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SUPPLEMENTAL RUMEN PROTECTED METHIONINE AND/OR CHOLINE FOR ZARAIBI GOATS:
2- PRODUCTIVE PERFORMANCE OF KIDS SUCKLED DAM COLOSTRUM

El-Gendy, M. E. ; K. F. El-Riedy ; Hanaa S. Sakr and H. M. Gaafar
Animal Production Research Institute, Agricultural Research Cemter, Dokki, Giza. hamedgaafar@gmail.com

ABSTRACT

Forty Zaraibi goats with average body weight of 34.64±0.79 kg and 3-4 years old were divided into four similar groups (10 in each). The goats were fed from the last two months of pregnancy till the fifth month of lactation a basal diet containing 0.8 kg concentrate feed mixture, 0.2 kg barley grain and 5.0 kg berseem without additive (control, G1) or with 2 g/head/day rumen protected methionine (RPM, G2) or with 2 g/head/day rumen protected choline (RPC, G3) or 2 g/head/day RPM+ 2 g/head/day RPC (RPM+RPC, G4). After kidding, the produced kids were left with their dams in pens and allowed to sucke dam colostrum and small amounts of mash concentrate feed mixture, barley grains and berseem during the suckling period for three days. Results revealed that yield and components of colostrum were the highest ($P<0.05$) in G4. Colostrum yield increased and its components decreased gradually from 1st to 3rd day after kidding in all groups. Percentages of non-casein and non-protein nitrogen in colostrum decreased ($P<0.05$), however percentages of albumin, globulin**,** β-lactoglobulin, calcium, phosphorus and total amino acids increased ($P<0.05$) with RPM and/or RPC supplementation as compared to control group. Body weight, total and daily weight gain of produced kids were highest ($P<0.05$) in G4. Concentrations of total protein, albumin and globulin in blood serum were higher ($P<0.05$) in G4. Kids in G4 showed the lowest percentage of diseases incidence and mortality rate.

It could be concluded that supplementing diets of Zaraibi goat does, during the last month of pregnancy up to the suckling period, with 2 g/head/day rumen protected methionine and 2 g/head/day rumen protected choline improved yield and chemical composition of colostrum, which consequently improved growth rate, blood serum proteins, and reduced diseases incidence of their kids suckled colostrums.

Keywords: Goat does, rumen protected methionine, choline, colostrum, kids, growth, mortality rate.

INTRODUCTION

Goats are widely distributed around the world with high demand to their meat in many developing and subtropical countries and arid regions (Casey *et al.,* 2003). In most of these countries, the productivity of goats is below their potential with inefficiency at primary production and post production system (Matossian de Pardo, 2000). Some of the most frequently reported limiting amino acids for milk production in lactating goats are lysine and methionine (NRC, 2006). Researchers also have reported that dairy cattle can produce more milk when fed supplemental rumen protected choline (Pinotti *et al*., 2003). Methionine, as a sulphur amino acid, is considered to be one of the most limiting amino acids for protein synthesis in growing ruminants and consequently increases growth rate of lambs (Lynch *et al*., 1991). Additional methionine optimized growth of high growing ruminant animals (Loerch and Oke, 1989). Moreover, the protected amino acids, such as protected methionine, as a first limiting amino acid (Shan *et al.,* 2007) can be used for goats to increase the dietary protein and consequently growth performance. Meeting the amino acid requirements becomes more crucial during high productivity stages (high milk production or rapid growth for meat production) (Izumi *et al*., 2000).

Choline is a vitamin-like compound whose metabolism interacts very closely with methionine and vitamin B12 metabolism (Pirestani *et al*., 2009). Because choline either present in or added to feedstuffs is degraded extensively in the rumen (Sharma and Erdman, 1989), so it must be protected from degradation to be of value to ruminants. Ruminally protected choline has improved growth performance of finishing cattle without negative effects on carcass characteristics. Researchers observed an interaction between dietary fat and supplemental choline, but others contradicted this finding. The mechanism by which choline improves growth performance is unknown. Improvements may be due to alterations in lipid metabolism and/or transport. In dairy cattle, choline supplementation has improved lactation performance and fertility rate (Janovick Guretzky *et al*., 2006). Drouillard *et al*. (1998) found that addition of rumen protected choline in diets of finishing steers increased dressing percentage, decreased dry matter intake, increased average daily gain and improved feed efficiency.

The objective of this study was to evaluate the effects of addition of rumen protected methionine and/or choline to diets of lactating Zaraibi goats on growth rate, blood parameters, diseases incidence and mortality rate of their offsprings during the colostrums suckling period.

MATERIALS AND METHODS

The current work was carried out at Sakha Experimental Farm, belonging to the Animal Production Research Institute (APRI), Agricultural Research Center.

Forty Zaraibi goat does (body weight of 34.64±0.79 kg and 3-4 years of age) at the last month of pregnancy were divided into four similar groups (10 in each). Goats were housed in semi open backyards and fed a basal ration containing 0.8 kg concentrate feed mixture, 0.2 kg barley grains and 5.0 kg berseem. Goats in the 1st group were fed the basal diet without additive (control), while those in the 2nd , 3rd and 4th groups were fed the basal diet with 2 g/head/day rumen protected methionine (RPM), 2 g/head/day rumen protected choline (RPC) and 2 g/head/day RPM+2 g/head/day RPC (RPM+RPC). Rumen protected methionine was in a form of Methionine Hydroxy Analogue, Calcium (MHA), Novus Internaional, Inc, Missouri, USA. Rumen protected choline was in a form of choline chloride (Qingdao Worldwide International Trade Co. Ltd., China).

Goats were fed to cover their maintenance and production requirements according to their body weight and milk yield (NRC, 1981). Concentrate feed mixture and barley grains were fed in two equal parts at 9 a.m. and 3 p.m., while berseem was given at 11 a.m. Drinking water was available in build basin all the day round. Chemical composition of feedstuffs and basal ration is presented in Table (1).

After kidding, yield of colostrum was determined for 3 consecutive days and samples were taken daily for chemical analysis for fat, protein, lactose, solids not fat (SNF), and total solids (TS) by Milko-Scan (Model 133B), while ash was calculated by the difference. Samples for the determination of calcium and phosphorus were prepared according to the wet method and digested in sulfuric acid with some drops of hydrogen peroxide (Ryan *et al*., 2001). Calcium was determined by Atomic Adsorption Spectrometer (GBC Σ Avente Vir 1.3) and phosphorus was determined using spectrophotometer (Pharmacia Biotech Novaspec II).

Table (1): Chemical composition of feedstuffs and basal ration.

Item	DM %	Composition of DM %					
		OM	CP	CF	EE	NFE	Ash
Concentrate feed mixture*	91.23	90.95	13.98	9.08	3.12	64.77	9.05
Barley grain	89.77	97.53	12.25	8.54	2.52	74.22	2.47
Berseem	17.27	87.41	15.92	27.65	2.59	41.25	12.60
Basal ration**	29.56	89.88	14.75	18.06	2.80	54.27	10.12

*** Concentrate feed mixture consisted of 27% undecorticated cotton seed cake, 25% wheat bran, 25% yellow corn, 13% rice bran, 5% linseed cake, 2% molasses, 2% limestone and 1% common salt. ** Calculated.**

Total of 73 newly born kids (17 in control group, 19 in RPM group, 18 in RPC group and 19 in RPM+RPC group) were left with their dams in pens and allowed to suckle their dams and to receive small amounts of mash concentrate feed mixture, barley grains and berseem during the colostrums suckling period for three days. Kids were weighed at birth and biweekly thereafter before the morning suckling until the weaning age to calculate average daily weight gain. Blood samples were collected from the jugular vein of kids using sterile needle into clean dry tubes and left in refrigerator for two hours for blood clotting, then centrifuged at 4000 rpm for 15 minutes to obtain blood serum, which was stored at -20 ^{o}C till analyses. Concentration of total protein and albumin as well as activity of transaminases (AST and ALT) were calorimetrically determined in blood serum using commercial diagnostic kits (Test-combination, Pasteur lap.) and spectrophotometer. Diseases incidence of diarrhea, respiratory diseases, weakness and suckling refuse as well as mortality rate of produced kids were recorded during the whole suckling period in each group.

Data were subjected to statistical analysis using General Linear Models (GLM) procedures adapted by SPSS (2008) for user's guide with one-way ANOVA. Duncan test within SPSS was done to determine the degree of significance among group means.

RESULTS AND DISCUSSION

Yield and composition of Zaraibi goat colostrum are presented in Table (2). Goats in RPM+RPC group showed significantly ($P<0.05$) the highest colostrum yield during the first 3 days after kidding, followed by RPM and RPC groups, respectively, while the control group had the lowest yield. Results showed that, colostrum yield increased gradually from the first to the third day in all groups. Colostrum yield ranged from 1.63 to 2.15 kg for 1st day, from 1.73 to 2.29 kg for 2nd day and from 1.84 to 2.42 kg for 3rd day in all groups. These results agreed with those obtained by Rezai *et al.* (2012), who found that the amount of colostrum increased with increasing of rumen undegradable protein.

Results concerning colostrum composition presented in Table (2) showed that RPM+RPC and RPC groups recorded significantly ($P<0.05$) the highest fat content during the first 3 days after kidding, followed by RPM group, while the control group had the lowest content. Also, RPM+RPC group showed significantly ($P<0.05$) the highest protein, lactose, solids not fat (SNF), total solids (TS) and ash contents during the first 3 days after kidding, followed by RPM and RPC groups, while the control group had the lowest contents. Contents of fat, protein, lactose, SNF, TS and ash decreased gradually from the 1st to 3rd day post-kidding in all groups. These results are in accordance with those obtained by Mahmoud *et al.* (2012), who found that the colostral constituents of Damascus goats were significantly ($P<0.05$) higher in the first day and then decreased sharply in the second day.

Percentages of non-casein nitrogen and non-protein nitrogen in colostrum significantly ($P<0.05$) decreased in colostrum of RPM+RPC group as compared to the control group and decreased gradually from the 1st to 3rd day post-kidding.

Percentages of albumin, globulin and β-lactoglobulin significantly ($P<0.05$) increased in colostrums of RPM+RPC group as compared to the control group, and all decreased sharply from the 1st to 3rd day post-kidding in all groups. Globulin content was higher than albumin content in colostrum of all groups during the 1st and 2nd days post-kidding, while during the 3rd day post-kidding, globulin content was lower than albumin content. These results indicated that colostrum during the first two days post-kidding was rich in globulin and it is very important for improving immunity of the suckling kids. Calcium and phosphorus contents were the highest in colostrum of RPM+RPC group. In addition, calcium and phosphorus contents increased by advancing suckling days (Table 2).

Concentration of total amino acids in colostrum on the first day post-kidding increased with RPM or/and RPC additives than the control group and the RPM+RPC group had the highest concentration. Total amino acids concentration in colostrum of RPM, RPC and RPM+RPC groups increased by 23.76, 21.78 and 29.70% compared with that of the control group, respectively. Methioine metabolism is closely linked to that choline and it is important in the dairy cow because it is required for milk protein synthesis. Methioine is, also, involved in many pathways including the synthesis of phospholipids, carnitine, creatine and polyamines (Bequette *et al*., 1998; Berthiaume *et al*., 2006). Also, methioine is the source of the methyl donor *S*-adenosyl methionine, the metabolite that provides methyl groups in a variety of reactions including the de novo synthesis of choline from phosphatidylethanolamine.

Table (2): Effect of dietary supplementation of rumen protected methionine and/or choline on yield and composition of Zaraibi goat colostrum.

Item	Day	Experimental group				SEM
		Control	RPM	RPC	RPM+RPC	
Yield (kg/day)	1	1.63	1.94	1.86	2.15	-
	2	1.73	2.07	1.97	2.29	-
	3	1.84	2.19	2.09	2.42	-
	Mean	1.73^{b}	2.07^{ab}	1.97^{ab}	2.29^{a}	0.04
Composition %						
Fat	1	5.90	6.34	6.83	6.87	-
	2	4.82	5.19	5.59	5.62	-
	3	4.12	4.43	4.77	4.80	-
	Mean	4.95^{c}	5.32^{b}	5.73^{a}	5.76^{a}	0.15
Protein	1	10.65	11.29	10.84	11.94	-
	2	8.42	8.99	8.57	9.43	-
	3	6.93	7.45	7.06	7.76	-
	Mean	8.67^{b}	9.24^{ab}	8.82^{ab}	9.70^{a}	0.28
Lactose	1	4.81	4.95	5.24	5.35	-
	2	4.44	4.57	4.84	4.94	-
	3	3.79	3.90	4.13	4.22	-
	Mean	4.35^{b}	4.48^{ab}	4.74^{ab}	4.84^{a}	0.09
SNF	1	16.33	17.12	16.99	18.19	-
	2	13.71	14.42	14.29	15.27	-
	3	11.54	12.18	12.03	12.84	-
	Mean	13.86^{c}	14.58^{b}	14.44^{b}	15.43^{a}	0.37
TS	1	22.23	23.47	23.81	25.06	-
	2	18.54	19.61	19.88	20.89	-
	3	15.66	16.61	16.80	17.64	-
	Mean	18.81^{c}	19.90^{bc}	20.17^{ab}	21.20^{a}	0.52
Ash	1	0.87	0.88	0.90	0.92	-
	2	0.85	0.86	0.88	0.89	-
	3	0.82	0.83	0.85	0.86	-
	Mean	0.85^{b}	0.86^{ab}	0.88^{ab}	0.89^{a}	0.01
Non casein nitrogen	1	0.783	0.693	0.702	0.627	-
	2	0.413	0.366	0.381	0.325	-
	3	0.171	0.147	0.163	0.127	-
	Mean	0.456^{a}	0.402^{ab}	0.415^{ab}	0.360^{b}	0.07
Non protein nitrogen	1	0.051	0.041	0.041	0.037	-
	2	0.038	0.031	0.033	0.028	-
	3	0.029	0.025	0.025	0.022	-
	Mean	0.039^{a}	0.032^{ab}	0.033^{ab}	0.029^{b}	0.002
Albumin	1	2.21	2.32	2.31	2.54	-
	2	1.24	1.34	1.33	1.52	-
	3	0.38	0.45	0.46	0.56	-
	Mean	1.28^{b}	1.37^{ab}	1.37^{ab}	1.54^{a}	0.23
Globulin	1	3.25	3.44	3.43	3.53	-
	2	1.55	1.77	1.82	2.04	-
	3	0.15	0.16	0.18	0.20	-
	Mean	1.65^{b}	1.79^{ab}	1.81^{ab}	1.92^{a}	0.40
β-lactoglobulin	1	0.40	0.42	0.42	0.45	-
	2	0.23	0.25	0.25	0.31	-
	3	0.13	0.15	0.15	0.17	-
	Mean	0.25^{b}	0.27^{ab}	0.27^{ab}	0.31^{a}	0.03
Calcium g/l	1	1.22	1.23	1.28	1.36	-
	2	1.34	1.57	1.63	1.68	-
	3	1.42	1.65	1.80	2.00	-
	Mean	1.33^{b}	1.48^{ab}	1.57^{ab}	1.68^{a}	0.07
Phosphorus g/l	1	0.60	0.75	0.83	0.90	-
	2	0.79	0.94	0.98	1.05	-
	3	0.86	1.11	1.17	1.24	-
	Mean	0.75^{c}	0.93^{b}	0.99^{ab}	1.06^{a}	0.05
Total amino acids (mg/ml)		1.01	1.25	1.23	1.31	-

$^{a, b, c}$: Values in the same row with different superscripts differ significantly (P<0.05).

In addition, Choline increases the supply of methyl groups, which can affect the availability of other methyl donor compounds (Frank and Karl-Heinz, 2006). Moreover, Emmanuel and Kennelly (1984) and Lobley *et al*. (1996) demonstrated that up to one third of the total methionine supplement can be lost due the need to synthesize choline. Because of these metabolic relationships, dietary supply of choline affects methionine requirements and methionine supply can affect choline metabolism. Since choline is susceptible to rapid ruminal degradation, the amounts available for absorption are limited (Erdman *et al*., 1984).

The effect of rumen protected methionine and/or choline additives to lactating goats on body weight, total and daily weight gain of their suckling kids are shown in Table (3). Results showed that kids produced from RPM+RPC group showed significantly (P<0.05) the highest body weight, and total and daily weight gain, followed by RPM and RPC groups, respectively, while the control group had the lowest values. Total weight gain of RPM, RPC and RPM+RPC groups during colostrums suckling period increased by 4.67, 2.87 and 8.97% and average daily gain increased by 4.58, 2.86 and 8.89% compared with control group, respectively (Table 3).

Table (3): Effect of supplementation of rumen protected methionine and/or choline in diet of lactating goats on body weight, total and daily weight gain of their kids suckled colustrum.

Period (month)	Experimental group				Sex		SEM
	Control	RPM	RPC	RPM+RPC	Male	Female	
Body weight (kg)							
0	2.28^{b}	2.39^{ab}	2.35^{ab}	2.49^{a}	2.46^{a}	2.27^{b}	0.05
1	4.49^{b}	4.69^{ab}	4.62^{ab}	4.87^{a}	4.83^{a}	4.47^{b}	0.09
2	7.26^{b}	7.59^{ab}	7.47^{ab}	7.90^{a}	7.83^{a}	7.21^{b}	0.16
3	10.65^{b}	11.14^{ab}	10.95^{ab}	11.60^{a}	11.48^{a}	10.58^{b}	0.23
Total weight gain (kg)							
0-1	2.21^{b}	2.30^{ab}	2.27^{ab}	2.38^{a}	2.36^{a}	2.20^{b}	0.06
1-2	2.77^{b}	2.90^{ab}	2.85^{ab}	3.03^{a}	3.00^{a}	2.75^{b}	0.03
2-3	3.39^{b}	3.54^{ab}	3.49^{ab}	3.69^{a}	3.66^{a}	3.36^{b}	0.04
0-3	8.36^{b}	8.75^{ab}	8.60^{ab}	9.11^{a}	9.02^{a}	8.31^{b}	0.18
Daily weight gain (g)							
0-1	73.68^{b}	76.67^{ab}	75.55^{ab}	79.47^{a}	78.77^{a}	73.25^{b}	1.96
1-2	92.17^{b}	96.72^{ab}	95.02^{ab}	100.99^{a}	99.92^{a}	91.52^{b}	2.12
2-3	112.89^{b}	118.16^{ab}	116.18^{ab}	123.09^{a}	121.85^{a}	112.14^{b}	2.46
0-3	92.92^{b}	97.18^{ab}	95.58^{ab}	101.18^{a}	100.18^{a}	92.30^{b}	2.00

$^{a,\,b}$: Values in the same row for each item with different superscripts differ significantly (P<0.05).

These results agreed with those obtained by Lynch *et al*. (1991), who reported that methionine, sulphur amino acid, is considered to be one of the most limiting amino acid for protein synthesis of growing ruminants and consequently increase growth rate of lambs. Also, Drouillard *et al*. (1998) found that addition of rumen protected choline in diets of finishing steers increased average daily gain. Results showed that, body weight, total and daily weight gain were significantly (P<0.05) higher for male than female kids. Body weight at birth and weaning, total and daily weight gain increased by 8.37, 8.51, 8.54 and 8.54% for male compared with female, respectively

(Table 3). These results agreed with those obtained by Islam *et al.* (2009), who reported that the average growth rate was higher in male than female goats during the suckling period.

Results in Table (4) showed the effect of feeding lactating goats on diets supplemented with RPM and/or RPC on some blood serum parameters of their kids suckled colostrums for three days. The differences in the concentrations of total protein, albumin and globulin in blood serum were significant (P<0.05). Kids in RPM+RPC group showed significantly (P<0.05) the highest concentrations of total protein, albumin and globulin, followed by RPM and RPC groups, while control group had the lowest concentrations (Table 4). These results agreed with those obtained by El-Ganiny *et al*. (2007), who found that rumen protected methionine increased plasma total protein, albumin and globulin in blood of lactating cows. The RPM or RPC supplementation not revealed any disorder effects on liver enzymes activity, whereas the activity of AST and ALT enzymes were nearly similar in all groups and are within the normal range, being below 70 and 40 IU/l, respectively (Kaneko, 1989).

Table (4): Effect of supplementation of rumen protected methionine and/or choline in diets of lactating goats on blood serum parameters of their kids suckled colostrum.

Item	Experimental groups				SEM
	Control	RPM	RPC	RPM+RPC	
Total protein (g/dl)	6.63^{c}	7.27^{b}	6.92^{bc}	7.67^{a}	0.20
Albumin (g/dl)	2.98^{c}	3.34^{b}	3.25^{bc}	3.68^{a}	0.09
Globulin (g/dl)	3.64^{b}	3.92^{a}	3.67^{b}	3.98^{a}	0.12
AST (IU/l)	40.86	40.93	41.10	41.25	0.56
ALT (IU/l)	9.79	9.99	10.21	10.44	0.18

$^{a, b, c}$: Values in the same row with different superscripts differ significantly (P<0.05).

The percentages of diseases incidence and mortality rate of suckling kids are presented in Table (5). Results show that control group revealed the highest diseases incidence, followed by RPM and RPC groups, while RPM+RPC group had the lowest incidence. Also, control group recorded the highest percentage of mortality rate, followed by RPM group, while RPC and RPM+RPC groups had the lowest mortality rate.

Table (5): Effect of supplementation of rumen protected methionine and/or choline in diets of lactating goats on percentage of disease incidence and mortality rate of their kids suckled colostrum.

Item	Experimental group				Sex	
	Control	RPM	RPC	RPM+RPC	Male	Female
Number of born kids	17	18	19	19	42	31
Number of weaned kids	14	16	17	17	35	29
Disease incidence, %	47.05	22.22	26.32	10.53	28.57	22.59
Mortality rate, %	17.65	11.11	10.53	10.53	16.67	6.45

Percentage of diseases incidence and mortality rate were higher in male than in female kids. In this respect, Shitta (2005) found that probiotic additive to suckling Friesian calves reduced diseases incidence and mortality rate. Kid mortality is responsible with many factors such as effect of dam weight at kidding, effect of birth weight of kid, dam's milk yield, season, litter size, parity, dam's nutrition and disease (Chowdhury *et al*., 2002).

Based on the foregoing results, it could be concluded that supplementing diets of Zaraibi goat does, during the last month of pregnancy up to the suckling period, with 2 g/head/day rumen protected methionine and 2 g/head/day rumen protected choline improved yield and chemical composition of colostrum, which consequently improved growth rate, blood serum proteins, and reduced diseases incidence of their kids suckled colostrums.

REFERENCES

Akinsoyinu, A.O. and I.O. Akinyele (1979). Major elements in milk of the west African dwarf goats as affected by stage of lactation. J. Dairy Res., 46: 427. Bequette, B.J.; F.R.C. Backwell and L.A. Crompton (1998). Current concepts of amino acid and protein metabolism in the mammary gland of the lactating ruminant. J. Dairy Sci., 81: 2540-2559.

Berthiaume, R.; M.C. Thivierge; R.A. Patton; P. Dubreuil; M. Stevenson; B.W. McBride and H. Lapierre (2006). Effect of ruminally protected methionine on splanchic metabolism of amino acids in lactating dairy cows. J. Dairy Sci., 89: 1621-1634.

Casey, N.H.; W.A. Van Niekerk and E.C. Webb (2003). Goat Meat. In: Caballero, B., Trugo, L., Finglass, P. (Eds.), Encyclopaedia of Food Sciences and Nutrition. Academic Press, London, pp. 2937-2944.

Chowdhury, S.A.; M.S.A. Bhuiyan and S. Faruque (2002). Rearing black bengal goat under Semi-intensive management. I. Physiological and reproductive performances. Asian-Australisian Journal of Animal Science, 15(4): 477-484.

Drouillard, J.S.; A.S. Flake and G.L. Kuhl (1998). Effects of added fat, degradable intake protein, and ruminally protected choline in diets of finishing steers. Kans. Agric. Exp. Sta. Coop. Ext. Serv. Rep. Prog. No. 804. pp 71–75. Manhattan, KS.

El-Ganiny, Shahera M.M.; M.A. El-Ashry; A.A.M. El-Mekass; M.M. Khorshed and S.A. Ibrahim (2007). Effect of feeding different concentrate: corn silage ratios with or without protected methionine supplement on performance of dairy cows. Egyptian J. Nutrition and Feeds, 10: 1.

Emmanuel, B. and J.J. Kennelly (1984). Kientics of methionine and choline and their incorporation into plasma lipids and milk components in lactating goats. J. Dairy Sci., 67: 1912-1918.

Erdman, R.A.; R.D. Shave and J.H. Vandersall (1984). Dietary choline for the lactating cow: Possible effects on milk fat synthesis. J. Dairy Sci., 67: 410-415.

Frank, B. and S. Karl-Heinz (2006). Rumen protected choline for dairy cows: The *in situ* evaluation of a commercial source and literature evaluation of effects on performance and interactions between methionine and choline metabolism. Anim. Res., 55: 93-104.

Islam, M.R.; M.R. Amin; A.K.M.A. Kabir and M.U. Ahmed (2009). Comparative study between semi-intensive and scavenging production system on the performances of Black Bengal goat. J. Bangladesh Agric. Univ., 7(1): 79-86.

Izumi, K.; C. Kikuchi and M. Okamoto (2000). Effect of rumen protected methionine on lactational performance of dairy cows. Asian-Aust. J. Anim. Sci., 13: 1235-1238.

Janovick Guretzky, N.A.; N.B. Litherland; K.M. Moyes and J.K. Drackley (2006). Prepartum energy intake affects health and lactational performance in primiparous and multiparous Holstein cows. J. Dairy Sci. 89(Suppl. 1): 267. (Abstr.).

Kaneko, J.J. (1989). Chemical biochemistry of domestic animals. California: academic press Inc. 4th edition. p. 932.

Lobley, G.E.; A. Connell and D. Revel (1996). The importance of transmethylation reactions to methionine metabolism in sheep: Effects of supplementation with creatine and choline. Br. J. Nutr., 75: 47-56.

Loerch, S.C. and B.O. Oke (1989). Rumen protected amino acids in ruminant nutrition. In: M. Friedman (Ed.). Absorption and Utilization of Amino Acids. pp 196. CRC Press, Boca Raton, FL.

Lynch, G.P.; T.H. Elasasser; C. Jackson; T.S. Rumsey and M.J. Camp (1991). Nitrogen metabolism of lactating ewes fed rumen- protected methionine and lysine. J. Dairy Sci., 74: 2268-2276.

Mahmoud, N.M.A.; I.E.M. El Zubeir and A.A. Fadlelmoula (2012). Colostrum composition and performance of Damascus goats raised under Sudan conditions. Wudpecker Journal of Agricultural Research, 1(8): 341-345.

Matossian de Pardo, C. (2000). Market studies and good quality products are the key to successful projects. Paper Presented at the Seventh International Conference on Goats, France, pp 15-21.

NRC (1981). Nutrient Requirements of Dometic Animals. Nutrient requirement of goats. National Research Council, Washington DC.

NRC (2006). Nutrient requirements of small ruminants. Sheep, goats, cervids, and new world camelids. National Research Council. The National Academies Press, Washington, DC, USA.

Pinotti, L.; A. Baldi; I. Politis; R. Rebucci; L. Sangalli and V. Dell'Orto (2003). Rumen protected choline administration to transition cows: Effect on milk production and vitamin E status. J. Vet. Med. A., 50:18-21.

Pirestani, A.; S. Rokh; S.N. Tabatabaei; G.R. Ghalamkari and Z. Alibabaei (2009). Effect of L-Carnitin Supplement in Diet transitional Cows on Reproduction Indices and Milk Parameters. Veterinary Journal of Islamic Azad University – Tabriz Branch, 3(2): 205-208.

Rezai, F.; F. Zamani and M. Vatankhah (2012). Effect of rumen undegradable protein (RUP) on colostrum quality and growth of Lori Bakhtiari lambs. Global Veterinaria, 8 (1): 93-100.

Ryan, J.; G. Estefan and A. Rashid, 2001. Soil and Plant Analysis Laboratory Manual (2nd edn.). International Center for Agricultural Research in the Dry Areas ICARDA: Aleppo, Syria.

Shan, J.G.; Z.L. Tan; Z.H. Sun; J.P. Hu; S.X. Tang; H.L. Jiang; C.S. Zhou; M. Wang and G.O. Tayo (2007). Limiting amino acids for growing goats fed a corn grain, soybean meal and maize stover based diet. Small Rum. Res., 139:159-169.

Sharma, B.K. and R.A. Erdman (1989). Effects of dietary and abomasally infused choline on milk production responses of lactating dairy cows. J. Nutr. 119:248−254.

Shitta, A.A. (2005). Commercial probiotic supplementation for suckling Friesian calves: 2- Immune response and mortality rate. J. Agric. Sci. Mansoura Univ., 30: 4451.
SPSS (2008). Statistical package for the social sciences, Release: 16, SPSS INC, Chicago, USA.

تأثير إضافة المثيونين و/أو الكولين المحمى فى الكرش على أداء الماعز الزرايبى:
١- الأداء الإنتاجى للماعز الحلاب

محمود السيد الجندى، قطب فتح الباب الريدى، هناء سيدأحمد صقر و حامد محمد جعفر
معهد بحوث الإنتاج الحيوانى، مركز البحوث الزراعية، الدقى، الجيزة

استخدم فى هذه الدراسة ٤٠ من الماعز الزرايبى متوسط وزنها ٣٤,٦٤±٠,٧٩ كجم وعمر ٣-٤ سنوات قسمت إلى ٤ مجموعات متماثلة (١٠ بكل منها)· غذيت الماعز خلال الشهر الأخير من الحمل وخلال فترة الرضاعة على العليقة الأساسية المكونة من ٠,٨ كجم مخلوط علف مركز + ٠,٢ كجم حبوب شعير + ٥,٠ كجم برسيم بدون إضافة (مجموعة المقارنة) أو مع إضافة ٢ جم/رأس/يوم مثيونين محمى فى الكرش (مجموعة المثيونين المحمى) أو مع إضافة ٢ جم/رأس/يوم كولين محمى فى الكرش (مجموعة الكولين المحمى) أو مع إضافة ٢ جم/رأس/يوم مثيونين محمى فى الكرش + ٢ جم/رأس/يوم كولين محمى فى الكرش (مجموعة المثيونين+الكولين المحمى)· تركت صغار الماعز فى الأحواش لرضاعة أمهاتها مع اعطائها بعض مخلوط العلف المركز المجروش والبرسيم خلال فترة الرضاعة حتى الفطام على عمر ١٢ أسبوع·

أظهرت النتائج ما يلى:

١- ارتفاع إنتاج السرسوب ومكوناته معنويا عند مستوى ٠,٠٥ فى مجموعة المثيونين+الكولين المحمى·
٢- ازداد إنتاج السرسوب وانخفضت مكوناته تدريجيا من اليوم الأول حتى اليوم الثالث بعد الولادة· انخفضت النسبة المئوية للنيتروجين الغير كازينى والنيتروجين الغير بروتينى، بينما ارتفعت النسبة المئوية للألبيومين والجلوبيولين والبيتالاكتوجلوبيولين والكالسيوم والفوسفور والأحماض الأمينية الكلية فى السرسوب معنويا عند مستوى ٠,٠٥ مع إضافة المثيونين والكولين المحمى فى الكرش عنه فى مجموعة المقارنة وانخفضت هذه المكونات تدريجيا من اليوم الأول حتى اليوم الثالث بعد الولادة·
٣- ارتفع وزن للجسم والزيادة الكلية واليومية فى وزن الجداء معنويا عند مستوى ٠,٠٥ فى مجموعة المثيونين+الكولين المحمى وكذلك فى الذكور عن الاناث·
٤- ارتفع تركيز البروتينات الكلية والألبيومين والجلوبيولين فى سيرم الدم معنويا عند مستوى ٠,٠٥ فى مجموعة المثيونين+الكولين.
٥- لم تظهر إضافة المثيونين والكولين المحمى أى تأثير سلبى على نشاط أنزيمات الكبد·
٦- انخفضت نسبة الإصابة بالأمراض ومعدل النفوق فى مجموعة المثيونين+الكولين المحمى·

نستخلص من هذه الدراسة أن اضافة ٢ جم مثيونين محمى فى الكرش + ٢ جم كولين محمى فى الكرش للرأس يوميا للماعز الزرايبى أثناء الشهر الأخير من الحمل وفترة الرضاعة أدى إلى تحسن إنتاج وتركيب السرسوب واللبن، معدل نمو الجداء، تركيز بروتينات سيرم الدم وخفض الإصابة بالأمراض ومعدل النفوق وزيادة الكفاءة الاقتصادية·

قام بتحكيم البحث

أ.د / عبد الخالق السيد عبد الخالق	**كلية الزراعة – جامعة المنصورة**
أ.د / سعيد احمد محمود	**كلية الزراعة – جامعة كفر الشيخ**