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Improvement of immune response and performance of Zaraibi goats by using natural nutritional supplement

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ABSTRACT

This study carried out to investigate the effect of using Echinacea extract as natural supplement on improvement of immune response and performance of Zaraibi does and their kids. Zaribi does, at the last month of pregnancy, were divided into 3 groups (A, B and C).Group A was kept as control, while Echinacea purpurea extract (as pills)were given orally once daily till kidding to goats in group B (350 mg/ day/ head) and C (525 mg/ day/ head).

Results showed that milk yield throughout the suckling period (12 weeks) were significantly higher in treated does of groups B and C (21.05 and 21.63 kg, respectively) than in the control group A (19.81 kg).

Body weight of kids born from treated does in groups B and C were significantly heavier during suckling (1- 12 weeks) than kids of the control group, where kids in-group C had the highest body weight. Moreover, male kids were significantly heavier than the female ones.

Concentrations of milk albumin and globulin were significantly higher in treated does in-group C compared to those in group A and B. Milk total protein and globulin tended to increase during the first 3 days of suckling, reaching the highest levels after 24 hours. Moreover, concentration of serum globulin of kids born from treated does in group C were significantly higher than those in groups A and B, while serum total protein levels were significantly higher in both treated groups than in the control ones. Milk globulin level was significantly of positive correlation with milk total protein, while serum total protein and globulin levels for kids were positively correlated to those in doe' milk. Treated doe of groups B and C had significantly higher globulin concentrations (4.68 g/ml) than control group (A, 4.32 g/ml) during suckling. Moreover, serum globulin for kids positively correlated with total protein and followed the same previous trend. Results also showed that kids in-group C had the highest levels of total protein and globulin comparing to other groups.

Serum glucose level in Zaraibi kids was not significantly differed among groups (A, B and C), while, its level significantly affected by weeks. All kids showed a drop in glucose levels at week 6 (42 days) followed by an increase at weeks 7 and 8 (49 and 56 days, respectively).

In conclusion, the use of Echinacea extract as immuno-stimulating additive considered useful for improving goat immune response and kid's growth performance. Prenatal supplementation of Zaraibi goats ration with 525 mg /day/head of Echinacea extract are recommended for improving goats immune response and performance, as healthy does produced good colostrum rich in protein and immunoglobulin.

Key words: Goats, Kids, Echinacea pupurea, milk production, immunity, performance.

INTRODUCTION

Small ruminants occupy an important economic and ecological niche in agricultural systems in developing countries **(Devendra, 2005).**Keeping farm animals healthy is necessary to obtain efficient production. Only quality feed together with proper hygiene, potable water and management can together ensure the production of nutritious animal products with desired organoleptic properties **(Saxena, 2008).**During the last decade, use of additives of natural origin for animal and human feeding has been encouraged. Herbs, spices and their extracts already used thousands of years ago in Egypt and other countries **(Greathead, 2003).**

The immune system generally benefits from the herbs spices rich in flavonoids, vitamin C and carotenoids. The use of officinal plants to enhance the immune system has studied with goats. Echinacea purpurea is a popular medicinal herb, which activates the body's immune system and increases the chance of fighting most diseases **(Burger *et al*., 1997 and Chang 2000).** Echinacea plant contains molecules that possess immune stimulatory properties. They can improve the activity of lymphocytes, macrophages and NK cell and they stimulate phagocytosis or the interpheron synthesis **(Graig, 1999).** Moreover, **Reklewska *et al*. (2004) and Teleb *et al*., (2009)** reported that Echinacea purpurea extract reduced mammary infections and SCC in goats' udder by increasing lactofferin secretion, which is anti-bacterial, anti-viral and immuno-stimulating compound. In many newborn animals, colostrum is the main source of immunoglobulin and other proteins necessary for future life **(Constant *et al*., 1994).** Therefore, total protein, in colostrum and serum, contribute profoundly to neonate immunity and growth not only due to the immunoglobulin content but also possibly due to other nutritional and physiological effects on the neonates **(Piccione *et al*., 2007).** Since total protein level in the serum was found correlated with concentration of serum Ig and was much less expensive and time consuming than other tests, it is used as a mean to monitor factors influencing passive transfer and for estimating Ig concentrations in calves **(O'Brien and Sherman,1993),** in lambs and goats **(Teleb *et al*., 2009).**

In Egypt, Zaraibi goats considered of high genetic potential as a prolific dairy breed **(Aboul-Naga *et al*., 1993).** So, the present study aimed to investigate the effect of using different doses of Echinacea extract, as immuno-stimulating additive, during the last month of pregnancy on performance and health status of Zaraibi does and their respective kids.

MATERIALS AND METHODS

This study carried out at Sakha Research experimental Station, Animal Production Research Institute **(APRI),** Ministry of Agriculture.

Animal management

A total number of 45 Zaribi does at the last month of pregnancy were used in this experiment. Animals fed according to their physiological status using **NRC, (1981) allowances.** Water and minerals blocks were available all the time. Animals were divided into 3 groups; group A was kept as control, treatment group(B) was given orally 350 mg and group (C) 525 mg once daily in form of pills each contains 175 mg of dry Echinacea purpurea extract (Immulant, Mepaco- Egypt)till kidding. The given dose was suitable for adult man **(Reklewska *et al*., 2004).** Data concerning milk production, kid's weight and sex were recorded.

Blood and milk samples

After kidding, milk and blood samples were collected from 5 randomly selected does and their kids. Milk samples from does and blood samples from kids collected from all groups at 0 hour (before kids allowed suckling), 24, 48 and 72 h. Moreover, blood samples collected from both does and their kids weekly throughout suckling period until weaning (12 weeks). Blood samples collected from the jugular vein and left to clot at room temperature for at least 4 h. The clots removed and sera cleared by centrifugation at 1500×g for 20 min and stored at –20 ºC until analysis. In addition, whey of milk samples separated and stored.

Biochemical analysis

Total serum and milk protein and albumin levels measured using Stanbio kit (Catalog No. 0250 and 0285, respectively) used for quantitative colorimetric determination of total protein and albumin **(Gornal *et al*., 1949 and Dumas and Biggs, 1972**, respectively). Globulin levels where calculated from data recorded for total protein and albumin. Glucose concentrations detected in serum samples of kids of different groups using Stanbio kit (Catalog No. 1075) for the quantitative enzymatic-colorimetric determination of glucose (**Trinder, 1959**).

Statistical Analysis:

Collected data were analyzed using SAS program (SAS, 1999). Significant differences among groups tested according to Duncan

(1955). Moreover, person correlation coefficient assessed among doe milk and serum protein and globulin with kids' serum protein and globulin. Results expressed as least square means (LSM± SE).

RESULTS AND DISCUSSION

Milk yields of Zaraibi goats as affected by treatment and weeks presented in table 1. The overall mean values of milk yield during suckling was significantly higher (P> 0.001)in treated does groups (B and C)than the control group(A), where no significant difference detected between treated does. Milk yield fluctuated throughout the suckling weeks showing the highest at the 6thweek in all does groups (Fig 1). The changes in milk yield throughout the suckling period may be due to individual variation, season and/ or age of does. **Teleb *et al*. (2009)** reported that milk yield in Zarabi does, at mid of lactation, was not significantly affected by supplementation with Echinacea extracts. They observed slight increase in milk yield in does received different doses of Echinacea extract comparing to the control. **Mousa, (1996)** reported that milk yield of Zaraibi does reached the peak at the 4th and 6th weeks of lactation with high feeding level. The same observed with **Abdelhamid *et al.* (2011)** when used some medicinal herbs and plants (Artemisia absinthium, Rosemarinus Officinalls and Pimpinella anisumin). Moreover, **Mestawet *et al.* (2012)** reported that the peak of daily milk yield occurred in the mid of lactation, while lower values were found in the early and late lactation stages. Using different medicinal herbs or plants**, Shehata *et al.* (2004 and 2006)** observed positive effect on milk yield, for supplementation with herbs in Zaraibi goats ration. They suggested that improvement in milk yield may be due to the effect of medicinal herbs on improving digestion which reflected on better nutrients and feeding values (as TDN and DCP). **El- Saadany *et al.*, (2008)** found that supplementing lactating Zaraibi goats ration with Oregano (OV) and Nigella sativa (NSS) during hot summer season increased milk yield. **Stzalkowska *et al.*, (2010)** and **Kralickova *et al.*, (2013)** reported a decrease in daily milk yield from the beginning till the end of lactation which may be affected by deteriorating the quality of pasture.

Table 1: Least squares means (±SE) of average milk yield in Zaraibi does during suckling period (1- 12 weeks) as affected by treatment and suckling weeks.

Treatments groups	Average milk yield (Kg)
A	19.81±0.3^{b}
B	21.05± 0.4^{a}
C	21.63± 0.3^{a}
Weeks	
1	14.96± 0.7^{f}
2	21.24± 0.7^{c}
3	24.04± 0.7^{b}
4	16.67± 0.7^{ef}
5	25.65± 0.7^{b}
6	28.46± 0.7^{a}
7	25.96± 0.7^{b}
8	16.65± 0.7^{ef}
9	22.01± 0.7^{c}
10	18.92± 0.7^{d}
11	17.33± 0.7^{ed}
12	18.38± 0.7^{ed}

Means with the same letter are not significantly different.

Results showed that kids body weights were significantly (P> 0.0001) affected by treatment, suckling weeks and sex (Table 2). The body weights of Kids born from treated doe groups B and C during the period from birth until weaning were significantly higher than kids born from control doe group, where kids in-group (C) showed the highest body weight. Mean values of kids body weights in all doe groups (A, B and C) tended to increase significantly (P> 0.0001) throughout the suckling period, where kids in all groups reached the highest body weight at week 12 (Fig. 2). Male kids were significantly heavier than female ones (Table 2). **Gupta and Taneja (1983)** reported that herbs known to have antioxidant activities, as carotenoid and other plants' pigments, succeed to improve growth performance of livestock through increasing immune status.

Zeid (1998) observed that birth weights and the corresponding values of weaning weights were higher in Zaraibi kids born from does given, in late pregnancy stage, garlic (GR), Nigella sativa (NS), Fenugreek (FN) and Chamomile (CH) than in control group.

Table 2: Least squares means (±SE) of average body weight of Zaraibi kids from birth until weaning (1- 12 weeks) as affected by treatment, weeks of life and sex.

Treatments groups	Average body weight (Kg)
A	6.29±0.08[c]
B	6.60±0.10[b]
C	6.94±0.08[a]
Weeks	
0	2.12±0.18[M]
1	2.75±0.18[L]
2	3.52±0.18[k]
3	4.25±0.18[j]
4	4.90±0.18[i]
5	5.80±0.18[h]
6	6.55±0.18[g]
7	7.40±0.18[f]
8	8.40±0.18[e]
9	8.99±0.18[d]
10	9.71±0.17[c]
11	10.48±0.17[b]
12	10.99±0.18[a]
Kids sex	
Male	7.11±0.07[a]
Female	6.65±0.07[b]

Means with the same letter are not significantly different. 0= birth weight.

El-Hosseiny *et al.*, (2000) and Abdelhamaid *et al.*, (2011) found that total body weight and daily body gain were significantly higher in goats supplemented with medicinal herbs (Artemisia absinthium, Rosemarinus Officinalls and Pimpinella anisumin). **Abdelhamaid *et al.*, (2011)** also, recorded that birth and weaning weights of male kids were heavier than that of female kids (2.30 vs. 1.93 & 9.23 vs. 8.49 kg, respectively). The same reported by **Ahmed (1999) and Sadek (2011)** in Zaraibi goats and Rahmany ewes, respectively. **Shehata *et al.*, (2007)** reported that addition of different doses of 5 and 10 g of chamomile medicinal herb to Zaraibi goats' ration, at late pregnancy period, had a positive effect on growth rate during suckling period. The average daily body weight gain of male kids were 115 and 119 g for both does fed chamomile (5 and 10 g/10 kg BW/day, respectively vs. 109 g gain in control group).

In the present study, all kids survived till weaning were selected for blood sampling to determine levels of serum total protein, albumin, globulin and glucose. Changes of doe's milk and kid's serum total protein, albumin and globulin during the first 3 days after kidding (72 hours) illustrated in table 3. Milk albumin and globulin concentrations were significantly higher (P> 0.0001) in treated does of group C comparing to those in group A and B, while no significant differences were observed in total protein levels. Average levels of milk total protein and globulin increased significantly (P> 0.02 and 0.0001, respectively) during the first 3 days of suckling reaching the highest levels after 24 hours (Table 3 and Fig 3), while albumin levels showed the opposite trend. Moreover, serum total protein, albumin and globulin levels in newly born Zaraibi kids during the first 72 hours of their life significantly affected by treatment and time (P> 0.0001). Kids born from treated does in group C had significantly higher globulin concentration than those in groups A and B, while total protein level was significantly higher in both treated groups (B and C) than in the control one (Table 3). Average concentration of serum total protein and globulin in Zaraibi kids were low during the first hours of suckling and increased after 24 hours (Table 3 and Fig 3). Correlations between milk total protein and globulin in does' and those in kids' serum during the first 3 days after kidding, as well as, correlation between serum total protein and globulin in does and their kids throughout the suckling period are illustrated in table 5. Results showed that milk globulin increased with the increase of milk total protein. Moreover, serum total protein and globulin levels in kids increased with the increase of milk total protein and globulin (Fig. 3). **Abdel- Bary (1990), Chen *et al.*, (1999), Arguello *et al.*, (2004) and Teleb *et al.*, (2009)** reported that total proteins and globulins levels increased significantly in lambs serum to reach a peak after 24 h of suckling then decreased thereafter.

Table 3: Least squares mean (± SE) of total protein (TP), albumin (ALB) and globulin (Glob) in Zaraibi doe milk and kids' serum throughout the first 3 days (72 hours) after kidding as affected by treatment and hours.

Treatments groups	Does Milk (g/ dl)			Kids serum (g/ dl)		
	TP	**Alb**	**Glob**	**TP**	**Alb**	**Glob**
A	6.78±0.15[a]	3.36± 0.11[b]	2.91±0.15[b]	5.80±0.14[b]	2.72± 0.10[c]	3.08± 0.13[b]
B	7.0± 0.17[a]	3.51± 0.11[b]	3.27± 0.15[b]	6.64±0.16[a]	3.69± 0.11[a]	2.94± 0.15[b]
C	7.1± 0.15[a]	4.06± 0.11[a]	3.71± 0.15[a]	6.84±0.14[a]	3.27± 0.10[b]	3.56± 0.13[a]
Hours						
0	6.38± 0.22[b]	4.06±0.15[a]	2.33±0.22[c]	5.46±0.21[e]	3.36±0.15[ab]	2.10±0.19[e]
4	6.73±0.22[ab]	3.72±0.15[ab]	3.01±0.22[b]	5.59±0.21[ed]	3.13±0.15[b]	2.46±0.19[ed]
8	6.78±0.22[ab]	3.85±0.15ab	2.94±0.22[bc]	6.68±0.21[cb]	3.69±0.15[a]	2.99±0.19[cd]
24	7.12±0.22[a]	3.56±0.15[bc]	3.56±0.22[ab]	6.99±0.21[b]	3.08±0.15[b]	3.91±0.19[b]
48	7.38±0.22[a]	3.55±0.15[bc]	3.83±0.22[a]	7.69±0.21[a]	3.07±0.15[b]	4.63±0.19[a]
72	7.22±0.22[a]	3.12±0.15[c]	4.10±0.22[a]	6.15±0.21[d]	3.07±0.15[b]	3.07±0.19[c]

Means with the same letter are not significantly different.

The increase in serum proteins and globulins after suckling is due to the absorption of immunoglobulin from colostrum **(Hunter, *et al.*, 1977).** Moreover, **Chen *et al.*, (1999)** found that total protein in first colostrum positively correlated with that of kid serum up to 5 days old. **Mellor and Murry (1985)** reported that the increase of total protein and globulin in dams and their lambs could be a reflection of the passive transfer of maternal protein via the colostrum from dams to offspring, where healthy dam produced good colostrum rich in protein and immunoglobulin.

Changes of serum total protein, albumin and globulin levels in doe of different groups and their respective kids, from kidding till weaning (1- 12 weeks), are illustrated in table (4) and figs (4- 6).Total protein and globulin levels in does serum were significantly (P> 0.0001) affected by weeks. Meanwhile, albumin levels significantly affected by both treatment and weeks (P> 0.0001). Albumin levels were significantly higher in doe of control group (A) than treated groups (B and C). Treated doe in groups B and C showed non- significantly higher globulin concentrations than in control group A. Concentrations of serum globulin in does and kids followed the same trend of total protein, where its level increased and/or decreased with the increase of their total protein (Table 5). **Teleb *et al.*, (2009)** reported that serum total protein and globulin levels increased significantly at the 2nd week during the treatment. They also, reported that electrophoresis pattern of goats' serum total protein showed that changes of serum γ-globulin levels were parallel to those of serum total protein and globulin. The close relation between serums IgG, total protein and globulin concentrations suggest that serum protein and globulin can be used as an indicator for monitoring passive transfer of IgG from ewes to offspring as reported by **O'Brien and Sherman, 1993; Oztaban and Ozpinar, 2006 and Teleb *et al.*, 2009.** The decrease of serum albumin levels in kids, during the first 2 weeks after birth (Fig 5), with subsequent increase may reflects the albumin medium half-life that ranges from 14- 16 in ruminants, after that the liver is responsible of albumin synthesis **(Kaneko, 1997 and Thrall, 2004).** Using different herbal plants as chamomile flowers inclusion in Zaraibi goats ration increased serum total protein and globulin levels (**El-Hosseiny *et al.*, 2000). Awadalla and Gehad (2003)** reported a significant increase in blood total protein levels in growing sheep supplemented with 2 % Nigella sativa (NSS) compared to control and those supplemented with 1 % NSS. They suggested that this increase may be due to the increase in globulin fraction in the 2 % NSS group and since globulin is the main component of antibodies, an increase in the globulin levels indicates a good immune status of the animals. **Mohammed *et al.*, (2013)** reported that serum total protein, globulin and its fractions (α_1, β_1, β_2 and γ_2 globulins) concentrations in ewes increased significantly due to addition of Nigella sativa (NSS) to ewes' diets. Moreover, **Allam *et al.*, (2007)** observed that rations of lactating goats supplemented with 0.25 g NSS as powder/kg LBW/day increased significantly the concentration of serum total protein, albumin and globulin of Zaraibi kids.

Average serum glucose levels were not significantly different among Zaraibi kids born from different groups (Table 6). Meanwhile, its levels were significantly (P> 0.0001) affected by suckling weeks (Table 6). All kids showed a drop in glucose levels at week 6 (42 days) flowed by an increase at weeks 7 and 8 (49 and 56 days, respectively), then another drop was recorded during the weeks from 9 to11. Several factors could affect serum glucose levels in newly born animal as nutrition, season, type of birth, sex, as well as age. **Antunovic *et al*. (2002)** reported that concentrations of glucose reflect the energy status in sheep, where it depends on the glucogenesis processes. **Bernabucci *et al*. (2009)** observed that ambient temperature and relative humidity have a considerable influence on farm animals, causing changes in feed intake, metabolism and heat balance. **Teleb *et al. (2009)*** recorded high glucose levels in lambs born during winter season than in those born in summer, higher glucose levels in single lambs comparing to twins, as well as, higher glucose levels in male lamb than in female (**Hamdon, 1996 and Oztaban and Ozpinar, 2006)**.

Table 4: Least squares means (± SE) of serum total protein (TP), albumin (Alb) and globulin (Glob) levels in Zaraibi doe and their respective kids throughout suckling period (12 weeks) as affected by treatment and weeks.

Treatments groups	**Does serum (g/ dl)**			**Kids serum (g/ dl)**		
	TP	Alb	Glob	TP	Alb	Glob
A	8.48± 0.15[a]	4.16± 0.06[a]	4.32± 0.14[a]	7.8± 0.17[b]	4.2± 0.08[a]	3.6± 0.17[b]
B	8.52± 0.16[a]	3.84±0.06[b]	4.68± 0.16[a]	7.4± 0.19[b]	4.0± 0.09[b]	3.4± 0.18[b]
C	8.38± 0.15[a]	3.69±0.06[b]	4.68± 0.14[a]	9.3± 0.17[a]	4.2± 0.08[a]	5.1± 0.07[a]
Weeks						
1	10.37± 0.30[a]	5.60± 0.12[a]	4.77± 0.29[cbd]	10.08± 0.32[a]	3.36± 0.12[ed]	5.72± 0.32[a]
2	9.28± 0.30[bc]	4.46± 0.12[b]	4.82± 0.29[cbd]	7.14± 0.32[ef]	4.20± 0.12[fe]	2.93± 0.32[e]
3	6.98± 0.30[gf]	2.99± 0.12[e]	4.00± 0.30[efd]	7.50± 0.32[ed]	3.34± 0.12[g]	4.16± 0.32[bcd]
4	6.49± 0.30[g]	3.68± 0.12[dc]	2.83± 0.29[g]	8.34± 0.32[bcd]	3.31± 0.12[g]	5.08± 0.32[ba]
5	7.27± 0.30[gef]	3.68± 0.12[dc]	3.59± 0.30[gef]	8.36± 0.32[bcd]	3.23± 0.12[g]	5.12± 0.32[ba]
6	7.59± 0.30[def]	4.17± 0.12[b]	3.42± 0.30[gf]	7.90± 0.32[ed]	4.80± 0.12[b]	3.10± 0.32[e]
7	7.42± 0.30[ef]	3.33± 0.12[d]	4.09± 0.30[cefd]	8.26± 0.32[cd]	4.63± 0.12[cbd]	3.63± 0.32[ecd]
8	9.59± 0.30[ba]	4.47± 0.12[b]	5.11± 0.30[b]	7.21± 0.32[ef]	3.93± 0.12[f]	3.29± 0.32[ed]
9	10.10± 0.30[ba]	3.53± 0.12[dc]	6.58± 0.30[a]	9.29± 0.32[ba]	5.43± 0.12[a]	3.86± 0.32[ecd]
10	8.12± 0.30[de]	3.67± 0.12[dc]	4.45± 0.30[cebd]	7.97± 0.32[ecd]	4.75± 0.12[cb]	3.22± 0.32[ed]
11	9.87± 0.30[ba]	3.76± 0.12[c]	6.10± 0.30[a]	8.92± 0.32[bc]	4.42± 0.12[ced]	4.50± 0.32[bc]
12	8.47± 0.30[dc]	3.48± 0.12[dc]	5.00± 0.30[cb]	6.51± 0.32[f]	3.26± 0.12[g]	3.24± 0.32[ed]

Means with the same letter are not significantly different.

Table 5: Correlation between milk and serum total protein (TP) and globulin (glob.) in does and kids during the suckling period.

Items	Milk TP	Does serum TP	kids serum TP
Milk TP (during the first 3 days)	---	----	----
Milk glob. (during the first 3 days)	r= 0.7 P> 0.0001	----	---
Does serum TP (during suckling weeks)	---	----	----
Does serum glob. (during suckling weeks)	---	r= 0.9 P> 0.0001	---
Kids serum TP (during the first 3 days)	r= 0.01 P> 0.005	----	----
Kids serum glob. (during the first 3 days)	r= 0.2 P> 0.01	----	-----
Kids serum glob. (during suckling weeks)	-----	----	r= 0.9 P> 0.0001

Table 6: Least squares means (± SE) of serum glucose (mg/ml) in Zaraibi kids throughout the suckling period (12 weeks) as affected by treatment and weeks.

Treatments groups	Serum glucose (mg/ ml)
A	73.04± 1.5[a]
B	73.68± 1.6 [a]
C	73.73± 1.5 [a]
Weeks	
1	82.14± 3.07[bac]
2	88.79± 3.07[a]
3	73.31± 3.11[c]
4	75.72± 3.07[bc]
5	83.33± 3.11[ba]
6	60.82± 3.11 [d]
7	87.86± 3.11 [a]
8	87.35± 3.11 [a]
9	56.16± 3.11 [d]
10	55.67± 3.11 [d]
11	53.95± 3.11[d]
12	76.72± 3.11[bc]

Means with the same letter are not significantly different.

Teleb *et al.* (2009) also recorded that glucose levels increased to reach the peak at 28 and 49 days in winter and summer, respectively. The increase in glucose concentrations in lambs born during winter might due to the high energy needed for neonatal lamb to survive under cold weather or due to stress **(Sanhouri *et al*., 1991 and Kannan *et al*., 2000**). **Pietro *et al*., (2008)** reported a significant effect of time on glucose levels. **Abdelhamaid *et al*., (2011)** found that inclusion of medicinal herbs to the diets (Artemisia absinthium, Rosemarinus Officinalls and Pimpinella anisumin) did not affect serum glucose levels.

Conclusion, data obtained in the present study show a significant effect of perinatal supplementation with Echinacea extract on milk yield, kid's weight, levels of serum total protein and globulin in both does and their kids. These results prove its efficiency in activating goat's immune system. Therefore, perinatal supplementation with 525 g/head/day of Echinace extract as immuno-stimulating additive is recommended to improve goat' and kids' immune status and performance.

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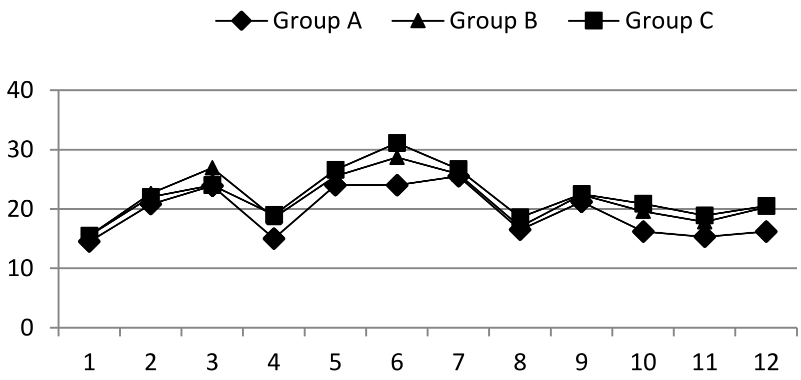

Figure 1: Changes in milk yield of Zaraibi doe groups A, B and C during suckling period (12 week).

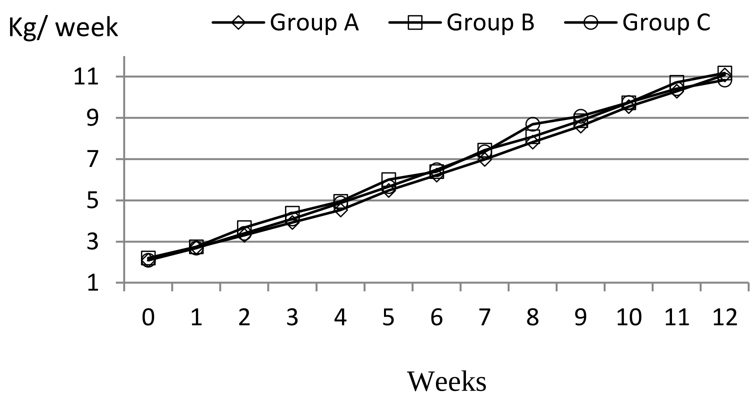

Figure 2: Body weights of Zaraibi kids in group A, B and C during suckling period (1- 12 weeks).

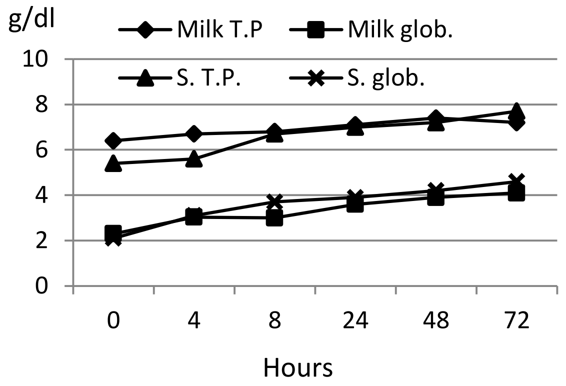

Figure 3: Relationship between doe milk and kid serum total protein, and globulin in different treatment groups at 0, 4, 8, 24, 48 and 72 hours during the suckling period.

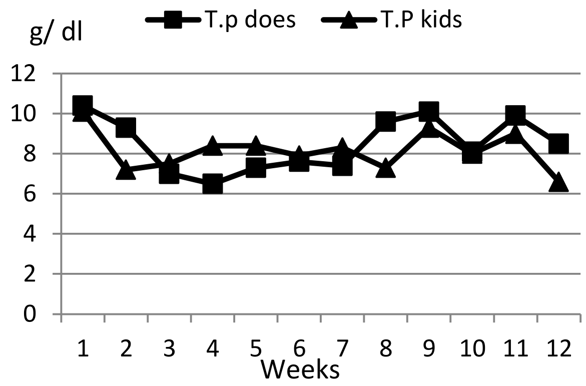

Figure 4: Average levels of serum total protein (g/dl) in Zaraibi does and their kids during suckling period (1- 12 weeks).

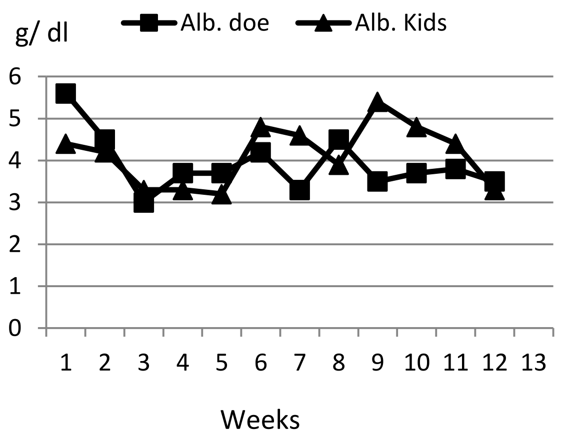

Figure 5: Average levels of serum albumin (g/dl) in Zaraibi does and their kids during suckling period (1- 12 weeks).

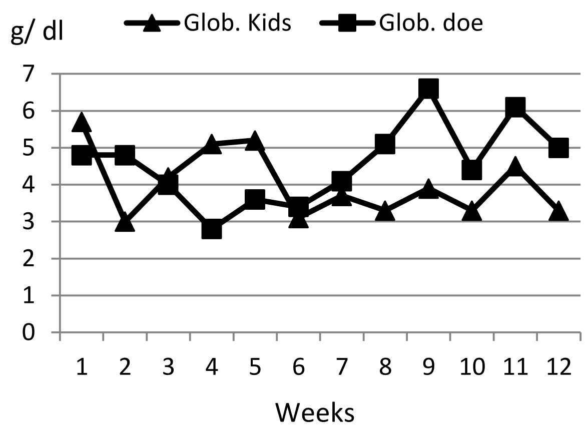

Figure 6: Average levels of serum globulin (g/dl) in Zaraibi does and their kids during suckling period (1- 12 weeks).

Improvement of immune response and performance of Zaraibi goats by using natural nutritional supplement

الملخص العربى

تحسين الاستجابة المناعية و آداء الماعز الزرايبى باستخدام المكملات الغذائية الطبيعية

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أجريت هذه الدراسة للتحقق من أثر استخدام مستخلص نبات الإشنشيا كمكمل غذائى طبيعى على تحسين الاستجابة المناعية وأداء أمهات الماعز الزرايبى و مواليدها. قسمت الماعز الزاريبى في الشهر الأخير من الحمل إلى ٣ مجموعات (أ و ب و ج)، وقد ظلت المجموعة الأولى ككونترول، في حين تم تناول مستخلص الأشنشيا كحبوب عن طريق الفم مرة واحدة يوميا حتى الولادة للماعز فى المجموعة ب (٣٥٠ ملجم / يوم / رأس) و المجموعة ج (525 ملجم / يوم / رأس) .

أظهرت النتائج أن متوسط إنتاج الحليب طوال فترة الرضاعة (١٢ أسبوعا) كان أعلى معنوياً فى الأمهات المعاملة بالمجموعة ب و ج (٢١,٠٥ و ٢١,٦٣ كجم، على التوالى) عنه فى المجموعة الكونترول أ (١٩,٨١ كجم).

كان متوسط وزن الجداء المولودة للماعز المعاملة فى المجموعة ب و ج خلال فترة الرضاعة (١٢ أسبوع) أثقل معنوياً عن الجداء المولودة للمجموعة الكونترول (أ)، و قد أظهرت الجداء المولودة للماعز بالمجموعة ج أعلى وزن جسم. كما كانت وزن الجسم لذكور الجداء أثقل معنوياً من الإناث.

كان متوسط تركيزات الألبومين والجلوبيولين فى اللبن أعلى معنوياً فى الماعز المعاملة بالمجموعة (ج) مقارنة بتلك بالمجموعات (أ و ب). كما كانت تركيزات كلا من البروتين الكلي والجلوبيولين فى اللبن خلال الثلاث الأيام الأولى من الرضاعة يتجه إلى الزيادة، حيث يصلا إلى أعلى المستويات بعد ٢٤ ساعة. بالإضافة إلى إن تركيز الجلوبيولين في دم الجداء المولودة للماعز المعاملة بالمجموعة (ج) أعلى معنوياً عنه في مواليد المجموعات (أ و ب)، في حين كان مستوى البروتين الكلى أعلى معنويا فى سيرم مواليد كلا المجموعتين المعاملة عنه فى الكونترول. و كان مستوى الجلوبيولين فى اللبن مرتبطاً إيجابيا بمستوى البروتين الكلى به، و كان مستوى البروتين الكلي و الجلوبيولين في دم المواليد مرتبطاً بشكل إيجابي بمستواهما باللبن. كان متوسط تركيز الجلوبيولين خلال فترة الرضاعة فى سيرم الماعز المعاملة بالمجموعات (أ و ب) أعلى معنوياً (٤,٦٨ جم/مللى) عنه بالمجموعة الكونترول (٤,٣٢ جم/ مللى). كما كان مستوى الجلوبيولين في دم المواليد مرتبطاً إيجابيا بمستوى البروتين الكلي و يتبع نفس إتجاهه.

كان مستوى الجلوكوز في سيرم جداء الماعز الزرايبى لا يختلف كثيرا بين المجموعات (أ و ب و ج)، بينما كان مستواه خلال فترة الرضاعة يتأثر بتتابع الأسابيع. أظهرت جميع المواليد إنخفاضا في مستوى الجلوكوز في الدم فى الأسبوع ٦ (٤٢ يوما) تبعتها زيادة في الاسابيع ٧ و ٨ (٤٩ و ٥٦ يوما، على التوالى).

في الختام، استخدام مستخلص نبات الإشنشيا كإضافات غذائية مفيداً لتحسين الإستجابة المناعية للماعز و نمو الجداء. لذا ينصح بإعطاء الماعز الزرايبى فى آخر فترة الحمل ٥٢٥ ملجم/ يوم / رأس من مستخلص نبات الأشنشيا بالإضافة إلى العليقة لتحسين الاستجابة المناعية وآداء الماعز حيث إن الأمهات السليمة صحياً تنتج سرسوب غني بالبروتينات و الأجسام المناعية.