Black Sea Journal of Engineering and Science 3(1): 15-18 (2020)
doi: 10.34248/bsengineering.627982

Black Sea Journal of Engineering and Science
Open Access Journal
e-ISSN: 2619-8991

BS Publishers

Research Article
Volume 3 - Issue 1: 15-18 / January 2020

SURVIVAL ANALYSIS AND APPLICATION IN LIVESTOCK

Esra YAVUZ[1]*, Mustafa ŞAHİN[2]

[1]*Kahramanmaraş Sütçü Imam University, Faculty of Agriculture, Department of Animal Science, 46040, Onikişubat, Kahramanmaraş, Turkey*

[2]*Kahramanmaraş Sütçü Imam University, Faculty of Agriculture, Department of Agricultural Biotechnology, 46040, Onikişubat, Kahramanmaraş, Turkey*

Received: *October 01, 2019;* ***Accepted:*** *November 26, 2019;* ***Published:*** *January 01, 2020*

Abstract

Life analysis is a collection of analysis methods used to examine the time elapsed until the emergence of any phenomenon identified by the researcher. In medical studies, such as clinical trials comparing two or more trials; time is taken as the beginning of the individual's participation in the experimental study. Life analysis is researched not only in the field of medicine but also in many branches such as economy, social life, zoology and botany. In this study, milk data of Damaskus hybrid and Pure Damaskus goat herd consisting of two different races were used to make an application of life analysis in livestock field. In milk goatness, the life expectancy of the Damaskus hybrid and Pure Damaskus breeds in milk yield was analyzed by Kaplan-Meier test. IBM SPSS Statistic 23 package program was used for data analysis. As a result, it was seen that the length of life of the pure damask race on milk yield was longer than the Damaskus hybrid race. In other words, the results of the Log-rank test statistics for the data obtained as a result of the study were significant according to the significance level of 0.05. In addition, according to Kaplan-Meier life analysis hypothesis, the mean life milk yield age was different between the groups.

Keywords: Survival analysis, Kaplan-Meier, Time series, Livestock

***Corresponding author:** Kahramanmaraş Sütçü Imam University, Faculty of Agriculture, Department of Animal Science, 46040, Onikişubat, Kahramanmaraş, Turkey
E mail: yavuz7346@gmail.com (E. YAVUZ)
Esra YAVUZ https://orcid.org/0000-0002-5589-297X
Mustafa ŞAHİN https://orcid.org/0000-0003-3622-4543
Cite as: Yavuz E, Şahin M. 2020. Survival analysis and application in livestock. BSJ Eng Sci, 3(1): 15-18.

1. Introduction

Survival analysis is the analysis of the time period until the occurrence of so-called failure, such as death and deterioration. For living things, the concept of death and for the inanimate are often mentioned (Miller, 2011). Survival analysis is mostly used in medicine, engineering and social sciences. This study investigates the application of survival analysis in the field of Animal Science. Thus, it is shown that life analysis can be used in animal science as well as in medicine (Cox, 2018). Survival analysis is the realization of an event depending on time and the importance of the factors affecting this event during the realization process. Life analysis can be applied to any time-dependent event rather than just death and illness (Sutton et al., 2000). The analysis made

for this purpose is also called monitoring or observation analysis.

Any material other than living material, such as human and animal, can also be used as the material in survival analysis (Zhang, 1997). Furthermore, the most important feature that distinguishes life analysis from other analyzes is that the event is not necessarily defined for all subjects or samples. Especially in animal studies and animal breeding, genetic parameter estimation allows survival analysis to be a usable analysis (Vukasinovic, 1998). In studies on animals, quantitative yield characteristics such as meat, milk yield, egg yield and economic yield level durations depending on time and survival analysis and methods can be examined in determining the characteristics that affect this period.

The aim of this study is to define the survival analysis and to examine an application in the field of Animal Science. In addition to the widespread use of survival analysis in the medical field, it also shows good results when used in other fields. In this study, Kaplan-Meier test of survival analysis was applied to the data obtained from livestock and interpreted in tables (Cox, 1972). For this purpose, the survival analysis of small ruminants selected from the field of Animal science was introduced and a practical application of the Kaplan-Meier test was performed (Efron, 1988).

2. Material and Methods

In this study, milk data of Damaskus crossbreed and Pure Damaskus goat herd consisting of two different races were used to make an application of survival analysis in the field of animal husbandry (Seker et al., 2004; Van et al., 2014). In this flock, the identification code for the last lactation of goats of different ages was analyzed for survival analysis (Harman et al., 1996). In milk goat, the life expectancy of milk yield of Damaskus hybrid and Pure Damaskus races was analyzed by Kaplan-Meier test (Rich et al., 2010). IBM SPSS Statistic 23 package program was used for data analysis. Survival analysis methods investigate the events occurring at predetermined time intervals (Li et al., 1994). This method creates completed and incomplete events. Events that cannot be obtained in cases where the event of interest does not occur within the specified time interval or if the event is excluded from the investigation is called an incomplete event. The expression of survival is the state in which the event in the monitoring process after a certain starting point is investigated or attained the desired state. One feature that distinguishes survival analysis from other analyzes is the absence of incomplete data. The data generated in the survival analysis may not occur within the defined periods of the identified event. The data obtained in these cases is called incomplete data (Guyot et al., 2012).

Kaplan-Meier method was used for life analysis. Kaplan-Meier method was used to compare the races Log-Rank test. Time is very important in Kaplan-Meier method (Jager et al., 2008; Goel et al., 2010). The Kaplan-Meier method is the general form of survival curves. Log-Rank test is used to compare these curves. In the Kaplan-Meier method, a probability is estimated for each event. The distinguishing feature the Kaplan-Meier method from life analysis is that it evaluates each time of death separately (Ture et al., 2009). Thus, survival occurs in the form of probabilities and step function.

The assumptions of Kaplan-Meier method; when the subjects began to work, the date of occurrence of the events and the occurrence of losses should be known. In addition, the event and losses should not occur at the same time (Vukasinovic et al., 2001).

3. Results and Discussion

Widely used in the determination of productive life length in animal husbandry, the lifestyle of various breeds of goats helps to manage the milk yield age (Zırhlıoğlu and Kara, 2004). In this study, the survival of two different breeds in milk yield was analyzed by Kaplan-Meier test. Table 1 shows the completed and incomplete data of two different breeds. According to Table 1, 10 out of 18 goats from Damaskus race and 7 out of 27 goats from Pure Damaskus race were evaluated as incomplete observation. According to Table 1, 10 out of a total of 18 goats from Damaskus race have died and 44.4% are complete observations, 7 out of 27 goats from Pure Damaskus race have died and 74.1% are complete observations.

Table 1. Kaplan-Meier analysis according to the complete and incomplete observations and percentages

Group	Total n	n of events	Censored	
			n	Percent
Damascus	18	10	8	44.4%
Pure Damascus	27	7	20	74.1%
Overall	45	17	28	62.2%

As a result of Kaplan-Meier analysis in Table 2 averages of two different races and the median life expectancy. In Table 2, the average milk yield age was 5 in the Damaskus breed, while the average milk yield age was 7 in the Pure Damaskus breed. In addition, while the standard error of the Damaskus race was 0.497, the standard error of the pure Damaskus race was 0.612. Thus, it is seen that the length of life of the pure Damaskus race on milk yield is longer than the Damaskus hybrid race.

In Table 3, it is stated that two different races are equal in terms of survival. In addition, as a result of the Log rank test, the chi square test statistic was calculated as 1.838 and $p > 0.05$.

Finally, Figure 1 shows the milk yield ages of two different breeds. According to Table 1, it is seen that the milk yield age is higher than that of the Pure Damascus race, which is the second group.

Table 2. Kaplan-Meier analysis and average life expectancy

Group	Mean	Standard Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Damascus	5.00	0.497	4.348	6.295
Pure Damascus	7.00	0.612	5.869	8.268

Table 3. Survival distributions for the different levels of group

	Chi-Square	df	Sig.
Log Rank (Mantel-Cox)	1.838	1	0.175

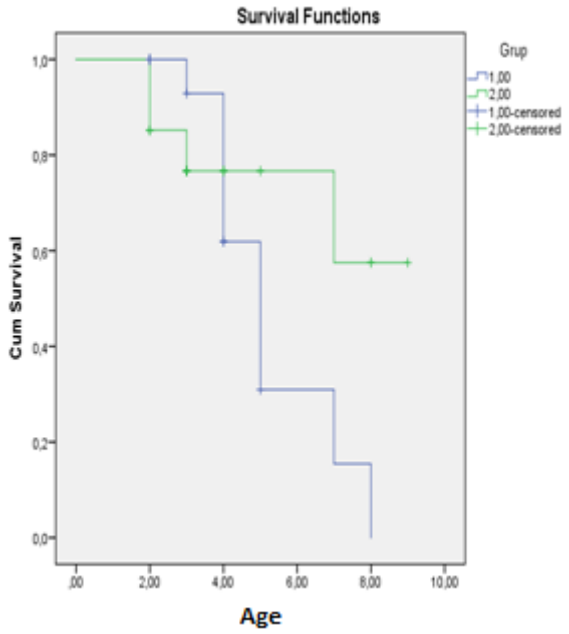

Figure 1. Survival times of two different races. 1. Group: Damascus, 2. Group Pure Damascus.

As a result, it was seen that the length of life of the pure damask race on milk yield was longer than the Damaskus hybrid race. In other words, the results of the Log-rank test statistics for the data obtained as a result of the study were significant according to the

Insignificant level of 0.05. In addition, according to Kaplan-Meier life analysis hypothesis, the mean life milk yield age was different between the groups.

4. Conclusion

In this study, Kaplan-Meier test was used to determine the survival rate of milk yields of different breeds. As a result of the analysis, it is shown that the length of life of the pure damask race on milk yield is longer than that of the Damaskus hybrid race. In addition, as a result of the Log rank test, the chi square test statistic was found to be 1.838 and P> 0.05 was statistically insignificant.

Conflict of interest

The authors declare that there is no conflict of interest.

Acknowledgements

This research was presented as an oral presentation at the International Congress on Domestic Animal Breeding Genetics and Husbandry (ICABGEH-2019) held on 11-13 September 2019 in Prague.

References

Cox DR. 1972. Regression models and life-tables. J Royal Stat Soc: Series B (Methodological), 34(2): 187-202.

Cox DR. 2018. Analysis of survival data. Chapman and Hall/CRC.

Efron B. 1988. Logistic regression, survival analysis, and the Kaplan-Meier curve. J American Stat Assoc, 83(402): 414-425.

Goel MK, Khanna P, Kishore J. 2010. Understanding survival analysis: Kaplan-Meier estimate. Int J Ayurveda Res, 1(4): 274.

Guyot P, Ades AE, Ouwens MJ, Welton NJ. 2012. Enhanced secondary analysis of survival data: reconstructing the data from published Kaplan-Meier survival curves. BMC Med Res Methodol, 12(1): 9.

Harman JL, Casella G, Gröhn YT. 1996. The application of event-time regression techniques to the study of dairy cow interval-to-conception. Preventive Vet Med, 26: 263-274.

Jager KJ, Van Dijk PC, Zoccali C, Dekker FW. 2008. The analysis of survival data: the Kaplan–Meier method. Kidney Int, 74(5): 560-565.

Li Y, Klein JP, Moeschberger ML. 1994. Effect of model misspecification in estimating covariate effects in survival analysis for small sample size. Technical Report No. 511. Departmenet of Statistics, the Ohio State University, Columbus, OH.

Miller Jr RG. 2011. Survival analysis. John Wiley and Sons. (Vol. 66)

Rich JT, Neely JG, Paniello RC, Voelker CC, Nussenbaum B, Wang EW. 2010. A practical guide to understanding Kaplan-Meier curves. Otolaryngol Head Neck Surg, 143(3): 331-336.

Seker I, Kul S, Bayraktar M, Akcan A. 2004. Effects of crossbreeding with East-Friesian to Awassi on milk production and mammary gland traits. Medyc Weterynar, 60(08): 815-818.

Sutton AJ, Abrams KR, Jones DR, Jones DR, Sheldon TA, Song F. 2000. Methods for meta-analysis in medical research. Chichester: Wiley, vol: 348.

Ture M, Tokatli F, Kurt I. 2009. Using Kaplan–Meier analysis together with decision tree methods (C&RT, CHAID, QUEST, C4. 5 and ID3) in determining recurrence-free survival of breast cancer patients. Expert Syst Applicat, 36(2): 2017-2026.

Van Melis MH, Figueiredo LGG, Oliveira HN, Eler JP, Rosa GJM, Santana ML, Ferraz JBS. 2014. Quantitative genetic study of age at subsequent rebreeding in Nellore cattle by using survival analysis. GMR, 4071-4082.

Vukasinovic N, Moll J, Künzi N. 1997. Analysis of productive life in swiss brown cattle. J Dairy Sci, 80: 2572-2579.

Vukasinovic, N. 1998. Application of survival analysis in breeding for longevity. Animal Breeding Group, Swiss Federal Inst Tech.

Vukasinovic N, Moll J, Casanova L. 2001. Implementation of a routine genetic evaluation for longevity based on survival analysis techniques in dairy cattle populations in Switzerland. J Dairy Sci, 84(9): 2073-2080.

Zhang M. 1997. Grouped failure times, tied failure times. Two Contributions to the Encyclopedia of Biostatistics, To The. Encyclopedia of Biostatistics, Technical Report 24.

Zırhlıoğlu G, Kara K. 2004. Estimation of some parameters related to queen bee breeding using life analysis methods. Yüzüncü Yıl Univ J Agri Sci, 14(1): 7-15.