

Importance of body weight, age and body condition in weaning of goat kids: a review

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Abstract

Weaning management in commercial goat farming is an imperative potential welfare issue. The future of successful dairy goat farming is mainly depending on scientific methods of rearing of and doeling for replacement stock. Accelerate the breeding cycle and improve the milk production early weaning is adopted in commercial goat farms. However, at early age kids are prone to weaning stress and being separated from their mothers and are often artificially reared with a milk substitute. But early weaning is the successful key for increase total amount of milk available for marketing milk, decrease the kid mortality, reduce labor and feed cost, and increase the early rumen development in kids. A complete milk diet in kids significantly reduces rumen development and should be avoided and stimulate solid feed intake. Early rumen development is essential for weaning goat kids and using feedstuff not utilized by non-ruminant animals. Delay weaning is costly and can be harmful to the development of a functional reticulo-rumen. Our review provides importance of body weight, age and body condition in early weaning weaned and artificially reared of goat kids.

Keywords: Body weight; Goat kids; Nutrients; Stress; Weaning

Introduction

Weaning is a method that is tightly correlated to goat production economics. Understanding when and how to wean or knowing the weaning technique is critical components in properly weaning a young goat off milk also on solid diet (El-Raghi and Hashem, 2022). When a kid's birth weight reaches a predefined level, which often happens between 60 and 90 days after birth, it is time to wean them (Zhang et al., 2022). To achieve optimum productivity and profitability in goat farming, the majority of goat producers choose early weaning of goat kids (Gelasakis et al., 2017). The weaning of goat kids is also important when goats are raised in halal way in many parts of world (Salvana et al 2019). Weaning age young animals should therefore take the place of breeding stock whenever possible because doing so increases farm output and satisfies the objectives of the dairy sector, provided that the animal's ability to live and grow unharmed is provided (Ibrahim et al., 2022). Understanding rumen development is important because it affects later life digestion and absorption of necessary nutrients from solid diet. It has been discovered that the pre-weaning growth performance of goat babies is linearly connected with milk consumption (Palma-Hidalgo et al., 2021). The digestive system of a new infant differs from that of an adult goat. A kid has four stomachs, but because the digestive system is not fully formed at birth, it does not use all of them in the early years of life (Lei et al., 2018). Overfeeding by newly weaned kids on grains can result in indigestion and scours, both of which, in severe or persistent cases, can be deadly (Spaulding and Clay, 2011). While an excess consumption of concentrate will lower the rumen's pH and cause acidosis, which can immediately cause kids to consume less food, an excessive intake of fibre will encourage the growth of the rumen's epithelial lining, which is essential for future digestive health and function (Chai et al., 2021). Knowing the link between each kid's body weight and condition is necessary to make the best weaning options (Chalmers and Katzer, 2013).

Goat kids weaning process

When weaning a kid, preparation must be done gradually (Zobel et al., 2020). Goat babies should begin the process of weaning at an early age (Belanche et al., 2020). The weaning process, in addition to the kid's body weight and age, will play a big part in how capable it is to fight off disease and flourish well into adult. According to research by Caro-Patrovic et al., (2012), birth weight and weaning weight are correlated. Age at weaning is essential for the effectiveness of lamb early weaning (Chai et al., 2015). According to Vickery et al. (2022), there was a favourable correlation between solid feed consumption and reticulo-rumen weight in young goat kids. Additionally, it was discovered that the starting diet's dry grains encourage the rumen's fermentative digestion and the gut's enzymatic activities (Castillo-Lopez et al., 2022). Rumen papillae are induced to develop by organic acids, which are results of fermentative digestion (Dias et al., 2018). It was discovered that kid's pre-weaning growth was linearly connected with milk consumption (Rojo-Rubio et al., 2016). However, excessive milk feeding decreases the ability of nutrients to be digested, leads to scours and stomach disturbances, and is not cost-effective. For successful weaning of young kids and utilization of feed ingredients not used by non-ruminant animals, rapid rumen growth is essential. Additionally, it was noted that a diet high in milk should be avoided since it significantly slows rumen development (Gorka et al., 2011). To promote the ingestion of solid foods, milk feeding should be limited. In contrast to ad libitum feeding, limited feeding had a better efficiency of gain. For goat kids, gradual weaning has been determined to be the least stressful form of weaning (Vickery et al., 2022). Weaning shock is significantly likely to affect kids who are weaned before 70 days than those who are weaned after 70 days (Panzuti et al., 2018). Goat kids can be weaned at 9 kg of body weight (Nalbert et al., 2019). However, after 10 weeks, kids who were weaned at 7 kg were 1.2 kg lighter than those who were weaned at 8.5 and 10 kg. A few weeks before to weaning, the weaning pens should be ready. Introduce the baby to pen, and you might even let them stay there for a few days with their mother. After a few days, remove the mother from the enclosure and leave kids inside. All kids who are about to be weaned should have the recommended vaccinations and deworming. The practice of intensive management though costly is crucial for growth of kids in Indian conditions (Mandal et al 2022). When milk is given freely to kids, their growth rate can be enhanced, but the early development of a functioning rumen is postponed (Palma-Hidalgo et al., 2021). Therefore, a good weaning programme requires striking a compromise between maximal growth and the early establishment of a functioning rumen. They said that early weaning is feasible and cost-effective if solid meal consumption can be increased. Delaying weaning costs money and may be detrimental to the growth of a healthy reticulo-rumen. To encourage the formation of the upper rumen, kids must be exposed to hay and concentrate early in life (Palma-Hidalgo et al., 2021). Young kids will not absorb many nutrients from solid foods, but eating a tiny amount of these foods will encourage the development of the rumen. Later in life, the ability to digest and absorb vital nutrients from solid diet depends on a fully formed rumen (Govil et al., 2017). Without proper intake of solid feeds and rumen adaptation to solid feeds, the abrupt removal of milk can result in stunted development as well as a number of other health issues. After two weeks of age, give young kids

unrestricted access to solid food. Although the kid probably did not eat much, it is crucial to keep providing them with fresh solid food. Giving them a modest quantity of solid food each day and taking away any leftovers before giving them new, clean drinking water from birth can also encourage them to eat more solid food. However, excessive milk consumption in goat kid's decreases nutritional digestion, leads to scours and stomach problems, and is not cost-effective. Dry grains in the starting diet promote fermentative digestion in the rumen and intestinal enzyme activity (Govil et al., 2017). The rumen papilli in kids are stimulated to proliferate by organic acid, which is a byproduct of fermentative digestion (Michalak et al., 2021). The quick establishment of a functioning rumen is crucial for weaning goat calves and using feed ingredients that are not utilised by non-ruminant animals (Lei et al., 2018). In goat newborns, a complete milk diet significantly slows rumen development and should be avoided. Instead, milk consumption should be limited to promote the consumption of solid foods. When compared to ad-libitum feeding, regulated feeding was found to be more effective in helping goat kids gain weight (Panzuti et al., 2018). It was also proposed that limiting milk feeding promoted the intake of solid diet. Nutritional stress during weaning in goat babies has been linked to disruptions in behavioural and physiological responses, which in turn affect post-weaning growth performance in goat production (Nordquist et al., 2017). Weaning also has effect on reproduction in dam and medicinal plants have been tried for improving goat reproduction (Ogbuewu et al 2016).

Weaning as per body weight

Generally in goats the mortality of goat kids occurs in the period between birth to puberty (Rojo-Rubio et al., 2016). This stage is the most critical stress and some factor is very essential to maintain which are responsible prenatal and postnatal growths (Flowers, 2015). The prenatal growth is affected by parents genetic and nutrition, and postnatal growth is affected by birth weight, birth type, sex, litter size, age and milk production of mothers (Rojo-Rubio et al., 2016). Birth weight of kids has been reported in negative correlation with survival and positively correlated with subsequent weight gain (McGregor et al., 2016). However the weaning and post-weaning weight gains can be affected by sex (Mustefa et al., 2019). According to Vuchkov (2020) male kids gain a heavier body weight than female kids with about 8.1% (20 versus 18.13 kg for male and female kids, respectively). Similar results were reported by Rojo-Rubio et al. (2016) who found significant differences due to sex of kids, where male kids were higher (16.5 kg) than female kids (12.4 kg). On the other hand, the average birth weight of male kids was higher than female kids (2.34: 2.27 kg), although the differences were not significant female kids (2.34 : 2.27 kg), although the differences were not significant (Mioc et al., 2011). It is also observed that the weight gain pre-and post-weaning is higher in single births kids compare to multiple births (Belay et al., 2014). The research determined the significantly higher average birth weight of single kids (2.50 kg) in comparison to twin kids (1.93 kg) (Mioc et al., 2011). A better measure for weaning a kid is when it weighs at least 2 to 2.5 times its birth weight and is eating a significant amount of dry food. It may help to gradually reduce the amount of milk replacer being offered as you approach the designated weaning date. According to Tesema et al. (2017) birth weight at one month, two month, three month weight and pre weaning growth rate of kids were 2.6±0.02 kg, 5.75±0.07 kg, 8.06±0.11kg, 9.63 kg and 77.4±1.6 g/day respectively. Pre weaning live weight and growth rate of kids was significantly influenced by non genetic factors such as birth type, sex, birth weight, season, year, and age of dam (Assan et al., 2020).

Weaning as per age of kids

Weaning at early age

It is a universal concept that newborn goat kids are not ruminants (Lv et al., 2019). A goat kid's stomach must depend on milk or milk substitutes for crucial nutrients for the first 7 to 14 days of life since it is underdeveloped (Abecia et al., 2017). The rumen and reticulum start to grow as soon as the baby starts eating dry foods like hay or concentrates (Govil et al., 2017). Kids continue growing and develop a microbial population. Pre-weaning management is intended to make sure that goat kids are ruminants, as they must be fully functional ruminants before they are weaned. According to Caro-Patrovic et al., (2012), a kid's weight at the time of weaning is more significant than age. According to Hassan (2017), weaning Ossimi sheep lambs at 56 days will result in greater LBW, higher TWG, and higher ADG. A young at 4 weeks can be used to wean goat kids. Weaning shock was shown to be more severe in kids weaned at 8 and 10 weeks of age, while body weight losses were seen in those weaned at 4 and 6 weeks (Yanez-Ruiz et al., 2019), who also suggested that weaning at 8 weeks was optimal. The growth of kids weaned at 4 weeks was stunted for three straight weeks, whereas kids weaned at 6 weeks was stunted for two weeks before recovery. Early weaning of kids was supported by Rangaswamy et al. (2014). According to research, the best time to wean is not a specific day but rather a weight. It has been shown that goat kids undergoing weaning may have weight loss in the days immediately after their separation from their mother's milk. Monitoring the weight of kids and ensure they are consuming solid food and not losing too much body weight.

Weaning at late age

The weaning shock is less harsh with later the weaning age (Belanche et al., 2020). Economic conditions and management techniques will often affect the weaning weight. By limiting the amount fed and the number of feeds each day, weaning can occur either early or late with milk withdrawal (Belanger-Naud and Vasseur, 2021). When kids are weaned, whether early or later, they must be eating high-quality solid food. A minimum of 180 gm of crude protein (18%) and 11 MJ of metabolic energy per kg of dry matter, together with the appropriate amounts of minerals and vitamins, should be included in the diet (Hart and Delaney, 2011). High grade roughage may be included in the diet to aid rumen growth (Htoo et al., 2018). Water that is both clean and fresh should always be available to kids. Weaning age for sheep was recommended to be 75-90 days after birth by Abdel-Fattah et al. (2013). The choice of weaning age, however, depends on the circumstances around production. A normal practice for goat production has been to wean goat kids between 60 and 90 days after birth. Live weight and average daily increase under early and late weaning ages are significantly influenced by gender (Abdel-Fattah et al., 2013). In the long-term, late weaning will have a negative impact on the dam's proactive life because it will encourage the ewes or does to have longer lactation periods (Peugnet et al., 2017). On the other hand, delaying the weaning of goat babies is an expensive technique that has an impact on daily reticulo-rumen development because it delays the stimulation of solid feed (Assan, 2020). Early weaning may cause weaning shock, which will cause weight gain to slow for seven to ten days (Vickery et al., 2022). Therefore, it's crucial to get kids ready for weaning by introducing a proper creep feed gradually starting at three weeks old (Starbard, 2005). According to Amjad et al., (2021), early weaning has a negative impact on a buck's body weight, testicular development, sexual behaviour, and the start of puberty as compared to late or standard weaning. Starting early will help youngsters get ready for weaning (Zobel et al., 2020). To encourage healthy rumen growth in kids, hay and concentration must be offered to them at a young age (Belanche et al., 2020). Young kids cannot digest many nutrients from solid foods, but eating a small bit of these foods will encourage the development of the rumen. Later in life, the ability to digest nutrients from solid diet depends on the development of the rumen (Bach, 2011). Without proper solid feed intake and rumen adaption to solid feed, suddenly halting milk can cause development to slow down as well as a variety of different health issues (Fischer et al., 2019).

Weaning as per body condition

Body condition score (BCS) is one of the tools goat farmers can use to achieve proper management of body reserves (Ghosh et al., 2019). Nutritional requirements decrease after weaning in goats being raised for meat and in approximately the third month of lactation in dairy goats, and this is the time for body reserves to be replenished, resulting in weight gain and an increase in the BCS (Mendizabal et al., 2011). Body Condition Score (BCS) is subjected to quantify the degree of fatness or condition of the live animal. BCS is the best simple indicator of body fat reserves which can be used by the animal itself in the periods of high energy demands, various stresses or under nutrition condition, and thus widely accepted indicator of post nutritional status. BCS is used for evaluating the adequacy of previous feed supply, determining the future feed requirements, assessing the health status of individual animals, establishing the condition of animals during routine animal management and welfare inspections and in meat production systems (Ghosh et al., 2019). BCS of doe affects the parent's ability to give birth to the litter size. Litter size and birth weight of kid have important economic significance, useful to evaluate the mothering ability of doe (Susilorini et al., 2018). Based on Haldar et al. (2014) there was a strong, positive relationship between litter size and various body linear type traits. The high variability of birth weight, birth type and pre-weaning survivability presents an opportunity for genetic improvement of these traits in goat. Pre-weaning survivability is the most important trait amendable for genetic improvement as it had the highest coefficient of variation (Hagan et al., 2014). Birth weight is one of the factors that can be used to predict growth and weight in adulthood, high birth weight of a young goat will grow faster than children who have low birth weight, because goats that have high birth weight has more food reserves, so the opportunity to grow and live is also great. According to Jalilian and Moeini (2013) BCS = 3 had a significant effect on the kg lambs born per ewes. Ewes with BCS = 3 had a better performance in the percentage of lambs born per ewes at mating, while the lambing rate reduced in ewes with BCS of 3.5 or more. Jalilian and Moeini (2013) founded that birth weight of lambs was significantly affected by BCS of their ewes. Selected reproduction criteria fertility (percentage of kidding goats), prolificacy or litter size and fertilization date (deducted from kidding date) were affected by different BCS in ewes (Jalilian and Moeini, 2012). The overall effect of doe's BCS on mean kid weaning weight was not significant, but kid weaning weight was elevated to approximately 3.5 kg in dams with BCS of 3.5 following dam body weight increases, kids born per joined does and body weight of kids born at birth increased (Okere et al., 2022). The kids born/does at mating and kilograms kids born in does with BCS = 3 were significantly more than those in other BCS groups. Kids born per joined does in

dams with BCS = 3 and 3.5 were 140 vs. 105% (Okere et al., 2022). The single and twin male goat kids of the BCS3 group reached slaughter weight (15.16 ± 0.08 and 14.15 ± 0.51 kg, respectively) at 50 days of age (50 days), whereas male kids from the BCS2 group did not reach slaughter weight in an equivalent timeframe. Furthermore, the single and twin female goat kids born from BCS3 group between 50 and 90 days of age doubled in weight compared to those born from the BCS2 group (Okere et al., 2022). The result indicated that BCS = 3.0 had a significant effect on the kilogram kids born per goat. Similarly, Jalilian and Moeini (2012) found that the kilogram kids born in mated Merghoze goats with the BCS of 3.0 were significantly higher than other groups. Results highlight the need for supplementation management strategies to increase does' BCS during gestation and lactation in order to improve kids' BW, reduce kid mortality and to ensure target slaughter weights are achieved before 2 months of age. Developing early supplementation strategies in the last stage of lactation before weaning and in the rearing period post-weaning may increase survival and anticipate the reproductive age of female kids.

Conclusion

This review highlights a need for more research to improved goat kid welfare. Kid safety, health, environmental enrichment and gradual weaning strategies should be a priority for future research. Goat farmers need further information on enrichment in order to be persuaded that safe enrichment with clear benefits can be provided to young goat kids. Our studies on weaning methods for goat kids suggest that kids can be weaned earlier than the traditional weaning age of 3 months. If solid feed intake can be stimulated, early weaning is possible as well as economical. Delayed weaning is costly and can be harmful to the development of a functional reticulo-rumen.

Conflict of interest- Authors declare that there are no conflicts of interests.

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