

Effects of Feed Supplementation in Friesien Holstein Crossbreed Cows at the First Quarter on the Production and Quality of Milk

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Abstract

Nine heads of dairy cows were used in the study. The dairy cows were in 7-8 months pregnant condition, lactation II and were expected calving soon. The purpose of this study was to determine the effect of feed supplementation to increase the production and quality of milk. The feeding treatment was divided into 3 groups, G_I (control) given the usual feed given by livestock owners, G_{II} was given G_I+500 g UMMB/h/d and G_{III} was given G_I + 500 g MFS/h/d. Variables observed were feed and nutritional consumption, average milk production, milk quality, cumulative milk production, average 4% fat corrected milk (FCM) production, peak milk production. The experimental design used a completely randomized design of direct pattern, continued by Duncan's new multiple range test (DMRT) if there were a significant difference of variable values between treatments. The results showed that the addition of dietary supplement significantly affected the mean consumption of crude protein between G_{III} and G_I and G_{II}, respectively 1.22 kg /d versus 0.99 and 0.33 kg/d. The average milk production was also influenced by the addition of dietary supplement that was between G_I; G_{II} and G_{III}, respectively 9.55; 10.69 and 11.85 l/d. Cumulative milk and 4% FCM production were also significantly different at P <0.05, with value of each G_I; G_{II} and G_{III} was 954.98; 1068.70 and 1184.57 l; 10.72; 12.06 and 13.70 kg /d respectively. The conclusion was MFS to be able to increase cumulative and 4% FCM milk production.

1. Introduction

One of the most important factors in livestock raising is feed. The main factor influencing the efficiency and profit in the dairy cattle business is the quantity and quality of feed given to dairy cattle [1] The success or failure of the livestock raising business is largely determined by the feed given as a source of energy and protein. The reality in the field shows that many farmers who feed their animals do not pay attention to the quality, quantity and nutritional adequacy required. As a result, livestock productivity that is maintained does not achieve as they expect.

The first trimester of lactation is a critical period for dairy cattle. In this period milk production increases but the cattle's ability to consume nutrients is not proportional to the need of cows to produce milk. As a result of this condition during this period the cows have a nutrient deficiency of feed, causing the mobilization of the body's reserve energy in the tissues that cause weight loss. This is supported [2,3] mentioned that dairy farmers are generally less concerned about the condition of the cows when the dry phase, consequently at the beginning of lactation there is a backup of



body mobilization. This will cause a negative energy balance and simultaneously a decrease in body weight of the initial lactation cattle, resulting in a fall in body condition score.

This means that dairy cows that do not get the feed as required, in the early period of lactation will not be able to show the milk production curve and weight changes as expected [4]. Weight loss is too high will cause productivity decreased. Furthermore, it has been suggested by previous researchers [5] who stated that in order to avoid NEB at the time of cow 2 weeks before and 4-12 weeks after calf was born, the feeding strategy in that phase must be done, because NEB is also a factor which causes the profit or loss of dairy cattle business for livestock farmers. Van Straten *et al.*, 2009 suggests that early dairy lactation of reproductive performance declines as a result of changes in BCS and body weight which are also associated with negative energy balance [6]. Early lactation dairy feeding strategies in order to reduce the energy of negative balance and decrease in body weight and maintain milk production [7]. The strategy that has been done is by feeding individually on the cow's early lactation. Other researchers also stated that provision of higher energy sources in the ration at the beginning of lactation affects higher milk production and peak persistence of milk production is also longer [8]. One attempt to avoid NEB reduction should be added a high-quality feed that has nutritional content that is able to meet the nutritional needs required to increase the production of dairy cows in a late pregnant and the early lactation [1]. Lebih lanjut menyebutkan bahwa ransum yang diberikan pada sapi perah tersebut berupa konsentrat yang mengandung protein tinggi yang mana berbasis bahan baku lokal [1]. The improvement of feed on dairy cows that produce first-trimester milk with supplements based on local ingredients as well, the name of the feed supplement is urea molasses multi-nutrient block (UMMB) and multi nutrient feed supplement (MFS) [9,10]. Other studies have stated that UMMB as a dietary supplement contains nutritional sources of minerals, proteins, and energy that had an important role to increase ruminant livestock [11]. Molasses urea blocks have utility for providing trace elements in ruminant diets [12].

Feed supplement of UMMB and MFS had been tested on ruminant livestock (sheep, goat, beef cattle and dairy cow) [10,13], the result shows a positive response to the increase in production of body weight and milk, and used as a business unit by livestock farmer group, especially UMMB [14,15]. The socio-economic assessment of this UMMB feed supplement has been conducted by [16]. The results reported that farmers as users of UMMB for beef cattle agree very well if this feed supplement was always given every day on the cow. Further, it was mentioned that UMMB was needed to be developed more widely because it had been able to increase the production of beef cattle. Technically, economically, socially and culturally the characteristics of this feed supplement technology have been accepted by user farmers.

Similarly for multi-nutrient feed supplements (MFS) which was able to increase milk production and maintain the persistence of milk production longer [9,10]. The high content of crude fiber caused the consumption of feed decreases, whereas when dairy cows got forage feed as much as 17% dry matter or 1.35% of body weight, then the quality and production of milk will increase [17]. The UMMB and MFS supplements contained crude protein, crude fiber, and energy, 24.5 each; 28.8% and 6.5; 17.2%, 2889 and 3997 K-cal [9,10], were expected to meet the nutritional requirements of dairy cattle used for research. The purpose of this study was to determine the effect of feed supplementation on increasing milk production and quality in the first lactation tri-semester period.

2. Materials and Method

Friesian holstein crossbreed cow were used in this study 9 heads with a mean body weight of 350 in lactation II. The average age of 2 to 3 years was pregnant 7-8 months and soon gave birth to a calf. Feeding was adapted to cow owner management. Forage was given in the form of cuttings with a size of 10-15 cm. Concentrate used was a commercial concentrate (Production Argasari Boyolali) with crude fiber (CF) content 22.61% and crude protein (CP) 14.71%. The feed treatment was divided into three groups, group I (G_I) : was given daily by the farmer, G_{II} : $G_I + 500g$ UMMB and G_{III} : $G_I + 500 g$ MFS. The content of CF and CP respectively for UMMB and MFS 19.06% and 19.58%;

14.96% and 16.90%. While the elephant grass content for CF and CP are 32.75 and 8.78%, respectively. The experimental design used a completely randomized design of direct pattern, which then when there was a difference between treatments followed by DMRT test [18]. Parameters observed included nutritional content [19], feed intake, nutritional balance, average milk production, milk quality (fat and protein), cumulative, average 4% FCM, and peak milk production, then losing body weight. For the composition of rations used in the study are presented in Table 1. Table 1 shows that the composition of rations in G_{II} and G_{III} were added 500 g of UMMB and MFS respectively.

Table 1. Composition of Rations for Dairy Cattle (Head/Day) in This Study

Feed ingredient	Feed treatment		
	Control G_I	$G_I + 500$ g UMMB (G_{II})	$G_I + 500$ g MFS (G_{III})
Elephant grass (kg)	14	14	14
Concentrate (kg)	8	8	8
Rice bran (%)	45	45	45
Coconut meal (%)	25	25	25
Oil palm cake (%)	10	10	10
Soy meal (%)	10	10	10
Coffee peels (%)	7	7	7
Vitamins and minerals (%)	3	3	3
Feed supplement (g)			
UMMB	0	500	0
MFS	0	0	500

3. Results and Discussion

3.1. Nutrient Content

The nutrient content of the feed ingredients used for the observations has been analyzed, the results obtained are presented in Table 2. The nutrient content of basal diet for CF content of 32.75% and CP 8.78%, and concentrate, respectively 22.61% and 14.71% (G_I). Therefore, with the addition of 500g UMMB or MFS provided information that G_{II} and G_{III} , the CF content was lower while the CP content was high. Because each got additional nutrients from CF and CP from G_I . Therefore, CF content would be lower, while the CP content was higher in each of G_{II} and G_{III} . The CF and CP content of G_{II} and G_{III} are presented in Table 2.

The nutrient content of this analysis shows that the added CP content of MFS 16.90% which is greater than the concentrate and concentrate + UMMB is 14.71 and 14.96%. This was due to the CP content of MFS and UMMB, respectively 28.8 and 24.5% [9].

3.2. Feed Consumption

The feed given was forage of *Pennisetum purpurium* and concentrate. The results of the observation of forage consumption and concentrates for the G_I , G_{II} and G_{III} groups are presented in Table 3.

Table 2. Nutrient Content of Feed Ingredients Used for Experiments (%)

Materials	DM	Ash	CP	Extract ether	CF	TDN	OM
Elephant grass	25.41	11.39	8.78	1.71	32.75	54.93	88.61
Concentrate (C)	80.76	12.17	14.71	5.01	22.61	73.44	87.83
C + UMMB	81.27	11.43	14.96	5.95	19.06	76.54	88.57
C + MFS	81.14	10.86	16.90	4.01	19.58	74.37	89.14

TDN elephant grass was calculated using the formula of regression equation No.2 [20]

TDN concentrate was calculated by using formulas from [21]

Table 3. Average of Forage Consumption and Concentrate (Kg / day)

Feed Ingredient	Feed Consumption/DM		
	G _I : control	G _I + 500 g UMMB (G _{II})	G _I + 500 g MFS (G _{III})
Elephant grass (F)/kg ^{ns}	2.93	2.86	2.84
Concentrate (C)/kg	4.96 ^a	4.50 ^a	5.74 ^b
Total ^{ns}	7.89	7.37	8.58
Ratio F:C	37:63	39:61	33:67

a, b Different superscripts on the same line show the difference of $P < 0.05$

ns was not significantly different $P < 0.05$.

The treatment of feed supplementation did not significantly influence $P < 0.05$ in forage consumption. This was because the forages given to the dairy cattle were not different both in quality and quantity from the three treatments. In contrast to consumption of concentrates, it appears that feeding supplementation had an effect on $P < 0.05$, especially G_I and G_{II} differing from G_{III}. Each value was 4.96 and 4.50 kg / day compared to 5.74 kg/day. This was because the level of palatability MFS on G_{III} responded to appetite. There were several factors that influenced feed consumption such as feed form, nutrient content and palatability. Dairy heifers behavior to increase feed intake was done by adding oregano extract in concentrate feed, physiologically it did not change the parameters measured, including feed intake, body weight, and body performance [22]. This material has a distinctive flavor and aroma when used as an additive in the concentrate for the dairy cow [22]. Cows that consume concentrate, generally higher energy intake than forage, so if the proportion of concentrate in the feed is higher, the feed intake becomes lower [23]. Attempts to increase appetite and high DMI in dairy cows after calving need to be noted that some environmental conditions and body stay comfortable, BCS is not excessive, energy consumption in accordance with requirements that have been set at the time of the needs of the cow in the dry period, and forage intake adequate after calving [24].

The total consumption of the ration was also not significantly different, but G_{III} tended to be higher when compared with G_I and G_{II}, respectively 8.58 vs 7.89 and 7.37 kg/day. Forage given to the cow was limited to only 3.6 kg/day/DM, while the concentrate was 6.5 kg/day as fed. Based on the calculation of total DM rations given a percentage, feed treatment on G_I, G_{II} and G_{III} each value 1.95, 1.89 and 1.96% body weight. This means that it was not sufficient for what has been determined in [25] NRC (2001) that was for dairy cattle with body weight 400 kg, dry matter intake (DMI) 2 to 4%. This may be due to the limited supply of forages and the low palatability of the concentrate feed provided.

3.3. Consumption of Feed Nutrients

The result of observation of nutrient content of feeds presented are organic matter (OM), crude protein (CP), crude fiber (CF) and total digestible nutrient (TDN). The results are presented in Table 4.

Table 4. Consumption of OM, CP, CF and TDN (kg / DM / d)

Parameters	Feed treatments		
	G _I : control	G _{II} : G _I + 500 g UMMB	G _{III} : G _I + 500 g MFS
OM ^{ns}	6.95	6.53	7.63
CP	0.99 ^a	0.93 ^a	1.22 ^b
CF ^{ns}	2.08	1.79	2.05
TDN ^{ns}	5.25	5.02	5.83

^{a, b} Different superscripts on the same line show the difference of $P < 0.05$

^{ns} was not significantly different $P < 0.05$.

The feeding supplement of UMMB and MFS did not have a significant effect on nutrient consumption of OM, CF and TDN feed, only tended to be higher than G_I and G_{II} (Table 4), whereas CP consumption was significantly affected $P < 0.05$ as a result of the addition of MFS which differed significantly from G_I and G_{II} of 1.22 kg /DM /d compared with 0.99 and 0.93 kg / DM/d. This difference was likely due to increased consumption of CP and the ability of the cows to consume concentrates also increased. In addition, CP content of concentrate + MFS (G_{III}) was higher when compared with G_I and G_{II} of 16.9 vs. 14.71 and 14.96%. Further CP content of forage was the same from the three treatments (Table 2). The results of the study [26] reported that the soy bean meal present in the initial lactation dairy ration was an undegradable protein in the rumen containing amino acids by bypass to small intestine, a factor that might also affect CP consumption and concentrates.

3.4. Nutrient Balance

The balance of energy and protein could be known from the consumption and the needs of cows used in the study. The average consumption, need and balance of nutrient of cattle feed in the three treatment groups can be seen in Table 5.

Based on the table of lactation dairy requirement according to [25] NRC (2001), the calculation of DM, CP, and TDN in the treatment group G_I, G_{II} and G_{III} shows a negative balance on total DM, CP and TDN consumption of the three feed treatments, each of which was, -3.28, -2.73 and -4.24 kg DM/d, -0.34, -0.52 and -0.36 kg/d, -1.96, -3.5 and -2.21 kg/d respectively. It means that to obtain a negative balance as a result deficiency of DM, protein, and energy. Low consumption of DM, TDN and protein were likely due to limited feeding forage and consumption of less optimal concentrate, thus causing consumption of DM, TDN and CP were smaller than its needs.

Table 5. Balance of Consumption and Needs of DM, CP, and TDN (kg DM/d).

Parameters	Feed Treatments		
	G _I	G _{II}	G _{III}
Dry matter (DM) (kg/d)			
Consumption	7.89	7.37	8.58
Standard of minimum needed	11.17	10.15	12.82
Balance	-3.28	-2.78	-4.24
Organic matter (OM) (kg/d)			
Consumption	6.95	6.53	7.63
Crude protein (CP) (kg/d)			
Consumption	0.99	0.93	1.22
Standard of minimum needed	1.33	1.45	1.58
Balance	-0.34	-0.52	-0.36
Total Digestible Nutrient (TDN) (kg/d)			
Consumption	5.25	5.02	5.83
Standard of minimum needed	7.21	7.52	8.04
Balance	-1.96	-3.50	-2.21
Crude fiber (CF)			
Consumption	2.08	1.79	2.05
Standard of minimum needed	1.90	1.72	2.18
Balance	0.18	0.07	-0.13

3.5. The Balance of Dry Matter Ingredients (DM)

Based on the requirement of lactation dairy cows according to [25], the DM requirement corresponding to the standards for the cows in the treatment of G_I, G_{II}, and G_{III} was 11.17, 10.15, and 12.82 kg DM / d, respectively. While total DM consumption from research result to three treatments were 7.89, 7.37 and 8.58 kg DM / d, respectively. The result is a negative balance, of course, the impact of deficiency in each treatment is -3.28, -2.78 and -4.24 kg DM/d. DM deficiency was due to the limitations of forage feeding and low levels of palatability of the concentrate feed. This was what causes the low consumption of DM. Dairy cows need a number of nutrients to meet the needs of various body functions that is for basic needs of life and the need for production. The basic necessities of life were the need to fulfill the processes of life alone without the process of growth and milk production, while those for milk production were also used to produce milk also for growth and growth of the fetus when the cows were pregnant [27]. Feed consumption is an important parameter because feed consumption is related to the fulfillment of the need for basic living and producing. It was also important to determine the nutrient supply, function and response of livestock and use in feed [28]. According to [25], daily consumption of feed depended on the level of palatability of feed, weight, production, and livestock itself. Bath, *et.al.* (1985) [17] states that in high-yielding cows, the consumption per unit of body weight was higher than that of low-yielding cattle.

3.6. Consumption Balance Crude Protein (CP)

Based on the requirement of lactation dairy cows according to [25] about the required standard need, the requirement of each CP on treatment is 1.33 (G_I), 1.45 (G_{II}) and 1.58 kg DM / d. While total CP consumption in this study, each treatment was 0.99, 0.93; and 1.22 kg DM / d. Consequently each feed treatment occurs a negative balance. The values are -0.34 (G_I), -0.52 and -0.36 kg DM / d. This may be due to low DM consumption especially forage feeding and low concentration of feed concentrate, thus causing CP deficiency. However, the total CP consumption of G_{III} was higher at 1.22 kg DM / d and was significantly different ($P < 0.01$) with G_I and G_{II} of 0.99 and 0.93 kg DM / d, respectively. Meaning that MFS feed treatment can reduce CP deficiency. According to [29], low protein consumption in lactating cattle can decrease milk production, milk protein content and solid nonfat content (SNF). In some cases of deficiency, loss of body weight at the beginning of lactation will not be able to return to normal at the end of lactation.

3.7. The Balance of Total Digestible Nutrient Consumption (TDN)

Based on the requirement of lactation dairy cows according to [17] NRC (2001) has obtained the required TDN standard for each treatment G_I , G_{II} , and G_{III} , the value is 7.21, 7.52 and 8.04 kg DM/d. Total of TDN consumption G_I : 5.25, G_{II} : 5.02 and G_{III} : 5.83 kg DM / d, resulting in a negative balance or deficiency in the treatment group, respectively -0.96, -2.50 and -2.21 kg DM / d. According to [29] deficiency in energy consumption caused low milk production, followed by a decline in body condition score, also caused a decrease in solid nonfat content (SNF) and milk protein content.

3.8. Crude Fiber Balance (CF)

The minimum requirement of CF 17% DM total, so for the G_I group: 1.90, G_{II} : 1.72 and G_{III} : 2.18 kg DM/d, while total CF consumption of the three treatment groups, respectively 2.08, 1.79 and 2.05 kg DM / d, to obtain a negative balance or deficiency in group G_{III} of -0.13 kg DM / d, whereas G_I and G_{II} have a surplus of 0.18 and 0.07 kg DM / d respectively. CF deficiency by group G_{III} was caused by the minimum requirement of CF namely 17% requirement of DM total. Group G_{III} higher than G_I and G_{II} group whereas highest CF consumption occurs in group G_I , this was influenced by CF content contained in concentrate feed respectively - each group was G_I : 22.6%; G_{II} : 19.06 and G_{III} : 19.58%.

3.9. Milk Production

Results from observations on feeding treatment on G_I , G_{II} , and G_{III} on milk production and quality from early lactation dairy cow are presented in Table 6. Feed treatment for G_{III} was significantly different $P < 0.05$ compared with G_I and G_{II} . The average milk production was 11.85 l/d compared with 9.55 and 10.69 l/d. Measurement of production in month II, total cumulative milk and 4% FCM production were significantly different at $P < 0.05$ and $P < 0.01$, respectively values for G_I , G_{II} and G_{III} were 9.62, 10.66 and 12.32 l / d; 954.98, 1038.70 and 1184.57 l / 14 weeks and 10.72, 12.06 and 13.70 kg/h respectively. The milk production was influenced by the cow response to dietary supplements added in the treatment group concentrate especially the addition of MFS. This was probably because in the second month the G_{III} group experienced a period of peak production and this group has a better ability to maintain peak production. The addition of UMMB and MFS feed supplements in commercial concentrates was able to increase milk production and peak milk production achievement [10]. The response from the addition of MFS proves that the cow was more utilizing feed with high protein content to produce milk. The increase in production in G_{III} may also be affected by the soy bean meal contained in the G_{III} ration, as it is an undegradable feed material in the rumen which directly enters the small intestine [26] and supplementation with cotton seed meal can increase milk production [30]. Wanapat et al (2018) states that cotton seed meal instead of soy bean meal [1].

The response of dairy cows that got feed treatment with the addition of UMMB production was smaller (10.69 vs 11.85 l/d). This may be due to the difference in the crude protein content of which the MFS of its CP content was 16.90% compared to UMMB only 14.96% (Table 2).

Table 6. Mean of Milk Production and Quality

Parameters	Feed treatments		
	G ₁	G ₁₁	G ₁₁₁
Average of milk production (liter/d)	9.55 ^a	10.69 ^{ab}	11.85 ^b
Milk production month I (l/d) ^{ns}	9.98	10.13	11.78
Milk production month II (l/d)	9.62 ^c	10.66 ^c	12.32 ^d
Milk production month III (l/d) ^{ns}	9.07	11.23	11.44
Cumulative Milk production (l/14 weeks)	954.98 ^a	1068.70 ^{ab}	1184.57 ^b
Average of milk production (kg/d)	9.77 ^a	10.93 ^{ab}	12.13 ^b
Average of milk production 4% FCM/kg/d	10.72 ^a	12.06 ^{ab}	13.70 ^b
Peak of milk production (l) ^{ns}	11.33	12.67	13.00
Average of fat content in milk (%) ^{ns}	4.65	4.69	4.87
Average of protein content in milk (%) ^{ns}	2.77	2.79	2.86

^{a,b} a different superscript b on the same line shows a significant difference (P < 0.05)

^{c,d} different superscript on the same line show very real difference (P < 0.01)

^{ns} non significant (P > 0.05)

3.10. Dynamics Weight Loss

The change of dairy cattle weight in the control group (G₁), UMMB (G₁₁) and MFS as the average weighing result during the initial 14 weeks of lactation is presented in Figure 1. The change in body weight was related to the amount of feed consumption or the amount of nutrient and feed consumed, as well as the amount of milk production. The weight loss of cows in this study was calculated from the initial weight difference with the lowest body weight. The average weight of dairy cows from each treatment is shown in Table 7.

Table 7. The Lowest Average Weight Loss of Dairy Cows (kg)

Cows	G ₁	Weeks to	G ₁₁	Weeks to	G ₁₁₁	Weeks
1	56	8	58	10	44	8
2	84	4	62	6	71	10
3	82	10	40	4	99	10
Average	74	7	53.33	7	71.33	9

Weight loss from treatment G₁, G₁₁ and G₁₁₁ were 74, 53.33 and 71.33 kg at weeks 7, 7 and 9 respectively. The feed treatment did not show any significant difference, but the decrease in body weight obtained by MFS supplement tended to be longer. This was supported by the milk production in cows that got MFS also higher and also milk production peaked at 9 weeks. According to [25] NRC (2001), early weight loss lactation dairy cows were caused by the insufficient energy consumption of nutrients from the energy needed to be able to reach the peak production of milk. This condition can be seen from the TDN needs which had negative nutritional balance both G₁, G₁₁ and G₁₁₁. The nutritional balance values for each energy were -1.96, -2.50 and -2.21 kg/d.

A description of the relationship between milk production dynamics and body weight reduction in the study is presented in Fig.1 and 2. The results of the control feeding studies, the production tended to be lower starting from 2 weeks after birth compared with the added treatment feed of UMMB and MFS. Addition of MFS at week 10 started to decrease, while for cow that get UMMB tends to fluctuate but production is still lower if compared to cow that got MFS (Fig 1). This was not followed by the dynamics of weight gain. In accordance with Fig 2, the weight gain in cows that received MFS, UMMB and control tended to decrease until week 12 for cows given MFS, while those given UMMB and control, each at 14 and 16 weeks tended to increase body weight (Fig.2). This means that the addition of MFS to the cow at the early of lactation tended to increase milk production and improved their body condition.

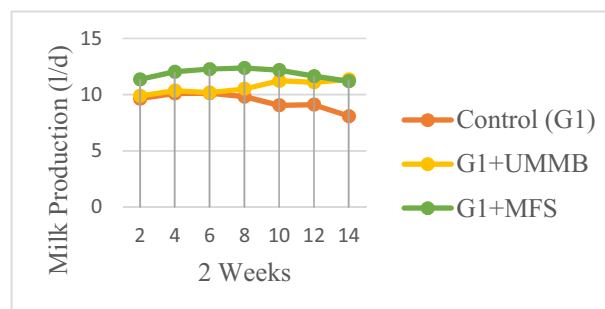


Figure 1. The Average Dynamics of Milk Production Every 2 Weeks

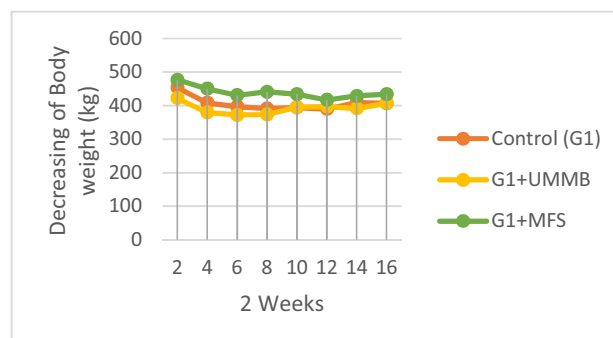


Figure 2. The Average Dynamics of Decreasing of Body Weight Every 2 Weeks

4. Conclusion

The addition of dietary supplements multi nutrient feed supplement (MFS) has a very real effect on CP consumption and was able to increase milk production and 4% FCM production. In addition, MFS tended to be able to improve the early body lactation weight loss at 10 weeks and this was faster when compared with cows fed with UMMB and control feed.

5. References

- [1] Wanapat. M, Foiklang S., Sukjai, S., Tamkhonburi, P., Gunun, N., Gunun, P., Phesatcha, K., Norrapoke, T and Kang, S. 2018 Feeding tropical dairy cattle with local protein and energy sources for sustainable production. *Journal of Applied Animal Research*, 46:1, 232-236.

- [2] Coffey, M.P., G. Simm and S. Brotherstone. 2002. Energy balance profiles for the first three lactations of dairy cows estimated using random regression. *J. Dairy Sci.* 85: 2669–2678.
- [3] Pryce, J.E., M.P. Coffey and S. Brotherstone. 2000. The genetic relationship between calving interval, body condition score and linear type and management traits in registered Holsteins. *J. Dairy Sci.* 83: 2664–2671.
- [4] Prihadi, S and Adiarto 2008 *Dairy Farming Science* Faculty of Animal Husbandry Gajah Mada University Press Yogyakarta
- [5] Collard BL, Boettcher, P.J., Dekkers, J.C., Petitclerc, D., Schaeffer, L.R. Relationships between energy balance and health traits of dairy cattle in early lactation. *J Dairy Sci.* 2000, 83(11):2683–90.
- [6] Van Straten M., Shpigel N.Y., Friger M. 2009 Associations among patterns in daily body weight, body condition scoring, and reproductive performance in high-producing dairy cows. *Journal of Dairy Science*, 92, 4375–4385
- [7] Bossen d, Weisbjerg, M.R., Munksgaard, L., and Hojsgaard, S. 2009. Allocation of feed based on individual dairy cow live weight changes: Feed intake and live weight changes during lactation. *Livestock Science* 126, 252–272.
- [8] Gaillard, C., N. C. Friggens, M. Taghipoor, M. R. Weisbjerg, J. O. Lehmann, § and J. Sehested 2016 Effects of an individual weight-adjusted feeding strategy in early lactation on milk production of Holstein cows during extended lactation. *J. Dairy Sci.* 99:2221–2236 <http://dx.doi.org/10.3168/jds.2015-10359> .© 2016
- [9] Suharyono 2010 Development of feed supplements for ruminants and introduction to farmers. Nuclear Sciences, scientific presentations of middle/major researchers. Center for the Dissemination of Nuclear Science and Technology. BATAN. 1(1): 1
- [10] Suharyono, L Farida, A Kurniawati and Adiarto 2008 Effect of feed supplement on peak milk production of dairy cattle at first lactation. *Prospect of Dairy Industry toward Free Trade 2020* Pusltnak Jakarta
- [11] Tekeba E, Wurzinger M and Zollitsch W 2012 Effects of urea-molasses multi-nutrient blocks as a dietary supplement for dairy cows in two milk production systems in north-western Ethiopia. *Livestock Research for Rural Development* Volume 24, Article #130. Retrieved September 30 2016 from <http://www.lrrd.org/lrrd24/8/teke24130.htm>
- [12] Forsberg, N.E., R. Al-Maqbaly, A. Al-Halhali, A. Ritchie and Srikandakumar 2002 Assessment of molasses-urea blocks for goat and sheep production in the Sultanate of Oman: Intake and growth studies. *Tropical Animal health and Production*, 34 231–239
- [13] Suharyono, N Litasova, A Kurniawati and Adiarto. 2014. Development of multi nutrient no molasses feed supplement for improving milk productivity on early lactation dairy goat. *Proceedings The 2nd Asian-Australian Dairy Goat Conference April 25-27th* Faculty of Animal Science Bogor Agricultural University. 209

- [14] Suharyono, H. Sutanto, H. Sutanto., Purwanti, Martanti, A. Agus and R. Utomo. 2014. The effect of urea multi-nutrient and medicated block for beef cattle, beef and dairy cow. *Atom Indonesia Journal* Vol. 40. 2.49-56.
- [15] Suharyono 2014 Development of feed supplement urea molasses multi nutrient block (UMMB) using protein from soy bean meal and *Gliricidia sepium* (Gs) for ruminant animal. *A Scientific Journal for the Applications of Isotopes and Radiation* **10**(1): 11
- [16] Lestari VS, Djoni PR, Tanrigiling R, Aslina A, Ikrar MS and Ilham R 2016 Beef cattle farmers perception toward urea mineral molasses block. *World Academy of Science, Engineering and Technology International Journal of Biological, Biomolecular, Agricultural, Food and Biotechnological Engineering* **10**(10)
- [17] Bath DL, FN Dickinson, H A Tucker and RD Appleman 1985 *Dairy Cattle, Principles, Problem, Profit* Third Edition Lia and Febiger Philadelphia
- [18] Astuti M 2007 *Introduction to Statistics for Animal Husbandry and Animal Health*. First Print Binasti Publisher Bogor
- [19] AOAC 2005 *Official Method of Analysis the Association of Official Analytical Chemists*. 18th Ed. Maryland AOAC International, William Harwitz (ed) United States of America
- [20] Hartadi H, S Reksohadiprojo and AD Tillman 2005 *Table feed composition for Indonesia*. Gajah Mada University Press. 5th Ed.
- [21] Crampton E W and L E Harris 1969 *Applied Animal Nutrition*. W H Freeman and Company United States of America
- [22] Giovani JK, Dejani MP, Alexandre MG, Marcelo T. S., Marcel B dos P, Eduardo A da C and Vivian F. 2016. Oregano Extract Added into the Diet of Dairy Heifers Changes Feeding Behavior and Concentrate Intake. *The Scientific World Journal*
- [23] Chamberlain AT and Wilkinson JM 2009 *Feeding the Dairy Cow*. Published in Great Britain by Chalcombe Publications, Mounthwood House, Biddenfield Land Shedfield, Hampshire SO32 2HP
- [24] Drackley JK and Cardoso FC 2014 Parturition and postpartum nutritional management to optimize fertility in high-yielding dairy cows in confined TMR systems. *The Animal Consortium*. 85.
- [25] NRC 2001 *Nutrient requirement of Dairy Cattle*, 7th Ed. National Academic Press Washington DC.
- [26] Broderick, G.A., Huhtanen, P., Ahvenjarvi, S., Reynal, S.M., Shingfield, K.J 2010 Quantifying ruminal nitrogen metabolism using the omasal sampling technique in cattle- a meta-analysis. *J.Dairy Sci.* 93:3216-3230.
- [27] Siregar S 1992 *Sapi perah Jenis, teknik pemeliharaan dan Analisis Usaha*. PT Penebar Swadaya Jakarta
- [28] Van Soest, P.J. 1994. *Nutritional Ecology of Ruminant* second edition. Cornell University Press Ithaca, New York.
- [29] Miller WJ 1979 *Dairy Cattle Feeding and Nutrition*. Academic Press. NewYork San Fransisco
- [30] Brito, A.F., and Broderick, G.A.2007. Effect of different protein supplement on milk production and nutrient utilization in lactating dairy cows. *J.Dairy Sci.* 90:1816-1827.

