Small Ruminant Research 104 (2012) 37–44

Contents lists available at SciVerse ScienceDirect

Small Ruminant Research

journal homepage: www.elsevier.com/locate/smallrumres

Factors influencing productive longevity of Awassi and Najdi ewes in intensive production systems at arid regions

Anas Abdelqader[a,*], Azzam Al Yacoub[b], Matthias Gauly[c]

[a] Institute of Agricultural Research, Training, Extension and Education, University of Jordan, Amman 11942, Jordan
[b] Biology Department, Faculty of Applied Sciences, Umm Al-Qura University, Makkah, Saudi Arabia
[c] Department of Animal Science, University of Göttingen, Albrecht Thaer Weg 3, 37075 Göttingen, Germany

ARTICLE INFO

Article history:
Received 28 February 2011
Received in revised form 26 October 2011
Accepted 8 November 2011
Available online 3 December 2011

Keywords:
Awassi
Culling
Intensive production systems
Longevity
Najdi
Survival analysis

ABSTRACT

Length of productive life (LPL) of a ewe is a trait of considerable economic importance in sheep farming. Records of 66,050 Awassi and 12,010 Najdi ewes belong to 28 flocks in the northern part of the Arabian Peninsula were used to investigate factors influencing their LPL under intensive production systems at arid regions. Ewes with first lambing January 1, 2003 through December 31, 2009 were subjected to survival data analysis. Weibull distribution model was used to explore different explanatory variables affecting LPL. Parity, breed, lambing interval, age at first lambing, flock effect and type of lambing were the variables with the largest contribution to the likelihood function for LPL. Average age at first lambing was 16.5 ± 1.18 and 17.7 ± 1.76 months for Awassi and Najdi ewes, respectively. Average LPL was 2204 ± 8.1 and 1635 ± 11.0 days for Awassi and Najdi ewes, respectively. Within analyzed LPL, Awassi ewes had an average of 4.1 ± 0.27 parities compared to 3.3 ± 0.34 for Najdi ones. Awassi ewes were more adaptable to intensive production system than Najdi ewes under arid conditions. Najdi ewe was 1.8 ± 0.32 more likely to be culled than Awassi ewe under the same conditions. The most important factor affecting LPL in the overall risk analysis was parity number. The relative culling risk was decreasing continuously in both breeds from the first parity (Awassi = 3.5, SE = 0.31; Najdi = 5.17, SE = 0.41) to the last one (Awassi = 0.45, SE = 0.14; Najdi = 0.63, SE = 0.42). The most appropriate lambing intervals (LI) were 221–340 days for Awassi and 251–310 days for Najdi ewes. LI below or above these ranges were significantly increased the risk of culling. Ewes lambed for the first time at $\leq$13 months were under considerable culling risk (Awassi = 1.42, SE = 0.19; Najdi = 2.73, SE = 0.33) compared to ewes lambed at older ages. The research showed that the optimum ages at first lambing were 17–19 months for Awassi and 20–22 months for Najdi. Ewes lambed triplets or more were under higher culling risk (Awassi = 1.72, SE = 0.10; Najdi = 1.97, SE = 0.19) than ewes lambed twins or singles. Interaction analysis showed that ewes lambed triplets or more during parity #1 were 3.42 ± 0.50 more likely to be culled than ewes lambed singles during the same parity. LPL could be increased by allowing optimum lambing intervals, mating for the first time at maturity stage, and avoiding enhancement of large litter sizes particularly during early and late parities. Different management and housing systems applied in different flocks showed significant effects on culling risk. Considerable variations in calculated LPL were due to breed and flock effects. This can be utilized by sheep breeders to increase LPL through genetic and environmental manipulations. Genetic evaluation of longevity trait in Awassi and Najdi breeds should be conducted, which will be of importance for sheep breeding programs at arid regions.

* Corresponding author. Tel.: +962 799 55 7018; fax: +962 5 3584736.
E-mail address: a.abdelqader@ju.edu.jo (A. Abdelqader).

0921-4488/$ – see front matter © 2011 Elsevier B.V. All rights reserved.
doi:10.1016/j.smallrumres.2011.11.007

1. Introduction

Length of productive life (LPL), usually defined as the time from the first lambing to death, is a trait of considerable importance in sheep farming. Efficient ewe's performance during her productive life is inversely associated with culling rates which considered the most integrated business concerns for intensive production systems. Intensive culling increased production cost in sheep farming (Nugent and Jenkins, 1992). Thus, culling decision should be based on economic consideration since it can impair the farm profitability. Well-adjusted benchmarks for culling strategies in intensive sheep production systems are needed in order to extend the ewes' productive life. Ewes that have longer productive life will produce more lambs than ewes culled at early ages. Therefore, ewe's productive longevity can be defined as the days from first lambing to be removed from the flock. Typically, the length of the productive life is the major determinant for longevity value. Different approaches are used for productive longevity evaluation including cumulative binary data analyses and linear models (Hohenboken and Clarke, 1981; El-Saied et al., 2005; Hadley et al., 2006). However, modeling the longevity as a time-dependant variable can be better described by survival data analysis because it offers the advantage of using censored and uncensored records, thus it can retain the information from animals that were culled before completing the study period (Ducrocq et al., 1988; Ducrocq, 1994; Vukasinovic et al., 1999). Survival time can be defined broadly as the time to the occurrence of a given event (Hosmer and Lemeshow, 1999; Lee and Wang, 2003). Such class of analysis provides an applicable method for analyzing performance traits at specific time with clear discrimination between animals culled early or late in the period. Schneider et al. (2005) used different models for genetic evaluation of female fertility and concluded that survival analysis (SA) give more accurate results than other methodologies. Weigel (2004) concluded that SA can provide a powerful and defensible analysis of interval traits like calving interval, days open, first service and calving days until first positive pregnancy examination. SA has a high potential of analyzing the interaction between diseases and days to conception (Lee et al., 1989; Harman et al., 1996b), the effects of body condition score on reproductive efficiency (Suriyasathaporn et al., 1998), the time to first case of clinical mastitis (Carlén et al., 2005) and the effect of early lactation milk yield on days open (Harman et al., 1996a).

The demand on meat and dairy products from local breeds are increasing and expected to increase many folds in future. The farmers' general trends now are to commercialize the production systems of these breeds by intensifying management practices and applying accelerated lambing systems (Gürsoy, 2006; Galal et al., 2008). Applying of these systems combined with intensified production systems under arid regions may impair the economic sustainability of local breeds (Gootwine et al., 2008). Awassi and Najdi are examples of desert breeds that are well adapted over centuries for nomadic use under range lands and desert plains with extensive management systems. Awassi and Najdi are the most common breeds of sheep in the Arabian Peninsula (Yamoor et al., 1988; Galal et al., 2008). Awassi is the most common sheep breed in many Middle Eastern countries (Zarkawi, 1997). Najdi, a native breed of the Arabian Peninsula, ranked first for consumers' preference for its tasty meat over other breeds in the region (Abouheif et al., 1989; Alamer and Al-hozab, 2004). Both breeds have fatty tail, Awassi covered with white and brown wool, while Najdi covered with coarse and long hairy black wool. They are triple purpose breeds raised for meat, milk, and wool production. They are extremely hardy breeds known as highly adaptive animals to the harsh desert conditions and arid environments, and also known for their ability to tolerate diseases (Al-Jassim et al., 1999; Anonymous, 2011). To our knowledge, there have been no previous studies conducted to investigate longevity and culling patterns in Awassi and Najdi ewes kept in intensive production systems. The primary objective of this study was to investigate explanatory factors influencing culling rate and productive longevity of Awassi and Najdi ewes kept in intensive production systems by using survival analysis.

2. Materials and methods

2.1. Scope of the study

The study area is dominated by arid climate (annual precipitation < 50 mm), long hot summer, where day temperature can exceed 40 °C in August and short cold winter, where minimum temperature can go below 0 °C in January. The central geographical coordinates of the study area were latitudes: 29°56′ N, longitudes: 38°29′ E. The selected farms were applying intensive production practices with accelerated lambing systems. In general, ewes were hormonally treated before exposure to enhance annual lambing rate and reduce lambing interval. Breeding season is extended with successful out-of-season breeding. Lambing occurred usually at 148 days post-exposure. After lambing, ewes and their lambs were housed together. Lambs were mostly weaned at day 60 of age, while creep feed offered at day 44. Replacement ewes were soundly recruited for the breeding flock and fed the requirements to maintain the normal growth. Lambs other than replacements were entered in a fattening program.

2.2. Data collection

The study used data records belong to 28 sheep flocks kept under intensive production systems at the northern part of Saudi Arabia. The records included dates of birth, first mating, successive mating, first lambing, successive lambing, number of lambs born at each lambing and total in lifetime, type of lambing, total number of lambing in a lifetime and number of lambs born alive or dead, culling date, and reason of removing from the flock. Measured parameters were age of dam at first mating, age at first lambing, age at culling, number of parities per ewe's life, number of twins (or triplets) lambing, lambing interval, culling rate, replacement rate, death rate, lambing rate, and litter size. Farms were selected through a stratified sampling method, and then the flocks with reliable registration systems were enrolled in the study. Foreman of each flock was collecting data on a daily basis, and then data were processed either by commercial Sheep Flock Monitoring and Management Systems or by Excel sheets. The data file consisted of more than 400,000 records. A validated data analysis was performed to check for missing records. From this data set, we extracted 78,060 complete records corresponding to 66,050 Awassi and 12,010 Najdi ewes. Ewes with first lambing January 1, 2003 through December 31, 2009 were considered for data analysis. A ewe's record was considered to be censored if she still in the flock as of December 31, 2009. Parameters selected for survival analysis were breed, age at first lambing, parity, type of lambing, lambing interval, age at culling and length of productive life (LPL).