FEED NUTRITIVE VALUE, MILK PRODUCTION AND MILK QUALITY STATUS OF DAIRY COWS IN JOHORE

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ABSTRACT. Information on the nutritional content of animal feed is very important in improving milk production and the quality of milk produced. Data on the nutrition and nutritional quality of feed given to livestock are not comprehensively evaluated and recorded in any dairy farms in Johore. The objective of this study is to determine the nutritional content of selected feedstuffs, with production and quality of milk in selected dairy farms in Johore. Data were collected from 94 dairy farms during field visits through face-to-face interviews. Feed samples collected were dairy cattle pellet, Napier grass, palm kernel cake, palm kernel expeller, soybean hull, corn, cassava peel and agricultural waste. Proximate analysis was performed using standard AOAC methods. The result of this study found that 67.0% of dairy farmers in Johore use Napier grass as the main source of fodder. The survey showed that 46% of the farmers in Johore give a suitable quantity of Napier grass based on body weight, while for milk production, the survey showed that 54 dairy farms in Johore produce less than 100 litres/day, 18 farms produce 101-200 litres/day, 12 farms produce 201-300 litres/day, and 10 farms produce more than 300 litres/day. The overall status of dairy farms in Johore shows that 60% of the farms produce an average of 5.1-10 litre milk per cow per day in which 92.5% of milk samples collected had acceptable Total Dissolved Solid values indicating good quality of milk production.

Keywords: feed, proximate analysis, milk production, milk quality, dairy cows, Johore

INTRODUCTION

One of the issues in Malaysia's ruminant industry is that the self-sufficient level rate (SSL) is still lower than demand (Fadhilah Annaim Huda, 2015). Among the aspects that need to be focused on the ruminant industry are breed selection, high quality of animal feed, economics, and efficiency of the production system. In 2016, the cost of imports of animal feed in Malaysia is RM6.67 billion (Mohamad Zin, 2017). Therefore, domestic production of animal feed is encouraged to reduce importation. The demand for raw milk and dairy products has increased over the years in Malaysia. However, the self-sufficient level (SSL) of milk in 2018 can only meet Malaysian needs at approximately 61% (DVS, 2016), while 39% of the demand for milk and dairy products is met through imports from countries including India, Australia, and the Netherlands (Ramlan, 2015).

Among the step to improve dairy production in Malaysia is to make sure they meet local demand. On-going and intensive research and development should be done to increase milk production. Until now, research data from local sources are still limited. The source of the data and information is still based on overseas' studies. According to several overseas' research reports, the main problem faced by the dairy farmer is poor knowledge and skills of dairy cow management that can affect the production of dairy cows. Farmers have issues in recording the frequency of pregnant cows as well as proper nutrition to be given to livestock. Nutrition is an important factor in the production of livestock (National Agrofood Policy, 2011- 2020). Dairy cows need to be given well-balanced diet to produce optimum yield and good quality milk. The dependency of this industry on imported feed is not a healthy development as it causes price fluctuations and high production (Wan Zahari and Wong, 2009).

Various strategies have been introduced to reduce the importation bill as about 70% of the cost of livestock production is attributed to the feed (Wan Zahari and Wong, 2009). Unfortunately, farmers have lack of knowledge in the nutritional quality of feed provided to livestock. Malaysia's major crops such as rice, coconut, and oil palm produce many by-products such as broken rice, rice bran, copra cake and palm kernel expeller that could be used as animal feed (Wan Zahari and Wong, 2009). The local ruminant industry depends on locally available agricultural by-product such as rice bran, copra cake, palm kernel cake (PKC), oil palm fronds, sago, and broken rice in contrast with non-ruminant industry that depends more on imported material such as corn and soybean meal (Loh, 2002).

The feeding values of the ingredients evaluated were compiled more recently by Yusoff (2010). In dairy cattle rations, PKC is used as an energy and fibre at the inclusion level of 30%-50%. PKC-based dairy cattle pellets are popular in Malaysia and are commonly fed together with grass and other concentrates. Under Malaysian local conditions, milk yield between 10 to 12 litres/day/head can be achieved and reach higher yield with good formulation (Wan Zahari and Alimon, 2005). Expeller PKC (PKE) is more common and widely available throughout Malaysia. Solvent extracted PKC has an oil content ranging from 2-4% while that of expeller pressed PKC (PKE) has 6-8% oil. PKC is classified as an energy-feed and its chemical composition is somewhat similar to copra meal, rice bran, or corn gluten feed (Alimon and Wan Zahari, 2012).

There is a huge amount of industrial soybean by-products produced from soybean which needs to be disposed, including soybean waste from the tofu and soybean milk processing factories. Soybean waste is characterized by high moisture and high crude protein (CP) contents (Mohammad *et al*., 2018). Soybean hull is a high fibre by-product produced during soybean processing. Its main fibre component is cellulose, and it is low in lignin content. This makes its fibre highly digestible thus making it an ideal energy source when used in ruminant feeds (Liu and Li, 2017).

Napier grass is the most popular fodder used in dairy and feedlot production (Halim *et al*., 2013). The nutritive value of grasses decreases with advancing maturity. The reduction of digestibility as the harvesting age increase is related to lignin content in the mature plant (Zailan *et al*., 2016). When analysing corn silage for chemical compositions, several quality factors have to be considered. Several dynamics come into play when determining the quality of corn silage, such as maturity, harvesting at proper moisture, chop length, and packing at an adequate density. There are certain target value parameters that corn silage must meet to ensure optimal forage quality and optimal animal performance. Target values are considered on a dry matter basis with analysis results indicating percentages of protein, fibre content, energy values, digestibility, and mineral in the corn silage (Chahine *et al*., 2017).

In Johore, there are approximately 130 dairy farms. Data on the nutrition and nutritional quality of feed given to livestock are not comprehensively evaluated and recorded. Information on the nutritional content of the feed is very important in improving milk production and the quality of milk produced. According to Suntharalingam and Zhen (2015), one of the challenges concerning the dairy sector in Johore is poor dairy farm management and inadequate nutritious feed. Production remains low as management and record keeping systems are still not up to standard. Small scale dairy animals still typically use handwritten recording system, while many fails to produce any records (Jeyabalan, 2010). Dairy cows are not given nutritious and adequate feed, thereby this factor causes low milk production. According to Devandra and Wanapat (1986), milk cows that produce milk need adequate feed supply as well as feed supplements. The quality of feed should be considered. The farmers should understand the composition of feed based on the fact that standard consumption will help the cows to increase milk production. Therefore, this study is conducted to evaluate the status of animal feed quality, milk production, and milk quality produced by Johore dairy farmers as well as to observe the feeding management of the milking herd.

MATERIALS AND METHOD

Field Visits and Data Collection

Data for this study were collected from dairy farmers during field visits through interviews. The interviews were conducted in Malay language where the contents were related to livestock feeding, forage production, and milk production of dairy cows. 94 dairy farms were visited - 24 from Kluang district, 15 from Labis district, 13 from Muar district, five from Batu Pahat district, 21 from Ulu Tiram, and 16 from Johor Bahru district.

Feed Sampling

A total of 276 feed samples were collected from 94 dairy farms in Johore. Feed samples were collected and divided according to feed types. A minimum weight of 0.5 kg of grain samples or pelleted feed were collected and put in clean and dry plastic bag using grain scoop from drums stored at respective farms which include dairy cattle pellet (n=78), palm kernel cake (n=55), palm kernel expeller (n=8), soybean hull (n=30), corn silage (n=9) and coarse ground corn (n=9). For the wet samples which are Napier grass (n=27), soybean waste (n=42), fresh corn (n=9), cassava peel (n=4), sago waste (n=3), and bread waste (n=2), a minimum weight of 1kg of the samples were collected in plastic bag. General requirements for feed sampling were according to Malaysian Standards Method for Animal Feedstuffs, second revision (MS743: 2009). All the feed samples were sent to Malaysian Veterinary Institute (IVM), Johore for further analysis.

Proximate Analysis

The ground feed samples were weighed and put in a forced-air drying oven at $103 \pm 2^{\circ}C$ overnight (AOAC 2000) to determine the dry matter (DM). Ash content was determined by incineration at $550 \pm 20^{\circ}C$ for 4 hours (FAO, 2011). The crude protein (CP) content (N x 6.25) was determined after digestion in sulphuric acid by the Kjeldahl method using the Kjeltec™ analyser (FOSS, 2003). Crude fibre (CF) was measured after being treated with boiling dilute sulphuric acid and with boiling sodium hydroxide solution using the Fibertec™ system (FOSS, 2010). Crude fat/Ether extract (EE) was determined using the Soxtec Extraction System (FOSS, 2008). Calcium (Ca) concentrations were determined using Atomic Absorption Spectrophotometer (Perkin Elmer Corp., Connecticut, USA), equipped with a flame burner fed with an air-acetylene mixture and AA WinLab software. Finally, the metabolised energy (ME) for ruminants was calculated using the Menke equation (Close and Menke, 1986).

Milk Samples

Milk production data from each farm were also recorded from the interviews. 94 milk samples were collected from each farm. 100 ml of the bulk tank milk samples were taken from each farm and put in the airtight container, stored at 4°C in an icebox. This is according to the standard method outlined in APTVM (2011). Milk samples were collected between 7 am to 9 am during their milking time. The sample containers were labelled with producer's number and date collection after proper agitation. The milk samples were sent to the Milk Quality Control Laboratory, Malacca for fat percentage, protein percentage, lactose percentage, Total Digestible Solid (TDS), and Solid Non-Fat (SNF) test. They were delivered to the laboratory on a daily basis to ensure that testing can be conducted within 36 hours after sample collection.

RESULTS AND DISCUSSION

Classification of Dairy Farms

In Malaysia, dairy farms are classified based on the number of adult females in a farm. A farm with 30 or less adult female cows is classified as small scale. Semi-commercial farms have between 31 to 49 adult female cows while large-scale farmers or commonly known as commercial farmers, manage 50 and more adult female cows (Suntharalingam and Zhen, 2015). Analysis from the survey showed that 63 (67.0%) of dairy farms in Johore are operated on small scale, 13 (13.8%) on semi-commercial, followed by commercial scale 18 (19.1%).

Breed

The study found that 64.8% are Friesian Sahiwal (FS) breeds and 35.1% of Friesian Sahiwal cross Jersey in Johore dairy farms.

Proximate Analysis on Feed Samples

A total of 276 feed samples collected were analysed for dry matter (DM), crude protein (CP), crude fat/ether extract (EE), crude fibre (CF), calcium (Ca), and metabolized energy (ME) content to evaluate the feed quality given to dairy cows in Johore state. The nutrient content of the samples was calculated based on DM (%). The result of proximate analysis of all the samples collected based on DM (%) are as shown in Table 1.

Dairy Cattle Pellet

Seventy-eight (78) samples of dairy cattle pellet (DCP) were analysed, and the results are as tabulated in Table 1. The DM result from this study is consistent with Yusoff (2010) but contains higher values of CP, EE, CF, and Ca. Dairy cattle pellet requirements proposed by MS743:2009 are DM (88%), CP (14.0%), EE (3.0 – 8.0%), Ca 0.43% and ME (9.90 MJ/kg). CP for each samples contains more than specifications stated in MS743:2009, and 74 samples containing EE in the range between 3.0-8.0%. Proximate analysis showed that only one sample contains Ca less than the recommended amount. Eleven samples from 78 samples of DCP have the value of the ME less than 9.90 MJ/kg, which is the recommended amount in MS743:2009.

Palm Kernel Cake and Palm Kernel Expeller

Fifty-five (55) samples of palm kernel cake (PKC) and eight samples of palm kernel expeller (PKE) were analysed, and the results are as tabulated in Table 1. The average DM and CF value from this study for PKC is as reported by Abdeltawab *et al*. (2018), but higher levels of CP, EE and Ca were found as compared to the same author.

The difference in the quality of PKE and PKC is small, although in general PKE contains more oil than PKC. PKE is classified as an energy feed with nutritional values with higher levels of EE and CF as compared to PKC (Alimon, 2004). Average DM and ME value from this study is consistent with Alimon (2004) which is considered suitable for most ruminants.

Napier Grass

Twenty-seven (27) samples of Napier grass (NG) were analysed, and the results are as tabulated in Table 1. Overall, the nutritive values of NG sampled in this study was in good quality The recommended age to harvest NG is at 6-8 weeks of growth to optimize the dry matter yield and nutritive value (Lounglawan *et al*., 2014). Haryani *et al*. (2018) found that CF of NG at 6-8 weeks is approximately 29.60-35.50%. However, the minimum and maximum of CF value obtained in this study were 25.3% and 39.2% respectively, showing that some samples were harvested too early or too late. To make sure the livestocks get all the benefit from this grass, harvest timing is crucial because CP value will decline if harvested too late and DM yield will be low if it is harvested too early (Wadi *et al*., 2004). Harvesting NG at an early age also may harm the long-term sustainable regrowth of the grass (Rusdy, 2016).

In general, CP content from NG harvested until 8 weeks of age was above the minimum level of 7% required for optimum rumen function, but it was not sufficient to meet the minimum CP requirement of 15% for lactation and growth (Mc Donald *et al*., 2002). According to Haryani *et al*. (2018), generally, the ME of NG has declined at 8 weeks of age compared to 6 weeks of age, and also the CF value of NG tends to increase with advancing maturity of NG.

Napier grass (NG) has been identified to be a suitable fodder due to its high dry matter yield. The high dry matter potential, ease of propagation, cultivation, and harvest are the reasons for NG's popularity among the dairy farmers in Johore. Unfortunately, not all farmers can provide this grass due to insufficient and suitable areas for cultivation of NG, especially for urban and smallholder farmers.

Fresh Corn, Corn Silage and Coarse Ground Corn

A total of 27 corn products were analysed in this study which were fresh corn (FC, n=9), corn silage (CS, n=9), and coarse ground corn (CGC, n=9). The chemical compositions of fresh corn (FC) and corn silage (CS) are quite similar as shown in Table 1.

The analysis showed inconsistencies in nutritional values of FC, which may be caused by environmental factors and agronomic practices such as fertilization, nitrogen losses due to rain, weed competition, or improper harvesting as discussed by Subedi and Ma (2009). The range target value in DM for CS as suggested by Chahine *et al*. (2017) is 30-40%, however, from this study, only two samples out of the nine samples analysed are within the target range. High variability was found for DM for CS. Some literature has indicated that the CP content of CS should range between 7 to 9%. Based on previous studies (Chahine *et al*., 2017; Idris *et al*., 2020), all samples from this study have higher CP value which is between 8.9 to 14.5%. The result of CF analysis from CS samples is between 24.7 to 32.7%. The low and high percentage in CF may be caused by improper harvesting where a low percentage in CF showed that the age of FC used to make the silage was too young and a high percentage of CF may be caused by the usage of old corn in the making of silage. Coarse ground corn samples analysed from this study are consistent with the nutritive value reported by Yusoff (2010).

Table 1: Nutrient content of feed samples collected in this study. Values expressed as Mean ± S.D.

No.	Feed Stuffs	Feed Type	Sample Size, N	Dry Matter (%)	Crude Protein (%)	Crude Fat (%)	Crude Fibre (%)	Calcium (%)	ME (MJ/KG)
1.	Commercial pellet	Dairy cattle pellet	78	91.9 ± 1.99	23.8 ± 2.85	5.0 ± 1.04	11.1 ± 5.09	1.01 ± 0.32	11.26 ± 1.38
2.	Grass	Napier grass	27	18.5 ± 6.34	13.2 ± 3.85	2.0 ± 0.46	32.8 ± 3.39	0.26 ± 0.12	8.56 ± 0.53
3.	Palm Oil By-product	Palm kernel cake	55	92.6 ± 1.64	23.3 ± 2.31	3.2 ± 1.26	13.7 ± 2.71	0.57 ± 0.28	10.89 ± 1.08
4.		Palm kernel expeller	8	94.0 ± 1.61	22.0 ± 3.96	8.8 ± 2.85	12.1 ± 5.45	0.63 ± 0.27	10.67 ± 1.68
5.	Soybean By-product	Soybean waste	42	19.1 ± 3.25	33.3 ± 4.02	7.7 ± 2.53	18.0 ± 3.48	0.31 ± 0.10	10.99 ± 0.74
6.		Soybean hull	30	91.2 ± 1.13	24.0 ± 4.04	5.8 ± 1.83	24.5 ± 6.52	0.74 ± 0.45	8.23 ± 2.05
7.	Corn Products	Fresh corn	9	24.3 ± 3.83	12.0 ± 2.43	2.2 ± 1.48	26.9 ± 8.65	0.19 ± 0.13	9.23 ± 0.74
8.		Corn silage	9	25.1 ± 6.26	12.3 ± 1.65	2.2 ± 1.52	27.7 ± 2.44	0.19 ± 0.13	8.77 ± 0.42
9.		Coarse ground corn	9	90.3 ± 1.11	10.9 ± 3.70	2.4 ± 0.93	4.4 ± 2.95	0.17 ± 0.37	12.24 ± 1.36
10.	Other By-products	Cassava peel	4	33.2 ± 5.22	8.0 ±1.91	0.7 ±0.13	12.1 ±3.25	0.23 ±0.17	10.79 ±3.27
11.		Sago waste	3	15.9 ± 0.55	1.5 ± 0.92	0.1 ± 0.00	18.1 ± 3.66	0.68 ± 0.38	10.19 ± 0.31
12.		Bread waste	2	77.3 ± 0.00	20.1 ± 0.71	3.2 ± 0.35	0.2 ± 0.14	0.19 ± 0.15	12.66 ± 0.73

Soybean Waste and Soybean Hull

Forty-two (42) samples of soybean waste (SBW) and 30 soybean hulls (SBH) were analysed, and their nutrient contents are as tabulated in Table 1. Fresh and wet SBW can be used directly as a ruminant feed due to its high nutritive value. SBW are good protein sources as reported by Yusoff (2010) and Anggraeni *et al*. (2013) with high levels of CP and CF. Furthermore, in this study we found higher levels of CP in both SBW and SBH as compared to Ipharraguerre and Clark (2003), and Yusoff (2010).

Other By-products

In addition to the common feedstuffs given to dairy cows in Johore, other types of by-products are also used by Johore farmers to be given to their livestock. Cassava peel (CAP) is one of the by-products given to dairy cows in the state of Johore, which are readily available at low prices. We analysed four samples of CAP in this study and the results are as demonstrated in Table 1. Crude protein levels of CAP from this study are higher than reported by Oppong-Apane (2013) with an average of 4.8%, but they have higher EE, CF, and Ca with average value 1.3%, 21.0%, and 1.7% respectively. According to Oppong-Apane (2013), in Ghana CAP is an important source of energy in ruminant feeding systems, served either as the main basal diet or as a supplement. However, there is a need to sun dry, ensile, and ferment the CAP before serving it to the livestock to reduce the concentration of the cyanogenic glycoside to tolerable levels. The results indicated that cassava peels in feed can produce higher total solid and protein level of milk. It also has high potential as an alternative feed source to cut production cost; therefore, it increases farmers' income (Herinda *et al*., 2019).

Sago waste (SW) comes from a few manufacturers of sago flour located at Batu Pahat Johore. Despite the lowest CP value compared to other by-products, several farmers at Batu Pahat district still use SW to diversify feedstuffs for their livestock. Three samples of SW were analysed in this study and the results are as tabulated in Table 1. Even though the nutrient content from SW is very low especially in CP, the core content is high enough so it could potentially be utilized as energy sources for ruminant feed.

Finally, proximate analysis for two samples of bread waste (BW) was done and the results are also as tabulated in Table 1. Bread waste is also a potential alternative to feed dairy cows if resources are readily available at low prices. Crude protein values found in this study were higher when compared to studies done by Mahmoud *et al*. (2017) and Kumar *et al*. (2014). However, Mahmoud *et al*. (2017) emphasized that the actual nutrient content of a given flour may differ because of the wide variation between plant varieties, processing methods, and handling of the flour after processing. He reported that the CP value of wheat flour may vary from 9.0 to 14.0% and EE may range from 1.5 to 2.0%.

Feeding Management

In the dairy system, the principles for feeding milking cows should be to feed sufficient quality forages first than supplementing with concentrates, which are formulated to overcome specific nutrient deficiencies to achieve milk yields. The cows need fresh grass weighing 10% of body weight. For 400 kg of body weight, 40 kg/day of grass is needed. Quantity and quality of forage are very important in milk production (Moran, 2012). In Johore, most of the dairy feeding system is based on hand feeding a single or combination of forages together with supplements. Supplements with high energy concentrate are fed to improve or maintain milk production. Basal forages are the major forages fed by farmers, while supplements include all the additional feeds offered to improve cow's performance.

The result of the study showed that 91.4% of the farmers in Johore never sent samples of feedstuffs for testing to ensure quality control of nutrients. The survey showed that 67.0% of dairy farmers in Johore use NG as the main forages, with 46% of the farmers in Johore give adequate quantities of NG based on the cow's body weight. The cows are fed chopped Napier grass. Nutritive value in 27 samples of Napier grass was of good quality.

The rest of the farmers (33%), especially in Labis and Johor Bahru farms, release their cows to graze in oil palm plantations after completion of the milking process in the morning. Due to poor quality of forages coupled with lack of land for forage production, the amount of forage in typical diets of dairy cattle in Malaysia is only about 47.5% (Moran and Brouwer, 2014).

Many Asian dairy advisers use a general rule of thumb that for every 2.0 kg of milk produced above that supplied from forages, farmers should feed 1 kg concentrate. This is a safety measure because of lack of knowledge on the nutritive value of feedstuffs, particularly the forages (Moran, 2012). Dairy farmers in Johore apply the same concept. This survey showed that 89% of farmers in Johore use DCP, PKC, SBW, molasses and minerals in the feed formulation of the cows. If SBW supply is not available, the farmers replace SBH as another alternative to animal feed.

Milk Production and Quality

Milk production

Field interviews and data collection involved 94 dairy farmers in Johore state, comprising these districts: Kluang, Labis, Muar, Batu Pahat, Ulu Tiram and Johor Bahru. The survey from this study found that 20 farms (21%) produce less than 5.0 litres of milk per cow per day, 56 farms (60%) produce around 5.1-10.0 litres of milk per cow per day, 17 farms (18%) produce 10.1-15.0 litres of milk per cow per day and only one farm (1%) can produce more than 15 litres of milk per cow per day. Analysis from the survey also showed that 54 farms (57.4%) produce milk less than 100 litres/day, 18 farms (19.1%) produce 101-200 litres/day, 12 farms (12.76%) produce 201-300 litres/day and 10 farms (10.6%) produce more than 300 litres/day. Milk production values per cow per day as well as average production of milk per farm per day is demonstrated in Table 2.

Table 2. Milk production values per cow per day and also average production of milk per farm per day according to sampled districts in Johore.

District	Sample size, n	Production (L) / cow				Production (L) / farm			
		< 5.0	5.1-10.0	10.1-15.0	>15.0	< 100.0	100.1-200.0	200.1-300.0	>300.1
Kluang	24	0	19	4	1	13	4	4	3
Labis	15	9	5	1	0	3	2	0	0
Muar	13	2	9	2	0	13	1	0	1
Batu Pahat	5	0	1	4	0	7	5	1	0
Ulu Tiram	21	4	14	3	0	9	2	7	3
Johor Bahru	16	5	8	3	0	9	4	0	3
TOTAL	**94**	**20**	**56**	**17**	**1**	**54**	**18**	**12**	**10**

Table 3. Milk quality testing on selected dairy farms in Johore.

Variables	Fat (%)	Protein (%)	Lactose (%)	TDS	SNF
No. of sample (n)	94	94	94	94	94
Percentage of sample in the limit, n (%)	87 (92.55%)	94 (100%)	94 (100%)	87 (92.55%)	49 (52.12%)

Lactating dairy cattle not fed with adequate nutritious feed is another contributing factor that led to low productivity of dairy cattle as reported by Suntharalingam and Zhen (2015). According to Devandra and Wanapat (1986), lactating ruminants require adequate feed supplies and supplements and there must be variation in feed quality. Farmers need to balance the use of concentrates, formulate proper dietary composition and use acceptable feeding standards coupled with a variety of feeding routines, which will in turn assist dairy cattle in increasing milk production. Dairy cows need to be given a well-balanced diet to produce optimum yield and good quality milk. Upon further investigation, 18% of farms that produce optimum yield and good quality milk, i.e., 10.1-15.0 litres of milk per cow per day use the best quality of NG which implies good agronomic practices, with DCP, PKC and SBW in the formulation of dairy cow feed.

Milk Quality

94 milk samples were collected from selected dairy farms in Johore and sent to Milk Quality Control Laboratory, Malacca for milk quality testing, namely fat percentage, protein percentage, lactose percentage, total dissolved solid (TDS), and solid non-fat (SNF) test. The chemical composition of milk can be influenced by several factors such as animal species and genetics, environmental conditions, lactation stage, and animal nutritional status (Kalac and Samkova, 2010). Generally, milk is composed of 87.7% water, 3.3% protein, 3.4% fats, 4.9% lactose, and 0.7% mineral (Poulsen *et al*., 2012). The limit composition of raw milk for fat percentage should be more than 3.24%, protein percentage is between 2.3 to 4.4%, lactose percentage is between 3.8 to 5.3%, TDS is between 11 to 15%, and SNF should be more than 8.5% (DVS, 2016). Analysis from this study showed that 87 farms (92.55 %) have acceptable levels of TDS (Table 3).

Poor quality and inadequate amounts of feed available to cows are common problems resulting in low levels of milk production (Muia, 2000). With knowledge of the feeding value of the forages as well as concentrates and their costs, more objective and better decisions can be made on how much concentrates should be fed to achieve target milk yields. This study found that only 17 farms (18%) produce 10.1-15 litres of milk per cow per day. This farm uses the best quantity and quality of NG which implies good agronomic practices. DCP, PKC and SBW are supplements with high energy concentrate that are fed to improve milk production.

CONCLUSION

Dairy cows need to be given well-balanced diet to produce optimum yield and good quality milk. Napier grass is the most popular fodder used among the dairy farmers in Johore. To optimize the dry matter yield and nutritive value, it is recommended that the age to harvest NG is at 6-8 weeks of growth and good agronomic practices such as fertilization. It was observed that DCP, PKC and SBW have high feeding values based on protein and energy content.

Evaluation of the nutritive value in DCP, PKC, PKE, SBW, SBH, and CGC at IVM, Johore showed that they are consistent in DM and CP content. This study found that only 17 farms (18%) produce 10.1-15 litres of milk per cow per day. From the result of this study, it is found that to achieve an average milk production from 10.1-15 litre/cow/day, most of the farmers in Johore use DCP, PKP, SBW and NG in the formulation of dairy cow feed. It was observed that from 94 milk samples analysed, 92.55% of milk samples had acceptable TDS values which indicate good quality of milk produced in Johore. The overall status of dairy farms in Johore shows that 60% of the dairy farms produce an average of 5.1-10 litres of milk per cow per day. The quantity and quality of feed are the main factors that affect milk production in Johore dairy farms.

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