Sjournals
Scientific Journals
Agricultural Advances (2015) 4(1) 1-6
ISSN 2251-7820
doi: 10.14196/aa.v4i1.1764

Contents lists available at Sjournals

Agricultural Advances

Journal homepage: www.Sjournals.com

Review article

Significance of parity, year-season and prolificacy in influencing goat milk production traits

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ARTICLE INFO

Article history,
Received 13 December 2014
Accepted 29 December 2014
Available online 27 January 2015

Keywords,
Goat
Milk production
Parity
Year-season
Prolificacy

ABSTRACT

Milk production traits in goats are affected by different non genetic factors and the knowledge of these factors is essential for efficient management and for accurate estimation of breeding values. Adjusting for the known non genetic factors is necessary to increase efficiency of animal selection in dairy goats. The discussion explores the significance of dam's parity, year-season and prolificacy in influencing milk production traits in goats. Much valuable research already exists on the influence of non genetic factors in dairy cattle; however, not much mention has been done pertaining to dairy goats. This is on the assumption that the spectrum of non genetic factors which affect milk production traits in goats are the same factors which influnce milk production traits in cattle. The understanding of different non genetic factors and their impacts is the first step in improving goat milk production, and prerequisite for defining appropriate management practices in the milk production process. Knowledge of non genetic factors is important in matching goat milk production to specific production system ensuring a sustainable level of milk production.

1. Introduction

Goat milk is considered to be the most complete and balanced food, and due to its exceptional quality, high nutritive value, easy digestibility and low allergenic potential, goat milk is recommended in the diets of children, adults and convalescents (Ribeiro and Ribeiro, 2001). The production of goat milk is influenced by many non genetic factors in various ratios. Therefore, quantifacation of the effects of non genetic factors which influence milk production traits is essential in development of appropriate general management programs, and to make suitable adjustments in the data to obtain precise estimates of genetic parameters which are needed for genetic evaluation of breeding animals. The role of different non genetic factors has been the subject of extensive number of studies in dairy cattle, in an attempt to improve cattle milk production; however less work has been directed towards goat milk production. There is a consesus that both genetic and non genetic factors will influence milk production and the role of goat milk producers is generally to take the end result of genetic improvement and manage animals in a manner to maximize expression of their genetic potential in milk production. The review alludes to the complexity of the non genetic influences on milk production traits. The present discussion is an attempt to explore the effect of some non -genetic factors affecting milk production traits.

2. Effect of dam's parity or lactation number on milk production traits

First parity goats had the lowest milk yield but the highest fat and protein percentages, while third parity goats had the highest milk yield (Peris et al., 1997). The significant increase of milk fat with increasing parity was in line with the findings of Ehoche, et al., (1990). Like the seasonal effect, parity had significant effect only on fat and lactose content of milk with third parity having the highest values (Addass et al., 2013). Zeng and Escobar (1995) observed that the greatest milk yield occurred with goats from the second lactation, which was explained by Knight and Peaker (1982), being attributed to the fact that older goats present greater udder volume than goats of first lactation, i.e., the proportion of mammary alveoli which are developed in previous lactations do not regress completely, but it is added to those developed in subsequent lactations, increasing secretory parenchyma. The increasing trend of milk production with increasing parity order may be result of better udder development and growth in size of the animal (Ishag et al., 2012). However, in contrary Večeřová and Křížek (1993b) found a decreasing trend of milk fat content by parity or lactation number. According to Zeng and Escobar (1995) the influence of parity on protein content was not observed. It was also emphasized that although the milk production of the temperate breed observed in their study was lower than that in its home country, the yield is still much higher than the milk production of the indigenous goat. (Browning et al., 1995; Pacheco et al., 1998; Antunac et al., 1998; Fernández, 2000; Antunac et al., 2001; Milerski and Mareš, 2001; Ciappesoni et al., 2002a), all the models found the parity was a source of variation of milk yield, while the first-lactation goats had the significantly lowest milk production per day. Kala and Prakash (1990) explained that the lowest percentages of constituents observed in the milk of goats from previous lactations are caused by the effect of dilution, i.e., goats produced more milk, directly reflecting on composition and decreasing their concentration in the milk. Proceeded to argue that overall, percentages of milk constituents were less influenced by environmental effects. This could have occurred because it is a fraction of two traits and the variations are small because of the scale. The milk yield increased progressively with the parity until the 3rd lactation and the differences in the highest laclation yields observed in different lactation orders could possibly be due to differences in age at first calving and dry period. When dams freshen at a later age they are nearer to maturity than when they drop young ones at an earlier age. On the other hand, the animals which have a long dry period during the first two calving intervals, also have a chance to reach their mature body weight and maximum size at an earlier lactation than the others. Accordingly, they reach their maximum productivity at earlier parities as obsrved in dairy cows (Mohsen et al., 1999). However, Krajinović et al., (2011) observed that the order of lactation was not a source of variation affecting the percentage of proteins in milk, whereas the total protein yield in lactations was influenced by the order of lactation due to the differences in average milk yield in lactations. This is in contrary to milk yield increasing until goats reached their third lactation; a diminution in milk yield was noted for goats in subsequent lactations. According to Brito et al., (2011) lactation order did not influence percentages of fat and total dry extract. Rodrigues et al. (2006), in a study with Saanen goats observed significant effect of lactation order on total milk yield and on percentages of fat, lactose and total solids. Indicating that only first parity goats exhibited a lower milk yield when total expressed milk was considered, but the lactation curve of these goats also demonstrated higher persistency (Peris et al., 1997). Salama et al.,

(2005) observed dramatic reduction in milk yield due to gravidity, and without kidding, lactation can be prolonged for 2 to 4 years. The authors also reported that milk production was the lowest in the first lactation, gradually increasing until the fourth, and sometimes until the sixth lactation, after which it declines. This implies that milk yield will increase with lactation order which may seem logical due to the increase in body weight combined with advancing age and to the full development of the sensory tissue of the udder.

3. Effect of year or season of kidding on milk production traits

The effect of year and season of kidding on milk yield traits was significant and this was due to the variability in climatic conditions, fluctuations in the availability of nutrients and flock composition over the years (Ishag et al., 2012). The increased milk production during winter might be to the lower ambient temperatures, availability of feeds and lower incidence of diseases, while the lower milk production during wet summer may have resulted from the stress of high temperature and humidity, prevalence of external and internal parasites and scarcity of feedstuffs. This was confirmed by Crepaldi et al. (2000) who observed that kidding season significantly affected the milk yield with goats kidding in the winter period (the interval from January to February) have higher milk production compared with the goats kidded in the spring (the interval from March to April) or in the summer (the interval from May to July). In another study the effect of year-season was a significant sorce of variation in milk production traits, which was attributed to variations of climate, food nutritional quality and composition of herd. It was postulated that food intake on rainy days or days with strong heat can be null (Quittet, 1978). Appleman and Delouche (1958) reported that goats presented maximal intake at 0° to 10°C, gradually decreasing as temperature increased up to 40°C. Several studies working with tropical native breeds and subtropical in their origin observed that year-season effect affected milk production (Singh et al., 1970; Prakash et al., 1971; Barhat and Chowdhary, 1978; Mavrogenis et al., 1984), in specialized goats in the United States (Alderson and Pollak, 1980) and native, exotic goats and their crossbreds, in a total of 16 genetic groupings in Mexico (Montaldo et al., 1981). The year effect on milk yield and composition was attributed to goats grazing natural pastures and because environmental conditions varied among years, affecting grass characteristics (Piergiovanni and Casassa, 1982). This was confirmed by Ray et al., (1992) that the decrease in milk production in summer may be due to an increase in temperature and less feed concentrates. The high milk yield in cold season from dams could be attributed to mild climatic conditions. Mostly this is period of abundant green fodder supply and the mothers which receive good management could be expected to respond well by expressing better production potentiality, while the decrease in their milk production, in hot period, may be due to the decrease in adequate good quality feeds and the high temperature (Mohsen, et al., 1999). Cool season presumably may experience the highest milk production assumed to be due to the better climatic conditions, where the amount of feed intake, concentrates and feed utilization are generally increased. Cenciarelli (1980), Midau et al, (2010) and Brown, et al., (1983) reported lower fat content of milk during dry season, this was during period of higher ambient temperature which complied with low feed intake. With a good management system the animals could be expected to respond well expressed by better production potentiality. Elsewhere, the effect of season on protein content of milk was not important, may be due to steady nutrition and management practices under which the animals were subjected to throughout the period of study which might have suppressed the effect of season on protein content of the goats milk (Addass et al., 2013). This was in agreement with the observation by Hardwick, et al., (1961) and Egbowon (2004) who reported higher and lower proportion of milk components in well-fed and under-fed goats.

4. The effect of prolificacy of dam on milk production traits

Prolificacy did not affect milk yield, although milk yield was always higher for goats that had given birth to twins than for goats that had given birth to a single kid in 210 d of lactation (Peris et al., 1997). Nevertheless, the goats that had given birth to a single kid exhibited higher persistency during lactation and neither total milk yield nor the lactation pattern was significantly affected by year of birth. Goats with twins tend to yield significantly higher amounts of milk than do goats with a single kid (Zygoyiannis and Katsaounis, 1986), however, in a study where the dam kept one kid as a maximum the differences in the suckling stimulus did not exist (Peris et al., 1997). Multiple kidding can increase the interval of posterior kidding by extending it due to stress of the goat, as to keep the pregnancy of one or more does. This implies that there is a greater mobilization of nutrients for gestation and lactation, making it necessary to have a greater period of recovery of the doe until the next conception.

Therefore, if the goat has not properly recovered, this can harm subsequent lactation (Galina et al. 1995). Krajinović et al., (2011) stated that birth type is correlated with the amount of produced milk meaning goats with more kids per litter produce more milk than goats with single-born kids. This phenomenon is accounted for by mechanical stimuli on the udders of goats with more kids and by the impact of genetics. Multiple kidding, goats receive the same stimulus (milking) and the effect of the type of kidding occurred more because of the differences during pregnancy than in lactation. The argument is that perhaps, because of this, it was not possible to verify the significant effect of the type of kidding on some milk constituents (Pimenta Filho et al. (2004). However, the impact of the litter size on milk yield was independent from the order of lactation, body weight of goats and the kidding season (Mioč and Pavić, 2002). Goats with more kids have longer lactation, and produce more milk and milk fat (Subires et al., 1988). Type of kidding did not influence fat yield and percentages of protein and lactose (Brito et al., 2011), in contrary, the influence of type of kidding, simple or multiple, on milk yield has previously been verified by some authors, explained by the presence of the hormone placental lactogen, progesterone and prolactin during gestation, which are mammary gland stimulants. However, their influence differ in quantity according to the type of gestation, simple or multiple and also they might affect milk production during lactation and simultaneous pregnancies (Sands and Mcdowell, 1978; Analla et al., 1995; Browning et al., 1995).

5. Final comment

The discussion concludes that there is a strong influence of parity, season-year and type of birth on milk production traits in goats. However, the influence of these factors on milk production traits are not independent of each other, but may overlap considerably with other factors not discussed here. Parity influence seems inescapable in goat milk production, it is real and comparatively important among the other sources of variation in goat milk production. This implies that milk yield will increase with lactation order which may seem logical due to the increase in body weight combined with advancing age and to the full development of the sensory tissue of the udder. Practical implications of quantifying non genetic factors in goat milk production is not only for dairy goat enterprise management decision making but also to minimize the adverse effects of factors that retard milk production. Therefore, there is need to adjust for parity, season-year and prolificacy for accurate genetic evaluation in dairy goat populations.

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