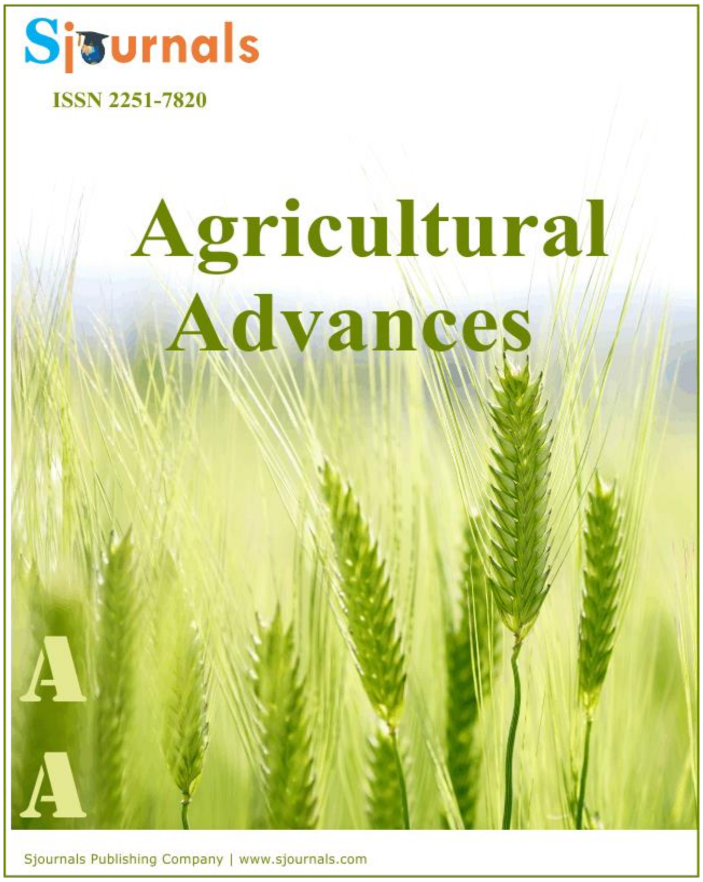
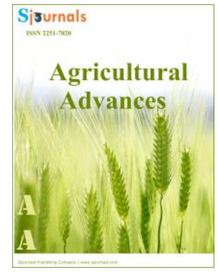

Sjournals
ISSN 2251-7820
Agricultural
Advances
A
A
Sjournals Publishing Company | www.sjournals.com

Sjournals
Scientific Journals

Agricultural Advances (2020) 9(1) 495-504
ISSN 2251-7820
doi: 10.14196/aa.v9i1.2643



Contents lists available at Sjournals

Agricultural Advances

Journal homepage: www.sjournals.com

Review article

Genotype and managing birth weight and status as determinants of kid/lamb mortality in small ruminants

Never Assan*

Department of Agriculture Management, Faculty of Science and Technology, Zimbabwe Open University, Zimbabwe.

*Corresponding author: neverassan@gmail.com

A R T I C L E I N F O

Article history,
Received 12 December 2019
Accepted 13 January 2020
Available online 20 January 2020
iThenticate screening 14 December 2019
English editing 12 January 2020
Quality control 19 January 2020

Keywords,
Genotype
Birth weight
Birth status
Mortality
Goat
Sheep

A B S T R A C T

One principal source of unsubstantial meat production efficiency in commercial small ruminants is high kid/lamb mortality, where a larger proportion of kid/lamb crop fails to reach marketable age resulting in immense economic losses. There is apparent evidence accrued through extensive studies which point to the fact that heredity and some non-genetic factors drive kid/lamb mortality in goats and sheep production. In this respect, mortality of kids/lambs may vary with genotype, nutrition, litter size, dam age and parity order, nutrition, sex and age of kid/lamb and season and year of kidding/lambing. The present review will give an insight on the influence of genotype, birth weight and birth status as determinants of mortality in goat and sheep. The resultant effect of genotype on kid/lamb mortality is associated with traits imparted to both dams and/or kid/lamb such as birth weight size related to difficult birth, kid/lamb viability after kidding/lambing and maternal characteristics. Low birth weight kid/lamb may die due to failure to adapt to life after birth, incompetence to sustain body temperature as a result of low energy body reserves at birth result into death, low kid/lamb potency and poor maternal attachment exposes kid/lambs to less survival chances. On the other hand, multiple birth has an adverse effect on kid/lamb survival due to lower birth weight as litter size increases, which is a lead factor to more hazard to mortality. The major reason for high mortality in underweight kid/lamb at birth is probably due to lack of suckling and/or exposure to low body temperatures. Mature dams give birth to heavier kids and provide enough milk to nursed kids/lambs promoting faster growth rates subsequently enhancing survivability of kids/lambs. There is potentiality of manipulation of husbandry practices focusing on ensuring that all born kids/lambs are as close as possible to the acceptable birth weight average for that specific breed of choice. It should be noted that due to multifaceted nature of the determinants of mortality it is reasonable to assume that appreciation of specific cause and occurrence of kids'/lamb mortality could be advantageous to minimise mortality rates. A total eradication of kid/lamb mortality is probably unachievable as a result partly targeting the control of both environmental and animal-related factors is of paramount importance. High kid/lamb mortality necessitate for good management practices and improved dam nutrition to support nursing of multiple birth, in addition to the exploitation of crossbred's livability and survivability. The present review gives an insight on the determinants of mortality and associated factors in goat and sheep meat production.

1. Introduction

World over, kid/lamb mortality has been a known impediment to viability of commercial goat and sheep enterprises (Mellado et al., 2016; Tifashe et al., 2017; Ceyhan et al., 2013; Ürüşan and Emsen, 2010). The direct and/or indirect influence of mortality on productivity which can be reflected in loss of income is through its effect on the reduction of the number of kids/lambs that reach marketable age and slaughter (Mukasa-Mugerwa et al., 2000) culminating into loss of profits. The influence of genotype (Petrović et al., 2013), birth weight (Ceyhan et al., 2013) and status or type (Urüşan and Emsen, 2010) are major sources of variation in kids'/lambs' mortality. The number of kids/lambs born per ewe/doe is absolutely an economically essential factor for the viability of commercial goat and sheep enterprise. Genotype effects on kid/lamb mortality have been previously reported in goats and sheep (Ukanwoko et al., 2012; Perez-Razo et al., 1998) through its influence on birth weight in different breeds. Nash et al. (1996) while Suffolk and Targhee lambs experienced greater risk of post-weaning mortality, multiple births showed high risk of perinatal mortality, particularly among Targhee lambs. Birth weight is a critical component which directly and/or indirectly influence the profitability of goat and sheep enterprises, through its effect on the survival of lambs (Alçayır and Karabacak, 2019). Debele et al. (2011) observed that kids born as singles had at lower hazard of mortality than their large litter counterparts who had higher mortality rates. Fostering multiple birth, has an opposing influence on kid/lamb survival (Adenaike and Bemji, 2011), this was ascribable to compromised birth weight of kids (Snyman, 2010). Comparable values (2.2%; 5.5%) were reported for lambs born as twins and quadruplets, while mortality was elevated (12.1%) for triplets. It was noted that as the number of kids/lambs in multiple birth increased mortality also increased (Sharif et al., 2005). In an attempt to manipulate birth weight producers should pay more attention to management of pregnant ewes/does prior and during the last trimester in order for dam to kid/lamb heavier progeny at birth (Chniter et al., 2009). Small ruminant enterprise viability is predominantly decided by the number of kids/lambs which survive to marketable age which translates to profits realization. In this regard, the number of kids/lambs born per ewe/doe and survives becomes a critical element of viability in a commercial goat and sheep meat enterprise (Devendra and Burns, 1970). The present review gives an insight on some determinants (genotype, birth weight and birth status) of mortality in goat and sheep production.

2. Genotype influencing kid/lamb mortality

Heredity can have a notable aftermath on kid/lamb mortality (Mellado et al., 2016). Genotype can have an indirect effect on mortality through variation in birth weight of different breeds. This is also important where dams genotype has a big impact on litter size, the number of lambs reared and the weight of lamb weaned which may probably influence kid/lamb survival. In different sheep breeds mortality of 5 to 59% were experienced in early ages of lambs at a time when environmental changes were harsh for both dams their lambs (Mukasa-Mugerwa et al., 2000). Genotype effects on kid/lamb mortality have been previously reported in goats and sheep (Hight, 1970; Dalton, 1980). Generally, the resultant effect of genotype on kid/lamb mortality is associated with the traits imparted to both ewes/does and/or kid/lamb that affect difficult birth, kid/lamb viability after kidding/lambing and also maternal characteristics. Viability and productivity in goat and sheep enterprises remains to a great extent analysed by reproductive performances and mortality rates (Delgadillo et al., 1997). Its influence on mortality is related to indirect effect on kidding/lambing ease, maternal ability, birthweights, state of being strong and active, milk yield and litter size (Sawalha et al., 2007). Nash et al. (1996) using profiles with logistic regressions assessed risk factors related to mortality and reported that mortality was prominent in Suffolk and Booroola Rambouillet lambs. In the study, Suffolk and Targhee lambs experienced greater risk of post-weaning mortality, multiple births experienced high risk of perinatal mortality, particularly among Targhee lambs. In a comparative study on kid in Beetal and Nachi goats, Faiz et al. (1993) observed values of 12.74 and 14.9 %, respectively. The potential explanation for higher mortality in a study of Teddy kids was the breed effect on multiple births as a consequence of low birth weight in kids, which explains the odds of survival of kiddies having low birth weight (Sawalha et al., 2007). Sharma et al. (1981) reported that mortality in different breeds was highest in a particular year, which showed probably the importance of good season in terms of nutritional availability on mortality. The breed dependent mortality has been attributed to birth difficulty due to large kids/lambs in certain breeds and poor kid/lamb vigour (Dwyer et al., 2012). Comparing sheep breeds elsewhere, Uda lambs recorded the highest mortality of 35.37%, compared to Balami, Sudanese, Yankasa and their crosses, which recorded 23.17%, 20.73%, 12.19% and 8.54% mortality rates, respectively. This result contradicts with that of Hassan, (2000) who observed lower mortality values for the same breed. This points to the variation in management in different flocks, which dictates differed mortality rates on the same breed. The disparity in mortality values reported might emanate from differences in management of flocks, probably more attention given to lambing dams hence minimizing mortality of lambs. Terminal sire breeds, selected narrowly for greater productivity targeting muscle growth and conformation traits were most probably encounter birth difficulty than the breed preferred for hardiness, or the cross breed hence influencing the rate of moratlity. A comparative study by Synman (2010) in sheep and goats it was observed that there was less incidence of mortality in sheep after weaning, where in goats' kid mortality was high as 15% from weaning till 18 months of age. Gaddour et al. (2007) studying pure and crossed Alpine kid's observed mortality rates of 4% at birth as the average ratio, this ratio reached 21% at weaning. In a similar study crossbreeding of Finn cross Romney (F x R), East Friesian cross Romney (EF x R) and Poll Dorset cross Romney (PD x R) weight at birth fluctuated from 1 to 9.8 kg. In this regard, lambs weighing to a lesser degree of 1.5 kg had less chances of survival (Hight and Jury, 1970). This trend was broader and the birth weights of singles and twins comparable increasing than other previous reports. Hinch et al. (1985) observed average birth weight of 4.1-4.9 kg for single lambs and 3.4-3.6 kg for twin lambs born to Booroola Merinos, while Hight and Jury (1970) observed average birth weights ranges of 3.8-4.4 kg for single lambs born to Romney and Border Leicester x Romney ewes. However, sometimes the effect of genotype on kid/lamb mortality is indirectly related to birth weight variation due to breed effect, and more so Petrović et al. (2013) observed a significant effect of genotype interaction with other factors such as sire*gestation length; sire*sex; gestation length*sex; sire*gestation length*sex which highly influenced birth weight in lambs. The interactions of various mortality determinants are probably a good indicator to be acquainted more on the complexity of managing mortality in goat and sheep. Studying survival characteristic in different genotypes through years it was noted that survival behavior or capabilities were different for each genotype as a function of the genetic groups (Mellado et al., 2016). Gaddour et al. (2007) observed a disparity of kid mortality ratios between studied genotypes of Alpine, Damascus and Murciana Granadina goat breeds which were imported for paternal genotypes crossbreeding in several generations. Charolais, Hampshire or Texel rams in Katahdin sheep flocks experienced comparable lamb weaning weight, yet Hampshire-sired progeny were outstanding with respect to pre-weaning survival (Mellado et. al. 2016). Therefore, however, minimized mortality from birth to weaning were experienced for Hampshire-sired progeny as compared to Texel and Charolais-sired lambs. In situation where weight at birth was comparable among genotype pointed to the fact that other characters than birth weight were influencing mortality in sheep flock (Mellado et al., 2016). In a study by Speijers et al. (2010) on assessing the effects of crossing sire breeds (Scottish Blackface, Swaledale, Cheviot, Lleyn and Texel) on breed performance with reference to survival it was noted that crossing sire breed is a potential intervention for lamb survival in sheep production. As a result, choice of breeds in small ruminant production requires careful consideration given its implications for dam and progeny survival, as mortality constitutes a major economic wastage (Dwyer, 2008). However, using sires from heavier breeds, as for example Lleyn and Texel, within the Blackface ewe flock increased the number of lambs weaned per ewe-mated and lamb performance in terms of growth, with no apparent adverse consequences on lamb survival. The kid's mortality ratio was prominent for Alpine goat breed and its crossbred progeny genotypes with a ratio of 4 and 3%, respectively. The probable reason was that kid mortality and reproductive performances were immensely associated with the genotype adaptive potentialities. Casey and Van Niekerk (1988) observed low mortality in kids of unimproved South African does than Boer does kids, however, this was not directly related to genotypes. It was noted that the smaller unimproved goat genotype exhibited better mothering ability to rear kids to weaning than the larger improved Boer goat in each case. It has been argued that the importation and successful introduction of specific exotic goat breeds should take into account the high survival rates that are essential for production viability especially in smallholder production systems. High mortality has grave consequences on ability to replace old small stock, effectiveness of selection of breeding animals, high mortality increases production costs and reduce reproductive performance. The dominance of domestic goats' genetic resources over exotic goat breeds is attested to better acclimatization of local genetic resources and to higher feed requirements of the exotic breeds associated with their improved growth. Indeed, parameters of production like mortality need to be included to reach more valid conclusions on importation of specialised goat breeds on the level of their development in resource poor environments. It has been observed that local goat breeds experience relative kids' survival even though in adverse climates (Guney et al., 2006). The important difference between the local and exotic goat genotypes appears visible by studying their performances accompanied by their survival rate. This could be ascertained by the interaction between genotypes and the environment which has an influence of adaptability hence differences in survival rates. Genotype adaptation is relative for the original environment and cannot be inferred to other production systems (Najari and Ben, 1996). There was quite a striking difference in mortality in different goat genotypes where heavier breeds showed a distinctly higher loss than the three lighter breeds. Cotswold, Oxford and Hampshire are heavier goat breeds consistently experienced a higher mortality rate. The disparities in lamb mortality amongst genotype groups remains unexplored. Survivability in sheep lambs is a low heritable trait (Brien et al., 2010) hence the interactions between rearing ability of the mother, lamb viability, and climatic conditions around lambing possibly accounted for the difference in the incidence of lamb losses among genotype groups (Hatcher et al., 2010). Goat and sheep industries have yet to determine the specific goat breeds and optimum combination of crosses that result in the highest profitability through minimal mortality rates under intensive management conditions. Taking into account the disparities in heavier and light goat genotypes it is critical that goat and sheep producers make the right choice of breeds in order to minimize mortality. However, this might be a surmountable task considering that the determinants of mortality are multifaceted. Some can be easily manipulated than others and there is existing interaction amongst these determinants. Producers can make the right choice in terms of breed, however if the management is not up to standard they may experience higher losses due to mortality. Rather large variation in mortality rate of kids born to different sires within a specific flock was observed (Snyman, 2010). Progeny born to different sires within the same stud experienced mortality which varied considerably, small, weak kids varied from 0% to 40% among sires, while deformed lambs ranged from 0% to 14.3%. Due to sire related mortality producers are expected to consider selection of superior breeding sires. Genotype influence on kid/lamb mortality could be primarily as a consequence of breed differences in kid/lamb birth weight and, to a lesser extent, teat morphology of dams and milking ability of different breeds. The differentiated milk production capacity is also related to breed potential in addition to influence of parity order. Across breeds first parity order and mature ewes/does milking potential is attributable to variation in mothering ability, where mature ewes/does have better maternal instinct than first order parity dams.

3. Size of birth influencing kid/lamb mortality

Birth weight is a critical component which directly and/or indirectly influence the profitability of goat and sheep enterprises, through its effect on the survival of lambs (Bunter et al., 2014; Sezenler et al., 2013). Lamb birth has long since been deemed a principal risk factor for lamb viability and survival (Christley et al., 2003), extraordinary birth weights being profoundly associated with considerable increase in lamb mortality (Casellas et al., 2007). Weaklings at birth had more hazard of postnatal mortality while strong lambs had a less risk, especially where dam milk was adequate during nursing (Nash et al., 1996). Inadequate dam milk supplies exposed lambs to higher risk of postnatal mortality for lambs of average potency, however this did not alter the risk for weak or strong lambs. Nowak and Poindron (2006) observed a curvilinear relationship of mortality and birth weight in lambs. The influence of birth weight variation on mortality is complex due to the fact that birth weight is a compound trait determined by various factors such as the individuals' genotype, environment, or an interaction between the two (Plomin et al., 1977). Notter et al. (1991) observed that weight at birth was affected by breed (genotype), sex of lamb, birth type, age of dam, feeding conditions and production environment. Kids/Lambs which are heavier at birth have higher chances of survival and in most cases are usually males, singles, produced by dams with larger body sizes and properly fed (Ceyhan et al., 2013). In comparison of light and heavy lambs at birth, low birth weight lambs had almost twice the risk of perinatal mortality than heavy birth weight lambs (Nash et al 199). In most cases mortality takes place within 3 days of birth and is predominant in twinning than single births (Hight and Jury, 1970). Therefore, the low birth weight in comparison with their heavier counterpart in sheep, are more likely to perish as a result of extreme cold due to their poorer body temperature control mechanism and proportionally higher surface area resulting in increased heat losses to the environment. High birth weights are highly correlated with difficult birth which elevate mortality ratios, mainly in single male lambs (Smith 1977), and low birth weights with starvation/exposure (Dalton et al., 1980). Morel et al. (2008) observed that birth weight had a significant influence on kid/lamb mortality in different breeds of goats. Different birth weight categories of light, medium and heavy lambs, experienced 56, 40 and 28% mortality hazards ratios, respectively. In this respect the lightest lamb in a litter was 3.2 times more likely not to survive than the heaviest littermates. The major highlight in their study was that low birth weight kids/lambs experienced higher mortality rates than those weighing lower than the breed population average. The environment may affect a kids'/lambs' birth weight directly or through environmental effects related to its mother maternal instinct (Rossiter, 1996). The direct and indirect environmental effects take the form of the dams' genotype for milk traits and the environment exposed to the mother, respectively (Freeman et al., 2013). Birth weight can partly be manipulated through breeding by using birth weight as a selection tool so positively most kids/lambs are dropped with reasonable birth weights. This means kids/lambs outside the intended population average may be culled from the flock. It should be taken into account that underweight and unduly overweight kids/lambs both often end up in added labour at kidding/lambing season as well as reduced survivability. There is need for goat and sheep producers to utilize birth weight selection in order to manage mortality rates in flocks. Low heritability for birth weight has been reported which means genetic progress might be also low. Environmental conditions contribute more to birth weight variation, however, because flocks manage dams as contemporary groups, producers can genetically select for average birth weights by culling progeny with low or high birth weights, in addition to dams that produced those kids/lambs. Genetic selection for enhancing birth weight, milk yield and growth rate could improve survivability standing of progeny especially prior weaning phase. Selection can be targeted on enhancing birth weight of kids/lambs and milk producing attributes of dams which will successively lessen the kid/lamb mortality to a greater extend and eventually improving goat and sheep meat production efficiency. Husain et al. (1995), who reported an increased survivability of kids with an increase in birth weight and milk yield of their dams. In this respect maternal nutrition plays a critical role in influencing foetal growth and development in most livestock species (Wu et al., 2004) and its birth weight and later on survival of kids/lambs. In a similar study mortality was influenced weight at birth where mortality rates tended to be minimal with increase in birth weight (Debele et al., 2011). The major reason for high mortality in underweight was probably starvation and/or hypothermia. The kids/lambs born relatively above flock average mostly have adequate energy reserves to sustain their body heat and compete for suckle immediately. The weakling or underweight mates may starve due to their inability to compete for milk. It has been noted that there is variation in milking capacity of different goat breeds, (Husain, 1993) working with Black Bengal goats reported that their milk production potential was very negligible. This to some extent affect the dams mothering ability that could have also had an implication on kid survival. It was frightening that approximately 30% of does after giving birth produced barely or no milk even for the lactating kids. Milk capacity for nursing kids is a critical component of the maternal instinct which promote kid survival. Dalton (1981) acknowledged that maternal characteristic is a compound attribute nearly related to the kid survivability and largely influence the dams' ability nourish, nurse and conceivably protect the kid from predators. Dams with poor maternal instinct are more likely to demonstrate inadequate care for their kids hence affecting kid growth and survivability. However, it should be noted that high milking capacity of dams is dependent on adequate nutritional supply and sound body condition. Failure to meet nutritional requirement during the last trimester off gestation and after kidding will compromise milking ability of dams and decisively affect kid survival. Maternal influence on birth weight starts from the manifestation of maternal instinct in the dam is affected by her preceding maternal experience, by nutrition in gestation, by genotype, by temperament, and, in a limited way, by the behavior of her lamb. The maternal characteristic in dams at kidding/lambing is a barometer of her behavior the entire lactation and in consecutive pregnancies, implying basis to maternal attribute intrinsic to that dam hence influencing birth size.

4. Birth status influencing kid/lamb mortality

Variation in birth weight in different breeds due to birth status is an important determinant of subsequent survival of kids/lambs. It is mostly likely that kidding/lambing in the low input systems mostly experience single and low birth that is ascribable to poor nutrition leading to high mortality rates. Relatively low birth weight lambs were exposed to high risk of mortality that heavier lambs in Decani sheep at lambing (Bangar et al., 2001). The low birth weight of kids observed for multiple births in this study may be partly responsible for higher mortality in triplets. Birth status influence on mortality is indirectly linked to weight at birth of different birth types, where in most cases the birth weight of kid/lambs born singles had less hazard of mortality than multiple birth mates (Urüşan and Emsen, 2010). Ahmed et al. (2010) observed a higher mortality hazard ratio among triplets (51.43%) and twins (28.57%) compared to singletons (26.67%) lambs. These results were in disagreement with those reported by Berger (2000) and Shelton and Willingham (2005). In a similar study, Adu et al. (1979) reported that a higher proportion of the dead young ones were from multiple birth due to low birth weights. The high mortality in twins and triplets may be explained by the facts that they have lower energy balance than singletons (Skalski, 2003). Besides, it also takes the ewe dam a longer time to lick and dry 2 or 3 lambs. The situation is made worse due to the fact that milk requirement of twins or triplets is higher than that of single lambs and starvation is more likely among them leading to higher rates of mortality. It is more likely that less mortality may be experienced in flocks where singletons may be because more single lambs were born compared to twins and triplets.

The effect of birth status is attributable to the link of depressed birth weights due to multiple birth, where the larger the litter size the smaller average birth weight hence less chances of kid/lamb survival. This was in conformity with reports by Adenaike and Bemji (2011), who reported that promoting multiple birth, has a negative influence on kid/lamb survival. This was ascribable to compromised birth weight of kids (Snyman, 2010). Some of the workers, however, reported that kids born to nulliparous dams suffered greater mortality (17.0%) probably due to low birth weight than those out of multiparous dams (7.2%). There was more death for triplets than twins and single litters. Hailu et al. (2006), who observed low survival in triplets compared to singles and twins. Low birth weight of kids observed for multiple births was partly responsible for higher mortality in triplets. In a similar study Mtenga et al. (1993) reported higher mortality in twins as compared with singles and Snyman (2010) observed lowest mortality in single born kids followed by twins and triplet born kids. This is in conformity with single born kids/lambs have high chances of survival than their counterparts in multiple birth (Ndamukong, 1985; Mackinnon et al., 1985). This is because birth weight in multiparous dams was higher than those of primiparous dams (Cam et al., 2018). In a breed comparative study on mortality it was observed that the rate of mortality in twins and triplet compared with the mortality in single (Prasaad, 1983). There is breed differences in terms of birth weight averages which can influence kid/lamb mortality. Also within breed single born kids from nulliparous females had lower birth weight than twins-born kids from multiparous females (Prasad, 1983). El-Abid and Abu Nikhaila (2009) observed that kids born as singles had at lower hazards of mortality than their large litter counterparts who had higher mortality rates. In actual fact, there a number of observations regarding the birth weight variation in favour of lambs born to multiparous ewes, and this keeps happening up to weaning time (Corner et al., 2013). Higher mortality for kids/lambs is experienced with low birth weight, while higher birth weight had less hazard to mortality. Kid/lamb mortality was highest in triplet births and was associated with lighter birth weights.

Improved nutritional management, particularly ewes/does nursing twins and triplets, is critical to reduce mortality rate of lambs and kids. Due to competition for milk in multiple birth, collect colostrum from single born dams and supplement it to larger litters. Additional feed during the third trimester will promote foetal growth before kidding/lambing which will enhance kid/lamb survival chances due to improved birth weights. Kids/lambs from multiple birth are do not suckle long as compared to their single born mates, consequently acquiring less colostrum than single born mates. This has been attributable to competition in large litters. Insufficient milk to satisfy triplets can also largely contribute for this mortality variation. The differences in litter size from year to year probably due to dam age and variation in feed availability. Inadequate milk to satisfy triplets can largely contribute to low body weight, where feed resources are in general in short supply in the dry season which can compromise dam nutrition (Petros et al., 2014). Variation in birth weight in multiple birth is an important trait affecting subsequent survival of kids/lambs. The low milk production in in multiple birth was ascribed to low feed intake which resulted in failure to meet nutritional requirements for lactation. Low milk production increased mortality rate in growing kids/lambs among multiple birth ewes/does, while milk yield increased with parity order (Kowalska, 2008). It is also important to consider the effects of suckling litter size which might have impacted negatively on multiple birth body reserves resulting in weight loss. However, it should be noted that birth weight of lambs is a multifactorial character in the sense that it is responsive to a variety of pressures such as parity, maternal body condition, gestation length, etc. (Sharma et al., 2012). There is a tendency of low birth weight kids/lambs being weak at birth as a result they may not be able to get up and suckle on their own hence exposing themselves to hazards of mortality. On the other hand, low birth weight kids due to multiple birth if exposed to very cold and/or wet weather when kidding, kids lose body energy very rapidly when in cold or wet environments with high chances of dying. This result was in conformity with other reports from various workers (González-García and Hazard, 2016). The underweight at birth of lambs delivered to primiparous dams comparative to multiparous ewes can be clarified by the fact that the uterus environment of primiparous dams was not completely developed, particularly when it comes to size (Griffiths et al., 2016).

More attention should be given to the feeding of dams with multiple kids/lambs and give additional feed to multiple kids/lambs. Improved nutritional management, particularly ewes/does nursing twins and triplets, is critical to reduce mortality rate of lambs and kids (Awemu et al., 1999; Hailu et al., 2006). This result complies with findings reported by. It was observed that most of the kidding in the traditional husbandry system were single birth and this may be attributed to the poor nutrition status that domain most of the year and consequently lower birth weight, that lead to high mortality rate. From management point of view goat and sheep producers should give more attention to feeding dams with multiple kids/lambs and also give additional feed to multiple kids/lambs in order to reduce mortality. Due to competition for milk in multiple birth, collect colostrum from single born dams and supplement it to larger litters might be warranted. Additional feed during the third trimester will promote foetal growth before kidding/lambing which will enhance kid/lamb survival chances due to improved birth weights. Insufficient milk to satisfy triplets can also largely contribute to starvation leading to increased rates of kid/lamb. Kids/lambs from multiple birth are do not suckle long as compared to their single born mates, consequently acquiring less colostrum than single born mates. This has been attributable to competition in large litters.

However, exceptions have also been reported where multiplicity of birth experienced less kid losses in twins and triplet than in single births (Prasad, 1983). The mortality rate among single, twins and triplet born kids averaged 4.5, 2.3 and 0.2 percent of total mortality respectively (Farooq et al. 2018). Declining trends in mortality with the multiplicity in births were observed. In another study mortality of singles and twins were similar in spite of the lower birthweights of twin lambs.

In an attempt to manipulate birth weight producers should pay more attention to management of pregnant ewes/does prior and during the last trimester in order for dam as to kid/lamb heavier progeny at birth. An understanding of specific causes and occurrence of kids'/lamb mortality could be advantageous to minimise mortality rates. In most cases producers promote multiple birth because it results in more kids/lambs to market hence improving the financial gains of the enterprise. However, multiple birth compromises average birth weight in a flock, where kids/lambs from multiple birth are smaller and lighter making them exposed to high risk of survival. Relatively low birth weight lambs were exposed to high risk of mortality that heavier lambs in decani sheep at lambing (Bangar et al., 2016). Therefore, culling of twin-kidding/lambing ewes/does is unlikely to be very beneficial for improving current flock performance, whereas eliminating the propensity for twinning in the population via selection may be beneficial to avoid kid/lamb wastage resulting from twin pregnancies. Twins in kid/lambs are generally the product of multiple ovulations rather than embryo splitting (Flores-Foxworth, 2007), and twinning cows might be better identified with ovarian scanning than from observing kids born. However, this recording option is likely to be impractical in extensive systems. Given the high mortality rate of twins, natural selection already operates against twinning in this environment. Multiple birth is the more important attribute affecting kid/lamb mortality during lactation. The assumption is that as litter size increases there is increased competition for the available milk supply resulting in more deaths among the smaller kids/lambs in the litter. Provide necessary heating facilities for multiple birth kids/lambs until they can adequately maintain their own body temperature. It is also to consider provision of heating facilities for multiple birth kids/lambs until they can adequately maintain their own body temperature.

5. Highlights

✓ High kid/lamb mortality rates impact negatively on the efficiency and profitability of goat and sheep meat production enterprise.

✓ Genotype has a direct influence on mortality through differences in magnitude of birth weight of different breeds where low birth weight kids/lambs have almost twice the risk of perinatal mortality than heavy birth weight kids/lambs.

✓ Dam genotype has a big impact on litter size, the number of kids/lambs reared and the weight of kids/lambs weaned which may probably influence kid/lamb survival.

✓ Multiple birth experience low birth weight resulting in high survival rate in single born followed by twins and triplets born kids/lambs.

✓ Low birth weight may die due to failure to adapt to post-natal life, inability to maintain body temperature, low lamb vigour and poor maternal bond.

✓ Mortality rate is high in low birth weight kids/lambs due to low energy reserve which renders the kid susceptible to harsh environmental conditions.

6. Derivations

✓ Supplementation of ewes/ does during last trimester of gestation will enhance birth weight of kids/lamb hence minimising mortality at a later stage of life.

✓ Ewes/does with multiple birth or those nursing twins, triplets, etc. need supplementation to boost their milk production for the effective suckling and improve body weight of kids/lambs which will minimize mortality.

✓ Minimising the variation in weight at birth within a litter in a flock through selection against low birth weight dams will increase the competitive aptitude for survival of individual littermates, consequently minimising overall mortality.

✓ Crossbreeding can be used to manipulate genetics in order to improve survivability through improved birth weight, however this has its own limit.

✓ Improve survival in kids/lambs by minimising mating closely related individuals to reduce inbreeding which may compromised weight at birth in goat/sheep flock.

✓ Producers should give more attention to caring for the lightest kids/lambs at birth to improve survivability which later improves the number of kids/lambs reaching marketable age and profitability.

References

Alçayır, E., Karabacak, A., 2019. The effect of some environmental factors on birth weight in Anatolian Merino sheep. Selcuk J. Agr. Food Sci., 33(3), 231-235.

Brien, F.D., Hebart, M.L., Smith, D.H., Hocking-Edwards, J.E., Greeff, J.C., Hart, K.W., Refshauge, G., Bird-Gardiner, T.L., Gaunt, G., Behrendt, R., Robertson, M.W., Hinch, G.N., Geenty, K.G., van der Werf, J.H.J., 2010. Opportunities for genetic improvement of lamb survival. Anim. Prod. Sci., 50, 1017-1025.

Bunter, K.L., Johnston, D.J., Wolcott, M.L., Fordyce, G., 2014. Factors associated with calf mortality in tropically adapted beef breeds managed in extensive Australian production systems. Anim. Prod. Sci., 54(1), 25-36.

Casella, J., Caja, G., Such, X., Piedrafita, J., 2007. Survival analysis from birth to slaughter of Ripollesa lambs under semi-intensive management. J. Anim. Sci., 85, 512-517.

Casey, N.H., Van Niekerk, W.A., 1988. The boer goat I. Ori-gin, adaptability, performance testing, reproduction and milk production. Small Rumin. Res., 1, 291-302.

Ceyhan, A., Sezenler, T., Yüksel, M.A., Yıldırır, M., 2013. Effects of some environmental factors on lamb growth and survival characteristics of Gökçeada lambs. 54(2), 14-17.

Chniter, M., Maali, S., Hammadi, M., Khorchani, T., Harab, H., Krit, R., Hamouda, M.B., Khaldi, G., Nowak, R., 2009. Effects of dam age, litter size and gender on birth weight of D'man lamb - Consequence on lamb mortality. J. Arid Land Stud., 19(1), 169-172.

Christley, R.M., Morgan, K.L., Parkin, T.D.H., French, N.P., 2003. Factors related to the risk of neonatal mortality, birth-weight and serum immunoglobulin concentration in lambs in the UK. Prev. Vet. Med., 57, 209-226.

Dalton, D.C., Knight, T.W., Johnson, D.L., 1980. Lamb survival in sheep breeds on New Zealand hill country. New Zeal. J. Agr. Res., 23, 167-174.

Debele, G., Duguma, M., Hundessa, F., 2011. Effect of different factors on mortality rate of Arsi-Bale kids in mid rift valley of Ethiopia. Glob. Vet., 6(1), 56-60.

Delgadillo, J.A., Malpaux, B., Chemineau, P., 1997. Reproduction of caprine in the tropical and subtropical zones. INRA Prod. Anim., 10, 33-41.

Dwyer, C.M., Bünger, L., 2012. Factors affecting dystocia and offspring vigour in different sheep genotypes. Prev. Vet. Med., 103(4), 257-264.

Dwyer, C.M., 2008. Genetic and physiological determinants of maternal behavior and lamb survival: Implications for low-input sheep management. J. Anim. Sci., 86, E246-E258.

Faiz, M.A., Tufail, M., Nawaz, H., Yaqoob, M., Ahmad, F., Younas, M., 1993. Factors affecting kid mortality in Beetal and Nachi goats. Pak. Vet. J., 13(1), 23-25.

Freeman, E.D., Larsen, R.T., Clegg, K., McMillan, B.R., 2013. Long-lasting effects of maternal condition in free-ranging cervids. PloS One, 8(3), e58373.

Gaddour, A., Najari, S., Abdennebi, M., Ouni, M., 2007. Reproductive performances and kid's mortality of pure breeds and crossed caprine genotypes in the coastal oases of southern Tunisia. Pak. J. Biol. Sci., 10, 2314-2319.

Guney, O., Torun, O., Ozuyanik, O., Darcan, N., 2006. Milk production, reproductive and growth performance of Damascus goats under northern Cyprus conditions. Small Rumin. Res., 65, 176-179.

Hassan, W.A., 2000. Biological productivity of sheep and goats under agro-silvo pastoral systems in Zamfara reserve of north western Nigeria. PhD Thesis, der Justus-Liebig Universitat, GieBen, Germany. 263p.

Hatcher, S., Atkins, K.D., Safari, E., 2010. Lamb survival in Australian Merino sheep: A genetic analysis. J. Anim. Sci., 88, 3198-3205.

Hight, G.K., Jury, K.E., 1970. Hill country sheep production. II Lamb mortality and birth weights in Romney and Border Leicester x Romney flocks. New Zeal. J. Agr. Res., 13, 735-752.

Husain, S.S., Horst, P., Islam, A.B.M.M., 1995. Effect of different factors on pre-weaning survivability of black Bengal kids. Small Rumin. Res., 18, 1-5.

Jordan, D.J., Le Feuvre, A.S., 1989. The extent and cause of perinatal lamb mortality in three flocks of Merino sheep. Aust. Vet. J., 66, 198-201.

Mellado, M., Macìas, U., Avendaño, L., Mellado, J., Garcìa, J.E., 2016. Growth and pre-weaning mortality of Katahdin lamb crosses. Rev. Colom. Cienc. Pecua., 29(4), 288-295.

Morel, P.C.H., Morris, S.T., Kenyon, P.R., 2008. Effect of birthweight on survival in triplet-born lambs. Aust. J. Exp. Agr., 48, 984-987.

Mukasa-Mugerwa, E., Lahlou-Kassi, A., Anindo, D., Rege, J.E.O., Tembely, S., Tibbo, M., Baker, R.L., 2000. Between and within breed variation in lamb survival and the risk factors associated with major causes of mortality in indigenous Horro and Menz sheep in Ethiopia. Small Rumin. Res., 37, 1-12.

Najari, S., Ben, A., 1996. Evaluation of the results of crossing of the local goat in the Tunisian south. Rev. Arid. Reg., 7, 363-367.

Nash, M.L., Hungerford, L.L., Nash, T.G., Zinn, G.M., 1996. Risk factors for perinatal and postnatal mortality in lambs. Vet. Rec., 139(3), 4-67.

Notter, D.R., Kelly, R.F., McClaugherty, F.S., 1991. Effects of ewe breed and management system on efficiency of lamb production. II. Lamb growth, survival and carcass characteristics. J. Anim. Sci., 69, 22-33.

Nowak, R., Poindron, P., 2006. From birth to colostrum: early steps leading to lamb survival. Reprod. Nutr. Dev., 46, 431-446.

Perez-Razo, M.A., Sanchez, F., Meza, C., 1998. Factors affecting kid survival in five goat breeds. Can. J. Anim. Sci., 78, 407-411.

Petros, A., Aragaw, K., Shilima, B., 2014. Pre-weaning kid mortality in Adamitulu Jedokombolcha district, Mid Rift valley, Ethiopia. J. Vet. Med. Anim. Health, 6(1), 1-6.

Petrović, C.V., Petrović, M.P., Ilić, Z., Petrović, M.M., Milošević, B., RužićMuslić, D., Maksimović, N., 2013. Effect of genotype, sire, sex, gestation length on birth weight of lambs. Biotechnol. Anim. Husb., 29(4), 685-693.

Plomin, R., DeFries, J.C., Loehlin, J.C., 1977. Genotype-environment interaction and correlation in the analysis of human behavior. Psychol. Bull., 84, 309.

Sarmah, P.C., Thakuria, K., Sarma, H.K., Borah, H.P., Mohan, M., Pant, K.P., 1981. Note on kid mortality in Assam local breed. Indian J. Anim. Sci., 51(2), 248-249.

Sawalha, R.M., Conington, J., Brotherstone, S., Villanueva, B., 2007. Analyses of lamb survival of Scottish Blackface sheep. Anim., 1, 151-157.

Sezenler, T., Soysal, D., Yıldırır, M., Yüksel, M.A., 2013. Influence of some environmental factors on litter size and lamb growth performance in Karacabey Merino sheep. J. Tekirdag Facult. Agr., 10(1), 40-47.

Sharif, L., Obeidat, J., Al-Ani, F., 2005. Risk factors for lamb and kid mortality in sheep and goat farms in Jordan. Bulgarian J. Vet. Med., 8(2), 99-108.

Smith, G.M., 1977. Factors affecting birth Sm weight, dystocia and preweaning survival in sheep. J. Anim. Sci., 44, 745-753.

Speijers, M.N.M., Carson, A.F., Dawson, L.E.R., Irwin, D., Gordon, A.W., 2010. Effects of sire breed on ewe dystocia, lamb survival and weaned lamb output in hill sheep systems. Anim., 4(3), 486-496.

Synman, G., 2010. Factors affecting pre-weaning kid mortality in south African Angora goats. S. Afr. J. Anim. Sci., 40 (1).

Tifashe, M., Hassan, A., Herago, T., Tesfamariam, G., 2017. Analysis of morbidity and mortality of sheep and goat in Wolaita Soddo Zuria district, southern Ethiopia. Glob. Vet., 18(3), 168-177.

Ukanwoko, A.I., Ibeawuchi, J.A., Okeigbo, A.N., 2012. Effects of sex, breed and season on birth weight of kids and effect of season on kid mortality in south eastern Nigeria. J. Anim. Prod. Adv., 2(11), 469-472.

Urüşan, H., Emsen, H., 2010. Effect of lambing season, lamb genotype, maternal and birth related factors on growth and viability of lambs. J. Tekirdag Facult. Agr., 7(3).

How to cite this article: Assan, N., 2020. Genotype and managing birth weight and status as determinants of kid/lamb mortality in small ruminants. Agricultural Advances, 9(1), 495-504.