

The Relationship Between Lactation Period and Colostrum Age With Colostrum Protein Content of Friesian Holstein (FH) Dairy Cattle in KPSP Setia Kawan, Pasuruan District

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Abstract

Colostrum is the secretion of the younger glands after the cow gives birth and is given to the calf for 3-5 days. The purpose of this study was to determine the relationship between the lactation period and colostrum age on the colostrum protein content of FH dairy cows. This research was conducted at KPSP Setia Kawan, Pasuruan. The research was conducted in August-November 2022. The research materials were FH dairy cows with lactation periods 1,2,3, and cow colostrum which were analyzed with the Lactoscan Milk Analyzer. The research method uses the case study method and purposive sampling. Research using simple linear regression analysis and correlation. The results of the regression equation study the relationship between the lactation period and colostrum protein content, namely $Y = 5.22 + 0.46X$ with a correlation value (r)=0.158 and a coefficient of determination (R^2) = 0.025. The results of the regression equation for the relationship between colostrum age and colostrum protein content are $Y = 10.79 - 1.55X$ with a correlation value (r)=0.88 and a coefficient of determination (R^2)=0.77. The conclusion of the study is that there is a positive relationship between the lactation period and colostrum protein and there is a negative relationship between colostrum age and colostrum protein.

Keywords : FH dairy cattle, colostrum, lactation period, colostrum protein.

Introduction

Colostrum is a yellow liquid that is secreted for the first time by a lactating cow through the udder after the cow gives birth, which contains nutrients and antibodies for the calf (Surjowardojo, Susilorini, and Rifa'i. 2021). Colostrum is used in newborn calves as the main food. The calf at birth does not have any immunity against disease. Therefore, colostrum given to calves after birth can be used to fight disease, giving colostrum to calves 30-60 minutes after the calf is born (Kusumo, 2013). Abdillah and Surjowardojo (2018) added that giving colostrum after the calf is born is important for the condition of the calf, because colostrum contains a source of nutrients such as protein, carbohydrates, fat, vitamins and minerals, and contains immune substances (immunoglobulin).

The quantity and quality of colostrum can be influenced by several factors, including physiological and environmental factors. Environmental factors that affect the productivity of FH dairy cattle are temperature, humidity, stable environment, and management of livestock rearing. Physiological factors are divided into two, namely genetic and non-genetic. The

genetic factor of livestock that affects milk production is the breed of cattle, because dairy cows have the potential to produce different amounts of milk. Genetic factors contribute between 25% -30% to milk composition and production (Harding, 2019). Non-genetic factors that affect milk production include cow age, body weight, BCS, milking frequency, livestock health and lactation period.

The lactation period is the time when the cows are producing milk and the number of dairy cows has given birth to calves. The milk production of dairy cows is affected by the lactation period. Milk production has a different capacity in each lactation period, increasing the value of the lactation period tends to cause a decrease in the amount of milk production in livestock. The peak of milk production in FH dairy cows occurs in the 2nd lactation period to the 4th lactation period, then gradually decreases with increasing lactation periods in dairy cows (Mahmud, Busono, Surjowardojo, and Tribudhi, 2020). During the lactation period dairy cows produce milk, the milk produced during lactation is divided into two, namely milk produced right after the dairy cows give birth which is called colostrum and pure milk produced after colostrum.

The quality of colostrum will decrease as colostrum ages until it becomes pure milk. The first milking of colostrum has better quality than the colostrum in the next milking until the dairy cows don't produce colostrum anymore. The quality of colostrum is always associated with the concentration of immunoglobulins contained therein (Esfandiari, Widhyari, Murtini, Febram, Wulansari and Maylina, 2014). Apart from immunoglobulins, the quality of colostrum can be seen from the content of Total Solids (TS). Total solids are solids found in milk, namely a combination of Solid Non Fat (SNF) and Fat. SNF consists of protein, lactose, minerals and vitamins. The high content of SNF at the peak of lactation is due to the high protein composition and relatively low fat content. Protein content of approximately 14% is an important component of colostrum to help prevent morbidity and mortality (Noegroho and Surjowardojo, 2019). Thus to determine the relationship between colostrum age and lactation period on colostrum protein content, it is necessary to do research.

Materials and Methods

This research was conducted at the dairy farming cooperative (KPSP) Setia Kawan, Jl. Raya Nongkojajar, Wonosari Village, Tukur District, Pasuruan Regency. The colostrum content analysis was carried out at the Setia Kawan KPSP Laboratory. The time of the research was carried out from August to November 2022.

The research material used in the study were 30 FH dairy cows from the KPSP Setia Kawan dairy farm which were in the lactation period 1, 2, and 3. Colostrum of FH dairy cows on day 1 to day 5, with milking frequency morning and evening. The tools used were 100 ml glass bottles, paper stickers, beaker glass, cooling box, and MCC W V1 lactoscan milk analyzer.

The method used is the case study method. Determination of the sample was carried out by purposive sampling, namely sampling deliberately in accordance with special requirements or criteria, namely, FH dairy cows that had just given birth during the 1st, 2nd, and 3rd lactation periods. Colostrum production data was collected starting from the first milking and subsequent milking every morning at 05.00 – 07.00 WIB and in the afternoon at 15.00 – 17.00 WIB. Milking is done manually, namely colostrum is milked and collected using a container. The results of colostrum milking are placed in sterile glass bottles equipped with rubber covers and stored in a cooling box or refrigerator before being tested in the laboratory.

Research variable

The variables observed in this study were: lactation periods 1, 2 and 3; colostrum ages 1, 2, 3, 4 and 5; and colostrum protein content.

Data analysis

The analysis used is correlation using a simple linear regression equation to determine the correlation coefficient r and the coefficient of determination (R^2), then assisted by the application of SPSS ver. 22. With the correlation formula:

Research Stages

1. Research Preparation

The research preparation was carried out by collecting data and selecting old pregnant cows that were approaching the day of birth according to the required criteria, namely cows in the 1st, 2nd, and 3rd lactation periods. The selected cattle were recorded and given an identity or number to facilitate data collection. In preparation for collection of samples, the bottles where the samples were taken were sterilized and labeled according to the cow and milking numbers to facilitate data collection.

2. Research Data Collection

The data collection stage was carried out for 30 days starting from the 1st milking to the 5th milking. The first collection of colostrum is carried out 30 minutes – 60 minutes after the cow has given birth. Milking is then carried out 2 times a day at 05.00 – 07.00 WIB and 15.00 – 17.00 WIB. The cows are manually milked and stored in bottles as much as needed directly. The samples needed for testing are collected in sterile glass bottles, then the colostrum is stored in a cooling box before being tested with the Lactoscan Milk Analyzer in the laboratory belonging to KPSP Setia Kawan, Pasuruan Regency.

3. Colostrum Protein Content Testing

The testing phase was carried out in a laboratory owned by KPSP Setia Kawan, Pasuruan Regency. Colostrum quality testing was carried out using a Lactoscan Milk Analyzer. Christi, et al. (2022) states that the procedure for using lactoscan is as follows:

- 1) Prepare a sample in a beaker glass as much as 30 ml. Analysis of the quality of colostrum using lactoscan requires a sample of ± 30 ml (Ariani, Rokana, and Afiyah, 2021).
- 2) Insert the tip of the lactoscan needle into the sample.
- 3) Press the lactoscan power button in the on position.
- 4) Insert the analysis hose into the sample.
- 5) Press the enter key and select the menu at the position of the milk to be tested, for example cow colostrum will be tested, then cow is selected on the menu.
- 6) Wait a moment and lactoscan will display the results of the analysis on the monitor screen.
- 7) The results of the analysis are recorded.
- 8) After testing all samples is complete, then press menu to return and select the cleaning position.
- 9) Wash the tools with Daily Clean solution, and turn the lactoscan power button to the off position to turn it off.

Results and Discussion

Relationship of Lactation Period with Colostrum Protein Content

The lactation period is the number or number of dairy cows that have given birth to calves. The lactation period starts from calving or after parturition until it ends in the dry period (Atabany, et al., 2011). The age of the first parturition cow affects the production and quality of milk. Dairy cows give birth at the age of 24-30 months (2-2.5 years) which will produce

high milk and have a fairly long production period. Milk and colostrum production will continue to increase as the cow ages up to 7-8 years. After that age, milk and colostrum production will decrease little by little until the cow is 11-12 years old. According to Ako (2015) generally the production capacity and quality of milk differ in each lactation period.

Productivity and colostrum quality also increase with increasing age of dairy cows. The average colostrum protein content based on different lactation periods at KPSP Setia Kawan is presented in Table 1.

Table 1. Average Colostrum Protein Content Based on Lactation Period

Lactation Period	Quantity (tail)	Colostrum Protein Content (%/head/day)
1	11	5.63 ± 2.07
2	8	6.27 ± 2.49
3	11	6.55 ± 2.83
Total	30	

Source: Field Result Data

Based on Table 1, the results showed that the protein content of colostrum continued to increase from the 1st lactation period to the 3rd lactation period. According to the research results of Zarei, et al. (2017) the average protein content in periods 1, 2, 3, and 4 of the first milking resulted in a protein content of 18.5%, 17.2%, 18.48%, and 19.25% respectively in the first milking. The average protein content in the 2nd lactation period experienced a decrease in protein content and increased again in periods 3 and 4.

Based on Table 1, the lowest average protein content occurs in the 1st lactation period. This may be due to the 1st lactation period, the heifers that give birth for the first time have not fully experienced sexual maturity. Zainudin, Ihsan and Suyadi (2014) stated that heifers that are not sexually mature enough can affect mammary development, even though the mammary glands and alveoli grow but are not optimal. As pregnancy increases, the mammary glands will continue to develop optimally for milk productivity. The large number of dairy cows that have experienced giving birth and producing milk, the udder glands and secretory cells in cows experience growth and development that continue to increase in each lactation period, so that the volume of the udder will be greater and the number of secretory cells will be many in number (Setyawan, 2018)

The highest average protein content was obtained in period 3. This is because dairy cows in the 3rd lactation period which are around 5 years old have reached reproductive maturity and are capable of producing colostrum with high protein quality.). Older cows (lactation period of more than 3) produce colostrum with a higher IgG content so that the transfer of antibodies from mother colostrum to calves is better, because calves born to older cows have more antibodies that bind to auto-antigens so that calves have better resistance to disease (Salimah, et al., 2022).

The results of the study in Figure 1 show that the relationship between the lactation period (X) and the colostrum protein content (Y) has a positive relationship, namely the colostrum protein content increases in each lactation period. Based on the results of a simple linear regression analysis of the lactation period with colostrum protein, the regression equation is $Y = 5.22 + 0.46X$, which means that every increase of 1 lactation period can increase the colostrum protein content by 0.46%. The correlation value R obtained was 0.158 which indicated that the close relationship between the value of the lactation period and the colostrum protein content of dairy cows at KPSP Setia Kawan was very low.

The coefficient of determination (R²) obtained is 0.025, meaning that this value indicates that the lactation period contributes 2.5% to the protein content of colostrum, the remaining 97.5% is influenced by other factors.

According to Ako (2015) internal factors affect the production and quality of colostrum for the nation and offspring, lactation period, age of livestock, condition of livestock and udders, while external factors affect production and quality, namely season or climate, length of dry period, calving interval, maintenance management and also the feed given. Efforts that can be made to improve the quality contained in colostrum are by paying attention to the nutrition given to livestock. The nutrients needed by dairy cows at the beginning of lactation must be fulfilled by consuming dry matter feed. BK feed has several nutritional contents which include fat, protein, calcium, phosphorus, vitamins and feed energy which can be digested in the total digestible nutrient (TDN).

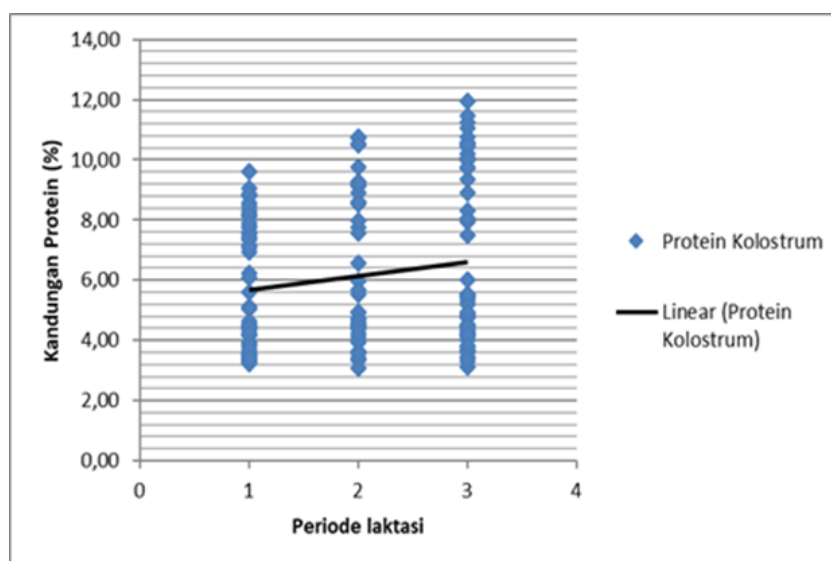


Figure 1. Relationship between lactation period and colostrum protein content

Colostrum Age Relationship with Colostrum Protein Content

Colostrum age can affect the productivity and quality of milk. Individual characteristics, heredity, feeding during the dry period, the length of the dry period of the cage, and the time to collect postpartum colostrum and BCS are factors that affect the productivity and quality of colostrum (Surjowardojo, Muarifah, Rifa'® and Handayani. 2022 Godden (2008) at colostrum ages 1, 2, 3, and 6 each had a protein content of 14.0%; 8.4%; 5.1%; and 3.1%. The quality of protein will decrease as colostrum ages, this is in accordance with the results of research at KPSP Setia friends that the increasing age of colostrum can reduce the protein content in colostrum.

Table 2. Average Colostrum Protein Content Based on Colostrum Age

Colostrum Age (day)	Amount (sample)	Colostrum Protein Content (%/head/day)
1	30	9.33 ± 1.34
2	30	8.50 ± 1.32
3	30	4.86 ± 0.63
4	30	4.33 ± 0.54
5	30	3.67 ± 0.42
Total	150	

Source: Field Result Data

Based on the data obtained in Table 2, the average colostrum protein content in KPSP Setia Kawan continues to decrease from colostrum age 1 to colostrum age 5. Colostrum age 1 has a higher average compared to the average production at the next colostrum age. This is in accordance with Esfandiari, et al. (2008) who stated that the colostrum content in the first milking is rich in nutrients and bioactive components such as growth factors, antimicrobial factors, immune factors (immunoglobulins).

The lowest average of the research results was obtained at the age of 5th colostrum, Belli (2009) stated that the chemical content in colostrum can change very quickly according to time, so that starting on day 3 postpartum the chemical content in colostrum has started to be the same as normal breast milk. The most visible change occurs in protein content. The sharp decrease in colostrum protein content is caused by Ig (Immunoglobulin) fractions, where the concentration is higher at the age of first colostrum. Colostrum is produced by postpartum lactating cows for approximately 24-168 hours or 1-7 days, the colostrum content is high in the first age and decreases from the 2nd colostrum age to the 5th colostrum age because the amount of colostrum produced decreases and the amount milk produced is increasing (Atabany, et al., 2011).

The results of the study in Figure 2 show that the relationship between colostrum age (X) and colostrum protein content (Y) has a negative relationship, namely colostrum protein content decreases with each increase in colostrum age. Based on Appendix 2, the results of a simple linear regression analysis of colostrum age with colostrum protein obtained a regression equation, namely the relationship between colostrum age and colostrum protein content has a regression equation that is $Y = 10.79 - 1.55X$ meaning that with an increase in colostrum age by 1 day, the protein content colostrum reduced by 1.55%. The correlation value R obtained was 0.879 which indicated that there was a strong negative relationship between colostrum age and colostrum protein content in FH dairy cows at KPSP Setia Kawan. The coefficient of determination (R^2) obtained is 0.

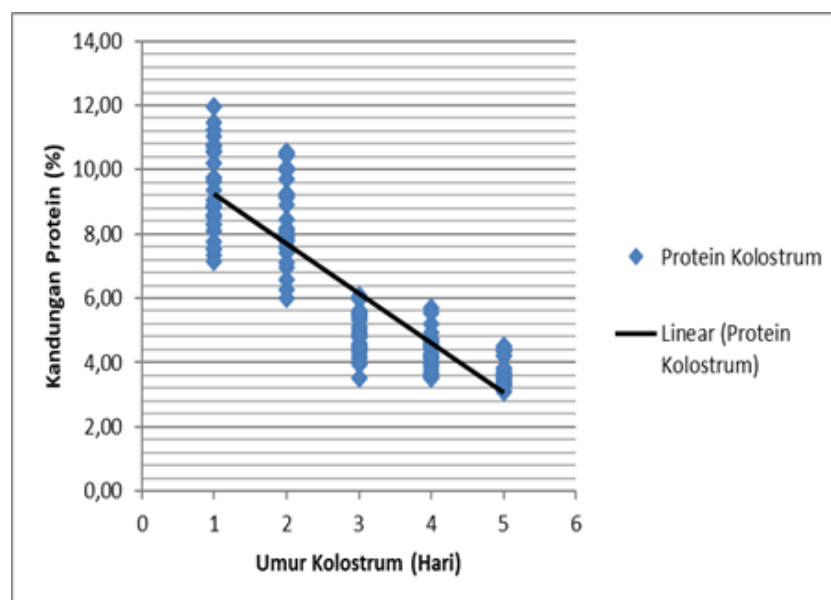


Figure 2. Relationship between Colostrum Age and Colostrum Protein Content

Conclusion

Based on the results of the study, it can be concluded that there is a positive relationship between the lactation period and colostrum protein content as indicated by an increase in colostrum protein content in the first lactation period to the third lactation period, and there is a negative relationship between colostrum age and colostrum protein content as indicated by a decrease in colostrum protein content in first to fifth day. Suggestions that should be done should be given to calves that have just been born immediately colostrum so that the nutritional needs for calf growth are met.

References

- Abdillah, Z., and P. Surjowardojo. The relationship between BCS and colostrum quality in terms of solid non-fat and colostrum specific gravity of PFH cows. *Livestock Tropics Journal of Tropical Animal Production*, 19(1): 53-59. <https://doi.org/10.21776/ub.jtapro.2018.019.01.8>, 2018.
- Adi, DS, DW Harjanti., and R. Hartanto. Evaluation of protein and energy consumption on milk production in early lactation dairy cows. *Indonesian Journal of Animal Science*, 22(3): 292-305. <https://doi.org/10.25077/jpi.22.3.292-305.2020>, 2020.
- Ariani, NF, E. Rokhana., and DN Afiyah. Quality of Milk for PFH Dairy Cows in the Karya Bhakti Ngancar Village Unit Cooperative (KUD), Kediri Regency. *Fillia Scholar Scientific Journal*, 6(2): 130-135, 2021.
- Ako, A. *Tropical Dairy Animal Science*. Bogor: IPB Press, 2015.
- Atabany, A., BP Purwanto., T. Toharmat., and A. Anggraeni. Relationship between idle period and productivity in Friesian Holstein Dairy Cattle in Baturraden, Indonesia. *Livestock Media*, 34(2): 77-77. <https://doi.org/10.5398/medpet.2011.34.2.77>, 2011.
- Atabany, A., A. Suprayogi., M. Muladno., F. Satrija., R. Tarigan., W. Sugiono., and Y. Queen. Production and Quality of Colostrum and Colostrum Milk in Dairy Cattle Consuming Depolarized Katuk Leaves. *Journal of Indonesian Agricultural Sciences*, 27(2): 263-268. <https://doi.org/10.18343/jipi.27.2.263>, 2022.
- Belli, HL. The Role of Colostrum in the Transfer of Passive Immunity in Newborn Calves. *Wartazoa*, 19(2): 16-26, 2009.
- Christi, RF, LB Salman., E. Wulandari., and A. Sudrajat. Display of the Physical and Chemical Quality of Milk Affected by Mild Mastitis in Friesian Holstein Dairy Cattle at CV Ben Buana Sejahtera Jatinangor, Sumedang. *Journal of Animal Resources*, 3(1): 1-5, 2022.
- Esfandiari, A., SD Widhyari., S. Murtini., B. Febram., R. Wulansari., and L. Maylina. Anti ETEC K99 Antibody Response in Pregnant Cows After Administration of Polyvalent Escherichia Coli Vaccine. *Journal of Indonesian Agricultural Sciences*, 19(2): 85-90, 2014.
- Esfandari, A., IW Wibawan., S. Murtini., SD Widhyari., and B. Febram. Production of Avian Influenza Antivirus Colostrum in the Context of Controlling Avian Influenza Virus Infection. *Journal of Indonesian Agricultural Sciences*, 13(2): 69-79, 2008.
- Godden, S. Colostrum Management For Dairy Calves. *Veterinary Clinics of North America: Food Animal Practice*, 24(1): 19-39. <https://doi.org/10.1016/j.cvfa.2007.10.005>, 2008.
- Harding, M. Analysis of the Factors Causing the Decreased Level of Cow's Milk Production in Sinjai (Case Study of Gunung Perak Village). Doctoral Dissertations. Muhammadiyah Sinjai Islamic Religious Institute, 2019.
- Kusumo, A. Management of calf rearing at PT. Tossa Shakti Kendal Agro Division, Central Java, 2013.

- Mahmud, A., W. Busono., P. Surjowardojo., and YA Tribudhi. Milk Production of Friesian Holstein (Fh) Cows in Different Lactation Periods. *Journal of Animal Husbandry Science and Technology (JITP)*, 8(2): 79-84. <https://doi.org/10.20956/jitp.v8i2.10132>, 2020.
- Noegroho, VAK, and P. Surjowardojo. Effect of Colostrum Age on Colostrum Quality in PFH Dairy Cattle in Ngantang District, Malang Regency Doctoral dissertation. Brawijaya University. Poor, 2019.
- Salimah, AB, N. Mayasari., and UH Tanuwiria. Management of Giving Colostrum and Starter Feed on Immunoglobulin-G (IgG) Content and Gain in Body Weight of Dairy Calves at PT UPBS Pangalengan. *Journal of Animal Science, Padjadjaran University*, 22(1): 61-70. <https://doi.org/10.24198/jit.v22i1.37804>, 2022.
- Setyawan, D. The Relationship between the Lactation Period and the Production and Length of Colostrum Production in Holstein Friesian Dairy Cattle (PFH). Doctoral Dissertations. Brawijaya University, 2022.
- Surjowardojo, P., H. Muarifah., and Rifa'i. M. Handayani. Colostrum Quality of Friesien Holstein (Fh) Dairy Cattle with Different Age of Colostrum in terms of Fat Content. *Journal of Agriovet*, 5(1): 125-132. <https://doi.org/10.51158/agriovet.v5i1.843>, 2022.
- Surjowardojo, P., TE Susilorini., and Rifa'i. Colostrum Production of Holstein Friesian (FH) Dairy Cattle in Different Lactation Periods. *Agriovet Journal*, 4(1): 31-36. <https://doi.org/10.51158/agriovet.v4i1.574>, 2021.
- Zainudin, M., MN Ihsan., and S. Suyadi. Reproductive Efficiency of Pfh Dairy Cattle at Various Ages in Cv. Milkindo Berka Abadi, Tegalsari Village, Kepanjen District, Malang Regency. *Journal of Animal Science (Indonesian Journal of Animal Science)*, 24(3): 32-37, 2014.
- Zarei, S., GR Ghorbani., M. Khorvash., OB Martin., AH Mahdavi., and A. Riasi. The Impact Of Season, Parity, And Volume Of Colostrum On Holstein Dairy Cows Colostrum Composition. *Agricultural Sciences*, 1(8): 572 – 581. <https://doi.org/10.4236/as.2017.87043>, 2017.