة لإناث الماعز فقد زاد ما تأكله من المادة الجافة وما تنتجه من لبن بنسبة ٨,٦ و ٢٥,٦% على التوالي.

ولقد بينت الدراسة أنه لم تحدث أي فروق معنوية بين المجموعتين فيما يتعلق بتركيب اللبن أو هيموجلوبين الدم – أو قياسات السيرم (بروتين كلي – نتروجين اليوريا – أنزيم GPT) فيما عدا أنزيم GOT فقد أدي الحقن إلى زيادته في السيرم بنسبة ١١ و ٧% خلال فترتي الحمل والحليب على التوالي.

استنتجت الدراسة أن حقنة واحدة أسبوعياً بها ٤٠ ملليجرام P.G.A أدي إلى تحسين المأكول وزيادة إنتاج اللبن في الماعز الزرايبي خلال فترة الحليب الأولى.

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