Effect of Milking Time Intervals on Production and Quality of Friesian Holstein

AUTHORS INFO

**Tedi Akhdiat**
Universitas Bandung Raya
akhdiatbdg@gmail.com
+6281320479622

**Hilman Permana**
Universitas Bandung Raya
hilmanpermana60@yahoo.com
+6287801815993

**Nilawat Widjaja**
Universitas Bandung Raya
nalamsyahsw@gmail.com
+6281288171732

**Raden Febrianto Christi**
Universitas Padjadjaran Bandung
radenfe brianto92@gmail.com
+6289516217280

**Dini Elsa Alfiani**
Dinas Peternakan Kabupaten Pangandaran
dinielsaalfianispt@gmail.com
+6285520751436

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Milking is the act of removing milk from the udder on purpose to get maximum milk production. A reasonable milking interval will affect the amount of milk production. This research aims to know the extent of the milking time interval affecting Friesian Holstein dairy cow milk production and the interval of milking time that produces the best production and quality of Friesian Holstein. The research method was an experiment using a completely random design with four treatments, namely: treatments 1 was 16:8 hours time delivery interval (TDI) dairy cow; treatments 2: time delivery interval (TDI) 15:9 hours; treatment 3: delivery time interval (TDI) 14:10 hours; treatment 4: time delivery interval (TDI) 13:11 hours. The observed variables are milk production and milk quality. The data were analyzed using verbal if any effect of treatment was done Duncan's distance test. Based on the results and discussion, the milking time interval significantly impacts milk production and water content. Still, it has no significant effect on the density, protein content, and milk fat content, 13:11 hours milking interval time produces the most milk and water content.

**Keyword:** Friesian Holstein, milk production, milk quality, the milking interval time
A. Introduction

Dairy cows are a type of livestock that is raised for the primary purpose of producing milk. Most of the dairy cows in Indonesia are from the Friesian Holstein (FH) nation. Dairy cow agribusiness development with a target of increasing production needs to be considered, considering that the majority of milk supplies to meet the needs of all consumers are still imported. The problem of dependence on imports is that more than 80% are smallholder dairy farms with the characteristics of the total ownership of no more than five dairy cows. Maintenance management is still far from the minimum standard so that the productivity level is low. The provision of rations that can meet production needs has not been given careful attention. Besides, the seeds cultivated are generally not from the breeds of superior dairy cows (Barkema et al., 2015).

Improving the management of dairy cows can optimize their ability to produce milk. One aspect related to this is milking management. Milking management should conduct an optimal level to produce maximum milk production and protect the udder from injury. Physiological and environmental factors affect the production and quality of milk for dairy cows. The milk synthesized in the udder is the prime physiological factor that will determine the amount of milk produced when milked. Optimizing dairy cows' physiological ability to produce the hormone oxytocin, which functions without disrupting milk production from the alveoli, must be considered in milk production. In general, environmental factors must keep dairy cows in a relaxed state during milking (Jacobs & Siegford, 2012). Milking processing usually is done twice a day.

In the maintenance of dairy cows during the lactation period, milking can generally be done twice, namely in the morning and afternoon. The first milking is done in the morning; the second milking is in the afternoon. The milking frequency is related to dairy cows-production capacity Indonesia's various livestock centers are only around 12-13 liters/head/day (Vidyanto et al., 2015). There are no requirements and standards of milking interval time to start either in the morning or in the afternoon. Thus, the milking interval time in the fields varies between farmers (Handayani & Purwanti, 2010). Variations of milking interval time between the morning and afternoon based on the farmer's considerations, such as distance and travel time during milk transportation to the marketing area, operating hours of the milk processing industry, the number of workers, milking machine and equipment facilities, etc. However, the milking interval time should consider producing high milk production and quality.

The farmer must understand that the volume of milk produced in the udder of a dairy cow correlates with the optimization of the length of time the udder is rested (not milked) shortly after milking is finished in the morning or afternoon. The amount of milk production from milked with the same milking time interval, for example, 12: 12 hours, will be the same. However, if the milking time is different, the amount of milk produced is also diverse (Mardalena, 2008). The exact time interval between milking in the morning and afternoon will give a relatively small milk composition change. The different time intervals for milking will differ in milk compositions (Torres et al., 2013).

B. Methodology

1. Materials of Research

The animal used are 16 lactating Friesian Holstein (FH) dairy cows, the 3rd lactation period. The dairy cows milked twice, such as in the morning and the afternoon. The combination of milking intervals is different, namely 13 hours: 11 hours; 14 hours: 10 hours; 15 hours: 9 hours; and 16 hours: 8 hours-intercede disinfectants used for immersing udder after milking. Feed in the form of forages and concentrates that adjust to the lactation period. The types of equipment used includes a cage with a head to head position between the cows, the size of the cage area for each adult dairy cow is 1.2 x 1.75 m², a milking machine, a full teat dipper, a milk can, an 80 mL milk sample bottle, and lactose can. The research method was an experiment with stages by adapting the treatment to experimental livestock for seven days and cleaning the cow sheds used for research preparation of clean dairy machine tools.

2. Procedure of Research

Dairy cows collection was carried out randomly, each taking four cows and then given an identity tag in the form of a ribbon with a different ribbon color according to treatment and replication. The udder and four nipples are cleaned with a clean cloth, installing suction machines one by one on all four nipples. The milking process is carried out. After milking, the
four nipples are immersed in the disinfectant solution, and the tools are cleaned and then stored back in their place. Daily milk production (lt/day) is measured by the milking results in the morning and evening. Milking is done according to the treatment twice a day using a milking machine. Milking procedure for 15 hours interval: 9 hours; 14 hours: 10 hours; and 13 hours: 11 hours following the milking procedure of 16 hours: 8 hours interval as before. This study's parameters were milk production and milk quality, i.e., fat content, water content, density, and protein.

3. Data Analysis

The experiments were arranged in a randomized completely design (RCD) with four treatment of intervals of milking time, namely were IP 16: 8 = Morning at 6: Afternoon at 14, IP 15: 9 = Morning at 6: Afternoon at 15, IP 14:10 = Morning at hours 6: In the afternoon at 16, IP 13:11 = Morning at 6 o’clock: In the afternoon at 17.

C. Results and Discussions

Based on the milking time interval on milk production and quality, the average output and quality of milk in each treatment is presented in Table 1.

Table 1. Average milk production and quality in each treatment.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Treatments</th>
<th>P1</th>
<th>P2</th>
<th>P3</th>
<th>P4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk Production</td>
<td></td>
<td>12.45(^a)</td>
<td>13.75(^a)</td>
<td>15.01(^a)</td>
<td>20.03(^b)</td>
</tr>
<tr>
<td>Milk quality Water content (%)</td>
<td></td>
<td>87.19(^a)</td>
<td>87.27(^a)</td>
<td>87.41(^a)</td>
<td>88.76(^b)</td>
</tr>
<tr>
<td>Density</td>
<td></td>
<td>1.024(^\text{ns})</td>
<td>1.025</td>
<td>1.025</td>
<td>1.0261</td>
</tr>
<tr>
<td>Fat content (%)</td>
<td></td>
<td>4.61(^\text{ns})</td>
<td>4.48</td>
<td>4.46</td>
<td>4.41</td>
</tr>
<tr>
<td>Protein (%)</td>
<td></td>
<td>2.86(^\text{ns})</td>
<td>2.83</td>
<td>2.84</td>
<td>2.82</td>
</tr>
</tbody>
</table>

\(a, b\) Different superscripts on the same line show significant differences (\(P<0.05\)), \(\text{ns}\) (non-significant) = not significant (\(P>0.05\)). \(P1 = \text{Milking Time Interval 16: 8 hours, P2 = Milking Time Interval 15: 9 hours, P3 = Milking Time Interval 14: 10 hours, P4 = Milking Time Interval 13: 11 hour.}\)

1. Milk Production

Compared with other treatments, the milking interval was significantly high on milk production in P4 (\(P<0.05\)). Milk production in P1, P2, and P3 was not significantly different (\(P>0.05\)) (Table 1). Under the research results by Mollenhorst et al. (2011), a long milking interval will have more milk residue, cows obtained with milking intervals of 15: 9 hours and 16: 8 hours produce lower milk than those with 12 milking gaps: 12 hours. O’Driscoll et al. (2010) stated that if the milking interval is not the same, then the milk production will be more at a more extended break.

According to Cabrera et al. (2010), environmental factors primarily feed an essential role in dairy cows’ bodies’ physiological processes, affecting milk production. It is supported by Noring et al. (2012), the quantity and quality of milk are influenced by physiological and environmental factors. Physiological factors include nationality, level of lactation, estrus, pregnancy, birth interval, and age. Ecological factors include food, dry time, childbirth conditions, milking frequency, milking interval, ambient temperature, disease, and drugs. DeVries et al. (2010) stated that the factors that influence milk production include milking each day, milking duration, and the time of milking.

2. Water Content

Breast milk is a food ingredient that is composed of food substances in balanced proportions. Breast milk can also be viewed as a raw material that contains a source of essential food substances. According to Williams et al. (2012), the main constituents are water, protein, fat, carbohydrates, minerals, and vitamins. Milk is the largest component because 87% of all elements of milk consist of water. The milking interval time was significantly high (\(P<0.05\)) on the water content in P4 compared with other treatments (Table 1). Please, explain here why P4 was higher compared with other treatments. The water content in the current study ranged from 87.19-88.76%, meet the minimum standard of milk content 80.00%–90.00% (Naved et al.,
2014); 87.00% (SNI, 2011) and 87, 20% (Umar et al., 2014). Nielsen et al. (2010) state that milk is an emulsion of fat in water so that the water content in milk is high. Other factors that affect milk's water content and chemical compositions are the quality and quantity of rations and drinking water. According to Williams et al. (2012), milk production is influenced by factors: type of livestock, level of lactation, age of cattle, injection of inflammation in the udder, livestock nutrition, environment, and milking procedures.

3. **Density of Milk**

The milk density is the ratio between the ingredients' weight and the water's value at the same volume and temperature (Myburgh et al., 2012). The treatment was no significant effect (P>0.05) on milk density. The average density of milk in the current study ranged from 1.024-1.026 was lower than the minimum standard of 1.0270 (SNI, 2011).

According to Gurmess & Melaku (2012), milk density is influenced by milk substances such as fat, protein, lactose, and minerals. The more solids content, the higher the specific gravity value and the thicker the milk. Utami et al. (2013) stated that milk density is inversely proportional to milk fat content, where the higher the milk fat content, the lower the viscosity. Vidyanto et al. (2015) stated that the 12:12 hour milking interval did not increase the specific gravity value but was still in the normal category dissolved content influences milk density in milk. The more compounds contained in milk, the thickness of milk will increase. Furthermore, Frkonja et al. (2012) stated that the carbohydrate content influences milk density in animal feed.

4. **Milk Fat Content**

Milk fat, also known as butterfat, is an essential component in milk; even commercially, milk fat is a valuable component. The flavor of milk and most processed milk products is mainly caused by milk's fat content (Soberon et al., 2011). The results showed that the milking interval time had no significant effect (P<0.05) on the milk fat content (Table 1). The absence of a significant impact on milk fat content is thought to be due to crude fiber content in the ration. It is relatively the same and meets the standard requirements of lactating FH dairy cows so that the percentage of fat content produced is relatively the same. According to Kurniawan et al. (2012) stated, the ratio of dairy cows with too much concentrate and limited forage would decrease saliva production. The pH of the rumen becomes low. This situation causes changes in volatile fatty acids in the rumen, resulting in acid production. Acetate is reduced as it is known that acetic acid formed in the rumen is the primary "precursor" (raw material) to include milk fat. Thus, if acetic acid production in the rumen decreases, it will result in low milk fat content.

The average percentage of milk fat in the current study was 4.41%-4.61% and meets the standard for dairy cows. This value was above the moderate milk fat content for FH, i.e., 3.80% (SNI, 2011) and 3.70 % (Umar et al., 2014). The shorter the milking interval, the higher the milk fat content. According to Adhania et al. (2012), if the intervals between milking are not the same, the fat content will be higher than the milking results at shorter intervals.

Golder et al. (2019) milk fat content is influenced by several factors, such as dietary fat content, climate milk fat content will be higher during winter season lactation time, milking procedures, the cow's age the milking time.

5. **Milk Protein Content**

Protein is the primary nutrient in milk because it contains essential amino acids needed by the body. The longer the milking interval, the milk protein content tends to decrease; this is thought to be related to the milk production difference between the milking intervals. According to Nielsen et al. (2010) and milk fat content, milk protein content also negatively correlates with milk production. The current study showed that the treatment had no significant effect (P<0.05) on milk protein content. The milking interval time was not changing the milk protein content significantly Table 1.

The milk protein synthesis process occurs in the alveoli's epithelial cells and control by genes containing DNA. The process is by incorporating several amino acids from proteins. Levels of milk protein are relatively constant during lactation because the protein synthesized in udder gland epithelial cells controlled by genes (Oravcova et al., 2015).

The protein content is also influenced by the ratio of the cow consumes. The protein content of milk-based on feed formulation and composition, which then flow in the blood and undergo a filtration process to be milk composition (Utomo & Miranti, 2010). Prieto et al. (2013) stated that additional sunflower oil to feed would increase milk protein. With the addition of
concentrate, more energy is available to form amino acids from microbial proteins. This amino acid will contribute to increasing milk protein synthesis (Sirohi et al., 2012). The increase in the concentrate ratio resulted in increased metabolic energy (ME) and crude protein in cattle feed. The protein content also influences by provision feed of forage and concentrate on lactating period is 60:40 or 50:50

The provision of rations with a balance of protein and energy in this study was adequate, seen from the average milk protein content produced, namely 2.82%; this figure is above the minimum limit set by SNI (2011), which is 2.80%. Some of the factors that affect milk protein are internal factors (physiological conditions, nationality, lactation level, pregnancy, and age) and external factors, namely ration (Jacobs & Siegfard, 2012).

D. Conclusion

Milking interval time affected milk production and water content but no effect on density, protein content, and milk fat content. The milking time interval of 13:11 hours resulted in the highest milk production and moisture content %.

E. References


