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Effect of Dry Period Time on Milk Production and Health in Dairy Cows

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Abstract

The dry period is when the cow is not milking before calving, traditionally around 6 to 8 weeks. The primary purpose of the dry period is to treat mastitis, accelerate the regeneration of mammary gland cells and increase milk production in the following lactation period. However, recent research studies have shown that a dry period of 6 to 8 weeks is still controversial in increasing maximal milk production after delivery. Until now, the most optimal dry period is still a subject of debate related to production efficiency and the health of the mother cattle. This paper aimed to review the results of research on the dry period, which is considered the most optimal for the health of cows and increasing milk production in the subsequent lactation period.

Keywords: controversial; dairy cows ; dry period; milk production

Introduction

The dry period is defined as the period when the cow is no longer breastfeeding but is experiencing changes in nutrition, metabolism, and mammary glands (Dingwell *et al.,* 2001; Kok *et al.,* 2019). The dry period also be defined as when the cow is not milked for approximately 6 to 8 weeks until the calf is born (Arnold and Becker, 1936; Knight, 1998; Bachman and Schairer, 2003). The dry period is intended to give the dairy cows rest to recover their health after the milking period. However, recent studies have shown that a dry period of 6 to 8 weeks has received many objections from researchers (Santschi *et al.,* 2011; Steeneveld *et al.,* 2013). According to Sawa *et al.* (2015), the optimal dry period to increase milk production is 51-70 days. Boujenane's research (2019) shows that a dry period of 40-80 days results in optimal milk production in Holstein cattle. Until now, the dry period considered the most optimal, is still a matter of debate related to the efficiency of production and the health of cows (Klein and Woodward, 1943; Smith and Legates, 1962; Bachman and Schairer, 2003).

Research on dry periods and their effects on milk production have been conducted with varying results (Wood, 1977; Dias *et al.,* 1982; Sorensen and Enevoldsen, 1991; Watters *et al.,* 2008). Klein and Woodward (1943) stated that an initial dry period would decrease milk production but significantly increase milk production in later lactation periods. The results of this study were also supported by Coppock et al. (1974), who stated that a dry period of 60 days was able to maximize milk production in the subsequent lactation period. According to Sawa *et al.* (2013), the dry period before delivery is needed to regenerate the mammary glands so that milk production is expected to be maximized during the subsequent lactation. This opinion was supported by several other researchers who state that the dry period of dairy cows is a critical phase of the lactation cycle and helps increase milk production for the next lactation period (Andersen *et al.,* 2005; Pezeshki *et al.,* 2010) as well as reproductive health for the next period (Andersen *et al.,* 2005; Pezeshki *et al.,* 2010) and reproductive health for the next period (Kuhn *et al.,* 2005; Beever, 2006). The results showed that

in the first three weeks after drying, cattle have a high risk of experiencing physiological changes, reproductive tract disorders, and mastitis (Green *et al.,* 2002; Pantoja *et al.,* 2009) and susceptible to exposure to bacteria from the environment (Capuco *et al.,* 1997)

Over time, reports from several researchers state that shortening the dry period can improve energy balance (EB), fertility, and metabolic status (Rastani *et al.,* 2005; Andersen *et al.,* 2005; Watters *et al.,* 2009; De Feu *et al.,* 2009). On the contrary, several studies have shown that shortening the dry period can reduce milk production and quality and reproductive health problems in the later lactation period (Annen *et al.,* 2004; Pezeskhi *et al.,* 2007; Mantovani *et al.,* 2010). Although there is still much debate, it is believed that the dry period in dairy cows is still one of the methods to increase milk production in the following lactation. This brief review aims to examine the effect of the dry period on dairy cows concerning increased milk production and quality, which is produced in the subsequent lactation period. The writing team hopes that this article can add insight to dairy farmer practitioners in Indonesia.

Dry period and its effect on milk production

The dry period is vital in calf birth preparation, milk production, and dairy cow health (van Knegsel *et al.,* 2013). Several factors influence the dry period method in cattle to achieve optimal results before entering the next lactation period. Factors that can influence milk production (Sorensen and Enevoldsen, 1991), parity (Funk *et al.,* 1987; Kuhn *et al.,* 2006), season (Fabris *et al.,* 2019), body condition of the cow (Singh *et al.,* 2020), spontaneous termination of lactation () and other livestock-specific factors (de Vries *et al.,* 2015). One of the benefits of the dry period, which is believed to be very influential, is increasing milk production during the subsequent lactation period. One of the benefits of the dry period, which is believed to be very influential, is increasing milk production during the subsequent lactation period. The increase in milk production is because this period allows the mammary glands to go through the average involution period and to ensure that the number of mammary cells will develop generally during early lactation (Van Knegsel *et al.,* 2013).

Research on the treatment of dry periods in dairy cows has long been carried out in order to obtain maximum yield and quality of milk (Woodward and Dawson, 1926; Arnold and Becker, 1936; Smith and Legates, 1962; Keown and Everett, 1986; Makuza and McDaniel; 1996). Several theories have been proposed to explain the importance of the dry period at the end of lactation, namely restoring the body to its original condition, regenerating the mammary glands, increasing milk production and minimizing metabolic disorders, and reducing the incidence of postpartum mastitis (Smith *et al.,* 1967; Kok *et al.,* 2019; Bradley and Green, 2001; Watters *et al.,* 2008; Van Knegsel *et al.,* 2013; Grewal *et al.,* 2018). According to Capuco *et al.* (1997), mammary cell regeneration will be faster during dry periods than when cows are still being milked until calving. Therefore the dry period will result in a large concentration of new mammary cells at delivery which explains the high peak milk production in the following lactation after the dry period (Van Knegsel *et al.,* 2013). Furthermore, according to Smith *et al.* (1985) and Burvenich *et al.* (2007), the dry period is also crucial for controlling intramammary infection (IMI) because there is a strong suspicion that many cases of clinical coliform mastitis that occur during early lactation originate at the end of the dry period.

Until now, there seems to be no agreement on the most optimal dry period for maximum milk production in the following lactation. However, ample research shows that an extended dry period of around 6-8 weeks will positively impact milk production in later lactation. On the other hand, a short dry period will harm milk production (Bachman, 2002; Hoseyni *et al.,* 2017). However, the differences in the results of these studies are not acceptable. The results of Watters *et al.* (2008) showed different results because the reduction of the dry period from 55 days to 34 days did not affect the health status of the animals, including milk production and colostrum quality. Table 1 below presents the research results related to the dry period with the result of increasing milk production and quality during the subsequent lactation period.

Table 1. Relationship between dry period and increased milk production and quality in the subsequent lactation period.

Cow	Dry Periods (day)	Milk production and quality	reference
Holstein	60-69	Increased milk production, percentage of fat content,	Funk et al., 1987
Jersey	70	Increased milk production	Sorensen and Enevoldsen, 1991
Holstein	60	Increased milk production, the percentage of fat and protein content	Kuhn *et al.,* 2006
holstein	34 - 55	There is no increase in milk production and colostrum quality	Waters *et al.,* 2008
Holstein	40-60	Increased milk production	Hussein, 2009
Holstein	40-60	Increased milk production	Hernandez *et al.,* 2012
Holstein	40-60	Increased milk production, the percentage of fat and protein content	Sawa *et al.,* 2012
Holstein	51-70	Increased milk production, the percentage of fat and protein content	Hossein-Zadeh and Mohit, 2013
Holstein	41-80	Increased milk production percentage of fat content	Boujenane, 2019

Table 1 shows that the optimal duration of the dry period can vary between cows. However, the recommended optimum time to increase milk production in the subsequent lactation is 45-60 days (Dias *et al.,* 1982; Bachman and Schairer, 2003). Table 1 also shows that almost all of the dry period between 45-60 days shows an increase in milk production in the following lactation period. Short dry periods of less than 45 days were not recommended because milk production will decrease in subsequent lactations (Rastani *et al.,* 2005; Church *et al.,* 2008) and insufficient time for the udder to involute (Collier *et al.,* 2012). In contrast, according to (Capuco *et al.,* 1997), mammary gland involution in dairy cows generally ends on day 25 of the dry period, and significant tissue proliferation occurs at that time. Thus a dry period of 30 days may be sufficient time for tissue involution and regeneration under suitable conditions. Different results were also obtained from the research report by van Knegsel *et al.* (2013), which stated that a short dry period (28-35 days) showed an increase in protein levels of 0.06% compared to a dry period of 56-64 days. Therefore, the time of the dry period until now remains an interesting research topic to find an ideal time to obtain maximum milk production. Although there are still a lot of controversies with the dry period length, from table 1, it can conclude that until now, the optimal dry period for increasing milk production in the following lactation is between 45-60 days.

Variations in the optimal duration of the dry period in cattle can also be caused by various conditions such as cattle genetics, type of cattle, animal physiological conditions, feed intake, nutritional quality, season, climate differences, rearing management, and pathogenic environmental bacteria (Smith *et al.,* 1985). ; Capuco *et al.,* 1997; Pezeshki *et al.,* 2010; Grewal *et al.,* 2018: Boujane, 2019; Kok *et al.,* 2019; Fabris *et al.,* 2019; Singh *et al.,* 2020). Therefore, more in-depth research is still needed to understand the dry period treatment in dairy cows to obtain maximum results and minimize the risk of unwanted health problems. Table 1 shows that a dry period of 50-60 days will improve BCS values (Hoseyni *et al.,* 2017). The improvement in the BCS value is likely due to a change in the cow's diet associated with a decrease in the provision of grain in the feed, accompanied by an increase in hay or high-fiber forage. According to Dingwell et al. (2001), adapting dry rations with high fiber content decreased dry matter intake and increased rumination time during dry periods. Furthermore, at the end of the dry period, there is a decrease in rumen volume due to the growth of the fetus, and its development will be complete during this phase.

Relationship between dry periods and cow health

Research on dry periods concerning cows' health has been done a lot. Many research results

still show contradictions; even so, researchers must look at the various aspects and methods used in the research to be more objective in assessing the results. In addition to showing positive results (Swanson and Poffenbarger, 1979), many dry-period treatments also show adverse effects on dairy cows in various aspects following the lactation period (Watters *et al.,* 2008). Dry periods are closely related to health, including mastitis (Natzke *et al.,* 1975; Bradley and Green, 2001), decreased fertility (Beever, 2006), calf health (Keown *et al.,* 1986), colostrum quality (Pritchett *et al.,* 1991) and milk quality or composition. The results of several studies have shown that cows without dry treatment can experience a decrease in milk production by 11-25% (Remond et al., 1992). Bachman and Schairer (2003) research showed the same results; there was a decrease in milk production of 5-6% during subsequent lactation when the dry period was shortened to 30 days. However, many positive effects are obtained by treating the dry period in cattle, although it still requires long research to determine the ideal dry period. Table 2 shows the period's effect on the cows' health.

Table 2 shows the results of the study where the dry period was reduced to a range of 20-40 days. The research results in table 2 also show various kinds of results, which are sometimes contradictory. Some research results show a decrease in milk production, but some show no change or even an increase in milk production. The shortening of the dry period also showed no adverse effect on the general health of the cattle (Pezeshki *et al.,* 2008). In contrast, Fraser *et al.* (1997) stated that a short dry period or even no dry period could affect the health of metabolism, udder health, and cattle fertility. Nonetheless, research by O'Hara *et al.* (2019) showed no significant difference in fertility between cows during the dry period of 4 weeks compared to 8 weeks. Furthermore, O'Hara *et al*. (2019) stated that cows diagnosed with postpartum mastitis had a 3-fold increase in the dry period of 4 weeks compared to 8 weeks.

According to some researchers, shorter dry periods will reduce the frequency of dietary changes, which can reduce stress. Reducing dietary changes in dry periods is thought to increase the survival of the rumen microbial flora population, which is desirable to optimize the work of the rumen microflora (Goff and Horst, 1997; Penner *et al.,* 2011; Jolicoeur *et al.,* 2014). The study results in table 2 also show that the dry period of 28 days

Table 2 shows the dry period's effect on the cows' health.

Cow	Dry Periods (day)	Effect	Reference
Holstein	30	Decreased milk production	Van Knegsel *et al.,* 2014
Murrah buffalo	16-30	Decreased milk production, fat content and total solids,	Reddy *et al.,* 2019
Holstein	35	Decreased milk production	Pezeshki *et al*., 2007
Holstein	28	Decreased milk production, no changes in somatic cells and milk composition, low Body Condition Score (BCS).	Hoseyni *et al.,* 2017
Holstein	28	There is no negative effect on health status and reproductive efficiency	Pezeshki *et al.,* 2008
Holstein	28	There is no effect on milk production	Annen *et al.,* 2003
Holstein	40	There is no effect on milk production	Shoshani *et al.,* 2014
Holstein	30	Prone to mastitis	Natzke *et al.,* 1994
Holstein	30-39	Decreased milk production	Makuza and McDaniel 1996
Holstein	34	Decreased milk production	Bachman, 2002
Holstein	30-39	Decreased milk production	Keown and Everett 1986
Holstein	32	Decrease in the number of somatic cells	Klusmeyer *et al.,* 2009
Holstein	30	mastitis	Church *et al.,* 2008
Swedish Red dan Swedish Holstein	28	Increased incidence of mastitis, low colostrum volume	O'Hara *et al.,* 2019

did not show any changes in the number of somatic cells. According to Lipkens *et al.* (2019), in healthy cows, the dry period shows a lower SCC in the subsequent lactation period compared to cows that experience pain during the dry period. Bradley *et al.* (2015) added the importance of management factors for controlling udder health during dry periods so that it was expected to reduce SSC rates during the subsequent lactation period. Even so, some researchers still think that the impact of the dry period on udder health observations based on SSC is still ambiguous because it shows different research results. According to Andersen *et al.* (2005), the dry period does not affect the number of SSC. On the contrary, Klusmeyer *et al.* (2009) showed increased SSC.

In table 2, it can see that short dry periods also increase the risk of mastitis. Nonetheless, the short dry period is still being debated today. According to Van Hoeij *et al.* (2016), the effect of prolonged dry periods on udder health is closely related to parity, milk production level, and udder health. According to Pantoja *et al.* (2009), intramammary infection during the dry period will increase the risk of clinical mastitis at the start of the next lactation. Therefore, dry period management is crucial in minimizing or preventing mastitis during dry periods (Eberhart, 1986). One of the management of the dry period to prevent mastitis is by giving antibiotics during the dry period (Janosi and Huszenicza, 2001; Hillerton *et al.,* 2017). Even though antibiotics are a strategy for treating mastitis in dry periods, we must be aware of the negative impacts. Most antibiotics used in the dairy farming industry are applied to control mastitis, especially in dry periods (Bradley and Green, 2000; Bradley and Green, 2001). However, excessive and uncontrolled use will lead to increased resistance.

Conclusion

The most optimal dry period is still a matter of debate related to production efficiency and the health of the mother cattle. Until now, research is still being carried out on the dry period that is most optimal for milk production produced and the cows' health in the subsequent lactation.

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