Friesian Holstein (FH) Dairy Cows Milk Quality that Experienced Repeated Breeding in Sendang District, Tulungagung Regency

Sintya Kumalasari Wibowo, Pudji Srianto, Dian Ayu Permatasari, Dadik Raharjo, Rimayanti, Erma Safitri

ABSTRACT

This study aims to observe a decrease in the quality of milk in Friesian Holstein (FH) dairy cows that experience repeated breeding (repeat breedings) at KUD Tani Wilis Sendang Tulungagung when viewed from density, fat content, Total Solid (TS), and Solid Non Fat (SNF). The milk samples to be used in this study were 32 with a ratio of 10 normal cow's milk samples as a control. The milk sample was examined using a lactoscan. The data obtained were analyzed using the Independent T-Test test. The results of the repeat breeding cow's milk samples for density, fat content, and Total Solids (TS) showed a significant difference (p <0.05) between the treatment group and the control of normal cow's milk. Samples of repeat breeding cow's milk on Solid Non Fat (SNF) showed that it was not significantly different (p>0.05). The average density of repeat breeding cows was 1.0282 and that of normal cow’s milk was 1.0260, which means that there is an increase in repeat breeding cow's milk when compared to normal cow’s milk. The fat content of repeat breeding cows was 1.08% and normal cows was 4.18%. Total Solid (TS) of repeat breeding cows was 9.38% and normal cows was 12.73%. Based on this, it can be concluded that the quality of repeat breeding milk has increased in terms of density, decreased in fat content and Total Solid (TS) when compared to normal cows, but has not decreased in Solid Non Fat (SNF).

Keywords: Repeat breeding, fat, density, total solid, solid non fat

Introduction

Dairy cows are livestock that are capable of producing milk products as their main product. Dairy cow maintenance management, especially Friesian Holstein (FH) dairy cows, has the main function of producing milk (Asmarasari et al., 2023). Dairy farming businesses in Indonesia are dominated by small-scale dairy farming businesses that have one to five cows. Livestock raising carried out by farmers in rural areas is still traditional. However, the dairy farming business is still surviving. The low productivity of dairy cattle is caused by the condition of dairy cattle business management at the farmer level which is still traditional (Consentini et al., 2021).

In Indonesia, FH cattle come from countries with a temperate climate which require an optimum temperature (around 18°C) with humidity of 55% to produce optimal production. Cows that are placed in less comfortable environmental conditions will experience heat stress and this can affect increased drink consumption and decreased appetite, increased...
body temperature, and changes in behavior (Summer et al., 2018). Milk production is the main thing in the sustainability of a dairy farm. According to Moschovas et al. (2023), increasing milk production must be balanced with good milk quality. Good milk quality can be seen from the structure and composition of milk, including density, fat content, Total Solid (TS) and Solid Non Fat (SNF). Increasing milk production can be done by increasing the productivity or population of lactating dairy cows (Rabiee et al., 2010).

One of the obstacles that results in low livestock productivity is that there are still many cases of reproductive disorders leading to the prosperity of female livestock. One of the causes of low livestock reproduction rates is repeated mating events. Dairy cow production of one calf per year is the reproductive goal. Dairy cows must become pregnant after insemination, maintain pregnancy, calve after approximately 270 days, and wait a period of 40-50 days to be successfully inseminated again (Barbato et al., 2022). However, this cannot always be achieved and cows must be re-inseminated for several consecutive cycles. Dairy cows that experience repeated mating syndrome are subfertile cows that experience reproductive disorders in a consistent pattern for three or more consecutive heat cycles, each with a normal cycle (17-25 days). A high repeat breeding rate will lead to reduced production and quality of milk produced because successful reproductive efficiency greatly influences productivity and milk quality (Eshete et al., 2023).

Tani Wilis village unit cooperative (VUC) is located in Sendang District, Tulungagung Regency. It is one of the milk producing areas in East Java with good management. However, in its implementation, several reproductive disorders were still found, such as repeated breeding, which could affect milk production in dairy cows being developed. The type of cattle most often kept by farmers in KUD Tani Wilis is FH cattle. FH cows inherit good characteristics, namely having a fairly high body weight and adapting easily to tropical environments with relatively high milk production (Sutarno and Setyawan, 2016). The aim of this research was to determine the quality of milk production in Friesian Holstein (FH) dairy cows that underwent repeated breeding in the Tani Wilis Sendang Tulungagung village unit cooperative.

Materials and methods

Research design

The research was carried out in January-February 2023 at the Tani Wilis Sendang Tulungagung village cooperative unit. Testing the quality of cow’s milk is carried out at the Milk Inspection Laboratory of the Tani Wilis Sendang Tulungagung village unit cooperative. This research uses a descriptive method with a quantitative approach. Data collection for this research used milk from Friesian Holstein (FH) dairy cows that underwent repeated breeding which included density, fat content, Total Solid (TS), and Solid Non Fat (SNF).

The sampling technique used in this research used a purposive sampling technique. The samples used in this research were fresh milk samples originating from Friesian Holstein (FH) cows that had undergone repeated breeding. Determining the number of samples can be done using statistical calculations, namely by using the Slovin Formula (Susanti et al., 2019). The Slovin formula was used to determine the sample size from a known population, namely 32 dairy cows that experienced repeated mating.

Research procedure

32 Friesian Holstein (FH) dairy cows that underwent repeated breeding (repeat breeding) had 250 ml of milk sample taken. Research and sampling were carried out in stages. Then an analysis was carried out on the cow’s milk samples that had been taken to check density, fat content, Total Solid (TS), and Solid Non Fat (SNF). Milk quality inspection uses Lactoscan and this tool is connected to a computer device. The milk to be tested must be homogenized first by shaking repeatedly to ensure the sample is homogeneous. The milk sample will be sucked automatically through a small tube inserted into the measuring cup and the results from the Lactoscan will be immediately displayed on the monitor screen and can be output in the form of data on paper printed by the Lactoscan.

Data analysis

The data obtained from this research is in the form of data on milk density, fat content, Total Solid (TS), and Solid Non Fat (SNF) from Friesian Holstein (FH) dairy cows that underwent repeated breeding which were tested using lactoscan. The software used for data analysis was the Statistical Program for Social Science (SPSS) version 25 for MacOs using the Independent Samples T-Test method.

Result

Milk Density

The results of data analysis obtained based on the independent samples T-Test on the quality of milk from repeat breeding dairy cows and milk from normal dairy cows as a comparison control showed significant changes (p<0.05). The average and standard deviation of the density values for repeat breeding cows and normal cows are shown in table 1.
Table 1. Average and standard deviation of specific weight of repeat breeding cows and normal cows

<table>
<thead>
<tr>
<th>Group</th>
<th>Density of milk (Mean ± Standard Deviation)</th>
<th>Milk standards based on INS</th>
<th>Milk standards based on VUC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repeat breeding cow</td>
<td>1.0282 ± 2.39344</td>
<td>1.0270</td>
<td>1.0235</td>
</tr>
<tr>
<td>Normal cow</td>
<td>1.0260 ± 2.49804</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Different superscripts in the same column indicate significant differences (p<0.05)

The results of analysis using statistical tests on the density of repeat breeding cow milk and normal cow milk show significant differences (Figure 1). These results show that the density quality of repeat breeding cow’s milk is higher when compared with normal cow’s milk.

Figure 1. Bar chart of the average density of repeat breeding cows and normal cows

**Fat level**

The results of data analysis obtained based on the independent samples T-Test on the quality of milk from repeat breeding dairy cows and milk from normal dairy cows as a comparison control showed significant changes (p<0.05). The average and standard deviation of the fat content values for repeat breeding cows and normal cows are shown in table 2.

Table 2. Average and standard deviation of fat content of repeat breeding cows and normal cows

<table>
<thead>
<tr>
<th>Group</th>
<th>Milk fat content (Mean ± Standard Deviation)</th>
<th>Milk standards based on INS</th>
<th>Milk standards based on VUC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repeat breeding cow</td>
<td>1.0878 ± 0.54723</td>
<td>3%</td>
<td>3%</td>
</tr>
<tr>
<td>Normal cow</td>
<td>4.1810 ± 0.98844</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Different superscripts in the same column indicate significant differences (p<0.05)

The results of analysis using statistical tests on the density of repeat breeding cow’s milk and normal cow’s milk show significant differences (Figure 2). These results show that the quality of the fat content of repeat breeding cow’s milk has decreased when compared with normal cow’s milk.

Figure 2. Bar diagram of average fat content of repeat breeding cows and normal cows

**Total Solid (TS)**

The results of data analysis obtained based on the independent samples T-Test on the quality of milk from repeat breeding dairy cows and milk from normal dairy cows as a comparison control showed significant changes (p<0.05). The average and standard deviation of the Total Solid (TS) values of repeat breeding cows and normal cows are shown in table 3.

Table 3. Average and standard deviation of Total Solid (TS) of repeat breeding cows and normal cows

<table>
<thead>
<tr>
<th>Group</th>
<th>Total Solids in milk (Mean ± Standard Deviation)</th>
<th>Milk standards based on INS</th>
<th>Milk standards based on VUC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repeat breeding cow</td>
<td>9.386 ± 0.90535</td>
<td>10.8%</td>
<td>11.85%</td>
</tr>
<tr>
<td>Normal cow</td>
<td>12.73 ± 1.2576</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Different superscripts in the same column indicate significant differences (p<0.05)

The results of analysis using statistical tests on the density of repeat breeding cow’s milk and normal cow’s milk show significant differences (Figure 3). These results show that the Total Solid (TS) quality of repeat breeding cow’s milk has decreased when compared with normal cow’s milk.

Figure 3. Bar chart of average Total Solid (TS) of repeat breeding cows and normal cows
Solid Non Fat (SNF)

The results of data analysis obtained based on the independent samples T-Test on the quality of milk from repeat breeding dairy cows and milk from normal dairy cows as a comparative control can be seen in Appendix 8 showing the results of changes that were not significant (p<0.05). The average and standard deviation of the Solid Non Fat (SNF) values of repeat breeding cows and normal cows are shown in Table 4.

Table 4. Average and standard for Solid Non Fat (SNF) for repeat breeding cows and normal cows

<table>
<thead>
<tr>
<th>Group</th>
<th>Solid Non Fat in milk (Mean ± Standard Deviation)</th>
<th>Milk standards based on INS</th>
<th>Milk standards based on VUC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repeat breeding cow</td>
<td>8.3659 ± 0.64095</td>
<td>7.8%</td>
<td>7.8%</td>
</tr>
<tr>
<td>Normal cow</td>
<td>8.5520 ± 0.71122</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Different superscripts in the same column indicate significant differences (p<0.05)

The results of analysis using statistical tests on the density of repeat breeding cow milk and normal cow milk show results that are not significantly different (Figure 4). These results show that the quality of Solid Non Fat (SNF) milk from repeat breeding cows does not decrease when compared with normal cow’s milk.

Figure 4. Bar diagram of the average Solid Non Fat (SNF) cows of repeat breeding and normal cows

Discussion

Milk Density

The research results based on Table 1 showed that the average milk fat content from dairy cows that experienced repeat breeding during morning milking during the study was 1.0282 and normal cows’ milk was 1.0260. The results of statistical tests using the Independent Samples T Test showed significant differences (p<0.05). The research results showed that the specific weight of dairy cows that experienced repeat breeding increased compared to normal cows. Costa et al. (2019) states that the greater the density of milk, the better it is because the content of the milk is still concentrated, the percentage of solid ingredients rather than fat is high, and the water content in the milk is lower, while the more fat in milk, the lower the density.

Variations in density occur due to differences in the amount of fat, lactose, protein and mineral salts in milk (Tsioulpas et al., 2007). A decrease in milk density can be caused by subclinical mastitis or reproductive disorders such as cases of repeat breeding. Normal cows have a larger volume compared to repeat breeding cows, because repeat breeding cows have a longer calving interval so the volume is smaller. Giving the same feed to repeat breeding and normal cattle will produce different results in terms of specific weight quality. High or low density values are influenced by the milk fat content component as the largest nutrient composition in milk. The density of milk depends on the fat content and solid ingredients of the milk, because the density of fat is lower than the density of water. The presence of carbon dioxide and nitrogen gas contained in milk can increase its density after going through the milking process (Murphy et al., 2016).

The density value is also influenced by race or nationality, birth period, physiological status, feed and milking time (Roche et al., 2009). The first and subsequent birth periods provide different values for milk density levels (Godden et al., 2019). Apart from that, the distance between morning and evening milkings generally produces different nutrients, especially density, this is because the alveoli cells have very little time to produce milk. The high amount of milk production is also accompanied by the quality of its nutrients (Gross, 2022). Based on Table 1, it can be seen that the standard density for cattle undergoing repeat breeding is higher than normal cattle, but does not meet the standards determined by Indonesian national standards, namely 1.0270, but is still accepted by village unit cooperative because the minimum density standard is 1.0235.

Fat level

The research results based on Table 2 show that the average milk fat content of dairy cows that experienced repeat breeding during morning milking during the study was 1.08% and normal cow’s milk was 4.18%. The results of statistical tests using the Independent Samples T Test showed significant differences (p<0.05). The results of the research showed that the fat content in repeat breeding cow’s milk had decreased compared to the fat content in normal cow’s milk. The fat content value of fresh milk is influenced by several factors including cow...
breed, feed, and milking interval (Ponnampalam et al., 2024).

The distribution of energy and nutritional requirements from the same feed is very different between repeat breeding cows and normal cows. The energy and nutritional needs of normal cows are only to meet their normal needs, whereas in repeat breeding cows the distribution of nutrition and energy is much greater to meet other needs due to suffering from reproductive disorders. There is a negative correlation between milk production and milk fat content, meaning that when milk production reaches its peak, the fat content is at its lowest point and then increases gradually until the end of lactation (Cabezas-Garcia et al., 2021). The relationship between reproductive status and milk production is influenced by the physiological status of dairy cows, especially the hormonal and metabolic physiological status of dairy cows. A good reproductive hormone cycle will keep the ovaries working normally. Hormones that play a role in milk production have an opposite relationship with reproductive hormones.

Pregnancy hormones such as progesterone and estrogen and lactation hormones such as prolactin and oxytocin have the properties of influencing and overpowering each other (Nevard et al., 2022). Towards the end of pregnancy, the increase in the hormones estrogen and progesterone during pregnancy also plays a role in the growth and development of the mammary glands (Kindahl et al., 2002). Increasing concentrations of the hormone progesterone and the hormone estrogen cause the hormone prolactin, which functions to stimulate milk secretion, to decrease and milk production to decrease (Yi et al., 2022). Prolonged milk production will stimulate the pituitary gland to produce the hormone Luteotropic Hormone (LTH) or prolactin which works to synthesize milk, high production of the hormone Luteotropic Hormone (LTH) will stimulate the pituitary gland to inhibit the production of the hormone Follicle Stimulating Hormone (FSH) which results in growth. The follicles do not develop so that the production of the hormone estrogen decreases and results in delayed estrus.

Lack of nutrition causes milk production to be low, so the fat of repeat breeding cows is lower compared to normal cows (Pérez-Marin and Quintela, 2023). If the feed given contains more concentrated dry matter than forage dry matter, then the ability to produce milk will increase, but the milk fat content will decrease. On the other hand, if the feed given contains more forage dry matter than concentrate dry matter, high milk production capacity will not be achieved, but the milk fat content will increase. The climatological environment is thought to influence milk quality and production (Toghdory et al., 2022). Based on table 2, it can be seen that the standard milk fat content value is in accordance with the Indonesian national standard 3141.1:2011, a minimum of 3%, while in village unit cooperatives it is 3%.

**Total Solid (TS)**

The research results based on table 3 show that the average Total Solid (TS) of milk from dairy cows that experienced repeat breeding during morning milking during the study was 9.38% and normal cow’s milk was 12.73%. The results of statistical tests using the Independent Samples T Test showed significant differences (p<0.05). The results of the research showed that the fat content in repeat breeding cow’s milk had decreased compared to Total Solid (TS) of normal cow’s milk. Regarding milk quality, Total solid (TS) is a determinant of whether or not milk is accepted and also determines the price of milk. If the fat content in milk decreases, the Total Solid (TS) of the milk will also decrease (Desye et al., 2023).

According to Bista et al. (2020) defines Total Solid (TS) as a milk component consisting of non-fat solids and fat content so that the Total Solid (TS) content depends on these components. The total solids of milk from dairy cows is influenced by the feed, namely the forage and concentrate given. Concentrate that meets livestock needs will affect the fat content in milk, this aims to increase Total Solids (TS) in milk (Brady et al., 2022). Based on table 3, it can be seen that the standard Total Solid (TS) value of milk in accordance with SNI 3141.1:2011 is 10.8%, while for KUD it is 11.85%. Based on this, good Total Solid (TS) of milk will have an impact on good milk prices for farmers. Total Solid (TS) with an average above the standard will get a bonus (Fahmid et al., 2016). This is based on the Indonesian National Standard where the Total Solid (TS) rules are not directly stated but are implicitly seen in the minimum density standard of 1.027 g/ml and 3% fat or the equivalent of Total Solid (TS) of 10.85%.

**Solid Non Fat (SNF)**

The research results based on table 4 show that the average Solid Non Fat (SNF) milk of dairy cows that experienced repeat breeding during morning milking during the study was 8.36% and normal cow milk was 8.55%. The results of statistical tests using the Independent Samples T Test showed that the results were not significantly different (p>0.05). The research results showed that Solid Non Fat (SNF) milk from repeat breeding cows did not experience any changes when compared to Solid Non Fat
Fat levels. The different view: Milk lactose.

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Solid Non Fat (SNF) milk from normal cows. Solid Non Fat (SNF) or Dry Material Without Fat is dry material other than fat that is left behind such as carbohydrates, proteins, vitamins and minerals. The Solid Non Fat (SNF) content of milk depends on the lactose and protein in the milk. The higher the protein and lactose content in milk, the more other components such as Solid Non Fat (SNF) can increase.

Protein levels in milk are more influenced by genetic factors than environmental factors including feed, so protein levels are not as sensitive to changes in feed as fat levels. The increase in Solid Non Fat (SNF) levels occurs because the fat content is not included in this section so that the total remaining protein and lactose can influence the high percentage produced (Sakkas et al., 2022). Solid Non Fat milk is also influenced by lactose and protein, if the levels of lactose and milk protein are high, then Solid Non Fat (SNF) of milk will also increase. Milk protein is formed from concentrate feed consumed by livestock. Adding protein source feed can increase milk Solid Non Fat (SNF) levels. If the levels of lactose and milk protein are high, the dry matter content without milk fat will increase (Imran et al., 2017). Based on table 4, it can be seen that the standard Solid Non Fat (SNF) value for milk meets standards in accordance with SNI 3141.1:2011 at 7.8%, while in village unit cooperatives it is 7.8%.

Conclusion

The quality of milk production in Friesian Holstein (FH) dairy cows that underwent repeated breeding in the Tani Wilis Sendang Tulungagung village cooperative unit experienced an increase in density, a decrease in fat content and total solids (TS), and had no effect on Solid Non Fat (SNF).

References


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