






The Quality of Milk Production in Friesian Holstein (FH) Dairy Cattle Experiencing Repeat Breeding at KUD Tani Wilis Sendang, Tulungagung Regency

Kualitas Produksi Susu Sapi Perah Friesian Holstein (FH) yang Mengalami Perkawinan Ulang di KUD Tani Wilis Sendang, Kabupaten Tulungagung

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ABSTRACT

Background: Repeat breeding is a notable reproductive problem where cows do not conceive after several insemination attempts, and it is typically defined as three or more unsuccessful attempts. This results in reduced reproductive efficiency, lower economic sustainability of the dairy farm, and decreased milk quality in dairy cattle. **Purpose:** The purpose of this study was to investigate changes in milk quality in Friesian Holstein (FH) dairy cows subjected to repeat breeding at KUD Tani Wilis Sendang, Tulungagung Regency, focusing on the milk's density, as well as fat, Total Solid (TS), and Solid Non-Fat (SNF) content. **Method:** Thirty-two milk samples were collected, including 10 from normal cows for comparison. The samples were analyzed using a Lactoscan to examine the density, fat content, total solid (TS), and solid non-fat (SNF) of milk. The data was subjected to Independent T-Test analysis. **Results:** The results revealed significant differences ($p < 0.05$) between repeat breeding and normal cow milk samples in terms of specific gravity, fat content, and Total Solids (TS), but not in Solid Non-Fat (SNF). Repeat breeding cow milk exhibited a higher specific gravity (1.0282 vs. 1.0260) but lower fat content (1.08% vs. 4.18%) and Total Solids (9.38% vs. 12.73%) compared to normal cow milk. However, there was no significant difference for Solid Non-Fat (8.36% for repeat breeding vs. 8.55% for normal cows). **Conclusion:** Repeat breeding cow milk showed increased specific gravity but decreased fat content and Total Solids compared to normal cow milk, while Solid Non-Fat remained relatively consistent.

ABSTRAK

Latar Belakang: Kawin berulang merupakan masalah reproduksi yang cukup sering terjadi dimana sapi tidak kunjung bunting setelah beberapa kali percobaan inseminasi, yang biasanya didefinisikan sebagai tiga kali percobaan yang tidak berhasil. Hal ini mengakibatkan berkurangnya efisiensi reproduksi, keberlanjutan ekonomi peternakan sapi perah, dan penurunan kualitas susu pada sapi perah. **Tujuan:** Tujuan dari penelitian ini adalah untuk mengetahui perubahan kualitas susu pada sapi perah Friesian Holstein (FH) yang mengalami perkawinan berulang di KUD Tani Wilis Sendang, Kabupaten Tulungagung, dengan fokus pada kepadatan susu, kadar lemak, *Total Solid* (TS), dan *Solid Non-Fat* (SNF). **Metode:** Sebanyak 32 sampel susu dikumpulkan, termasuk 10 sapi normal yang digunakan sebagai perbandingan. Sampel dianalisis menggunakan Lactoscan untuk memeriksa kepadatan, kandungan lemak, *Total Solid* (TS), dan *Solid Non-Fat* (SNF) susu. Data tersebut kemudian dianalisis dengan Uji-T Independen. **Hasil:** Menunjukkan perbedaan yang signifikan ($p < 0,05$) antara sampel susu sapi hasil pembiakan berulang dan susu sapi normal dalam hal berat jenis, kadar lemak, dan *Total Solid* (TS), tetapi tidak dalam *Solid Non-Fat* (SNF). Susu sapi hasil kawin berulang menunjukkan berat jenis yang lebih tinggi (1,0282 vs. 1,0260) tetapi kadar lemak yang lebih rendah (1,08% vs. 4,18%) dan *Total Solid* (9,38% vs. 12,73%) dibandingkan dengan susu sapi normal. Namun, tidak ada perbedaan yang signifikan dalam *Solid Non-Fat* (8,36% untuk pembiakan berulang vs. 8,55% untuk sapi normal). **Kesimpulan:** Susu dari sapi kawin berulang menunjukkan peningkatan berat jenis tetapi kadar lemak dan total padatan menurun dibandingkan dengan susu sapi normal, sedangkan *Solid Non-Fat* tetap relatif konsisten.

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Kata kunci: Friesian Holstein; Kawin Berulang; Kualitas Susu; KUD Tani Wilis

INTRODUCTION

Dairy farming primarily involves cattle that produce dairy products. In Indonesia, the dairy industry is largely made up of small-scale operations, typically owning one to five cows. A previous study by Nurtini and Um (2018) noted that 97% of dairy farming in Indonesia is concentrated in Java. Among the commonly raised dairy cow breeds is the Friesian Holstein (FH). Originating from temperate regions, FH cows thrive in temperatures around 18°C with a 55% humidity, which are conditions conducive to optimal milk production. Known for their favorable traits such as a high body weight and adaptability to tropical climates, FH cows exhibit relatively high milk production (Zainudin et al., 2014).

The sustainability of a dairy farm hinges on milk production, which must be complemented by good milk quality. Ibrahim et al., (2023) emphasizes that milk quality is determined by various factors including the specific gravity, fat content, Total Solid (TS), and Solid Non Fat (SNF) composition. Enhancing milk production entails improving dairy cow productivity (Nimbalkar et al., 2021). However, the traditional management practices at the farmer level and prevalent reproductive disorders among female livestock contribute to low dairy cow productivity (Tolosa et al., 2021). These reproductive disorders result in significant economic losses for farmers, leading to decreased income (Sutiyo et al., 2017).

One factor impacting dairy cow productivity is repeat breeding, where females undergo multiple unsuccessful mating or artificial insemination attempts despite normal estrus cycles. Cows experiencing repeat breeding exhibit a Service per Conception (S/C) value exceeding three (Islam et al., 2017), leading to longer calving intervals and reduced milk production compared to the population average (Pisantra et al., 2019). There exists a correlation between Body Condition Score (BCS) and milk production, with nutritional deficiencies causing low BCS and subsequently decreased milk production (Netika et al., 2019). The repercussions of repeat breeding include failure to calve yearly and a diminished milk yield (Yusuf et al., 2010).

KUD Tani Willis stands out as a prominent Cooperative Unit at the village level in Indonesia, known for its effective management practices. Nonetheless, despite its strong management, reproductive disorders like repeat breeding persist, potentially impacting milk production among dairy cows. This study was conducted to investigate the milk quality of Friesian Holstein (FH) dairy cows experiencing repeat breeding at KUD Tani Willis Sendang, Tulungagung Regency focusing on the milk's density, fat content, Total Solid (TS), and Solid Non-Fat (SNF).

MATERIALS and METHODS

Sample

This study was conducted from January to March 2023 at KUD Tani Willis Sendang, Tulungagung Regency. The quality testing of the milk was carried out at the milk examination

laboratory of KUD Tani Willis, Sendang, Tulungagung Regency. This study adopted a descriptive approach with a quantitative method. Purposive sampling techniques were employed to select the participants. The sample size was determined using statistical calculations based on the Slovin Formula (Adha et al., 2020). A total of 32 Friesian Holstein (FH) dairy cows consisting of 10 normal cows and 22 cows experiencing repeat breeding were selected, and their milk samples, totaling 250 ml per cow, were collected for an analysis of density, fat content, Total Solid (TS), and Solid Non Fat (SNF). According to a previous study by Pérez-Marin and Quintela (2023), the criteria for normal cows is that they typically conceive within 1-3 inseminations and maintain a regular estrous cycle of about 21 days. They generally become pregnant within 85-115 days after calving. In contrast, repeat breeders are cows that fail to conceive after three or more inseminations despite showing normal estrous cycles and having no detectable reproductive abnormalities. This research involves several stages, including sampling and the analysis of the milk samples for density, fat content, Total Solid (TS), and Solid Non Fat (SNF).

Milk Testing

The milk quality assessment was conducted using a Lactoscan (Type MCCW-V1 from Milkotronic LTD, Bulgaria) device connected to a computer. Prior to testing, the milk samples were homogenized through repeated shaking to ensure uniformity. The Lactoscan automatically drew the milk sample through a small hose inserted into the measuring cup. The results were then displayed directly on the monitor screen and were printed as data on paper by the Lactoscan.

Statistical Analysis

Statistical analysis was conducted using the Independent Samples T Test method with the data processed using Statistical Program for Social Science (SPSS) version 25 for MacOs.

RESULTS

The results of the data analysis based on the Independent Sample T Test on the quality of milk of repeat breeding dairy cattle and normal dairy cattle as a comparison control can be observed in Table 1 as showing a significant different ($p < 0.05$).

Table 1. Average and Standard Deviation of Milk Quality

Milk Quality	Repeat Breeding Cows	Normal Cows	Indonesian National Milk Standard (SNI)
Density	1,0282 ^a ± 2,39	1,0260 ^b ± 2,50	1,0270
Fat (%)	1,09 ^a ± 0,55	4,18 ^b ± 0,99	3
Total Solid (%)	9,38 ^a ± 0,91	12,73 ^b ± 1,26	10,8
Solid Non Fat (%)	8,37 ^a ± 0,64	8,55 ^a ± 0,71	7,8

Note: Different superscripts (a, b) in the same rows show a significant difference ($p < 0.05$).

The analysis of the findings indicates that the density quality of milk from repeat breeding cows was higher compared to that of normal cows. Conversely, the fat content quality of

milk decreased in comparison to normal cows. The analysis revealed a decrease in the Total Solid (TS) quality of milk when compared to normal cows. However, there was no significant change in the Solid Non-Fat (SNF) content of the milk from repeat breeding cows compared to that of normal cows.

DISCUSSION

Milk Density

According to Kailasapathy (2015), a higher milk density is favorable as it indicates a more concentrated milk with lower water content and relatively lower percentage of solid ingredients, particularly fat. Conversely, a higher fat content in milk leads to a lower density. Variations in density are attributed to differences in the fat, lactose, protein, and mineral salt content in milk (Costa et al., 2021). The fat content, being the predominant nutrient, significantly influences milk density. Milk density is determined by its fat and solid ingredient content, as the density of fat is lower than that of water. Additionally, the presence of carbon dioxide and nitrogen gas in milk can increase its density post-milking (Rosartio et al., 2015). A decrease in milk density may be indicative of subclinical mastitis or reproductive disorders such as repeat breeding. Repeat breeding cows typically exhibit lower volume compared to normal cows due to longer calving intervals (Damayanti et al., 2020). Providing identical feed to both repeat breeding and normal cows may yield different outcomes in terms of their density quality. Table 1 illustrates that the breed weight standard of repeat breeding cows is higher than that of normal cattle but falls short of the Indonesian National Standard (SNI) standard of 1.0270. However, KUD accepts this deviation as the minimum specific gravity standard is met at 1.0235.

Milk Fat

The fat content of fresh milk is influenced by various factors such as the breed of the cow, its diet, and the intervals between milking (Ozcan et al., 2015). There exists a negative correlation between milk production and fat content, meaning that as milk production peaks, the fat content tends to decrease initially and then gradually increase until the end of lactation (Assan, 2014). The relationship between reproductive status and milk production is intricately linked to the physiological status of dairy cows, particularly their hormonal and metabolic balance. Optimal reproductive hormone cycles are essential for maintaining normal ovarian function. Hormones involved in milk production, such as prolactin and oxytocin, have opposing effects to pregnancy hormones like progesterone and estrogen (Filian et al., 2016). Towards the latter stages of pregnancy, the rise in estrogen and progesterone levels contributes to the growth and development of the mammary gland (Zainudin et al., 2014). However, the increased concentration of progesterone and estrogen hormones during pregnancy leads to a decrease in prolactin levels, resulting in reduced milk secretion and production (Filian et al., 2016). Table 1 highlights that the standard value for milk fat content according to Indonesian National Standard is a minimum of

3%, which aligns with the standard set by KUD. Therefore, milk from cows experiencing repeat breeding tends to have a fat content below both the SNI and KUD standards. Fat levels in milk can decrease in repeat breeders, primarily due to the prolonged period of lactation without a new pregnancy. As cows progress further into their lactation cycle without becoming pregnant, their milk production naturally declines, and the composition of the milk changes (Burgers et al., 2021). This extended lactation period can lead to a reduction in milk fat synthesis, as the cow's body shifts its energy allocation away from milk production (Piantoni and VandeHaar, 2023). Additionally, the hormonal imbalances often associated with repeat breeding can interfere with normal mammary gland function and fat synthesis pathways, further contributing to the lower fat levels in the milk produced by these cows (Vandenberg, 2021).

Total Solid

Total Solid (TS) serves as a crucial factor determining whether milk is accepted and its pricing. When the fat content decreases, the Total Solid (TS) content of milk also decreases (Saputra, 2018). Marwah et al., (2010) defined Total Solid (TS) as a milk component comprising non-fat solids and fat content, thereby depending on these constituents. The Total Solid (TS) content of dairy cow milk is influenced by the feed provided, including forage and concentrates (Astuti et al., 2020). Table 1 illustrates that the standard value for Total Solid (TS) in milk, as per SNI is 10.8% (SNI 2011), while in KUD, it is set at 11.85%. Optimal Total Solid (TS) content in milk translates to better pricing for farmers, with those exceeding the standard often receiving bonuses (Saputra, 2018).

Solid Non Fat

Solid Non Fat (SNF) constitutes the dry matter in milk other than fat, encompassing carbohydrates, proteins, vitamins, and minerals. The Solid Non Fat (SNF) content in milk is influenced by the presence of lactose and protein. Higher levels of protein and lactose can lead to an increase in the Solid Non Fat (SNF) content (Astuti et al., 2020). Protein levels in milk are predominantly determined by genetic factors rather than environmental factors like feed, making them less sensitive to feed variations compared to fat levels. The elevation in Solid Non Fat (SNF) levels is attributed to the exclusion of fat, allowing the remaining total protein and lactose to contribute to a higher percentage (Christi et al., 2022).

CONCLUSION

The research shows the condition of repeat breeders in Friesian Holstein cows at KUD Tani Wilis Sendang Tulungagung does affect milk quality. Repeat breeder cows produced milk with an increased density, and decreased fat content and Total Solid (TS), all of which are generally considered to be negative changes in milk quality. However, the Solid Non Fat (SNF) content remained unchanged.

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CONFLICT of INTEREST

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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ETHICAL APPROVAL

This research activity did not require ethical approval.

AUTHORS' CONTRIBUTIONS

SKW, ARK, and CEAP: Drafted the manuscript. SKW: Conceptualized the research and took the field data. ARK and CEAP: Conducted the statistical analysis. PS, DAP, DR, R, and ES: Validation, supervision, and formal analysis. All authors have read, reviewed, and approved the final manuscript.

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