International Journal of Science and Research (IJSR)
ISSN: 2319-7064
SJIF (2022): 7.942

Female Bali Cattle Body Size Clusterization and its Impact on their Reproductive Status

I Putu Sampurna

Abstract: ***Background of the Study**: Bali cattle standardization stipulates quality requirements and measurement methods for Bali cattle breeds. Bali cattle breed are cattle that have superior characteristics and pass these traits to their offspring and meet certain requirements to be bred. This standard stipulates the quality requirements and method of measuring Bali cattle breeds. Quantitative requirements are determined based on the application of the Indonesian National Standard (SNI) for Bali cattle. Quantitative parameters based on SNI for female Bali cattle include chest circumference, shoulder height, and body length. However, the impact of the classification of Bali cattle based on SNI on their reproductive status has not been reported. The reproductive status can be observed from the age at first estrus, age at first breeding, gestation period, age at first calving, postpartumestrus, and postpartumbreeding. **Aim**: This study aims to investigate the clustering of female Bali cattle based on SNI and its impact on their reproductive status. Moreover, this study also aims to determine the diversity of reproductive status and the correlation between reproductive status. Thus, in making a selection of reproductive status, it can be determined which one is done first and which can be done simultaneously. **Method**: Data were obtained from 25 female Bali cattle intensively reared at the Center for Superior Bali Cattle Breeding (Pusat Pembibitan Sapi Bali Unggul, abbreviated as PPSBU) in Gerogak, Buleleng Regency, Bali. The data obtained were analyzed by hierarchical cluster analysis with SNI characteristics of Bali cattle as variables, such as chest circumference, shoulder height, body length, and cattle that had been clustered as objects (cluster cases). The results obtained were in the form of cluster membership tables and a dendrogram graph. To find out its impact on reproductive diversity, the obtained data were analyzed by biplot analysis. The analysis procedure was conducted using IBM SPSS (Statistical Product and Service Solutions) version 26. **Results**: The results showed that intensively reared female Bali cattle clustered using hierarchical cluster analysis with SNI characteristics for Bali cattle. The most uniform reproductive status was the gestation period, followed by the age at first calving, the age at first breeding, and the age at first estrus, while the most varied was postpartumestrus. There was a very significant correlation between the age at first estrus with the age at first breeding and the age at first calving, as well as between the age at first breeding and the age at first calving. This result indicates that the earlier the age at first estrus, the faster the breeding, which means that the age at first calving is also faster. Meanwhile, the gestation period and postpartumestrus had no significant correlation with the age at first estrus, the age at first breeding, and the age at first calving. The reproductive status of Bali cattle obtained was not influenced by body size which had been clustered into 3 classes, namely class I, class I, and class III based on SNI Bali cattle. **Conclusion**: Intensively reared female Bali cattle can be clustered using hierarchical cluster analysis with the SNI characteristics for Bali cattle, the most uniform reproductive status was gestation period, followed by the age at first calving, the age at first breeding, and the age at first estrus, while the most varied was the postpartumestrus. There was a positive correlation between the age at first estrus, the age at first breeding, and the age at first calving, but these three reproductive statuses were not correlated with gestation period and postpartumestrus. Hence, female Bali cattle clustering have no impact on the reproductive status of intensively reared Bali cattle.*

Keywords: Standardization, Cluster Analysis, Body Size, Reproductive Status, Biplot Analysis

1. Introduction

Bali cattle are one of the genetic resources of native Indonesian cattle and also one of the important types of beef cattle that contribute to the development of the livestock industry in Indonesia. Bali cattle have spread in almost all provinces in Indonesia and are growing quite rapidly in the regions because they have several advantages. Bali cattle have the advantage of surviving in an inadequate environment, for example without being penned, and in places of low feed quality, even though there is a decline in production and reproduction (Toelihere, 2003). Bali cattle have good adaptability to bad environments such as areas with high temperatures, low feed quality, and others. The fertility rate of Bali cattle is very high, not inferior to other cattle, which is up to 83%, regardless of feed quality. This high fertility rate is the uniqueness of Bali cattle (Gontoro, 2006).

The reproductive status that can be observed is the age at first estrus, age at first breeding, gestation period, age at first calving, postpartum estrus, and postpartum breeding. Sariubang et al. (2009) argue that in intensively reared Bali cattle, postpartum estrus will occur on the 81st day, while traditionally reared postpartum estrus takes 107 days. The age of the weaned calf will affect the emergence of postpartum estrus. Wiltbank (1970) believes that lactating female cattle, age, and nutritional level are important variables that affect postpartum estrus. Female Bali cattle that have good reproductive status cannot be said to be superior if their body size does not meet the standards to be maintained as brood female cattle. Saptayanti *et al*. (2015) reported that there was a correlation between the body size of the female Bali cattle and the body size of the calves that were born.

Bali cattle standardization stipulates quality requirements and measurement methods for Bali cattle breeds. Bali cattle breeds are cattle that have superior characteristics and pass these traits to their offspring and meet certain requirements to be bred. These standards stipulate the quality requirements and the method of measuring Bali cattle breeds. Quality requirements are distinguished for female and male Bali cattle, consisting of qualitative and quantitative requirements. Qualitative requirements for female cattle include coat color, reddish body color, white knees down, white rump in the shape of a half - moon, black tail tip, a black line on the back, short horns, long head, and slender neck. Meanwhile, the qualitative requirements for male cattle are black body color, white knees down, white bottom in the shape of a half - moon, the black tip of the tail, black horns towards the middle, a wide head, and a compact and strong neck. Whereas, quantitative requirements are set based on age and class for each male and female breed. Quantitative parameters include chest circumference, shoulder height, body length, and adjusted age (months). Age measurement is carried out in two ways, namely based on birth records and based on the replacement of permanent incisors according to the Indonesian National Standard or *SNI* (2017).

The application of *SNI* for Bali cattle can be done by cluster analysis and biplot analysis. Cluster and biplot analysis gave the same results for grouping Bali cattle based on the Bali cattle *SNI*. Grouping with cluster analysis is easier to see based on the obtained cluster membership, whereas biplot analysis provides additional information about correlational and variability between variables (Sampurna et al., 2020). Biplot analysis is able to directly display the most dominant variable or variable from a set of objects formed on the results of the biplot analysis results (Mattjik et al, 2011). Biplot analysis grouping produces a better percentage of accuracy than clustering cluster analysis. Yet, in general, it cannot be said that biplot analysis is better than cluster analysis in grouping data and vice versa (Ariawan et al.2013).

Clustering itself is the process of grouping similar objects into different groups, or rather partitioning a data set into subsets. Therefore, the data in each subset has a useful meaning. A cluster will consist of a collection of objects that are similar to one another and different from objects in other clusters. Clustering can also be interpreted as a process where grouping and dividing data patterns into several data sets. Thus, they will form similar patterns and are grouped in the same cluster and separate themselves by forming different patterns in the different clusters (Merliana et al., 2019).

The dendrogram describes the cluster formation process expressed in the form of an image or graph. The horizontal line above the dendrogram shows the scale that describes similarity, the smaller the scale value indicates the more similar the individual is (Annisa et al.2016). Dendrogram simulations with or without characterizing variables have similar results, but dendrogram simulations with variables identifiers from each cluster formed can be labeled according to the characteristics of the given variable, making it easier to communicate (Sampurna *et al* 2017).

Based on the description above, it is necessary to conduct a study to see whether body size has an impact on reproductive status. Hence, in conducting the selection of female Bali cattle as prospective broodstock for Bali cattle, it is necessary to standardize their body size to get Bali cattle broodstock that is superior to their body size and will get a good reproductive status as well.

2. Research Method

2.1 Research Object

The objects of this study were 25 female Bali cattle that were reared intensively at the Center for Superior Bali Cattle Breeding (*Pusat Pembibitan Sapi Bali Unggul*, abbreviated as *PPSBU*) in Gerogak, Buleleng Regency, Bali.

2.2 Data Collection

Data were collected using a questionnaire, interviews, and direct observation (measurement) in the field.

2.3 Data Analysis

The body size data obtained were analyzed by hierarchical cluster analysis referring to *SNI* characteristics for Bali cattle, as variables were chest circumference, shoulder height, body length, and cattle as subjects (cluster cases). The results obtained were in the form of cluster membership tables and dendrogram charts. Reproductive status data were analyzed by factor analysis based on the correlation between reproductive components. Biplot simulation was done to draw the coordinates of the reproductive status components and to describe the coordinates of objects (clustered Bali cattle) based on the Regression Method factor analysis, with factor score 1 as the axis and factor score 2 as the ordinate. Some important information obtained from the biplot analysis was the closeness between objects (clustered Bali cattle) observed. This information was used as a guide to finding out objects that had similar characteristics to other objects, the relative position of objects, and correlations between variables (reproductive status) based on the angle formed.

The analysis procedure was conducted using SPSS (Statistical Product and Service Solutions) IBM version 26.

3. Results and Discussion

The results of the study on the body size of 25 female Bali cattle that were intensively reared based on *SNI* are presented in Table 1.

Table 1: Cluster Membership of Intensively Maintained Female Cattle with *SNI* Characteristic Variables for Bali Cattle

SNI	Cattle Code	Total
Class I	C 0104, C 0114, C 0118, K 0119, C 0120, C 0138 andC 0139	7
Class II	C 0103, C 0106, C 0111, C 0112, C 0113, C0115, C 0116, C 0117, C 0121, C 0122 andC 0129	11
Class III	C 0105, C 0107, C 0110, C 0130, C 0131, C0133, and C 0137	7

The results of the hierarchical cluster analysis with the *SNI* characteristics of Bali cattle for 25 female Bali cattle that were intensively reared showed that 7 cattle were in class I, 11 cattle were in class II, and 7 cattle were in class III.

The results of the cluster analysis of 25 female Bali cattle with 3 *SNI* identification objects, class I, class II, and class III, can be depicted by a dendrogram graph as shown in Figure 1. The dendrogram graph of a 95% similarity level shows that intensively reared Bali cattle can be divided into 3 classes, namely class I (green box), class II (yellow box), and class III (red box). Each class still had sub - classes. Class II was the most diverse for it consisted of 2 sub - classes, while class I and class III had no sub - classes. The existence of sub - classes in class II was caused by each class in the *SNI* identification for Bali cattle determined by 3 criteria, namely shoulder height, body height, as well as body length, and chest circumference. Therefore, cattle with sufficient body height and sufficient body length, but thin, accordingly had thin chest circumference and cannot be categorized into class I. Instead, it might go to class II for being short (small height) and can even form a new class. The results of the cluster analysis of 25 female Bali cattle were mostly in class II and none were outside the class. This indicates that intensively reared female Bali cattle can be classified based on *SNI* Bali cattle.

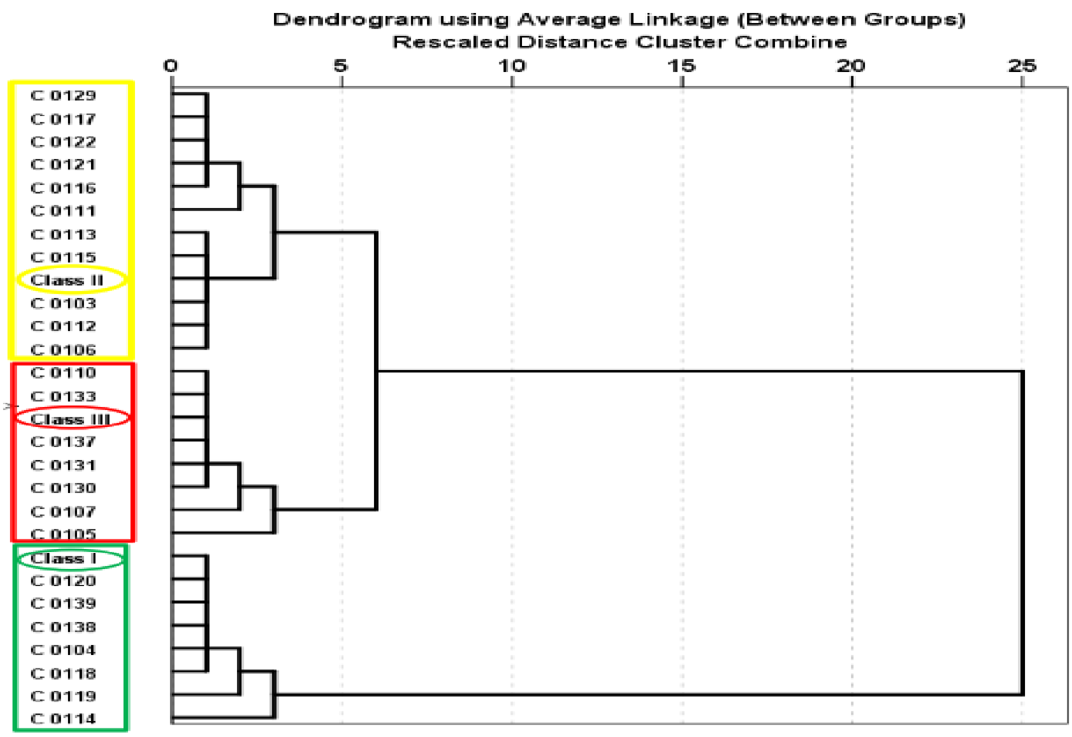

Figure 1: Dendrogram Graph of Reproductive status of Intensively Reared Bali Cattle

The results of the cluster analysis were divided into 3 major groups, namely cows with shoulder height, body length, and chest circumference below average, close to average, and above average. These findings support Everitt, *et al*. (2011) who stated that cluster analysis is a comprehensive analysis aiming to group objects from the data studied based on the characteristics they have in common. In other words, it groups objects or cases into smaller groups where each group contains objects that are similar to each other (Supranto, 2004). This study supports a previous study conducted by Ariawan, et al. (2013), by providing groupings based on variables or objects that can be determined and named according to the specified identifier variable or objects. The cluster analysis results can be used to classify the intensively reared female Bali cattle into 3 classes according to the 3 classes as characterizing variables determined by *SNI* for Bali cattle. Dendrogram simulation with identifier variables can be used to classify variables into clusters of as many identifiers as specified.

Based on the number of cattle included in each class based on *SNI*, Bali cattle intensively reared need to replace their female Bali cattle. In the beef cattle business, be it for breeding or fattening purposes, the replacement female cattle selection factor might determine the success of the business. The replacement female cattle that meet the specified criteria following the business objectives will provide optimal results. replacement is substitute livestock that is intended to replace livestock that is no longer suitable for production in terms of physical and age (rejected). To determine the cattle that are eligible to be rejected, therefore, the ability to choose and sort not to choose the wrong cattle that are not eligible need to be possessed. The feasibility of livestock to be rejected from a physical point of view can be determined based on the class set by the *SNI* for Bali cattle. To get superior breeds of cattle to be distributed to livestock, a minimum of class II should be chosen, since the body size of the female cattle is positively correlated with the calves that are born. Saptayanti et al. (2015) reported that there was a comparison between the dimensions of the length of the female cattle and the calf that was born. The ratio of the dimensions of the length of the calf to its mother was 57.6 % ear length, 45.5% neck length, 44.9% head length, 44% tail length, and 43.8 % body length of the size of the mother.

The results of the study on reproductive status showed that Bali cattle intensively reared obtained reproductive status results as presented in Table 2.

Table 2: Observations on the Reproductive status of Bali Cattle

Reproductive Status (month)	Mean	Standard Deviation	Minimum	Maximum	Coefficient of Diversity
Age at First Estrus	20.20	1.19	18.00	22.00	5.89228
Age at First Breeding	21.13	1.05	18.75	22.75	4.97440
Gestation Period	9.60	0.33	9.00	10.25	3.44500
Age at First Calving	30.88	1.24	28.50	33.50	4.01486
Postpartum Estrus	4.93	0.92	3.00	6.25	18.66187

Table 2 presents that the age at first estrus for Bali cattle was 20.2± 1.19 months, while the age at first breeding was at the age of 21.13 ± 1.05 months. These results indicate that not all cattle were immediately bred at the time of the first estrus. From observations, some were bred in the second estrus (0.75 months after the first estrus), and some were bred in the third estrus (1.5 months after the first estrus). Thus, the age at first breeding is longer than the age at first estrus. These findings support Mahasanti *et al* (2021) who reported that the puberty age of Bali heifers was 12 - 36 months with an average of 22 ± 6 months. This is slower than the age at first estrus in Bali cattle in Badung Regency using the *simantri* (integrated agriculture system), where the puberty age of female Bali cattle reaches an average of 18.26 months (Wimbavitrati *et al*., 2020). The age of puberty in female cattle can be influenced by internal factors, namely genetics or race, while external factors are maintenance management, climate, temperature, the presence or absence of males, and the health condition of the livestock.

The gestation period for Bali cattle that were intensively reared was 9.6 ± 0.33 months. Thus, the first calving age was obtained at the age of 30.88± 1.24 months. The gestation duration from this study supports a previous study conducted by Prasojoet al. (2010) which was 9.48 ± 5.70 or 19 months with a range of 9.29 – 9.67 months, whileWimbavitrati, *et al*. (2020) reported that the average gestation period for Bali cattle was cattle was 9.06 ± 0.24. postpartum estrus obtained in this study was 4.93 ± 0.92 months. From the observation, it was found that at the time of postpartum estrus, the female Bali cattle were directly bred or incinerated by butane (IB). therefore, the time of postpartum breeding was the same as the time of postpartum estrus. Dhayanti et a*l.* (2021) reported that the time of postpartum estrus was 3.24±1.118 months, with the highest frequency of 2.2 – 3.4 months of 54.17%. This difference was due to the difference in calf weaning time, the age of the cattle, and the different rearing systems. Dirgahayu *et al.* (2015) argue that the calves weaned for too long will cause a delay in ovarian activity in their parent, causing postpartum anestrus. The time of postpartum estrus, longer or shorter, is not only due to physiological factors and length of lactation but also due to female cattle calving for the first time or female cattle that have given birth more than four times (Dhayanti et al.2021).

The diversity of reproductive status of intensively reared Bali cattle is presented in Table 3. The table showed that the smaller the value, the more uniform the reproductive diversity, on the contrary, the larger the more diverse. Accordingly, the most uniform diversity of reproductive status is postpartum estrus, followed by gestation period, age at first calving, age at first breeding, and age at first estrus at last.

These results indicate that the most uniform female Bali cattle is the gestation period, followed by the age at first calving, the age at first breeding, the age at first estrus, and postpartum estrus at last. The diversity of reproductive status, namely gestation duration, and age at first calving is uniform, while postpartum estrus is the most diverse. The results of this study are in line with the results of a study by Wimbavitrati, et al. (2020) which reported that the gestation period had the least variation, while postpartum estrus was the most diverse. Short et al. (1996) reported that the lactation period or calf weaning age might affect nutritional requirements. Therefore, the lactation period of the calf will have an impact on feed consumption, affecting the bodyweight of the female cattle and conditions during the dry period. Accordingly, it can slow down the postpartum estrus of the female cattle. Schillo (1992) mentions that sufficient body energy is needed to produce Luteinizing Hormone (LH hormone). This hormone functions to stimulate follicular growth (activating ovarian function) which triggers postpartum estrus. Wiltbank (1970) states that breastfeeding cattle, the age of the mother, and nutritional level are important variables that affect postpartum estrus. The duration of postpartum estrus depends on the management and the environmentof the breed (Akma *et al*., 2016). The decline in postpartum estrus can be caused by the weaning of the offspring very late. Thus, the mother experiences very long days open which in turn has an impact on the spacing of calving (Diwyanto and Inounu, 2009).

Based on the correlation matrix between the reproductive status of female Bali cattle that were intensively reared, there was a significant correlation ($P < 0.01$), 0.928 between the age at first estrus, as well as between the age at first breeding and the age at first calving of 0.906. These findings show that the earlier the age at first estrus, the faster the breeding, hence, the age at first calving is also faster. Meanwhile, the gestation period and postpartum estrus had no significant correlation with the age at first estrus. The age at first breeding, or the age at first calving. The gestation period had a negative correlation with postpartum estrus, -0.301, but statistically not significant ($P > 0.05$). This indicates that there is a tendency for female Bali cattle that were reared intensively to get a longer gestation period to be faster in getting postpartum estrus.

Table 3: Correlation Matrix of Female Bali Cattle Reproductive Status

Reproductive Status (month)	Age at First estrus	Age at First Breeding	Gestation Period	Age at First Calving	Postpartum Estrus
Age at First Estrus	1.000	0.928**	- 0.106	0.928**	- 0.034
Age at First Breeding	0.928**	1.000	- 0.151	0.906**	- 0.227
Gestation Period	- 0.106	- 0.151	1.000	0.119	- 0.301
Age at First Calving	0.928**	0.906**	0.119	1.000	- 0.133
Postpartum Estrus	- 0.034	- 0.227	- 0.301	- 0.133	1.000

Note: ** Statistical significance (P<0.01)

The impact of body size of female Bali cattle intensively reared on their reproductive status can be simulated with a biplot graph (Figure 1). Figure 1 depicts the variables (reproductive status) and objects (clustered Bali cattle) in one two - dimensional space. The correlation between the reproductive status of female Bali cattle reared intensively can be depicted by arrows of a vector, namely the angle between vectors depicts the correlation between the reproductive status of female Bali cattle. Meanwhile, the location of the coordinates of the female Bali cattle that had been clustered is depicted in the figure ♀ .

The biplot graph explains the correlation between the reproductive status of female Bali cattle reared intensively indicates that if the angle between the vectors forms an acute angle (<90 degrees) then the correlation between the reproductive status shows a positive correlation. Moreover, the sharper the angle indicates the greater the correlation. Based on the biplot graph, it can be seen that the angle formed between the age of the first estrus, first breeding, and first calving forms an acute angle close to 0 degrees, indicating a very significant correlation. Meanwhile, if the angle formed is close to the angle of the elbow (90 degrees), it means that there is no correlation between the reproductive status. The biplot graph shows that the gestation period and postpartum estrus form an angle close to the angle of the elbow, indicating that there is no significant correlation (P > 0.05) with the age of first estrus, first breeding, and first calving. If the angle formed between the vectors of reproductive status forms an obtuse angle (>90 degrees), it means that the reproductive status is negatively correlated. These results can be seen that the angle formed between the gestation period and postpartum estrus is an obtuse angle or the opposite direction of the vector (Mattjik and Sumertajaya, 2011; Sampurna, 2019). The results of this study support a study conducted by Wimbavitrati, et al. (2020) which reported that there was a correlation between the first estrus and the first breeding as well as first calving, while there was a negative correlation between the gestation period and postpartum estrus.

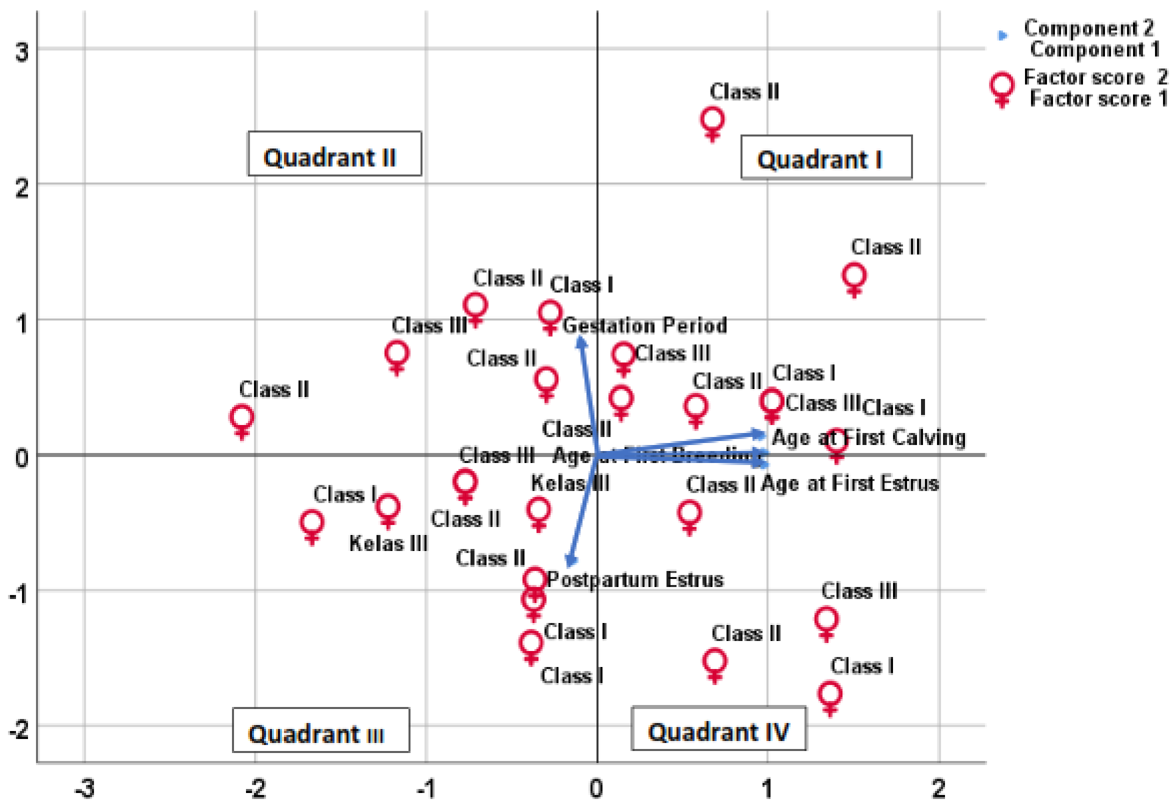

Figure 2: Biplot Graph of Female Bali Cattle Reproductive Status

The location of the coordinates of the female Bali cattle that have been clustered consisted of class I, class II, and class III spread in all quadrants. These results indicate that the class of female Bali cattle has no impact on the reproductive status of Bali cattle. These findings indicate that the body size of the female Bali cattle did not affect their reproductive status. Many factors influence an individual reproductive status, including the length of lactation, the age of the mother, and the level of nutritional intake (Wiltbank, 1970). Reproductive status can be improved by doing a good management of the influencing variables. The performance of reproductive status can be improved with additional feeding techniques in prepartum or postpartum or a combination thereof, as well as the provision of good quality feed to heifers. Pregnant female cattle and lactating cattle as well as calf weaning management can improve the reproductive performance of female cattle. Sutiyono, et al. (2016) reported that cattle reproductive activity disorders on smallholder farms are caused by nutritional factors in the feed given and reproductive disorders due to disease factors and reproductive organ abnormalities. The location of the coordinates of the female cattle that had been clustered on the biplot chart is very important for selecting female Bali cattle in order to improve their reproductive status. Therefore, superior Bali cattle are obtained based on their body size and reproductive status. Selection is one of the actions that can be taken to improve internal genetic quality (Oka, 2010). Livestock that has a greater breeding value will be better if used as seeds compared to livestock that has a low breeding value (Putra et al., 2015). The location of the biplot coordinates of an animal can show the superiority of the genetic potential of the animal to the average population where the animal is located. This result can be used as a reference for the selection of broodstock for parent stock replacement. Proven broodstock will have high productivity in producing superior offspring like their parents.

4. Conclusions

1) Intensively reared female Bali cattle can be clustered using hierarchical cluster analysis with *SNI* characteristics of Bali cattle.
2) The most uniform reproductive status is the gestation period, followed by the age at first calving, first breeding, and first estrus, while the most varied was postpartum estrus.
3) There is a positive correlation between the age at first estrus, first breeding, and first calving. However, these three reproductive statuses are not correlated with the gestation period and postpartum estrus.
4) Female Bali cattle clustering has no impact on the reproductive status of intensively reared Bali cattle

References

[1] Akma G. S., L. W. Pribadi and M. Yassin. (2016). Reproductive Performance of Indigenous Bali Cows in the Different Farming Management and Thermal Environment of Lombok Island Indonesia, Journal of Agriculture and Veterinary Science, 9 (12): 83 - 89.

[2] AnnisaNF, Rahmawati R2, Tarnon. (2016). Analisis Klaster Kecamatandi Kabupaten Semarang Berdasarkan Potensi Desa Menggunakan Metode Ward danSingle.

[3] Ariawan IMA, Kencana IPNK, Suciptawati, NLP. (2013). KomperasiAnalisisGerombol (Cluster) dan Biplot dalamPengelompokan. E - JurnalMatematika Vol.2, No.4, Nopember 2013, 17 - 22 ISSN: 2303 - 1751.

[4] DhayantiNLE, LaksmiDNDI, Sampurna IP. (2021). The Emergence of Post Partum Estrus on Bali Cattle in Some Livestock at the Working Area of Sobangan Animal Health Center, Badung, Bali. Indonesia Medicus Veterinus.10 (4): 576 - 588

[5] Dirgahayu FF, Hartono M, Santosa PE. (2015). Conception Rate SapiPotong di KecamatanJati Agung Kabupaten Lampung Selatan. JurnalIlmiahPeternakanTerpadu 3 (1): 7 - 14.

[6] Diwyanto K., dan I. Inounu, (2009). The Impact of Crossbreeding in the Artificial Insemination Program on Reproductve Performance on Beef Cattle. Wartazoa 19 (2):

[7] Everitt, B. S., Landau. S., Leese. M., dan Stahl, D. (2011). Cluster Analysis. Fifth Edition. London: John Wiley & Sons, Ltd

[8] Guntoro**,** S.2006. MembudidayakanSapi Bali Cetakankeenam. PenerbitKasinius, Yogjakarta

[9] Mahasanti IGAP, Trilaksana IGNB. Laksmi DNDI. (2021). The Age of Puberty in Bali Cattle Heifers in Galungan Village, Sawan Subdistrict, Buleleng Regency, Bali Province. Indonesia Medicus Veterinus.10 (4): 544 - 522.

[10] Mattjik, A. A., dan I. M. Sumertajaya. (2011). SidikPeubah Ganda. Bogor: InstitutPertanian Bogor Press.

[11] Merliana NPE, ErnawatiA, SantosoJ. (2018). Analisa PenentuanJumlah Cluster terbaik pada Metode K - Means Clustering. Posiding Seminar Nasional Multi DisiplinIlmu& Call for Papers Unisbank (SENDI_U) Kajian Multi Disiplin Ilmuuntuk Mewujudkan Poros

[12] Maritimdalam Pembangunan EkonomiBerbasisKesejahteraan Rakyat ISBN: 978 - 979 - 3649 - 81 - 8

[13] Oka, I G. L. (2010). Conservation and genetics improvement of bali cattle. Proceeding International Seminar on "Conservation and Improvement of World Indigenous Cattle".3 - 4 September 2010. Held by Studi Center for Bali Cattle Udayana University. Bali. Indonesia.

[14] Prasojo APS, G A K Surtiari, PPrasetyoputra (2021). The impact of natural disasters in Indonesia: How doeswelfare accentuate and attenuate the loss of people?. Journal of Physics: Conference Series 1869 (2021) 012148 IOP Publishing doi: 10.1088/1742 - 6596/1869/1/012148

[15] Putra WBP, Sumadi,, T Hartatik,, H Saumara (2015). Evaluation of growth traits of Aceh cattle at the breeding station in Indrapuri District of Indonesia. Bangladesh Animal Husbandry Association. All rights reserved. Bang. J. Anim. Sci.2015.44 (2): 85 - 91

[16] Sampurna IP, Nindhia TS, Sukada IM (2017). Dendrogram simulations with determinatvariableidentifer to determine the farm classification systems of bali pigs. International Journal of Science and Research (IJSR) ISSN (Online): 2319 - 7064 Index

[17] Sampurna, IP. (2019). Aplikasi SPSS GrafikdalamBiostatistika. PenerbitPuriBagia. https: //www.puribagia. com/blog/categories/buku. Published onlinenulisbuku. com/view - profile/90381/l%20 Putu - Sampurna

[18] Sampurna IP, Nindhia TS, SusariNNW, Suatha IK.2020. Application of Indonesian's National Standard for Grouping of Bali Cattle with Cluster and Biplot Analysis. Journal of Veterinary and Animal Sciences, [S. l.], v.3, n.2, p.57 - 68, ISSN 2622 - 0571.
[19] Saptayanti NNJ, Satha IK, Sampurna IP (2015). Corelation Between the Size of the Body Part of Dam and Calf in Bali Cattle. BuletinVeterinerUdayana. Volume 7 No.2: 129 - 136. p - ISSN: 2085 - 2495; e - ISSN: 2477 - 2712:
[20] Sariubang M, Nurhayu A, Saenab.2009. Pengkajiansistempembibitansapibali pada peternakan rakyat di KabupatenTakalar. Seminar Nasional TeknologiPeternakan dan Veteriner 2009.
[21] Standar Nasional Indonesia (SNI). (2017). BibitSapiPotongBagia4: SapiBali. Diterbitkandi Jakarta. SNI: 7651 - 4: 2017. ICS 65.020.30. Badan Standarisasi (BSN)
[22] Supranto, J.2004. AnalisisMultivariat Arti dan Interpretasi. Penerbitan: Jakarta: RinekaCipta, 2004 Jakarta: RinekaCipta. ISBN 9795189026
[23] Schilo. KK. (1992). Effects of Dietary Energy on Control of Luteinizing Hormone Secretion in Cattle and Sheep. Journal of Animal Science, Volume 70, Issue 4, April 1992, Pages 1271–1282, https: //doi. org/10.2527/1992.7041271x
[24] Short, R. E., E. E. Grings, M. D. MacNeil, R. K. Heitschmidt, M. R. Haferkamp, and D. C. Adams. (1996). Effect of Time of Weaning, Supplement, and Sire breed of CafDuring the Fall Grazing Period on Cow and Calfperformance. J. Anim. Sci.74: 1701 - 1710.
[25] Sutiyono, Samsudewa D, Suryawijaya A. (2016). Identification of Reproductive Disorders in Female at Local Farms. JurnalVeterinerDesember 2017 Vol.18 No.4: 580 - 588. pISSN: 1411 - 8327; eISSN: 2477 - 5665 DOI: 10.19087/jveteriner.2017.18.4.580.
[26] Toelihere, M. R. (1985), InseminasiBuatan pada Ternak, PenerbitAngkasa, Bandung
[27] Wimbavitrati KA,, Sampurna IP, Suatha IK. (2020). Reproductive Appearance of Bali Cattle at Simantri in BadungRegency. Buletin Veteriner Udayana Volume 12 No.1: 24 - 31
[28] Wiltbank JV. (1970). Research need in beef cattle production. J. Anim. Sci.31: 75.93 - 102