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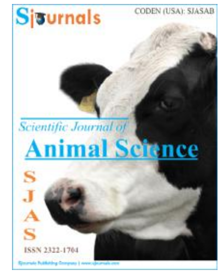

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Review article

Factors influencing post-weaning growth and mortality in rabbits

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Several random and nonrandom factors influence post-weaning growth and mortality in rabbits. The rabbit productivity is greatly influenced by post-weaning kits growth potential and the number that survives up to market. There is a definite important association between litter size and post-weaning growth, which can be manipulated to enhance rabbit production and profitability. In this respect maintaining an economically optimum average litter size, which promote post-weaning growth is critical. It is generally pronounced that genetic improvement will improve litter size, however, aided by provision of adequate nutrition and management translate to optimal degree of maximal profitability of rabbit enterprise. Post-weaning mortality has been associated with below average pre-weaning weights that are likely to adversely depress feed consumption, poor growth and compromised immune system. Reduced mortality and enhanced growth rates calls for improved nutrition and other management practices, in addition to the exploitation of crossbred livability and viability in rabbit production. Both selection and crossbreeding have played major roles in improving post-weaning growth in rabbits. Growth traits are moderately to highly heritable as a result selection of heavier kits on post-weaning growth could result in improving the character. The purpose of this review is to discuss the factors that affect post-weaning growth and mortality in rabbits.

1. Introduction

Post-weaning growth is influenced by both genetic and non-genetic factors (McNitt and Lukefahr, 1996) and is the major determinant of profitability function, since it affects the rate of attainment of slaughter weight (Onyiro et al., 2008). On the other hand, the number of marketable kits is dependent on post-weaning survivability and viability (Afifi and Emara, 1988). The understanding of post-weaning growth and mortality, among other traits could be a landmark to institute appropriate management practices and genetic selection schemes as a result improving overall productivity (Suárez-López et al., 2008). This implies that post-weaning growth rate is a critical indicator for efficient growth in rabbits (Borthakur et al., 2002). Post-weaning growth rate as a selection criterion for sire breeds has immensely improved total meat yield and financial gain in rabbit meat production (Baselga, 2004). It has been noted that the viability of a rabbit enterprise is determined by the number of kits which survive up to market and their growth potential. This implies that sustaining high financial gains in rabbit production is underpinned by reduced mortality and improved post-weaning growth. A comparison of studies comprising of the New Zealand, Californian, Champagne D'Argent and Palomino rabbit breeds observed both significant and non-significant variation for post-weaning growth performance (Roberts and Lukerfahr, 1992). Post-weaning mortality rate was marginally low with no variation registered between genotypes (Volek et al., 2006). Akanno et al. (2005) suggested that pre and post-weaning growth is a complex set of genetically and environmental controlled metabolic occurrence. Reasonable maternal effects existed in post-weaning growth traits Krogmeier et al. (1994). Post-weaning growth potential can be improved through crossbreeding (Saleh et al., 2005; Piles et al., 2004) and mortality curtailed by appropriate management practices. The purpose of this review is to discuss the factors that affect post-weaning growth and mortality in rabbits.

2. Post-weaning growth

Differences in post-weaning growth can be ascribed to genetic potential and influence of various non genetic factors (Ayorinde and Oke, 1995). Post-weaning growth potential extremely influence subsequent performance in rabbits (Tameem Eldar et al., 2012). Body weights at different ages can be derived from size and framework of an animal, including its body condition (Philip, 1990). There was breed variation for post-weaning growth at different ages (MacNitt and Lukefahr, 2014). A comparison studies comprising of the New Zealand, Californian, Champagne D'Argent and Palomino rabbit breeds observed both significant and non-significant variation for post-weaning growth performance (Roberts and Lukerfahr, 1992). Chinchilla crosses registered higher post-weaning growth traits than New Zealand White rabbits (Onyiro et al., 2008). The chinchilla crosses had a higher pre-weaning body weight, which was subsequently reflected on their high post-weaning improved performance. This implies that pre-weaning growth performance is highly correlated with post-weaning performance. This was also supported by Ayorinde (1997) who reported that the improved pre-weaning body weight gains in Dutch and New Zealand White rabbits were reflected in the post-weaning growth phase. In a similar study by Bianospia et al. (2006) observed that crossbreds were heavier and consumed more food than starightbreds, but no feed conversion efficiency differences were noted. At different ages, breed influenced post-weaning growth in Hyla rabbits (Akinsola et al., 2013). Ghoh et al. (2004) observed non-significant differences among rabbit breeds in growth traits at different ages after weaning. Breed influenced body weights and average daily gain at all ages during post-weaning phases (Lavanya et al., 2017). This was ascribed to improved feed conversion ratio. There was no variation in post-weaning growth performance of Vienna Blue and Burgundy Fawn rabbit, and also sire breed had no influence on growth but affected daily weight gain (Dalle Zotte and Paci, 2014). Burgundy Fawn rabbit performed better in post-weaning growth rate when used as sire breed under intensive system (Paci et al., 1995a). In a similar study by Raimondi and Auxilia (1973) observed that Burgundy Fawn rabbit and their crosses with New Zealand White and Carlifornia breeds reached an appropriate slaughter age at 15 weeks. Masoero (1992) approved the use of Vienna Blue as a sire breed for crosses to improve post-weaning growth rate, while Burgundy Fawn rabbit was not favored due to its high variation in daily weight gain. It is important to note that slow growth shown in the study by Dalle Zotte and Paci (2014) working with Vienna Blue and Burgundy Fawn rabbit, apart from being the influence of sire breed might be also the effect of feeding pattern which relied on organic diets. It could be reasonable to suggest that the low crude protein in organic diet resulted in poor growth of rabbits.

Post-weaning daily weight gain or actual weight in rabbit meat production have been used as selection criteria of paternal lines (Rafel et al., 1990; Estany et al., 1992). The most critical estimated differences observed between paternal and maternal lines in rabbits on post-weaning growth were that sire lines grew faster than the dam lines, importantly had greater feed consumption however lower feed efficiency rate. The differences were attributable to the fact that sire breeds were selected for growth potential (Feki et al., 1996). Confounding factors such as temperature could have played a significant role in influencing growth rate. It is generally pronounced that high temperatures could reduce feed intake which adversely affect growth through disturbing metabolic function reducing growth efficiency (Dallo Zotte, 2002). Castellini et al. (2010) and Rebollar et al. (2009) observed that parity order 2 progeny registered low post-weaning growth ascribable to the negative energy balance of their mothers, and this adversely affected the time expected to reach market weight. Genotype*feed interaction was significant on post-weaning live weight and daily gain, with New Zealand White registering superior performance (Suárez-López et al., 2008). Post-weaning growth potential and body weight are economic important factors in commercial rabbit meat production that can be improved through crossbreeding (Saleh et al., 2005; Piles et al., 2004). Post-weaning body weights registered positive heterotic effect and superiority percentage estimates for both pure and crossbreds under Egyptian condition (Abdel-Azeem et al., 2007).

Post-weaning live weight and daily gain are some of the most important economic growth traits in rabbit meat production, hence the understanding of these traits, among others could be a landmark to institute appropriate rabbit genetic selection schemes as a result improving productivity (Suárez-López et al., 2008). Post-weaning average growth were 181.25 g/week for diet containing soybean against 223.75 g/week for diet containing palm oil (Djakalia et al., 2012). This was after low growth of rabbits in first week after weaning which was attributable to weaning stress and the increase in solid feeding as compared to milk. In a similar study, genotype*feed interaction was significant on post-weaning live weight and daily gain, with New Zealand White registering superior performance (Suárez-López et al., 2008). A 14% dietary starch content was appropriate for post-weaning growth performance than 12% dietary starch content, however weight gain was not influenced by fiber dietary content (Volek et al., 2006). In a separate study, Lebas and Fortune-Lamothe (1996) suggested that dietary starch content should be reduced in post-weaning period. Digestive problems could be reduced by feeding appropriate fiber content (Gidenne et al., 2004).

The rise in seasonal temperature feed consumption of Botucata rabbits was marginally, but persistently, higher than crossbreds as post-weaning age progressed. This was ascribed to physiological response difference on heat stress in different genotypes (Dalle Zotte and Paci, 2014). Year of kindling apart from have an influence on post-weaning growth rate and mortality on different rabbit breeds, it also had a significant effect on litter size at weaning and litter weight at kindling (Apori et al., 2014). Fayeye and Ayorinde (2008) suggested that sex might be an important factor when selecting weaned kits for subsequent production, and mentioned the that female kits survived better than males. Variation in bodyweight due to sex in post-weaning phase was ascribed to biological sexual dimorphism (Mahgoub et al., 2005). However, there have been contradictory results on which sex is heavier than the other during post-weaning growth phase. The differences were probably due use of different breeds and production systems. At different ages, sex influenced post-weaning growth in Hylarabbits (Akinsola et al., 2013). Post-weaning growth potential of rabbit kits was affected by the weaning litter size (Fayeye and Ayorinde, 2008) and growth performance decreased with increase in weaning litter size. High plane of nutrition can compensate for the negative influence of weaning litter size on post-weaning growth. The negative effect of litter size at weaning on post-weaning performance is ascribed to the primary slowdown in preweaning growth of kits in relatively larger litters. Castellini et al. (2003) observed that litter size influenced bodyweight at 70 days, postpartum. Krogmeier et al. (1994) observed that litter size at birth had a significant effect on post-weaning growth in rabbits.

3. Post-weaning mortality

Post-weaning mortality can be explained by the low preweaning body weight, which is highly likely result into depress feed consumption, poor growth rates and as a result more susceptible to diseases (Oke et al., 2011). Ozimba and Lukefahr (1991) observed that mortality rate was lower in Chinchilla*New Zealand crosses as compared to California purebreds especially between 28 to 70 days of age. In addition, during the 42 days' growth phase the crosses maintained the lowest mean value for mortality rate. Post-weaning mortality rate was marginally low with no variation registered between genotypes (Volek et al., 2006). Gut disorders are the main source of rabbit mortality soon after weaning that contributing a larger segment of economic losses in a rabbit enterprise (Carabano et al., 2008). Post-weaning digestive disorders have been associated with the quantity and quality of feed and physiological status of the gut in terms of maturity (Kreg et al., 2009; Zita et al., 2007). On the other hand, disorders have been a result of stress induced by separation of kits from their dams. However, the condition can be exacerbated by transportation and change in nutrition. Kits sensitivity to stress slows down the rate of passage of feed in the gastrointestinal tract in turn cecotrophy ceases. This implies that the rabbits may lose out on cecotropes nutritional contribution of essential nutrients. On the other hand, stress causes imbalance of pH in the gastrointestinal tract, which influences the existence of pathogenic bacteria species hence diseases. The weaning age and solid feed distribution have been implicated in caeca fermentation pattern of growing rabbits (Piattoni and Maertens, 1999) which has a bearing on rabbit health status later in life.

Diet had a significant effect on post-weaning mortality, especially between 4 to 6th week. Due to dietary manipulation through increasing the digestible fiber/starch ratio and elevating the animal fat content, mortality rate was reduced (Soler et al., 2004). In a similar study, Perez et al. (2000) observed that replacing starch with digestible fiber in diets improved post weaning health condition of rabbits. Feed efficiency improved for rabbits fed low fiber diets, however, on the other hand, mortality was low in rabbits fed high fiber diets, especially for the first 2 weeks post-weaning (Grobner, 1985). Mortality rate was 10% for rabbits fed palm oil and 5% for soybean oil, which partly corroborates with observation by Lebas (2005) who reported mortality rate of 10 to 14% in fattening rabbits. Post-weaning mortality was curtailed in probiotic fed rabbits. This was attributable to improved microbial balance due to probiotic fortification. The elevated microbial balance improved growth rate, feed utilization and reduced mortality (Hollister et al., 1990; Laczaszabo et al., 1990). Inclusion of 1.5 to 3% pomegranate peel powder in diet resulted in improved caecal ecosystem through a reduction in pathogenic bacteria while mortality was greatly reduced (Mady et al., 2016).

4. Implication

Post-weaning growth rate of rabbits which is derived from body weight and its average daily gain have been associated with the viability and economic production of rabbit meat. It has been a character favorable for improving growth in rabbit breeding due to the fact that it is moderately and highly heritable as a result selection of heavier kits at post-weaning could result in improving growth traits. There is an inverse relationship of litter size at birth and weaning weight as age progresses, this may imply that weaning and/or birth weight might have an influence on post-weaning growth and it is reasonable to assume that litter size might influence variation in post-weaning growth. High post-weaning mortality calls for improved nutrition, and other management practices, in addition to the exploitation of crossbred livability and survivability.

World over, there are a few dominant rabbit breeds (New Zealand White, California, Chinchilla, etc.) which have been intensively selected for commercial meat production. The focus in developing countries is to breed and adapt these dominant breeds to their local environment. Over the years, the breeding results have been promising in different eco-climatic conditions, however, with some conflicting observations on performance of the same rabbit breeds. This implies that the thoughtful preferred rabbit breed utilization is now not based on the specific local country rabbit breed population but on the availability of the dominant European breeds. One of the implications for such a scenario is the disappearance of the local/native rabbits' populations within developing countries. It is reasonable to speculate that the impact of replacing local rabbits with unadapted exotic populations in the context of the predicted climate change and variability will have adverse effects on future rabbits' population performance. It would be otherwise important to maintain the dominant European breeds for the commercial sector due to their improved growth, and on the other hand, promote and develop local rabbit populations for the resource poor rural communities, as they are well adapted to the local conditions. Climate change and variability will have considerable adverse environmental impact on rabbits due to its influence on changes in temperatures regimes and rainfall patterns. Promotion of the few remaining adaptable local/native rabbits' species in different countries have been seen as a viable option to sustain the resource poor rural communities and partly deal with negative effects of climate change, especially in developing countries.

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