

Milk Composition and Milk Quality of Saanen Crossbred Goats Supplemented by Mineral Blocks

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ABSTRACT

The objective of this study was to investigate the effect of urea molasses multi-nutrient mineral block (UMMB) and medicated urea molasses multi-nutrient mineral block (MUMB) supplemented group on milk composition and milk quality of Saanen lactating does. A 90-day feed trial was conducted at a dairy goat farm in Felda Kemahang, Tanah Merah, Kelantan, Malaysia. Twenty four (24) Saanen lactating does (average milk yield < 1 L/d) were randomly assigned to four groups with six (6) goats each. Animals fed a basal diet, which consisted of 3 kg Napier grass (*Pennisetum purpureum*) and 1 kg commercial goat pellet as a control group. The experimental groups received equal amounts of basal diet with supplementation of UMMB and MUMB which were formulated using local agriculture by-products; and commercial mineral block (CMB), respectively. Milk samples were collected every two weeks for the analyses of milk composition, i.e., protein, fat, lactose, total solids, density, freezing point, pH, and temperature using EKOmilk analyzer. All results were analyzed using one-way ANOVA followed by Tukey's test by SPSS software version 23. It was found that milk yield in the group supplemented with UMMB (1.52 L/d) was significantly higher ($p < 0.05$), followed by MUMB (1.31 L/d), CMB (0.96 L/d), and control (0.78 L/d). Besides, the different group did not cause significant effect ($p > 0.05$) on milk composition and total bacteria count. Meanwhile, iron milk content in goat supplemented with MUMB (1.46 mg/g) was significantly lowered ($p < 0.05$), approaching the optimum value (0.36-0.75) compared to the control (4.08 mg/kg). In conclusion, UMMB and MUMB supplements had improved milk quality in terms of iron content and fatty acid concentration, which potentially can be utilized as feed supplements to increase the productivity of lactating goats.

Keywords: milk composition; Saanen goats; UMMB; MUMB

INTRODUCTION

Asia is the largest goat milk producer contributing 58.35% to the total milk produced in the world. Dairy goat and dairy sheep farming have a significant contribution to the national economy of Asia countries (Skapetas & Bampidis, 2016). In Malaysia, the livestock sector contributes 12.2% of Malaysia Gross Domestic Product in the agriculture sector in 2018 (Department of Statistics, 2019). Dairy goat production in Malaysia is a small livestock sector with no local breed specifically for milk production. Since goat milk has a significant niche market, the development of dairy goat farming has increased with large importation of dairy goats from various countries. Sazila *et al.* (2018) reported that the young generation in Malaysia showed a higher intention in livestock farming compared to previous years. However, the data and information on the production and nutrition of dairy goats locally are very limited (Shahudin *et al.*, 2018).

Ruminant livestock production is dependent on feeds comprising of fodder and crop residues. However,

these feeds are of inferior qualities. To improve livestock production, the efficiency of feed nutrients utilization must be optimized through feed supplementation (Mengistu & Hassen, 2018). In Malaysia, a major constraint of the dairy goat is nutrition deficiency and imbalance apart from poor animal health, which can severely decrease the productivity of dairy goat as well as decrease dairy goat's milk production and milk quality (Kanani *et al.*, 2006).

Feeds and fodders available throughout the country are rather scarce. To overcome this problem, most local farmers still use goat concentrates extensively to feed their animals since the concentrates can be included in the diet at a range of 35%-65% (Tufarelli *et al.*, 2009). However, as the main ingredient of concentrates is imported, the price of commodity fluctuates and increases every year. To reduce the production cost for feed and nutrients as well as for value addition of poor-quality feeds and fodders of ruminant animals, it is necessary to implement the supplementation strategy using local agriculture by-products.

Urea molasses multi-nutrient block (UMMB) is a convenient and inexpensive method of providing a range of nutrients to animals. The UMMB can improve the digestion of low-quality roughages in the rumen as well as increase the utilization of crop residue (Mengistu & Hassen, 2017). According to a previous study, the inclusion of 25% molasses, 30% brewers dried grains, 23% cottonseed cake, 5% mineral salt, 5% urea, and 12% cement as binders are the range used (Mubi *et al.*, 2013). Another study came with the other different formulations as follows: 45 % molasses, 3 % urea, 13.25 % bran, 14 % rice polish, 6 % calcite, 4 % calcium oxide, 4 % magnesium oxide, 10 % diammonium phosphate and 0.75 % trace minerals (Muralidharan *et al.*, 2016). However, UMMB with more quantities of non-sugar nutrients (within molasses) shows higher performance in live weight gain and feed conversion of the supplemented groups (Ramchurn & Ruggoo, 2000).

Different compositions on the animal basal diet by increasing concentrate ratio in the goat feed did influence the milk yield and milk composition of goats (Min, 2005). Increasing the energy intake by changing the feed component will upsurge the average level of milk production near the animal's genetic potential. However, the addition of oil or fat in the diet increases the fatty acid component in the milk without affecting milk yield (Gómez-Cortés *et al.*, 2018; Keles *et al.*, 2017).

To our knowledge, no prior studies have investigated the UMMB supplementation in dairy goats in Malaysia. The UMMB and medicated urea molasses multi-nutrient block (MUMB) in the current study are newly developed using locally available feed resources, which serve as a complete supplement for ruminants. It was shown that UMMB and MUMB acted as an excellent source of non-protein nitrogen, energy, vitamin, and minerals for ruminant production (Mira *et al.*, 2018). Therefore the current study aimed to investigate the effect of UMMB and MUMB supplemented group on milk composition and milk quality of Saanen lactating does.

MATERIALS AND METHODS

Animals

A 90-day feeding trial was done on a dairy goat farm in Felda Kemahang 1, Tanah Merah, Kelantan, Malaysia. Twenty-four female Saanen goats were assigned and allocated into four dietary treatments based on randomized complete block design with six goats per group. The animals' average weights were 40.58±1.50 kg (mean±SE). The goats were housed individually in wooden pens with a slatted floor two meters above the ground.

Experimental Diet

Animals were divided into four groups: a control group based on normal diet following farm practice (3 kg Napier grass and 1 kg concentrate), an experimental group with supplementation of UMMB; MUMB, and commercial mineral block (CMB) in the form of licks. Based on farm practice, all animals were fed based on

forage to concentrate ratio of 75:25, consisted of 3 kg fresh Napier grass in the morning and 1 kg of concentrates in the afternoon. All experimental groups were fed isonitrogenous diets (16% CP) for a period of 90 days and water was provided *ad libitum*.

Preparation of UMMB and MUMB

The ingredients of UMMB and MUMB utilized local agriculture by-product include rice bran, palm kernel cake (PKC), cornmeal, urea, molasses, and calcium oxide. MUMB contained 0.05% of fenbendazole for each 1 kg of blocks. After all the ingredients were mixed homogeneously, the mixture poured into a wooden mold to form a preferable size. The final step was drying, which was commonly done under sunlight. After drying, the blocks were wrapped with polythene bags and stored in a dry condition. Each UMMB and MUMB were fed in the form of 2 kg block to the goats. Chemical compositions of UMMB, MUMB, CMB, as well as basal diets, were shown in Table 1 and 2 (Mira *et al.*, 2018).

Milk Collection

Milk production was recorded daily for not less than six weeks during the morning milking. Similarly, milk samples were collected in the morning and pooled weekly. Individual milk samples were cooled to 5 to 8°C and transported in a thermo-box for laboratory analysis for milk composition.

Chemical Analysis of Milk

Protein, fat, lactose, total solid and density analyses. The milk samples were collected in a sterile bottle to reduce contamination for chemical analysis. About 100 mL of fresh milk sample was collected every two weeks for the analyses of protein, fat, lactose, total solid, density, freezing point, added water, pH, and temperature using EKOmilk analyzer (BOND, EON Trading INC) at Veterinary Laboratory, Kota Bharu, Kelantan, Malaysia.

Milk mineral analysis. Minerals such as potassium (K), sodium (Na), magnesium (Mg), Calcium (Ca), Manganese (Mn), and ferum (Fe) were examined. Approximately 100 mL of milk samples were collected in a sterile bottle and were cooled under -4°C in the freezer for storage. Then, these samples were analyzed using Atomic Absorption Spectroscopy (AAS) as described by Zailan & Yaakub (2018).

Fatty acid analysis. Fatty acid profiling, including fat extraction in milk, was determined before and after the experiment. Approximately 100 samples per group were collected in a sterile bottle and were cooled under -4°C in the freezer. The samples were analyzed using a gas chromatography-flame ionization detector (GC-FID) using IUPAC 2.301 method as described by Dieffenbacher & Pocklington (1987).

Microbiological analysis of milk. The microbiological test was conducted to investigate the microbial count

Table 1. Chemical composition of supplements (Mira *et al.*, 2018)

Nutrients	Supplements		
	UMMB	MUMB	CMB
DM (%)	90.06	90.13	92.26
Ash (%)	17.48	17.36	95.05
OM (%)	82.52	82.64	4.95
CP (%)	33.84	32.84	ND
CF (%)	4.49	4.07	ND
EE (%)	0.55	0.82	ND
ADF (%)	5.47	5.45	ND
NDF (%)	10.51	9.27	ND
Ca (g/kg)	36.54	34.95	21.23
Cu (mg/kg)	0.70	0.58	8.23
Fe (mg/kg)	11.27	3.87	259.07
Zn (mg/kg)	1.84	2.61	21.27

Note: UMMB= Urea molasses multi-nutrient block; MUMB= Medicated urea molasses multi-nutrient block; CMB= Commercial mineral block; DM= Dry matter; OM= Organic matter; CP= Crude protein; CF= Crude fiber; EE= Ether extract; ADF= Acid detergent fiber; NDF= Neutral detergent fiber; Ca= Calcium; Fe= Ferum; Cu= Copper; Zn= Zinc; ND= Not determined.

and bacterial presence before and after the experiment. The determination of milk quality was done using the standard plate count (SPC) method. A serial dilution of 10^{-2} , 10^{-3} , 10^{-4} , 10^{-5} was prepared by adding 1 mL of milk sample into 99 mL of Butterfield's Phosphate-Buffered Dilution Water (BPW) and then repeated by transferring 1 mL of the previous solution to 99 mL of diluent. All diluents were mixed and shaken 25 times within 7 seconds. One mL of each dilution was pipetted into the petri dishes which were appropriately marked. Next, 12 to 15 mL of plate count agar was added to each plate within 15 minutes of initial dilution. The sample dilution and agar medium were mixed thoroughly and uniformly by alternate rotation and back – and forth motion of plates. The agar was solidified and then inverted the solidified Petri dishes before they were incubated promptly for 48 hours at 35°C.

Statistical Analysis

All results were analyzed using one-way ANOVA followed by Tukey's test by Statistical Package for the Social Science (SPSS) software version 23.

Table 3. Milk composition of Saanen Crossbreed goats treated by urea molasses multi-nutrient block (UMMB), medicated urea molasses multi-nutrient block (MUMB), and commercial mineral block (Mean \pm SE)

Treatment groups	Composition						
	Temperature (°C)	Fat (%)	Snf (%)	Density (g/cm ³)	Protein (%)	L (%)	F.P (°C)
Control	27.85 \pm 0.38	4.741 \pm 0.39	8.31 \pm 0.58	28.35 \pm 2.50	2.99 \pm 0.22	4.71 \pm 0.48	-0.45 \pm 0.12
T1	27.67 \pm 0.47	4.25 \pm 0.31	7.49 \pm 0.16	25.58 \pm 0.60	2.70 \pm 0.06	4.12 \pm 0.13	-0.48 \pm 0.01
T2	27.71 \pm 0.45	5.40 \pm 0.56	7.94 \pm 0.15	26.26 \pm 0.78	2.85 \pm 0.06	4.28 \pm 0.10	-0.51 \pm 0.01
T3	27.53 \pm 0.40	4.33 \pm 0.33	7.08 \pm 0.46	23.83 \pm 1.59	2.53 \pm 0.17	4.07 \pm 0.13	-0.47 \pm 0.01

Note: Control= Basal diet (3kg Napier grass and 1 kg concentrates); T1= Basal diet+UMMB; T2= Basal diet+MUMB; T3= Basal diet+CMB; Snf= Solid non-fat; L; Lactose; F.P= Freezing point.

Table 2. Chemical composition of basal feed (Mira *et al.*, 2018)

Nutrients	Basal feed	
	Napier grass	Goat pellet
DM (%)	16.09	91.19
Ash (%)	5.33	7.19
OM (%)	94.67	92.81
CP (%)	15.54	17.13
CF (%)	33.26	20.07
EE (%)	2.44	3.33
ADF (%)	41.41	35.24
NDF (%)	65.77	61.21
Ca (g/kg)	0.40	3.86
Cu (mg/kg)	4.46	0.97
Fe (mg/kg)	10.69	45.18
Zn (mg/kg)	1.83	0.25

Note: DM= Dry matter; OM= Organic matter; CP= Crude protein; CF= Crude fiber; EE= Ether extract; ADF= Acid detergent fiber; NDF= Neutral detergent fiber; Ca= Calcium; Fe= Ferum; Cu= Copper; Zn= Zinc.

RESULTS

Milk Composition of Saanen Goat's Milk

The values of milk composition: temperature, fat, solid non-fat (SNF), density, protein, lactose (L), sucrose (S1), water, and freezing point (FP) are shown in Table 3. There were no significant differences in milk composition between the treatment groups ($p > 0.05$):

Milk Mineral Contents

Milk mineral contents between treatment groups were not significant ($p > 0.05$), except the iron content (Table 4). The optimal value of mineral content in goat milk was presented in Table 3 as a reference (Zamberlin *et al.*, 2012). Most of the mineral contents in all groups were higher than the optimal volume except the potassium content.

Standard Plate Count

There were no significant differences ($p > 0.05$) of standard plate counts between groups (Table

Table 4. Milk mineral contents of Saanen Crossbreed goats treated by urea molasses multi-nutrient block (UMMB), medicated urea molasses multi-nutrient block (MUMB), and commercial mineral block (Mean \pm SE)

Mineral contents (mg/kg)	Optimum value*	Treatments			
		Control group	T1	T2	T3
Calcium	1060-1920	1275.7 \pm 401.98	468.77 \pm 17.46	1136.6 \pm 430.55	478.6 \pm 41.71
Iron	0.36-0.75	4.08 \pm 0.34 ^c	2.48 \pm 0.07 ^{bc}	1.46 \pm 0.05 ^{ab}	0 \pm 0.00 ^a
Potassium	1350-2350	1836.85 \pm 4.41	1693.6 \pm 128.17	1584.42 \pm 38.95	1919.2 \pm 117.03
Magnesium	100-210	206.52 \pm 5.19	174.8 \pm 11.66	3464.3 \pm 1893.79	201.12 \pm 5.84
Sodium	340-500	549.82 \pm 97.24	874.35 \pm 102.16	923.17 \pm 103.62	745.57 \pm 118.86
Manganese	0.05	0.22 \pm 0.11	0.03 \pm 0.00	0.03 \pm 0.02	0.05 \pm 0.03

Note: *Source of Zamberlin *et al.* (2012). Means in the same column/row with different superscript differ significantly ($p < 0.05$). Control= Basal diet (3 kg Napier grass and 1 kg concentrates); T1= Basal diet + UMMB; T2= Basal diet + MUMB; T3= Basal diet + commercial mineral block (CMB).

Table 5. Standard plate count (SPC) in raw milk of Saanen Crossbreed goats before and after treatment of urea molasses multi-nutrient block (UMMB), medicated urea molasses multi-nutrient block (MUMB), and commercial mineral block (Mean \pm SE)

Treatment groups	Standard plate count (log CFU/mL)	
	Before	After
Control group	5.31 \pm 0.29	5.75 \pm 0.07
T1	4.69 \pm 0.35	5.50 \pm 0.17
T2	4.30 \pm 0.00	5.81 \pm 0.09
T3	5.10 \pm 0.39	5.66 \pm 0.14

Note: Control= Basal diet (3 kg Napier grass and 1 kg concentrates); T1= Basal diet + UMMB; T2= Basal diet + MUMB; T3= Basal diet + commercial mineral block (CMB).

5). The SPC levels in the control group, UMMB, MUMB, and CMB before the supplementation were 5.31 \pm 0.29, 4.69 \pm 0.35, 4.30 \pm 0 and 5.10 \pm 0.39 respectively while the reading of SPC after the supplementation were 5.75 \pm 0.07, 5.50 \pm 0.17, 5.81 \pm 0.09, and 5.66 \pm 0.14, respectively.

Fatty Acid Composition in Saanen Milk

Total saturated fatty acid (SFA) and total unsaturated fatty acid (UFA) between treatment groups were not significant ($p > 0.05$) (Table 6). SFA value (% in fat) in control, UMMB, MUMB, and CMB were 69.38 \pm 0.14, 66.53 \pm 0.07, 67.02 \pm 0.01, and 69.88 \pm 0.06, respectively, while for UFA, the value (% in fat) in control, UMMB, MUMB, and CMB were 30.61 \pm 0.14, 33.47 \pm 0.07, 32.98 \pm 0.008 and 30.12 \pm 0.06 respectively. Table 6 shows that undecanoic acid (C11), lauric acid (C12), myristic acid (C14), pentadecanoic acid (C15) and palmitic acid (C16) in CMB were significantly higher ($p < 0.05$) compared to the other groups. However, butyric acid (C4), caproic acid (C6), caprylic acid (C8), capric acid (C10), undecanoic acid (C11), lauric acid (C12), tridecanoic acid (C13), myristic acid (C14), and pentadecanoic acid (C15) in UMMB and MUMB were significantly lowered ($p < 0.05$) compared to the other groups.

DISCUSSION

Milk Composition of Saanen Goat's Milk

When compared to the previous data reported by Strzałkowska *et al.* (2009), both protein and solid-non-fat percentages in this study were lower. Meanwhile, lactose, fat, density, and freezing point were higher. It was also reported previously that the values of protein, solid-non-fat, lactose, fat percentage, density, and freezing point were 3.12%, 8.34%, 4.42%, 3.85, 1.025g/cm³, and -0.6 °C, respectively (Strzałkowska *et al.*, 2009). Although the UMMB and MUMB were high in protein and energy (Mira *et al.*, 2018), the supplementations of UMMB and MUMB did not alter the milk composition significantly compared to the control group. Another study suggested that the stage of lactation of goats might affect milk composition of goat milk. Idowu & Adewumi (2017) stated that milk composition of goat milk did change during the lactation period which was explained by another author as concentration effect, i.e., mineral content is low when the milk production is high and mineral content is high when the milk production is low (Curren *et al.*, 2019).

Milk Mineral Contents

Based on the result, iron composition in milk in all dietary groups were exceeded the normal range, especially the control group. Following the UMMB and MUMB supplementations, the iron content in milk was significantly improved. The possible reason might be due to the high Napier grass intake in T1 and T2 (Mira *et al.*, 2018). However, this reason was argued by Idamokoro *et al.* (2017) that pasture fodder did not affect iron concentration in milk. Iron binds naturally to the membrane of fat globules, casein, and whey protein, which are richly present in milk.

Standard Plate Count

For raw goat's milk, the limit value of the rolling geometric average of SPC was set at 6.18 log CFU/mL as according to Commission Regulation (EC) No 1662/2006 (Cupáková *et al.*, 2012). Thus, the results of all treatments were under the limit and considered safe to be consumed. In contrast, the SPC level in all treatments

Table 6. Fatty acid composition of Saanen Crossbreed goats treated by urea molasses multi-nutrient block (UMMB), medicated urea molasses multi-nutrient block (MUMB), and commercial mineral block (Mean \pm SE)

Fatty acids (% in fat)	Treatment groups			
	Control group	T1	T2	T3
C4	2.61 \pm 0.02 ^b	2.18 \pm 0.01 ^a	2.73 \pm 0.002 ^b	2.21 \pm 0.04 ^a
C6	2.48 \pm 0.01 ^d	1.90 \pm 0.01 ^a	2.25 \pm 0.004 ^c	2.08 \pm 0.03 ^b
C8	2.59 \pm 0.007 ^c	1.93 \pm 0.007 ^a	2.16 \pm 0.007 ^b	2.18 \pm 0.02 ^b
C10	8.25 \pm 0.002 ^c	6.44 \pm 0.001 ^a	6.37 \pm 0.001 ^a	7.53 \pm 0.04 ^b
C11	0.00 \pm 0.00 ^a	0.00 \pm 0.00 ^a	0.00 \pm 0.00 ^a	0.07 \pm 0.0005 ^b
C12	3.95 \pm 0.01 ^c	3.83 \pm 0.007 ^b	3.24 \pm 0.00 ^a	3.96 \pm 0.004 ^c
C13	0.33 \pm 0.01 ^b	0.84 \pm 0.02 ^d	0.08 \pm 0.0005 ^a	0.63 \pm 0.002 ^c
C14	9.29 \pm 0.03 ^b	8.78 \pm 0.03 ^a	8.84 \pm 0.009 ^a	10.37 \pm 0.01 ^c
C15	0.78 \pm 0.01 ^a	0.86 \pm 0.001 ^b	0.75 \pm 0.004 ^a	0.97 \pm 0.00 ^c
C16	25.55 \pm 0.11 ^a	26.56 \pm 0.04 ^b	26.75 \pm 0.01 ^b	28.20 \pm 0.07 ^c
C17	0.63 \pm 0.0005 ^a	0.67 \pm 0.007 ^b	0.75 \pm 0.002 ^c	0.63 \pm 0.001 ^a
C18	12.65 \pm 0.002 ^c	12.20 \pm 0.04 ^b	12.80 \pm 0.01 ^d	10.72 \pm 0.006 ^a
C20	0.22 \pm 0.001 ^a	0.28 \pm 0.005 ^b	0.24 \pm 0.01 ^a	0.26 \pm 0.004 ^{ab}
C14:1	0.12 \pm 0.001 ^a	0.16 \pm 0.002 ^b	0.12 \pm 0.01 ^a	0.19 \pm 0.002 ^b
C15:1	0.19 \pm 0.003 ^a	0.23 \pm 0.002 ^b	0.19 \pm 0.00 ^a	0.22 \pm 0.002 ^b
C16:1	0.68 \pm 0.001 ^a	0.73 \pm 0.01 ^a	0.71 \pm 0.004 ^a	0.82 \pm 0.01 ^b
C17:1	0.28 \pm 0.006 ^b	0.26 \pm 0.00 ^a	0.32 \pm 0.002 ^c	0.26 \pm 0.0005 ^{ab}
C18:1n9c	26.24 \pm 0.02 ^b	27.85 \pm 0.03 ^c	28.93 \pm 0.01 ^d	25.89 \pm 0.05 ^a
C18:2n6c	2.38 \pm 0.10 ^a	3.61 \pm 0.09 ^b	2.18 \pm 0.009 ^a	2.27 \pm 0.02 ^a
C18:3n3	0.25 \pm 0.005 ^a	0.41 \pm 0.007 ^b	0.26 \pm 0.02 ^a	0.27 \pm 0.00 ^a
C20:3n3	0.21 \pm 0.02 ^{ab}	0.18 \pm 0.001 ^{ab}	0.23 \pm 0.003 ^b	0.16 \pm 0.002 ^a
C20:5n3	0.21 \pm 0.01 ^b	0.00 \pm 0.00 ^a	0.00 \pm 0.00 ^a	0.00 \pm 0.00 ^a
Total SFA	69.38 \pm 0.14	66.53 \pm 0.07	67.02 \pm 0.01	69.88 \pm 0.06
Total UFA	30.61 \pm 0.14	33.47 \pm 0.07	32.98 \pm 0.008	30.12 \pm 0.06

Note: Means in the same column/row with different superscript differ significantly ($p < 0.05$). Control= Basal diet (3 kg Napier grass and 1 kg concentrates); T1= Basal diet + UMMB; T2= Basal diet + MUMB; T3= Basal diet + commercial mineral block (CMB). SFA= saturated fatty acid, UFA= unsaturated fatty acid).

was higher compared to the other studies (D'Amico & Donnelly, 2010 and Suguna *et al.*, 2012) reporting the average SPC of 3.34 log CFU/mL and 4.5 log CFU/mL, respectively.

However, the bacterial count did not significantly affect by diet supplementation, preferably by an external source like an airborne dust particle, unhygienic practices during milking, handling, and transporting milk (Delavenne *et al.*, 2011; Verraes *et al.*, 2014). Several others researcher also propose that dirty milking area or surrounding that permits bacterial contamination (Nordin *et al.*, 2018), season and geographical location of farmhouse and many additional extrinsic factors (Suguna *et al.*, 2012) result in unhygienic environment for milking purposes which prompting the high level of SPC value or bacterial contamination in milk.

Fatty Acid Composition in Saanen Milk

The non-significant effect of different groups in SFA and UFA might due to the same basal diet used in this study. The previous studies described that milk fatty acid could only be altered when there was additional oil supplemented or with high fat and low fiber diet (Chilliard & Ferlay, 2004; Novotná *et al.*, 2019; Silva *et al.*, 2020). The SFA in control and CMB were slightly higher compared to previous research by Singh *et al.*

(2018) at 68.37%, and UFA in both UMMB and MUMB was higher compared to previous researches (Singh *et al.*, 2018) at 31.63%. However, when compared to Zailan & Yaakub, (2018), all treatments had a higher SFA value (66%), while UFA was lower in all treatments (34%). The differences in fatty acids proportions were influenced by lipid metabolism (Zailan & Yaakub, 2018) and the composition of pasture (Singh *et al.*, 2018).

Current findings showed that higher butyric acid (C4), palmitic acid (C16), heptadecanoic acid (C17), stearic acid (C18), palmitoleic acid (C16:1), oleic acid (C18:1n9c), linoleic acid (C18:2n6c) and eicosapentaenoic acid (C20:5n3) values (1.37%, 21.58%, 0.45%, 8.58%, 0.40%, 16.56%, 0.99% and 0.09% in fat, respectively) compared to the previous studies (Sumarmono *et al.*, 2015; Strzałkowska *et al.*, 2009). However, C6, C8, C10, C12, C14, myristoleic acid (C14:1), α -Linolenic acid (C18:3n3), and eicosatrienoic acid (C20:3n3) showed lower fatty acid percentage (% in fat) compared to the previous findings (Strzałkowska *et al.*, 2009). Statements above were supported by the finding of Elgersma (2015), which described that increased intake of herbage or fresh grass could raise the PUFA content and reduce SFA content. Mira *et al.* (2018) stated that Napier grass intake was higher in UMMB and MUMB group, while CMB had a lower intake of Napier grass. The high content of SFA consumption is not healthy for humans

as it will increase the risk of cardiometabolic disease such as cardiovascular and coronary heart disease. Consumption of high SFA also leads to the increase of cholesterol content and the risk of an incident of type 2 diabetes (Chalder, 2015).

CONCLUSION

Dietary supplementations of UMMB and MUMB assist in maintaining the performance of lactating does by improving the iron content and fatty acid concentration of milk.

CONFLICT OF INTEREST

We certify that there is no conflict of interest with any financial, personal, or other relationships with other people or organization related to the material discussed in the manuscript.

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