Egyptian Journal of Sheep & Goat Sciences, Vol. 11, No. 3, December 2016 &Proceedings Book of the 6th International Scientific Conference on Small Ruminant Production, 6- 10 Nov., 2016, Sharm El Sheikh, Egypt, P: 25-35

Study of Chalcones' Effect on Milk Production in Zaraibi Goats

Hassan M.F. Madkour[1], Ferial Hassan [2], Marwa S. Salem[1], Manar R. A. Soliman[2].

[1]Department of Chemistry, Faculty of Science, Ain Shams University, Cairo, Egypt.
[2]Animal Production Research Institute, Agriculture Research Center, Dokki, Cairo, Egypt.

ABSTRACT

The present study aimed to evaluate the effect of chalcones on milk production and qualitative properties of milk in Zaraibi goats. Five chalcones have been synthesized *via* Clasien- Schmidt condensation under alkaline conditions. Structures of the synthesized chalcones confirmed by their melting point (mp), Infrared spectrum IR and Proton Nuclear Magnetic Resonance (^{1}H-NMR) spectra. Total antioxidant capacity (TAC) of the synthesized compounds were measured according to Phosphomolybdenum method, and the results indicated that chalcone V [1-(benzofuran-2-yl)-3-(4-methoxyphenyl)-prop-2-en-1-one] has the highest antioxidant activity among the five synthesized chalcones.

Sixteen dairy Zaraibi goats have been divided into three groups according to their parity, milk yield, body weight and age. G1 (4 animals) served as control group and were fed the basal diet, G2 (6 animals) were fed the basal diet + 250 mg/head/day of chalcone V and G3(6 animals) were fed the basal diet + 500 mg/head/day of chalcone V for a period of 90 days. Results showed insignificant increase in milk yield of the three groups (1.07, 1.07 and 1.14 L, respectively), in milk protein (2.80, 2.87 and 2.92%, respectively) and milk somatic cells (SCC) ($956.4*10^3$, $981.1*10^3$and $1181.7*10^3$ cells/ml, respectively).While there were insignificant decrease in milk fat of the three groups (3.70, 3.45 and 3.31%, respectively), milk lactose (4.45, 4.45 and 4.36%, respectively) and total milk solids (11.67, 11.47 and 11.29%, respectively). Total antioxidant capacity of blood serum was insignificantly higher in G2 than G1 and G3 (2.86, 3.25, 2.83 mM/L, respectively). Findings indicate negative response of using chalcones on milk production and qualitative properties of milk as it may decomposed in the rumen or not absorbed by the intestine due to its large particles.

Key words: Chalcone, Antioxidant, Milk production, milk quality, Zaraibi goats.

INTRODUCTION

Chalcones are 1,3-diaryl-2-propene-1-one, in which two aromatic rings are linked by a three carbon α,β-unsaturated carbonyl system **(Prashar *et al*., 2012)**. Chalcones represent an important group of the polyphenolic family, which includes a large number of naturally occurring molecules and possesses an interesting spectrum of biological activities including antioxidant (**Belsare*et al*., 2010)**, antibacterial (**Božić *et al*., 2014)**, anti-inflammatory **(Yadav *et al*., 2011)**, anticancer, cytotoxic, and immunosuppressive potential (**Echeverria *et al*., 2009)**. Over the last ten years, increasing attention dedicated to chalcones because of their biological activities. Although chalcones are abundant in fruits (e.g., citruses, apples), vegetables (e.g., tomatoes, shallots, bean sprouts, potatoes) and various plants and spices (e.g. Licorice), they could be available in larger amounts through an efficient and simple synthesis *via* Clasien- Schmidt condensation between acetophenones and benzaldehydes under alkaline conditions (**Orlikova *et al*., 2011)**.

Several studies conducted to investigate the possible effects of antioxidant supplementation on ruminant animal health and production; the studies indicated that feed supplements as antioxidants could enhance milk yield, milk quality, and the antioxidant capacities of milk and meat (**Mardalena *et al*., 2011 and Krzyzewski *et al*., 2014).**

Zaraibi goat is the most promising local goat breed in Egypt **(Galal *et al*., 2005)**. They are dual-purpose milk and meat goats. The milking

potential of Zaraibi does is high. **Aboul-Naga *et al*. (2012)** reported that the total milk yield (TMY) averaged 253.1± 1.5 kg in 251.3 ± 0.8 days of lactation (including 90 days suckling). Seventeen percent of the does produced more than 350 kg of milk / lactation.

The aim of this study is to evaluate the effects of chalcones on milk production, milk quality and the total antioxidant capacity of blood serum of dairy Zaraibi goats.

MATERIAL AND METHODS

Synthesis of chalcones

Melting points (mp) were determined on Gallenkamp electric melting point apparatus and are uncorrected. The infrared (IR) spectra were recorded using KBr disks on a PyeUnicam SP-3-300 infrared spectrophotometer. ^{1}H-Nucleur Magnetic Resonance (^{1}H-NMR) spectra were run at 300 MHz and /or 500 MHz on a Varian Mercury VX-300 NMR spectrometer using Tetramethylsilane (TMS) as internal standard in deuterated chloroform. The reaction monitored by thin layer chromatography (TLC) using MerkKiasel gel 60 F_{254} aluminum backed plates. The spots visualized by UV irradiation at 254-365 nm.

1-(substitutedphenyl)-3-Arayl-prop-2-en-1-one (I-III)

A solution of acetophenone (0.1mol) and aromatic aldehyde (0.1mol) in ethanol (20 ml) stirred in an ice-bath. Alcoholic NaOH (100-150 ml, 10%) added dropwise for 30 min., stirring continued until the completion of the reaction. Reaction mixture was poured on ice-cold water and neutralized by conc. HCl. The formed precipitate filtered off, washed with water, dried and recrystallized from ethanol.

3-phenyl-1-(2-hydroxyphenyl)-prop-2-en-1-one (I)

Chalcone **I** was obtained as yellow powder in 85.5% yield, mp = 81-82 °C, literature mp = 81-83 °C (**Ohkatsu and Satoh, 2008)**, and recrystallized from ethanol.

3-phenyl-1-(4-methylphenyl)-prop-2-en-1-one (II)

Chalcone **II** was obtained as pale yellow crystals in 75.7% yield, mp = 71°C, literature mp = 70-72 °C **(Syam *et al*., 2012)** and recrystallized from petroleum ether.

3-(1-phenyl-3-(p-tolyl)-pyrazol-4-yl)-1-(4-aminophenyl)-prop-2-en-1-one (III)

Chalcone **III** was obtained as yellow powder in 79.2% yield, mp = 217-219 °C and recrystallized from ethanol. The IR spectrum revealed bands at 1626.1 $\nu_{(C=O)}$, 1599 $\nu_{(c=c)}$, 3340.8 and 3470.2 $\nu_{(NH2)}$. The ^{1}H-NMR spectrum revealed signals at δ 2.34(s, 3H, CH_3 Aliphatic), 3.43(s, 1H, pyrazol), 6.12(s, 2H, NH_2), 6.61(d, 2H, CH=CH), 7.35-8.56(m, 13H, ArH's).

3-(1-phenyl-3-p-tolyl-1H-pyrazol-4-yl)-1-(4-(1-phenyl-3-p-tolyl-1H-pyrazol-4-yl) metheleneamino) phenyl)-prop-2-en-1-one (IV)

A mixture of **III** (0.01mol, 0.38 gm) and 1-phenyl-3-p-tolyal-pyrazol-4-carboxyaldehyde (0.01 mol, 0.26 gm) was refluxed for 72 h. in absolute ethanol (20 ml).The formed precipitate was filtered off, dried and recrystallized from ethanol to obtain **IV** in 52.8 % yield as yellow powder, mp = 223-227 °C, IR spectrum reveled bands at1650.9 $\nu_{(C=O)}$, 1590.5 $\nu_{(C=C)}$, 1535.1 $\nu_{(C=N)}$.

3-(benzofuran-2-yl)-1-(4-methoxyphenyl)-prop-2-en-1-one (V)

A mixture of 2-acetylbenzofurane (0.01 mol, 1.6 gm) and p-methoxybenzaldehyde was dissolved in absolute ethanol (10 ml). Alcoholic NaOH (20 ml, 10%) added dropwise for 30 min. in an ice-bath. The reaction mixture stirred for 4 h to form dark brown precipitate. The reaction mixture was poured into crashed ice and neutralized by HCl. The formed product filtered off, washed with water, dried and recrystallized from ethanol to obtain **V** in 86.2% yield as pale brown powder, mp = 120-122 °C, literature mp = 118-120 °C **(Rangaswamy *et al*., 2013**).

Antioxidant activity of the synthesized chalcones

Total antioxidant capacities (TAC) measurements of the formed chalcones were carried out in the Laboratory of Medicinal Chemistry, Theodor Bilharz Research Institute, Giza, Egypt. The absorbance measurements for

antioxidant activity recorded using the UV-Vis spectrophotometer Spectronic 601 (Milton Roy, USA).

The antioxidant activity (AOA) of each compound was determined according to phosphomolybdenum method **(Prieto *et al.*, 1999)** using ascorbic acid as standard. This assay is based on the reduction of Mo^{VI} to Mo^{V} by the sample analyte and subsequent formation of a green colored [phosphate=Mo (V)] complex at acidic pH with a maximal absorption at 695 nm. In this method, 0.5 ml of each compound (200 µg /ml) in methanol combined in dried vials with 5 ml of reagent solution (0.6 M sulfuric acid, 28 m M sodium phosphate and 4 mM ammonium molybdate). The vials containing the reaction mixture capped and incubated in a thermal block at 95°C for 90 min. After the samples had cooled at room temperature, the absorbance measured at 695 nm against a blank. The blank consisted of all reagents and solvents without the sample and it incubated under the same conditions. All experiments carried out in triplicate. The antioxidant activity of the sample expressed as the number of ascorbic acid equivalent (AAE) (**Table 1**) **(Prieto *et al.*, 1999andMosad *et al.*, 2014).**

Animal and feeding

The experimental work carried out at Sakha experimental station, Animal production Research Institute, Ministry of Agriculture and Land Reclamation, Kafer El-Sheikh governorate, Egypt. Sixteen Zaraibi dairy goats have been divided into three groups according to their parity, age, body weight, and milk production. The first group G1 (4 does) served as control and G2 and G3 (6 does each) served as experimental groups. G1 fed the Basal ration (BR) (25% concentrate feed mixture (CFM) + 75% green berseem), G2 fed BR besides 250mg/head/day of chalcone**V** and G3 fed BR besides 500mg/head/day of chalcone**V**. The experimental period lasted 90 days. Goats of all groups were given the NRC feed requirements (NRC, 2007) for production of 1-2 kg milk/ head/ day.

Samples and Data collection

During suckling period, hand milking was carried out twice daily at 6:00 am and 5:00 pm. After weaning, machine milking was applied for all animals up to the end of lactation period. Milk yield was individually measured and recorded biweekly, (total milk yield for a doe at the day of recording represents the average daily milk yield during the previous two weeks). Milk samples (100 ml each) were taken at 1st (0 time; before treatment), 30th, 60th and 90th days of lactation. Milk samples were analyzed for fat, total protein, lactose and total solid s using Milko-scan (133 BN. FOSS Electric, Denmark). However, milk somatic cel ls count (SCC) was determined using somatic cell counter (Nucleo counter SCC-100, Chemo Metec A/S, P/N 991-0200, Denmark).

Jugular blood samples (10ml each) were taken once monthly during the experimental period (90 days, post-weaning). Blood serum was collected and frozen at -20ºC until analysis. Commercial kit (Biodiagnostic, TAC, colorimetric method, CAT. No. TA 25 13) was used to measure the total antioxidant capacity of blood serum.

Statistical analysis

The statistical package (SAS, 2000) was utilized to test the significancy of the studied fixed effects; treatment (0, 1, and 2), time of measurements (1, 2, 3 and 4), and the interactions between them on the experimental observations (milk yield, milk composition, somatic cells count and total antioxidant capacity of blood serum) using the following fixed model.

$$\mathbf{Y_{ijk} = \mu + M_i + T_j + (M*T)_{ij} + e_{ijk}}$$

Where:

Y_{ijk} = the experimental observations measured by i^{th} treatment and j^{th} time of measurement,

μ = the overall mean,

M_i= the fixed effect of i^{th} treatment where i = 0 (control), 1 (250 mg of Chalcone**V**), and 2 (500 mg of Chalcone**V**),

T_j = the fixed effect of j^{th} time of measurement where j = 1 (1^{st} day of lactation), 2 (30^{th} day of lactation), 3 (60^{th}

day of lactation), and 4 (90^{th} day of lactation),

$(M*T)_{ij}$ = the effect of interaction between treatment and time of measurement,

e_{ijk} = the effect of random error assumed to be NID $(0, \sigma_e^2)$.

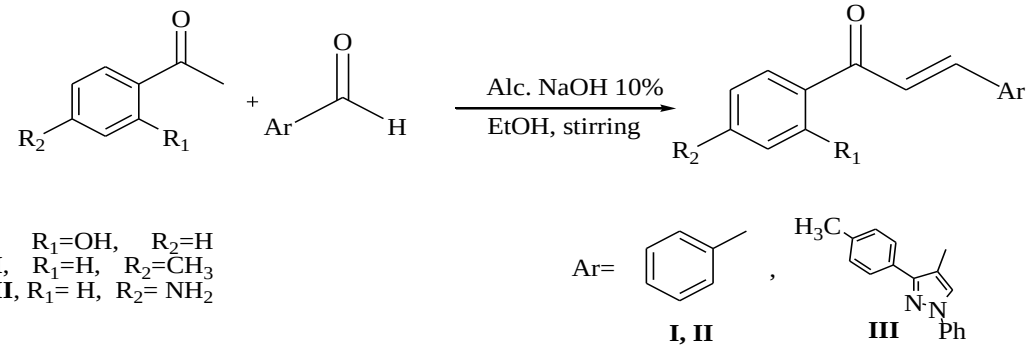
RESULTS AND DISCUSSION

Synthesis of chalcones

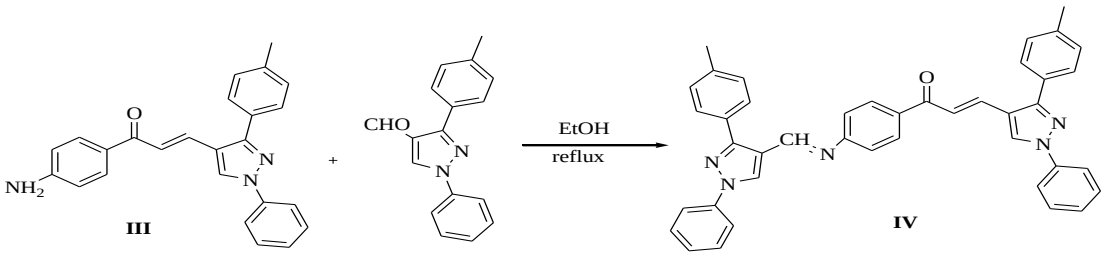
Chalcones (**I-III**) have been synthesized *via* Clasien- Schmidt condensation between different acetophenones and aromatic aldehydes under alkaline conditions (scheme 1). The synthesized compounds were obtained in high yield ranging from 75.7 to 85.5%. Compound **III** was obtained from the condensation between p-amino acetophenone and 1-phenyl-3-(p-tolyl)-pyrazol-4-carboxaldehyde in 79.2 % yield. Its structure was elucidated on basis of spectral data. Thus, IR spectrum indicated the presence of C=O stretching vibration at 1626.1cm^{-1}, C=C stretching frequency at 1599 cm^{-1} and NH_2 stretching frequencies at 3340.8 and 3470.2 cm^{-1}. The ^{1}H-NMR spectrum showed D_2O exchangeable tow protons for NH_2 group at 6.12 ppm. Also, revealed signals at δ 2.34(s, 3H, CH_3 Aliphatic), 3.43(s, 1H, pyrazol), 6.61(d, 2H, CH=CH) and 7.35-8.56(m, 13H, ArH's). Compound **IV** has been synthesized by the condensation between **III** and 1-phenyl-3-(p-tolyl)-pyrazol-4-carboxaldehyde (scheme 2). The IR spectrum indicated the absence of NH_2 stretching vibration and the presence of C=N stretching vibration at 1535.1 cm^{-1}, the C=O stretching frequency at 1650.9 cm^{-1} and C=C stretching frequency at 1590.9 cm^{-1}. Compound **V** has been synthesized according to scheme (3) and was obtained in the highest yield (86.2%) among the five synthesized chalcones.

Antioxidant activity of the synthesized compounds

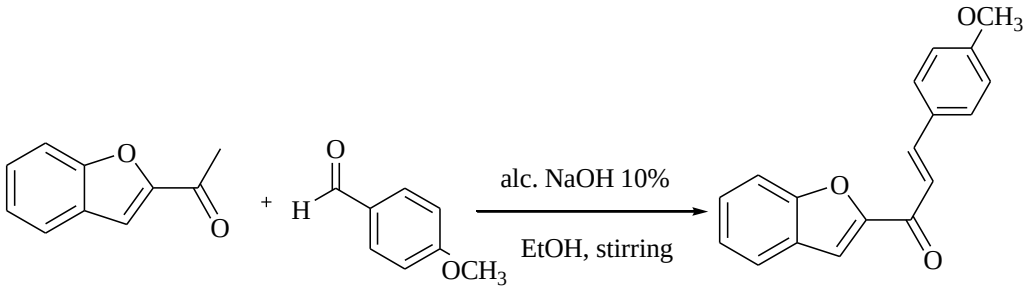
The antioxidant activities of the synthesized compounds were measured as the number of ascorbic acid equivalent (AAE). The potencies for the antioxidant activity of the test compounds were in the following order: **V** >**III**>**II**>**IV**>**I** **(**table 1**)**, where all tested compounds exhibited good antioxidant properties and the strongest being observed in chalcone **V** (399.32± 1.35 mg AAE/ g compound). According to this result, chalcone **V** was chosen to be used in our experimental trial.



Scheme (1): Clasien condensation between aromatic aldehydes and aromatic ketones to form chalcones



Scheme (2): Synthesis of **IV** from the condensation between III and 1-phenyl-3-(p-tolyl)-pyrazol-4-carboxaldehyde



V

Scheme (3): Aldol condensation between 2-acetylbenzofuran and p-methoxybenzaldehyde to form chalcone **V**

Table (1): Total antioxidant capacity (means ± S.D) of the synthesized chalcones.

Chalcone No.	Total antioxidant capacity (mg AAE/g compound)
I	86.44 ± 1.20
II	155.82 ± 0.95
III	166.66 ± 1.40
IV	98.82 ± 1.25
V	399.32 ± 1.35

TAC mean=$\sum TAC/n$; n=3, where (n) is the number of readings.
AAE= Ascorbic acid equivalent.

Milk yield

The average daily milk yield was insignificantly higher in G3 than either G2 or G1 (1.14 vs. 1.07 kg/day, respectively) (Table 2) and lies within the normal range for Zaraibi goats (1.01±0.24 and 2.65±0.24 kg/d) **(Doaa *et al*., 2016)**. While **Ashmawy *et al*., (2013)** reported a wider range of daily milk yield for the same breed (0.76±0.08 to 3.17±0.16 kg/d). The present study indicated that chalcone **V** supplementation had insignificant influence on milk yield of dairy goats. These results are in agreement with that reported by **Mardalena *et al*., (2011)** who found that, feed supplements containing flavanoids, polyphenols, quinones and saponines had insignificant influence on milk yield of Etawah goats. Also, **Galbat *et al*.(2014)** found that daily milk yield of Egyptian dairy goats slightly increased as a result of supplementation with medicinal herbs containing Nigella sativa, which had been proven to possess a good antioxidant activity as it rich in phenolic and flavonoids contents **(Kahkeshani *et al*., 2015)**. **Yang *et al*., (2010)** supplemented lactating Gray goats with different levels of vitamin A as a source of antioxidant; found that vitamin A supplementation had no significant influence on average daily milk yield. In contrast, **El-Saadany *et al*. (2008)** found that Nigella sativa rations could enhance milk yield of Zaraibi goat by 42%.

Milk composition

Data showed insignificant decrease in milk fat, lactose and total milk solids of the tested goats, while milk protein and milk somatic cells data showed insignificant increase in G3 than G2 and G1 (table 3). All milk components measured in the present study were in the normal range of milk of Zaraibi goats. Milk fat % were 3.70, 3.45 and 3.32;milk protein %2.81, 2.88 and 2.93;milk lactose % 4.46, 4.46 and 4.37;total milk solids%11.68, 11.48 and 11.30, respectively for G1, G2 and G3. These values were found to be similar to those reported by (**El-Emam *et al*., 2014 and Doaa *et al*., 2016)** and

slightly higher than that reported by **Ashmawy *et al*., (2013) and Doaa *et al*., (2009)**. Results indicated that supplementation of dairy Zaraibi goats with different levels of chalcone V insignificantly influenced milk components. These results are in agreement with that reported by **El-Saadany *et al*. (2008)**, who found that supplementation of dairy Zaraibi goat with Nigella sativa insignificantly affected on milk fat, protein, lactose and total milk solids.

Also, the results agree with those reported by **Mardalena *et al*. (2011),** who found that feed supplements containing flavanoids, polyphenols, quinones and saponines have no significant influence on milk fat, protein and milk antioxidants, while milk lactose was higher and milk cholesterol was lower in the treated groups. **Wang *et al*. (2010)**indicated that dietary antioxidants has no effect on milk protein, fat, lactose, total solids and non-fat solids of cow's milk.

The results indicated that milk SCC was insignificantly higher in milk of G3 than G2 and G1 during the experimental period except at the first month of treatment, where it possessed the lowest SCC among the three groups (table 3). In the control group (G1), the level of SCC was in continuous increase along the experimental period. While in supplemented groups (G2 and G3) SCC levels decreased during the first and second months and then increased afterwards.

El-Saied *et al*. (2003) stated that "the threshold of 1'600,000 cells/ml gave the best indication for Intra-mammary infection (IMI) and health status of the Egyptian Nubian (Zaraibi) goat breed". Values of SCC presented in the present study are within the normal range of the healthy Zaraibi does. The results are very close to that reported by **Doaa *et al*. (2009)** and lower than that reported by **Ashmawy *et al*. (2013)** for the same breed.

Total antioxidant capacity of blood serum

Results in table (4) showed that the total antioxidant capacity (TAC) of blood serum was insignificantly higher in G2 than G1 and G3.

Nawito *et al*. (2016) conducted a study on sheep and goats reared under the arid condition of south Sinai, found that non-pregnant does fed concentrate had the highest TAC (1.00±0.09 mmol/l) followed by non-pregnant does grazed (0.72±0.07 mmol/l). While in sheep, they found that non-pregnant ewes fed concentrate had the highest TAC (0.86±0.19 mmol/l) followed by pregnant fed concentrate (0.67±0.21 mmol/l).

The present study showed that, supplementation of dairy Zaraibi does, with different levels of chalcone V had insignificant influence on the oxidative status of animals. In contrary, **Yang *et al*. (2010)** found that, supplementation of lactating Gray goats with different levels of vitamin A (as a source of antioxidant) significantly increased the TAC of blood serum. Also, the supplementation of ewes with Nigella sativa seeds and Zingiber officinale powder significantly increased the TAC of blood serum **(El-Far *et al*., 2014)**. While in lactating dairy cows, **Mohammedreza *et al*., (2014)** studied the effect of rumen- protected choline and vitamin E on the TAC of blood serum and found that treatments did not have any significant effect.

Table (2): Least squares means (kg) ± SE of daily milk yield as affected by treatment, time and the interaction between them

Source of variation	No. of animals	Daily milk yield (kg)
Treatment		NS
G1	4	1.07 ± 0.04
G2	6	1.07 ± 0.04
G3	6	1.14 ± 0.04
Sampling time		
1st day of lact.	16	0.66 ± 0.05[b]
30th day of lact.	16	1.25 ± 0.05[a]
60th day of lact.	16	1.29 ± 0.05[a]
90th day of lact.	16	1.18 ± 0.05[a]
Treatment * time		NS
G1		
1st day of lact.	4	0.67±0.09
30th day of lact.	4	1.20±0.09
60th day of lact.	4	1.25 ± 0.09
90th day of lact.	4	1.18 ± 0.09
G2		
1st day of lact.	6	0.60 ± 0.07
30th day of lact.	6	1.29 ± 0.07
60th day of lact.	6	1.27 ± 0.07
90th day of lact.	6	1.13 ± 0.07
G3		
1st day of lact.	6	0.72 ± 0.07
30th day of lact.	6	1.27 ± 0.07
60th day of lact.	6	1.35 ± 0.07
90th day of lact.	6	1.21 ± 0.07

G1= control group, G2, G3 = goats received (250, 500 mg/h/d, respectively) of chalcone V, NS= insignificant, a,b = means with different letters are significantly different at $p < 0.05$.

Table (3): Least square means ± SE of milk properties as affected by treatment, time and the interaction between them.

Source of variation	No. of animals	Fat %	Protein %	Lactose %	Total solids %	SCC *10^3 cell/ml
Treatment		NS	NS	NS	NS	NS
G1	4	3.70 ±0.2	2.81±0.07	4.46±0.06	11.68±0.2	956.4± 171.7
G2	6	3.45 ±0.1	2.88±0.06	4.46±0.05	11.48±0.1	981.1±140.2
G3	6	3.32 ±0.1	2.93±0.06	4.37±0.05	11.30±0.1	1181.7± 140.2
Sampling time						
1st day of lact.	16	4.26±0.2[a]	3.14±0.08[a]	4.26±0.06[b]	12.36±0.2[a]	877.8±174.9[b]
30th day of lact.	16	3.04±0.2[c]	2.76±0.08[b]	4.54±0.06[a]	11.03±0.2[c]	709.9±174.9[b]
60th day of lact.	16	2.92±0.2[c]	2.80±0.08[b]	4.45±0.06[a]	10.87±0.2[c]	986.5±174.9[b]
90th day of lact.	16	3.75±0.2[b]	2.80±0.08[b]	4.46±0.06[a]	11.68±0.2[b]	1584.8±174.9[a]
Treatment * time		NS	NS	NS	NS	NS
G1						
1st day of lact.	4	4.28±0.3	2.97±0.07	4.36±0.1	12.32±0.3	645.0± 343.4
30th day of lact.	4	3.35±0.3	2.75±0.2	4.53±0.1	11.33±0.4	681.5± 343.4
60th day of lact.	4	3.35±0.3	2.73±0.2	4.46±0.1	11.23±0.3	938.3± 343.4
90th day of act.	4	3.84±0.3	2.79±0.1	4.50±0.1	11.83±0.3	1561.0± 343.4
G2						
1st day of lact.	6	4.27±0.3	3.10±0.2	4.39±0.1	12.46±0.3	930.5±280.4
30th day of lact.	6	3.03±0.3	2.73±0.3	4.59±0.1	11.04±0.3	752.7±280.4
60th day of lact.	6	3.03±0.3	2.87±0.2	4.39±0.1	10.10±0.3	752.3± 280.4
90th day of lact.	6	3.50±0.3	2.80±0.4	4.45±0.1	11.42±0.3	1489.0± 280.4
G3						
1st day of lact.	6	4.23±0.3	3.35±0.6	4.03±0.1	12.31±0.3	1058.0± 280.4
30th day of lact.	6	2.74±0.3	2.80±0.2	4.49±0.1	10.73±0.3	695.5± 280.4
60th day of lact.	6	2.39±0.3	2.79±0.3	4.50±0.1	10.38±0.3	1268.8± 280.4
90th day of lact.	6	3.92±0.3	2.78±0.4	4.45±0.1	11.79±0.3	1704.5±280.4

G1= control group, G2, G3 = goats received (250, 500 mg/h/d, respectively) of chalcone V, NS= insignificant, a, b, c = means with different letters are significantly different at $p<0.05$.

Table (4): Least squares mean (mM/L) ± SE of Total antioxidant capacity (TAC) of blood serum as affected by treatment, time and the interaction between them.

Source of variation	No. of animals	TAC (kg)
Treatment		NS
G1	4	2.86±0.4
G2	6	3.25±0.3
G3	6	2.83±0.3
Sampling time		
1st day of lact.	16	1.46±0.5^{c}
30th day of lact.	16	3.94±0.4^{a}
60th day of lact.	16	3.72±0.4^{a}
90th day of lact.	16	2.80±0.4^{b}
Treatment * time		NS
G1		
1st day of lact.	4	1.32±0.9
30th day of lact.	4	3.49±0.7
60th day of lact.	4	3.53±0.7
90th day of lact.	4	3.11±0.7
G2		
1st day of lact.	6	1.86±0.6
30th day of lact.	6	4.51±0.6
60th day of lact.	6	3.98±0.6
90th day of lact.	6	2.64±0.6
G3		
1st day of lact.	6	1.19±0.8
30th day of lact.	6	3.83±0.6
60th day of lact.	6	3.64±0.6
90th day of lact.	6	2.64±0.6

G1= control group, G2, G3 = goats received (250, 500 mg/h/d, respectively) of chalcone V, NS= insignificant, a, b, c = means with different letters are significantly different at $p< 0.05$.

CONCLUSION

From the findings, it can be conclude that, using chalcones as antioxidant supplements in dairy goat rations has insignificant influence on milk yield, milk composition, milk somatic cells count and total antioxidant capacity of blood serum. The undetectable response of using chalcones may be due to its decomposition in the rumen or it cannot be absorbed by the intestine due to its large particles. Further studies are required to detect why chalcones were not strongly absorbed in the intestine.

ACKNOWLEDGEMENT

Authors would like to express their deep appreciation and indebtedness to Prof. Dr. Adel Aboul-Naga, Dr. Mosad A. Ghareeb, Prof. Dr. Mohammed El-Shafie and Prof. Dr. Tarek Ashmawy for their support during the course of the work.

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