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Effect of lambing season, sex, parity, and litter size on growth performance in lambs—a review

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Abstract

Poor pre-weaning and post-weaning mortality in lambs is common in communal sheep productions due to the use of extensive management practices. Communal sheep producers often lack the resources to address poor performance issues associated with extensive production systems. Non-genetic factors present a potential tool for communal farmers to identify animals prone to poor performance in advance. By using these factors as indicators, farmers can prioritise limited feed additives for lambs at higher risk of poor performance. Key non-genetic factors such as lambing season, sex, parity, and litter size can help identify lamb groups prone to mortality. However, these factors have contrasting effects on pre-weaning and post-weaning lamb performance. Therefore, there is a need to summarise the individual effects of non-genetic factors on lamb performance for the identification of their current trends. Thus, the objective of this review was to assess the effect of lambing season, sex, parity, and litter size mainly on birthweight (0 d BW), weaning weight (90 d BW), and post-weaning weight (180 d BW), as well as pre-weaning (0-90 d BW) and post-weaning (90-180 d BW) average daily gains (ADGs) in lambs.

1. Introduction

Sheep production is one of the most cost-effective sources of animal proteins for human consumption due to the low requirements for its production inputs. Sheep provide mutton, offal, and wool, which serve as vital sources of income and food security for communal sheep producers. Furthermore, the requirement of fewer production inputs makes sheep production compatible with extensive production systems and suitable for communal sheep producers (Marufa et al. 2017). However, the disadvantage of an extensive sheep production system is its association with reduced growth performance, including lower birthweight (0 d BW), weaning weight (90 d BW), post-weaning weight (180 d BW), and average daily gain (ADG) of the sheep flock (Mseleku et al. 2020). Climate change further exacerbates these challenges by increasing disease risks and reducing pasture quality, potentially raising mortality rates (Visser 2025). To mitigate these issues, communal producers often rely on protein supplements, disease treatments, and antibiotics to enhance lamb growth.

As a result, there is a need for feed additives to combat pre- and post-weaning lamb mortality, primarily caused by malnutrition and scours, which is the main constraint in extensive sheep production (Hadgu et al. 2021). However, due to financial constraints, farmers must prioritize high-risk lambs (those with poor 0 d BW, 90 d BW, 180 d BW, or low ADG) for conventional supplementation and this is why farmers opt for non-conventional interventions (Mhlongo et al. 2024a). Efficient feed use not only reduces costs but also minimizes environmental impact, aligning with the United Nations' sustainable consumption and production goals by limiting waste and antimicrobial resistance (Rialch et al. 2013; Pedersen 2018).

Therefore, this necessitates investigating non-genetic factors for monitoring lambs at risk for early mortality. It will help identify lambs requiring veterinary and nutritional interventions in advance to lower lamb mortalities. This approach will ensure lower production costs in a more environmentally friendly manner. Non-genetic factors such as parity, sex, birth type, and lambing season affect the growth performance of lambs during the pre-weaning and post-weaning phases (Tesema et al. 2017) and can be used as detection tools for lambs at risk. However, there is a lack of understanding of how these above mentioned non-genetic factors affect the growth performance of lambs. The scarcity of this information limits their use as useful tools to optimize lamb growth performance (Zergaw et al. 2016). This is because current studies on this subject have reported varying results of how growth performance responds to the above-mentioned non-genetic factors. Hence, there is a need to summarize the results from previous studies to establish growth performance response *vis-a-vis* the above-mentioned non-genetic factors. Therefore, the objective of this review was to assess the effect of lambing season, sex, parity, and litter size on the growth performance of lambs.

2. Seasonal effect on pre- and post-weaning lamb growth performance

2.1 Effect of lambing season on pre-weaning and post-weaning body weight

The lambing season has shown a variable impact on birth weight (0 d BW), weaning weight (90 d BW), and postweaning weight (180 d BW) in lambs across different studies. Some studies indicate that 0 d BW is higher in summer and lower in winter, spring, and autumn, whereas the weaning weight was highest in spring and then revealed a decreasing trend from summer to winter through autumn (Mellado et al. 2016). However, contrasting findings show that winter-born lambs have higher 0 d BW than summer-born lambs, with no significant seasonal effects on 90 d BW and 180 d BW (Albial et al. 2014). Similarly, sheep in a communal grazing system revealed higher summer and winter 90 d BW and 180 d BW, while 0 d BW was higher in winter-born lambs than in summer lambs (Abebe et al. 2020). Pre-weaning and post-weaning weight responses to seasons may change because of factors like 0 d BW, disease prevalence (e.g. gastrointestinal nematodes), and feed quality during each lambing season. Seasonal effects are more pronounced during the pre-weaning phase than post-weaning. Lambs grazing on natural pastures with supplemental concentrates had higher 90 d BW in winter but greater 0 d BW and 180 d BW during wet seasons (Hagan et al. 2022).

The survival of lambs to weaning has a strong positive correlation with 0 d BW and the lambs with ideal birth weight often obtain ideal 180 d BW in a particular lambing season (Dixit et al. 2001). The winter-born lambs exhibited higher 0 d BW and 90 d BW compared to spring-born lambs (Behrem 2021). On the higher hand, higher 0 d BW and 90 d BW was observed in spring and summer seasons because of good feed quality, though this period corresponds to high disease frequency, particularly for gastrointestinal nematodes (Legesse and Alemayehu 2024; Mhlongo et al. 2024b). The use of deworming agents in summer-born lambs to reduce worm burden improves lamb growth performance. This was substantiated by the fact that 0 d BW, 90 d BW, and 180 d BW were the same in dewormed winter-born and summer-born lambs reared under communal grazing system (Taye et al. 2010). In another study, 0 d BW was higher in lambs born in the rainy season than in winter while 120 day weaning weight was higher in summer-born lambs compared to winter-born lambs (Teklebrhan et al. 2014).

Despite poor forage quality, the winter-born lambs may show better growth performance due to less gastrointestinal nematode infections. Improved winter lamb growth performance can be achieved by giving lambs extra feed during the winter. The 0 d BW, 90 d BW, and 180 d BW were larger in winter compared to spring in lambs fed indoors during winter and grazing spring pasture in the latter (Yilmaz et al. 2007). In lambs fed concentrates, the weaning weight at 60 days of age and post-weaning weight at 120 days of age were higher in winter than in spring, although their 0 d BW remained constant between lambing seasons (Norouzian 2015). However, early weaning should be practiced in flocks of higher 0 d BW in addition to adult and young flocks being given supplementary feeds in winter (Mustefa et al. 2019). Additionally, to boost performance in lambs born during both seasons, delayed weaning beyond 90 d BW is a viable option for flocks with poor birthweights.

2.2 Effect of lambing season on the pre- and post-weaning average daily gain

The lambing season significantly influences pre-weaning average daily gain (ADG), with winter often showing superior growth rates compared to other seasons. The ADG post-weaning (90-180 d BW) was not impacted by the lambing season, but the preweaning average ADG (0-90 d BW) was shown to be greater in the winter and lower in the spring (Yilmaz et al. 2007; Behrem 2021). On similar lines, the post-weaning ADG (60-120 d) was not influenced by season, although pre-weaning ADG (0-60 d BW) was higher in winter than in spring (Norouzian 2015). This may be because farmers typically feed concentrates to lambs during the winter. Feeding concentrate indoors may result in more weight gain than feeding outside because the animals use less energy for activity. Further studies have revealed that winter-weaned lambs occasionally outperform summer-weaned lambs in post-weaning ADG, possibly due to residual benefits from indoor winter nutrition (Taye et al. 2010; Gemiyo et al. 2014). However, better ADG can be achieved in spring when worm burden is high and forage quality is good, by incorporating deworming routines. Hence, seasonal effects may be completely eliminated if lambs are treated for endoparasites during rainy seasons and the good quality of indoor feeding guarantees that the weaners function better after weaning (Taye et al. 2010; Abate et al. 2020).

2.3 Strategy to combat the negative seasonal effect on lamb performance in lambs

The differences observed in the pre- and post-weaning body weights of lambs may be due to effect of lambing season on pasture quality. Pasture quality varies with seasons, influencing the body condition score of ewes, which in turn affects growth performance of lambs. Ewes lambing in autumn season generally exhibit higher body condition score compared to those lambing in winter (Esmailizadeh et al. 2009). Seasonal changes in ewe body condition score can negatively affect lamb performance by reducing colostrum intake and weaning weight. Specifically, ewes with body condition score either below or above three tend to produce less colostrum and have lambs with lower weaning weights (Jalilian and Moeini 2013). This is because the ewes in poor body condition postpartum typically have lower body weight (Cam et al. 2018). Poor body condition score results in poor lamb survival and disease resistance due to limited milk production. The body condition score deterioration can occur when the lambing season coincides with poor pasture quality, such as in winter (Mir et al. 2020). Therefore, supplementation programs are needed to prevent body condition score from being negatively affected during nutritionally challenging lambing seasons. Supplementation has been shown to increase body weight and body condition score in grazing lambs (Fernandes et al. 2012). Additionally, ensuring that lambs born in summer are dewormed can improve both pre- and post-weaning body weights in communal sheep production systems. It has been shown that deworming lambs increases weaning weight due to enhanced feed intake (O'Brien et al. 2024), which subsequently improves growth and average daily gains.

The negative effects of lambing season on pre- and post-weaning ADG can be overcome through practices such as creep feeding, enhanced nutrition during gestation and lactation, and housing pre-weaners in communal sheep productions. There is a need to feed pre-weaners a quality creep feed *ad libitum* during seasons with poor forage availability as a supplement to milk consumption to improve the pre- and post-weaning ADGs. It has been shown that providing lambs quality creep feed of high protein content and fibre quality increases the pre- and postweaning ADG (Htoo et al. 2015), *ad libitum* access to such feeds benefits lambs regardless of sex (Mushi et al. 2008). Additionally, communal farmers can further negate the effects of lambing season on lamb ADG by providing pregnant ewes with diets that meet the nutritional requirements of both ewes and fetuses to optimize birth weight (0 d BW), thereby improving subsequent ADG. It has been shown that supplementing pregnant ewes at 0.4% of their body weight decreased lamb mortality rate and increased weaning rate (Campos et al. 2022). The improvement by supplementation of ewes could be due to an increment in milk production which results in higher bodyweight gain in lambs. Moreover, the strategy of housing pre-weaners in extensive sheep production system may help reduce nutrient deficiencies to fight diseases. For instance, it has been shown that intensive sheep production has been associated with lower ADG due to poor dry matter intake and digestibility compared to the extensive production system (Karthik et al. 2021).

3. Sex effect on pre- and post-weaning lamb growth performance

3.1 Effect of sex on birth, pre-weaning and post-weaning body weight

Males naturally weigh more at birth than females and also tend to grow more rapidly. To ensure the sheep flocks with consistent weaning weights, this is a need of sex-specific feeding strategies. Studies have shown that males had higher 0 d BW and 90 d BW than females (Yilmaz et al. 2007; Bela and Haile 2009; Abegaz et al. 2011; Idris et al. 2011; Boujenane 2012; Ustuner and Ogan 2013; Behrem 2021; Habtegiorgis et al. 2022; Legesse and Alemayehu 2024). To lower lamb mortality, methods for optimizing female pre-weaning and post-weaning weights must be developed. Some studies revealed that males may have the same pre-weaning weight as females, but post-weaning weights may be higher in males than females (Benyi et al. 2006; Norouzian 2015). Even after the competition for resources during gestation, twins or triplets of different sexes may be able to achieve equivalent 0 d BW regardless of sex, with sex-related growth differences emerging only later (Mustefa et al. 2019). Contrastingly, other studies have reported that weaning weight (Asmare et al. 2021) and post-weaning weight (Dixit et al. 2001) are not unaffected by sex, although differences in pre-weaning weights are observed. In certain findings, 180 d BW was the same for both sexes, even when 0 d BW and 90 d BW were higher in males (Taye et al. 2010; Abebe et al. 2023). Sex-specific growth differences in flocks are due to less farmer intervention during the weaning and post-weaning phases, particularly in flocks that have been raised extensively. Thus, during the weaning and post-weaning phases, flocks with body weights unaffected by sex are crucial.

Selecting breeds of sheep whose growth performance is less influenced by sex, such as Bonga or Djallonké-Sahelian sheep, can enhance both pre- and post-weaning bodyweights (Hagan et al. 2022). This approach is especially beneficial for resource-limited farmers who cannot afford sex-specific feeding programs to improve twin-female weights. In Djallonké-Sahelian and Bonga sheep, 0 d BW, 90 d BW, and 180 d BW were similar across sexes (Hagan et al. 2022; Abate et al. 2020). Farmers are encouraged to select breeds with superior female performance and to crossbreed them with those exhibiting better male growth traits. Finally, the absence of sex influence on birth weight may also help in preventing dystocia. Since the presence of a sex effect on 0 d BW (Gemiyo et al. 2014) has been associated with birthing difficulties, minimizing such differences could reduce the risk of complications during lambing.

3.2 Effect of sex on the pre-weaning and post-weaning average daily gain

The average daily gain (ADG) of male lambs is often higher than that of females (Chniter et al. 2011). Males generally tend to have a higher pre-weaning ADG (0-90 d BW) than females (Yilmaz et al. 2007; Taye et al. 2010; Idris et al. 2011; Rosov and Gootwine 2013; Abate et al. 2020; Behrem 2021). Furthermore, it has been demonstrated that males also have a higher post-weaning ADG of 90–180 d BW than females (Chniter et al. 2011; Idris et al. 2011; Gemiyo et al. 2014; Mustefa et al. 2019; Behrem 2021). This compels farmers, particularly in communal production systems, to ensure that female lambs are born at the ideal birth weights to prevent mortalities, especially in cases of multiple births. The trend of better ADG in males than females correlates with their superior pre-weaning and post-weaning body weights compared to females. However, contrastingly, in another study it has been shown that female lambs of Djallonke x Sahelian crossbreeds exhibited higher ADG than males during both the pre-weaning and post-weaning phases (Benyi et al. 2006). This demonstrates that certain breeds have superior feed efficiency compared to others. Therefore, it is important for sheep producers to consider crossbreeding strategies that incorporate breeds with high ADG in both sexes to improve flock uniformity. Furthermore, there are some reports that have shown that sex has no effect on the pre-weaning (0-90 d BW) (Talore et al. 2015) and post-weaning ADG of lambs (Yilmaz et al. 2007; Taye et al. 2010; Talore et al. 2015; Abate et al. 2020). To achieve minimal differences in ADG between sexes, it is important to feed pregnant ewes high-quality gestation diets, especially in multiple births.

3.3 Strategies to combat the negative sex effect on lamb performance

To control the negative effects of sex on the pre- and post-weaning body weights and ADGs in lambs, communal farmers should ensure sex-specific feeding of primiparous females, castrate undesirable males and adopt parity-specific feeding strategies. Firstly, there is a need for sex-specific feeding regime for primiparous females, as ewes with higher parities have lambs of higher birth weight (Han et al. 2023). Consequently, the higher birth weight of lambs from multiparous ewes may reduce the negative effects of sex on body weight of lambs. Thus, lambs from primiparous ewes need to be fed well to boost their body weights and support optimal growth. In addition, ewes with higher litter size of more uniform birth weights could mask the sex effect. So, communal sheep producers need to ensure that female lambs from primiparous ewes are grouped and fed nutrient-dense diets in seclusion to promote optimal growth, regardless of sex. Furthermore, communal farmers should practice castration of males with undesirable characteristics, which not only increases the female to male ratio but also reduces the negative effects of the sex on pre- and post-weaning body weight in lambs. Castration potentially reduces feed competition and uneven feed intake among female and male lambs, as it has been shown that wethers have lower feed intake and body weight compared to intact rams (Claffey et al. 2018).

4. Parity effect on the pre- and post-weaning lamb growth performance

4.1 Effect of parity on birth, pre-weaning and post-weaning bodyweight

The effects of parity on pre-weaning performance of lambs is generally inconsistent (Abegaz et al. 2011). There are the reports of declining 90 d BW as parity increased up to three parities with no significant effects on the 0 d BW, 180 d BW of lambs (Gemiyo et al. 2014) and 90 d BW (Taye et al. 2010; Mustefa et al. 2019; Abebe et al. 2020; Asmare et al. 2021).

Compared to maiden ewes, ewes with greater parities typically have superior mothering skills and are more capable of caring for their young. Higher parity ewes tend to be better able to support lamb growth due to their more experience and higher milk production. This is why 90 d BW declines from first to second parity and its rise in the third parity (Hagan et al. 2022). This shows that lamb performance may improve after an ewe has undergone multiple parities. Sometimes parity increment decreases lamb growth performance due to poor teat health which may necessitate the use of milk replacers as the parity increases in ewes. For instance, 0 d BW and 90 d BW increased from the first to the second parity, they declined by the third parity (Abate et al. 2020). Finally, in some cases, parity has been shown to increase pre-weaning growth performance of lambs without significantly affecting their post-weaning performance (Bela and Haile 2009; Legesse and Alemayehu 2024). For instance, 0 d BW increased from first to third parity, while parity had no effect on 90 d BW or 150 d BW or 120 d BW (Idris et al. 2011; Gemiyo et al. 2014). This may be because weaners rely solely on the solid feed and nutritional quality provided during the weaning and post-weaning periods, thereby minimizing maternal effect.

4.2 Effect of parity on the average daily gain

It has been shown that ADG from 0-90 d BW and 90-180 d BW is not affected by parity (1-3) (Taye et al. 2010; Mustefa et al. 2019; Abate et al. 2020) This shows that, in a production system, the incorporation of feed supplements can mask the negative effects of parity on the ADG. However, despite these management interventions, the ADG has been observed to decrease, particularly between the first and second parity (Talore et al. 2015). This may be due to the stress associated with maiden lactation, which can negatively affect ewes in their second parity, leading to reduced milk production. However, some studies reported that pre-weaning and post-weaning ADG increase with an increase in parity (Lamesegn et al. 2018; Hagan et al. 2022). This could be attributed to better management practices, such as proper flushing of maiden ewes before breeding, avoidance of mating with oversized rams, and preventing overfeeding during gestation, all of which help with reducing dystocia risk. Consequently, these interventions lead to early return of ewes to oestrus and reduced physiological stress, thereby enhancing milk production in subsequent lactations. Higher milk production would lead to increased ADG among lambs. In addition, it has been shown that ADG and parity are positively correlated when the pre-weaning period extends beyond 90 days. For instance, ADG for 0-150 d BW and 150-240 d BW increased with increasing parity (1-3) (Benyi et al. 2006). Hence, delaying the weaning age may allow lambs sufficient time to improve their ADGs by affording them more time for nursing and consuming solids. However, delaying weaning age may decrease the recovery time for the ewe, leading to poor subsequent lactation cycle. Poor lactation in turn is bound to negatively affect the ADG of the next generation of lambs. Hence, there is a need for adequate lactation nutrition to support both ewe recovery and lamb performance.

4.3 Strategies to control the negative effect of parity on lamb performance

Communal sheep farmers can control the negative impact of parity on pre- and post-weaning weight and ADGs in lambs by using parity-specific feeding, artificially rearing lambs from high-litter-sized births, flushing first-time mothers, increasing weaning age, and practicing weaning by weight. These strategies emphasize the importance of providing extra care to first- and second-time mothers to improve the growth performance of their lambs. This is because milk production increases with increasing parity (Adegoke et al. 2016). Therefore, lambs born to low-parity ewes are more likely to experience poor pre- and post-weaning growth performance, resulting in inconsistent performance outcomes. Therefore, communal farmers need to practice natural rearing of lambs from low-parity ewes rather than artificial rearing. Natural rearing has been shown to produce better daily and weekly body weight gains compared to artificial rearing (Simitzis et al. 2024). Owing to low milk production in first-time mothers, communal farmers can foster lambs from low-parity ewes to high-parity ewes to ensure access to adequate milk. Fostered lambs have shown higher weaning weights and survival rates compared to non-fostered triplet lambs (Notter et al. 2018). In addition, communal farmers can practice late weaning and weaning by weight for lambs born to ewes with limited mothering experience. Late weaning reduces the mortality rate and increases weight gain in lambs (Hashem et al. 2013). Thus, late weaning of lambs from low parity number or low mothering experience ewes may enhance pre- and post-weaning lamb growth performance. Furthermore, communal farmers need to wean by weight to ensure high weaner survivability (Hatcher et al. 2008), as low-parity ewes are likely to produce lighter weaners that are susceptible to mortality.

5. Litter size effect on the pre- and post-weaning lamb growth performance

5.1 Effect of litter size on birth, preweaning and postweaning weight

Some results demonstrate that 0 d BW, 90 d BW, and 180 d BW are not affected by litter size (Taye et al. 2010; Abebe et al. 2020). However, other studies demonstrated that the birth weight (0 d BW), weaning weight (90 d BW) and post-weaning weight (180 d BW) decrease with an increase in litter size (1-3) (Bela and Haile 2009; Chniter et al. 2011; Idris et al. 2011; Ustuner and Ogan 2013; Gemiyo et al. 2014; Talore et al. 2015; Mustefa et al. 2019; Asmare et al. 2021; Habtegiorgis et al. 2022; Legesse and Alemayehu 2024). This is expected because ewes only have two teats, which at most can nurse twins at one time. Even twin lambs compete for milk and often bully each other for the teat. With triplets, this competition becomes even more intense, leading to uneven milk intake, non-uniform body weights among the offspring, and an increased risk of mortality, especially for the weakest lamb. However, on the other hand, a number of studies have found when litter size increases (1-3), the birth weight (0 d BW), weaning weight (90 d BW), and 180 d BW generally decrease (Talore et al. 2015) which aligns with expectations based on milk availability.

To maximize the survival of lambs, it is crucial to minimize the negative impact of litter size on the weaning weight. For example, one study reported that 90 d BW was unaffected by litter size (Abegaz et al. 2011), while 0 d BW decreased as litter size increased (Rosov and Gootwine 2013). One effective management strategy to reduce the adverse effects of litter size on 90 d BW is fostering additional offspring to ewes that have lost their own offspring or have only a single lamb. This can help balance milk availability across lambs. Moreover, parity has also been shown to negatively affect both 0 d BW and 90 d BW (Behrem 2021), highlighting the importance of managing both litter size and ewe parity to optimize lamb growth and survival.

5.2 Effect of litter size on the pre-weaning and post-weaning average daily gain

It has been noted that the increase in litter size generally decreases the pre-weaning ADGs. However, a contrasting observation has been reported in a particular study where ADG of 0-90 d BW increases with an increase in litter size (Taye et al. 2010), which has been attributed to deworming of animals, supplementary feeding, and vaccination against pasteurellosis, blackleg, and anthrax. Such intervention likely mitigates the negative effects of the litter size on ADG, whereas lack of such interventions results in a decline of ADG of 0-60 d BW with increasing litter size (Chniter et al. 2011). Similarly, post-weaning ADGs have also been negatively associated with increased litter size. For example, the ADG of 90-180 d BW decreased with an increase in litter size from one to two (Yilmaz et al. 2007). In some studies, litter size negatively affected pre- and post-weaning ADGs simultaneously (Benyi et al. 2006). This was evidenced by a decline in ADG of 0-90 d BW (pre-weaning) and 90-365 d BW (post-weaning) with an increase in litter size from one to two (Dixit et al. 2001). Additionally, while ADG can increase from the first to the second parity, it often decreases in parities beyond two (Hagan et al. 2022). This trend was observed in ADG measurements from 0–150 d BW and 150–240 d BW, both of which decreased with increasing litter size (Benyi et al. 2006). This may suggest that mammary gland issues, such as mastitis, become more severe beyond the third parity, leading to reduced milk production, particularly problematic when litter size is high. Moreover, some studies have reported no effect of litter size on the pre-weaning ADGs (Yilmaz et al. 2007; Taye et al. 2010; Talore et al. 2015; Mustefa et al. 2019). However, litter size has demonstrated a negative effect on the post-weaning ADG (Behrem 2021), with the ADG of 90-365 d BW decreasing with an increase in litter size from one to two (Dixit et al. 2001). This variability may be due, in part, to management practices such as accelerated lambing, which often involves artificial rearing. These practices can reduce or eliminate the influence of litter size on ADG by standardizing nutrition and care, thereby masking the natural effects associated with higher litter sizes.

5.3 Strategies to control the negative effect of litter size on lamb performance

The results show that higher litter sizes are likely to reduce the lamb birth weight, weaning weight, and survivability. Therefore, there is a need for communal sheep producers to use colostrum replacers, as ewes with high litter sizes may not produce sufficient colostrum for all their twins or triplets. It has been found that colostrum substitutes have the same positive effect on lamb growth performance as natural colostrum (Belanche et al. 2019). This is especially important because ewes only have two teats to nurse lambs, and when litter size exceeds two, it becomes difficult to meet the nutrient requirements of both the ewe and the additional lambs, particularly in communal systems with limited feed resources. Communal sheep farmers could tether ewes with twins or triplets in specific grazing areas to support better ewe performance, as tethering has been shown to increase organic matter and crude protein digestibility (Patra et al. 2008). Tethering could increase ewe milk yield for twins or triplets nursing and improve creep feed quality for development of lambs' rumen during the pre-weaning period. Lastly, communal farmers can mitigate the negative effects of litter size on the pre- and post-weaning lamb performance by adopting cultivated pastures such as ryegrass, which offer higher nutritional quality compared to natural pastures. However, the lack of annual ryegrass planting and poor pasture management often limit communal farmers' ability to utilize these feed-resources (Moyo and Ravhuhali 2023), reducing their capacity to offset non-genetic factors such as litter size that negatively affect lamb performance.

6. Conclusion

This review found that lambing season, sex, parity, and litter size affect the pre-weaning and post-weaning body weights in lambs. Additionally, current research demonstrated that these non-genetic factors also affect pre-weaning and post-weaning average daily gains (ADG) in lambs. The review further revealed a scarcity of studies specifically addressing the effect of parity on ADG. Therefore, future research is needed in this area, as the findings in this review showed inconsistent responses to non-genetic factors, likely due to variations in sheep breeds, production systems, vaccination programs, feed quality, and housing conditions used by different producers. Nevertheless, communal farmers can enhance sheep flock survivability by adopting integrated management strategies tailored to specific non-genetic factors. Such targeted interventions can help improve lamb growth and survival during both pre-weaning and post-weaning stages.

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