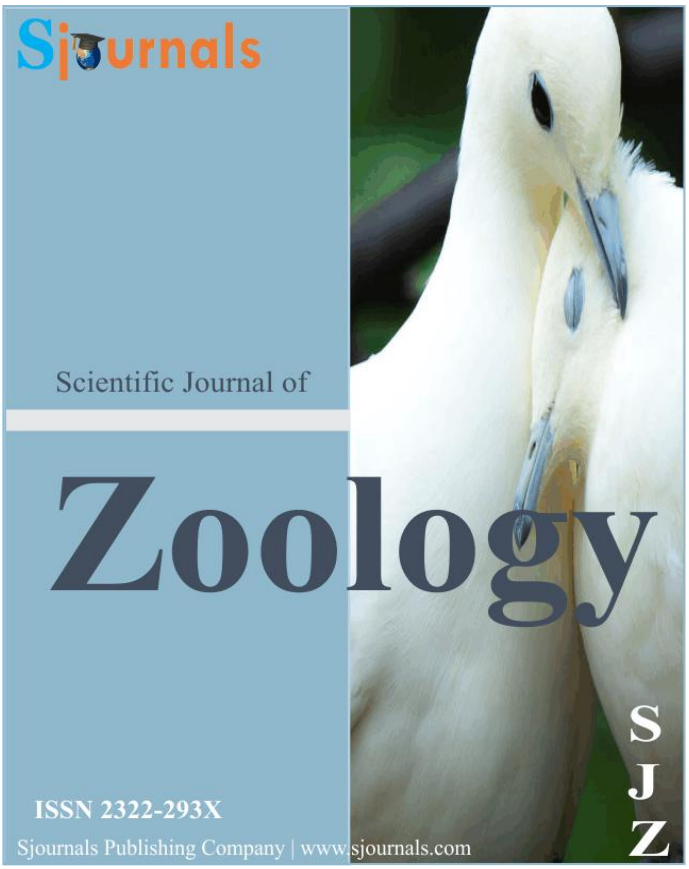

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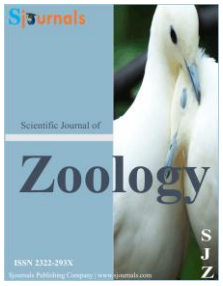

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Review article

Some animal-related factors affecting pre-weaning mortality in rabbits

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ABSTRACT

Pre-weaning mortality is one of the dominant aspect that impact negatively on productive and reproductive components in a commercial rabbit enterprise. This review article looks at some animal-related factors such as litter size and birth weight in influencing pre-weaning mortality in rabbits. There are several factors that influence pre-weaning mortality in rabbit production. Therefore, understanding of these factors may reduce production losses and maximize profits. Pre-weaning mortality restrict the output of any rabbit enterprise culminating in reduced income earned from rabbit production. A complicated interconnection between the doe, the kit and the environment influence pre-weaning mortality. A negative association between birth weight and litter size has been demonstrated in rabbits which implied that large litter resulted in individual low birth weight consequently increased pre-weaning mortality. Birth weight and litter size can be manipulated to the producers' advantage and improve rabbits' performance in the long run. A positive association of litter size and mortality has been reported in rabbits. The larger the litter the greater the mortality rate. The smaller the weight at birth of kits the less the chances of survivability. Mothers should be selected for good maternal attributes and reasonable litter size in order to curtail pre-weaning mortality. The present discussion will focus on litter size and birth weight as some of the major factors that influence pre-weaning mortality.

1. Introduction

Pre-weaning mortality in rabbits' production plays a decisive role of determining profitability (Rashwan and Marai, 2000), in addition to defining the productivity of the enterprise (Planinc et al., 2011). One may therefore expect that sustenance of high economic efficiency in a rabbit enterprise require low pre-weaning kits mortality. It is possible for pre-weaning mortality to erode income realized from rabbit enterprise. In a modern intensive reproduction system rabbit enterprise using highly prolific does pre-weaning mortality was estimated to be 5-7% of young as stillborn and another 16-20% die before weaning (Rashwan and Maria, 2000). Large litter size compromise the does nursing duration and individual milk share consequently lowering the litter survival percentage (El-Kholya, 2011). Litter size and birth weight are both controlled by two sets of components; those genetic and non-genetic. Litter size at birth has been established as one of the leading traits determining the profit function (Eady and Prayaga, 2000) and reproductive accomplishment is mainly represented by litter size. Due to the fact that large litter size and low birth weight escalates kit mortality, one may therefore expect that more adequate attention should be given to these factors for the short and long term sustainability of a rabbit enterprise (Egena et al., 2012). Rabbit birth weight size and vitality likewise doe maternal behavior is a critical element on kit survival. Maternal behavior interceded by litter size and birth weight have an impact on both pre-weaning growth and mortality in rabbits (Piogner et al., 2000). Khalil (1980) acknowledged that decline in mortality due to advanced parity was attributable to improvement in maternal care through the does' capacity to produce adequate milk and suckle her young one. Therefore, it implies that proper feeding of the mother may be crucial not only in promoting her body condition, but also improvement of milk quantity and quality for the suckling young ones. Several risk factors are associated with pre-weaning mortality in rabbits, however the focus of this review is on the influence of litter size and birth weight on pre-weaning mortality.

2. Litter size and mortality

Litter size the number of young born per kindling remains the most important biological variable for short and long term profitability in a commercial rabbit enterprise. Abou-Khadiga (2004), Belhadi (2004) and Nofal et al. (2005) concurrently described cases where litter size was the most important economic attribute in rabbit production. A positive relationship between litter size and mortality was confirmed in Slovenian SIKA rabbits' terminal line (Planinc et al., 2011). On the same note, a positive association was also reported by El-Maghray et al. (2004) of (r=0.64) between litter size and pre-weaning mortality in a large litter (10-14 kits) compared with (r=20) in smaller litter (1-9). El-Kholya (2011) assessing the effect of litter size on mortality observed that the mortality rates of litter size of 3-5 and 6-8 kits were 0.02% and 0.21%, respectively. However, litter sizes of more than 8 kits experienced the highest mortality rate of 0.51%. From these results, can deduce that the larger the litter the greater the mortality rate. Therefore, it is reasonable for does producing large litters, the producer should let them raise only a small number of litter of about 3-5 kits and the rest given to other does. The routine will curtail pre-weaning mortality considerably, especially on low birth littermates. It seems that there is no agreement in various studies on the optimal litter size for does to rear to lessen pre-weaning mortality. In various studies (El-Sheikh, 2000; Afifi and Khalil, 1990; Khalil et al., 1987) advanced the view that reducing the litter size through cross fostering to a maximum of nine kits per litter could minimize pre-weaning mortality. Elmaghraby et al. (2007) supported the optimum litter size of maximum of nine kits per litter as it resulted in reducing pre-weaning mortality from 20.24 to 8%. Szendro and Barna (1984) reported higher total litter loss and suckling mortality in small and large litter, respectively. This concord with the findings of Ibrahim et al. (2003) working with New Zealand white and other rabbits' groups and reported a significant increase in mortality of kits born in large litters. In another study, a higher mortality was experienced during the three first week of lactation in litters of 10 compared to litters of 6 (Szendro et al., 1996). This supports the notion that increased litter size will fuel mortality in rabbits due to reduced average birth weight in littermates of large litters. Previous studies have demonstrated the existence of a negative correlation between litter size and average litter birth weight. One may therefore expect that this negative association of litter size and birth weight is applicable in rabbits (Hammond, 1921).

Maternal behavior is critical when examining reproductive traits, especially the maternal effect on litter size. A good mother has the capacity to suckle a sizable number of kits and maintaining their vitality consequently minimizing pre-weaning mortality (El-Kholya, 2011). In rabbits' pre-weaning survival is dependent in part on the intrinsic ability of the mother to provide a favorable maternal environment (Yahaya, 1993). However, it should be

noted that maternal behavior is determined basically by birth weight and litter size both collectively and independently. Equalization of litters due to weight have been suggested as a solution to remove the effect of disparity of suckling of heavier kits ingesting more milk than lighter ones (Poigner et al., 2000). The influence of low birth weight on mortality can be considerably minimized by intra-litter homogenization which gives the low birth weight littermates a chance to efficiently enhance growth in the new environment. Gyarmati et al. (2000) observed that it was necessary to specify that the kit intake capacity is much higher than the milk available. It is advisable to improving the quality of milk through provision of a balanced diet as a management approach to avail essential nutrients to the doe for increased milk production which translate to reduced pre-weaning mortality. Milk limits growth and survivability as indicated by larger litters showing lower weight gain and higher mortality (Drummond et al., 2000). Compromised or inadequate maternal environment and littermates' competition for does milk reduce weaker kits survival probability. The success of heavier littermates competing for mothers' milk indirectly benefit from the deaths of their littermates by obtaining an increased proportion of an undiminished daily milk supply. The increase in pre-weaning mortality with the increase of litter size at birth is attributable to the decrease in the average individual weight per litter at birth (Afifi et al., 1973) as a result of competition for mothers' teats and therefore the smaller rabbits obtaining less milk. It is reasonable to assume that littermate competition for treat would increase with increasing rabbit litter size resulting in a higher pre-weaning mortality due to starvation caused by increased littermates competition for milk Ayyat et al. (1995) acknowledged that does' milk production is positively related to litter size, though kits from larger litter consume less milk than those from smaller litter. It is important for rabbit producers not to forget that sufficient milk production by the doe is crucial for proper nutrition of young ones and in reducing mortality. Larger litter size need adequate rate of milk production by the doe to secure survival of the entire litter. The litter size, littermates' uniformity and maternal behavior could influence doe's care competence and finally litter survival. The influence of litter size on pre-weaning mortality is associated with the chance of individual kit to find an accessible teat for suckling (Krogmeier and Dzapo, 1999) which may be difficult for small kits to compete for the teat with strong littermates. Ferguson et al. (1997) observed that in large litter the milk share for littermates is reduced due to smaller kits reduced access to the teats (Szendro and Kampits, 1985) resulting in higher pre-weaning mortality. Szendro et al. (1992) advanced the view that limitation of teat numbers (8-10) in rabbits does and once a day caring of kits by their mothers (Gonzalez-Marsical, 2007) lower the survival chances of weaker littermates. This concord with the findings by Zerrouki et al. (2005) who demonstrated that the share of milk to particular kit decreased with the increase of litter size. It is reasonable to suggest that weak littermates' contesters might not endure the competition and are more likely to die from starvation. Reduction in the size of lighter litters from 8 to 6 did not improve productive performance as does reduce their milk yield (Planinc et al., 2011). There was a negative correlation of -0.35 between litter size and milk intake by a kit (Lebas, 1975). In another study Szendro et al. (1996) reported that there was not relationship between litter size and mortality. The report by Hassan et al. (1994) supported the view that there was no relationship between litter size at birth and pre-weaning mortality.

3. Birth weight and mortality

Birth weight in rabbits build upon chiefly on the number of rabbits in the uterus or the uterine horn and also on the localization of the young in the uterus (Palos et al., 1996). Low birth weight kits result in lower probability of survival and reduced pre-weaning overall performance during lactation (Poigner et al., 2000). Seitz et al. (1998) observed a decline in pre-weaning mortality of the same litter within the first week post kindling. This was ascribed to mortality within a litter being restricted largely to low birth weight littermates. The kits birth weight through the early phase after giving birth where the kits rely entirely on their mother's milk is crucial period to curtail mortality. Pre-weaning mortality rate of kits is directly proportional to the number of suckling kits and decreases when kits birth weight increases (Rashwan and Maria, 2000). Bautista et al. (2008) advanced the view that dead kits averaged 10g less at birth, weighing 29.2% less within the first 5 days after birth. After examination of the gut it was found that the smaller littermates had no milk in their stomach compared to the survivors. This probably describe a case of starvation on smaller littermates and their more likely to die. Within litter variation in birth mass point up to competition for dams' milk where larger kits are more efficient at gaining access to mothers' milk than smaller littermates. This result into starvation of smaller littermates hence increased mortality in this group. Weighty kits are likely to survive because they contest more effectively for the mother's milk and take advantage of thermal position to keep themselves warm. In a situation where birth weight is less than the ideal weight,

energy reserves and thermoregulatory potentially compromised as a result prenatal mortality is increased (Vicente et al., 1995). Sizeable mortality rates associated with first parity does appear linked to low birth weight. Litter with high mean kit birth weight had significant higher pre-weaning survival compared to litters with low mean kit birth weight. Rabbits of low birth weight and low vitality cannot endure unfriendly environmental effects, especially when the small ones have to contest for the teat with strong littermates. Mortality in rabbits of low birth weight could be considerably reduced by assigning smaller littermates to smaller litters, or lessening within litter weight differences through homogenization. Assigning kits of comparable weight as littermates can scale down mortality in rabbit production (Gyovai et al., 2009).

Litter size and birth weight affected mortality in suckling rabbits (Krogmeier and Dzapo, 1991). Vicente et al. (1995) reported a negative association between birth weight and litter size, which implied that large litter resulted in individual low birth weight. An increase in litter size can reduce individual birth weight consequently reducing chances of survival. The same author observed that high pre-weaning mortality from birth to weaning increased in kits weighing less than 35g, implying a least possible weight for survival. In a similar study large litter did not have higher variation in birth weight (Argente et al., 1999) and individual survival was related to individual birth weight with low birth weight having lower probability of survival.

4. Implication

Comprehension of the pre-weaning sources of kits mortality in a rabbit enterprise will empower the producer to appraise their operation and employ management systems to cut down mortality rates and increase income. Litter size and birth weight are directly related to performance and profitability of a rabbit enterprise. Therefore, it would be reasonable to suggest litter size and birth weight should be target traits in any rabbit genetic improvement program. In recent past, the litter size has been improved in rabbit breeding. However, this approach has adversely increased pre-weaning mortality attributable to the increased average low birth weight in large litters. To avert this scenario, breeders should start assessing and recommend optimum litter size, which will facilitate the reduction in pre-weaning mortality. The challenge of coming up with an optimal litter size should also take cognizance of the contribution of other several variables which directly or indirectly impinge on mortality. It has been ambitious to compare results of pre-weaning mortality from different studies over the years simply because they differ in examinable fixed variables. Clearly, the direct and indirect determinants on pre-weaning mortality are numerous also quite inconsistent, some variables seem to be important for different production systems not others. Use of a selection index, which take into account the negative association of birth weight and litter size, and maternal behavior hold a promise in rabbit breeding.

From maternal point of view, a reduced litter size result in increased milk share for individual kits, consequently their survival chances. Rabbits survival rate can be enhanced by assigning low birth kits from large litters to comparable litters in terms of weight and physical fitness. Littermates uniformity might be beneficial to the producer as it relates to more efficiency in growth of rabbits of low birth weight hence promoting higher viability of kits. It might be assumed that the mothers' maternal instinct seems to be influenced by litter size. One may therefore expect an ideal average litter size not so large to constrain the physiological capacity of the mother and not so small to unsuccessfully fail to adequately utilize the abundant milk produced by the mother.

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