Livestock and Animal Research
Accredited by Directorate General of Strengthening for Research and Development No. 10/E/KPT/2019

Open Access
Livest. Anim. Res., March 2023, 21(1): 42-50
p-ISSN 2721-5326 e-ISSN 2721-7086
https://doi.org/10.20961/lar.v21i1.63993

Original Article

Cases of cow reproductive disorders at The Northern Bandung Dairy Farmer Cooperative by using Geographic Information System (GIS) approach

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Received: July 27th, 2022; Accepted: February 27th, 2023; Published online: March 10th, 2023

Abstrak

Tujuan: Tujuan dari penelitian ini adalah untuk mengetahui persentase kasus gangguan reproduksi pada sapi perah di kawasan Koperasi Peternak Sapi Bandung Utara (KPSBU) Lembang berdasarkan faktor kondisi nilai tubuh (BCS) dan faktor musim, serta mengetahui peta sebarannya.
Metode: Objek yang digunakan pada penelitian adalah data sekunder induk sapi perah tahun 2019 hingga 2021 yang terdaftar dalam pangkalan data koperasi. Parameter penelitian ini adalah jenis, persentase kasus, faktor risiko, dan sebaran kasus gangguan reproduksi. Data penelitian dianalisis secara deskriptif berdasarkan faktor nilai kondisi tubuh (BCS) ternak dan faktor musim.
Hasil: Hasil disajikan dalam bentuk table dan gambar yang telah diolah menggunakan aplikasi Microsoft Excel, sementara peta sebaran telah diolah menggunakan aplikasi QGIS. Persentase kasus gangguan reproduksi pada sapi perah di KPSBU Lembang pada tahun 2019–2021 secara berturut-turut adalah sebagai berikut: Retensi plasenta sebesar 11,5%, 14,9%, dan 14,4%; Distokia sebesar 11,5%, 12,6%, dan 14,2%; Gangguan fungsi ovarium (kista folikel dan kista korpus luteum) sebesar 10,2%, 8,8%, dan 9,9%; Endometritis sebesar 9,3%, 9,5%, dan 10,4%. Berdasarkan peta sebaran kasus gangguan reproduksi, diketahui seluruh desa di Kecamatan Lembang.
Kesimpulan: Gangguan reproduksi pada sapi perah di kawasan KPSBU Lembang adalah, retensi plasenta, distokia, gangguan fungsi ovarium (kista folikel dan kista korpus luteum), dan endometritis. Distokia dan retensi plasenta menjadi kasus tertinggi di kawasan KPSBU Lembang pada musim kemarau dan musim hujan. Daerah-daerah yang memiliki sapi perah dengan BCS tidak ideal menjadi daerah dengan kasus tertinggi di setiap jenis gangguan reproduksi.

Kata Kunci: BCS; Gangguan reproduksi; Musim; Sapi perah; Sistem informasi geografis

Abstract

Objective: This study aimed to determine the percentage of reproductive disorders in dairy cows at The Northern Bandung Dairy Farmer Cooperative (KPSBU Lembang) based on body condition score (BCS) and season factor and determined the distribution map.
Methods: The object of this study was secondary data on dairy cows from 2019 to 2021 registered on the cooperative database. The parameters of this study were type, case percentage, risk factor, and distribution of reproductive disorders. The data were analyzed descriptively based on BCS and season factors.

Results: The percentage results were presented in tables and figures after being processed using Microsoft Excel, while the distribution maps were processed using the QGIS application. The percentages of reproductive disorders in KPSBU Lembang in 2019–2021 respectively as follows: Retained placenta were 11.5%, 14.9%, and 14.4%; Dystocia were 11.5%, 12.6%, and 14.2%. Ovarian function disorders (follicular cyst and corpus luteum cyst) were 10.2%, 8.8%, and 9.9%; Endometritis was 9.3%, 9.5%, and 10.4%. Based on the distribution maps of reproductive disorders, it was known that all villages in Lembang District in 2021 had cows with reproductive disorders.
Conclusions: The reproductive disorders in dairy cows at KPSBU Lembang had retained placenta, dystocia, ovarian function disorder (follicular cyst and corpus luteum cyst), and endometritis. Dystocia and retained placenta are the highest cases in KPSBU Lembang during the dry and rainy seasons. Areas that had dairy cows with unideal BCS became the highest area of each type of reproductive disorder cases.

Keywords: BCS; Reproductive disorders; Season; Dairy cow; Geographic information system

INTRODUCTION

Dairy cows are one of the most common farm animals in Indonesia. Based on data from the Central Statistics Agency or *Badan Pusat Statistik* (BPS) for 2021, Indonesia had 578,579 dairy cows, with East Java as the region with the highest number of dairy cows with 301.780 cows. West Java was in third place with the largest population of 119,915 dairy cows, with West Bandung Regency as the area with the highest population [1]. The high population is due to several dairy cooperatives in West Java, one of which is the North Bandung Cattle Breeders Cooperative (KPSBU) Lembang. In 2021, KPSBU Lembang had 19,712 dairy cows.

The large cattle population in the Lembang KPSBU work area often encounters animal health problems, one of which is reproductive disorders. In 2021 there were more than 6,000 cases of reproductive disorders in dairy cattle at KPSBU Lembang, with the four highest cases were retained placenta, dystocia, endometritis, and ovarian function disorder (follicular cysts and corpus luteum cysts). Reproductive disorders can increase the costs and expenses of farmers because of the extension of the delivery interval and the budget for cow treatment [2]. According to Rukayah [3], the farmer can lose up to ten million per seven years of cattle production due to an extension of the calving interval of cow.

This research utilized geographic information system applications in making distribution maps that contain information related to the relationship between the percentage of cases and disease risk factors presented on a map model of an area. Geographic information systems can sort and analyze data from a database in the form of a map [4]. This study aimed to determine the percentage of cases of reproductive disorders based on seasonal risk factors and body condition values (BCS) of cows and then classified them based on area.

MATERIALS AND METHODS

Time and location

This research was conducted from June 20 to July 30 2022 in Lembang District, West Bandung Regency, West Java (Figure 1).

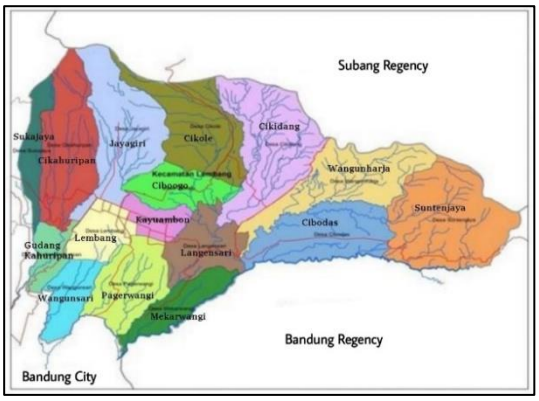

Figure 1. Administrative map of Lembang District [5].

Population and sample

Cow population from 2019 to 2021 respectively 21,643, 19,676, and 19,712 dairy cows spread across 26 Cumulative Collection Points or *Tempat Pengumpulan Kumulatif* (TPK) of milk used as the population in this study.

Table 1. Cases of reproductive disorders in dairy cattle at KPSBU Lembang 2019–2021

Case type	Number of cases			
	2019	2020	2021	Total
Retained placenta	1350	1606	1520	4476
Dystocia	1348	1360	1499	4207
Ovarian function disorder	1194	949	1047	3190
Endometritis	1087	1023	1100	3210

Research design

This research was a descriptive study to describe the types and proportions of reproductive disorders cases in dairy cattle at KPSBU Lembang traditional farm from 2019 to 2021 based on seasonal factors and cow BCS. Furthermore, this study described the distribution of cases of reproductive disorders in dairy cows in the KPSBU Lembang traditional farm in 2021 using a geographic information system. The data were obtained from secondary data from KPSBU Lembang. The data obtained were then processed using the Microsoft Excel application. Furthermore, the distribution map based on the area is made with the data processed using a geographic information system application.

Sample size

The sample used as the research object is the primary data of KPSBU Lembang dairy cattle from 2019 to 2021 respectively 11,683, 10,804, and 10,569 dairy cows. The areas used on the distribution map are 20 TPK from 26 TPK in the KPSBU working area that is included in the Lembang District: Cibodas, Cilumber, Manoko, Corner, Keramat, Cibogo, Cibedug, Genteng, Gunung Putri, Pasiripis, Cikawari, Pencut, Nonagara, Pagerwangi, Barunagri, Citespong, Nagrak, Pamecelan, Pasar Kemis, and Suntenjaya.

Research Procedure

The research procedure began with collecting secondary data on dairy cattle and cases of reproductive disorders from the KPSBU Lembang database. Furthermore, geospatial data were collected from the Lembang District from the Indonesia Geospatial Portal website. Secondary data were processed using the Microsoft Excel application to find out the percentage of cases of reproductive disorders in cows, while geospatial data were processed using the Quantum Geographic Information System (QGIS) application to divide the KPSBU work area based on the village area. After that, tables and diagrams were made to present the average BCS and the percentage of cases of reproductive disorders. The distribution of cases was carried out by dividing the groups on the distribution map based on the rate of cases of reproductive disorders in cows. The data processing results were shown in tables, diagrams, and distribution maps then analyzed descriptively based on seasonal factors and BCS.

RESULTS

Based on secondary data from the Lembang KPSBU, data were obtained regarding reproductive disorders from 2019 to 2021. The reproductive disorders discussed in this study were retained placenta, dystocia, ovarian function disorder (follicular cyst and corpus luteum cyst), and endometritis. Cases of reproductive disorders in dairy cattle at KPSBU Lembang in 2019-2021 are shown in Table 1. The number of cases of reproductive disorders in dairy cattle at KPSBU Lembang per season in 2019-2021 is shown in Figure 2.

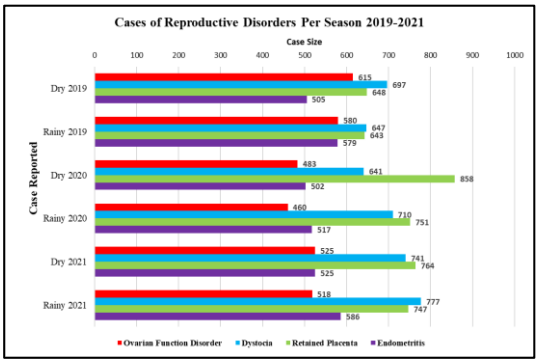

Figure 2. Diagram of reproductive disorders cases in dairy cattle at KPSBU Lembang per season 2019-2021.

Mapping the distribution of cases of reproductive disorders at KPSBU Lembang was carried out using the QGIS application.

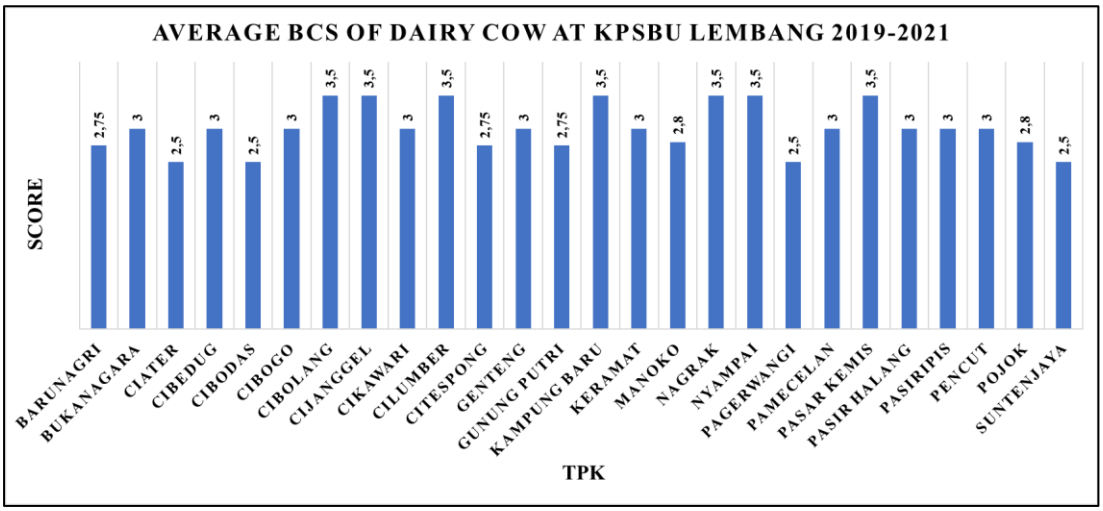

Figure 3. Diagram of the average BCS of dairy cows at KPSBU Lembang for 2019-2021.

The mapping was based on a combination of TPK, the village area in Lembang District, and cases of reproductive disorders in 2021. The mapping of cases was divided into four distribution maps based on cases of reproductive disorders shown in Figure 4, Figure 5, Figure 6, and Figure 7. The distribution map were divided into five groups: group 1 with a ratio of 0 cases per 1000 cows, group 2 with a ratio of 1-100 cases per 1000 cows, group 3 with a ratio of 101-250 cases per 1000 cows, group 4 with a ratio of 251-500 cases per 1000 cows, and group 5 with a ratio of more than 500 cases per 1000 cows.

Several TPK had non-ideal BCS values for dairy cows. BCS values of dairy cows that are not ideal will increase the risk of retained placenta because it can cause mineral and vitamin deficiencies [6]. According to Beagley *et al.* [7], deficiency of vitamin E and selenium will increase the risk of retained placenta. Vitamin E and selenium act as antioxidants in the body to maintain the immune system. In poor conditions, the cow's body will experience immunosuppression, especially the ability of chemotaxis and the number of lymphocyte cells that play a role in releasing the placenta [7].

DISCUSSION

The highest percentage of retained placenta cases were found in TPK Suntenjaya in 2019 (185 cases), 2020 (136 cases), and the second highest was in 2021 (118 cases). Meanwhile, the average BCS at TPK Suntenjaya was 2.5, which is presented in Figure 3. This data shows that dairy cows at TPK Suntenjaya had a low average BCS. According to Phillips [8], the ideal BCS in dairy cows is 3.5–4.0 on a scale of 1-5. Cattle with a BCS of 1.0–2.0 or a BCS of more than 4.0 tend to had poor reproductive performance [8].

Based on Figure 2, cases of retained placenta in 2019-2021 were higher during the dry period. In the dry season, animals are more at risk of heat stress [9]. Divers and Peek [6] state that heat stress is a predisposing factor for retained placenta. Cattle that experience heat stress during the dry period of the pen tend to experience immunosuppression such as the decreased ability of cell phagocytosis, weak cell proliferation system and reduced ability of immune response [10]. In addition, another factor that is indirectly related to the dry season is that it will be more difficult for farmers to meet cows' nutritional needs due to the difficulty in finding good quality feed [9].

The lowest percentage of retained placenta cases were at TPK Nyampai in 2019 (3 cases) and 2020 (3 cases), while in 2021 it was at TPK Cikawari (8 cases). In Figure 3, TPK Nyampai had an average BCS of 3.5 and TPK Cikawari had an average BCS of 3. These results indicate that the cattle are getting good feed intake [8]. In addition to BCS and season factors, good cage management can also prevent animals from being exposed to heat stroke which is a predisposing factor for retained placenta [6].

The distribution of cases of retained placenta is presented in Figure 4. The majority of areas had a percentage of cases that fall into group 3 with a ratio of 101–250 cases per 1000 cows. Cikahuripan-Gudang Kahuripan Village,

Cikidang-Cikole Village, and Langensari-Wangunharja Village were included in group 2, with a ratio of 1-100 cases per 1000 cows. Based on the distribution map, no areas belonged to group 1, group 4, or group 5.

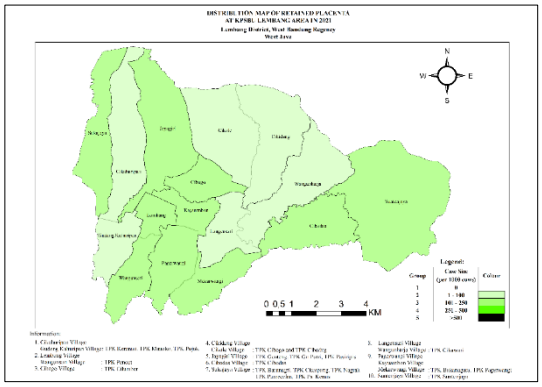

Figure 4. Distribution map of retained placenta at KPSBU Lembang in 2021.

There were two TPKs with the highest percentage of dystocia cases in 2019-2021, namely TPK Barunagri (131, 144, and 138 cases) and TPK Suntenjaya (155, 140, and 160 cases). Meanwhile, TPKs with the lowest percentage of dystocia cases in 2019-2021 were TPK Cibolang (7 cases), TPK Cikawari (6 cases), and TPK Cibolang (8 cases).

The high percentage of dystocia cases in dairy cattle at TPK Barunagri and TPK Suntenjaya may be due to the low BCS of the cattle. In Figure 3, the average BCS of dairy cows at TPK Suntenjaya was 2.5, and at TPK Barunagri is 2.75. This data shows that the two TPKs had cattle BCS below the ideal value 3.5–4.0 on a scale of 1-5 [8], while TPK Cikawari and TPK Cibolang had the lowest percentage of cases with an average cattle BCS of 3.0. and 3.5.

According to Phillips [8], a cow's BCS can range from 2.0 to 3.0 after giving birth but will return to the ideal value at the end of the lactation period. If the mother at the time of delivery does not reach the ideal BCS, it will increase the risk of dystocia. Cow should not be given excessive or underfeeding when entering the last trimester of pregnancy. Cow with below-ideal BCS conditions will experience a lack of nutrition in the muscles so muscle tone decreases [7]. This condition can cause dystocia in the mother due to uterine inertia or inadequate pelvic relaxation [11]. Conversely, a cow with BCS above the ideal number or excess feed also has a risk of experiencing dystocia due to the large size of the fetus and the smaller birth canal due to fat deposits in the pelvic area [11].

There was an exceptional case at TPK Cilumber, which had a BCS value of 3.5 but is the fourth TPK with the most dystocia cases in 2020. The incident at TPK Cilumber may be caused by other factors such as the size of the fetus being too large, abnormalities in the position of the fetus such as bent front legs, changes in the shape of the fetus, or a narrow birth canal [11].

Dystocia cases at KPSBU Lembang decreased in 2020 but increased again in 2021. More dystocia cases in 2019 occurred during the dry season. This data showed that season was not a risk factor for dystocia cases at KPSBU Lembang. Another possible factor that influences dystocia cases in housing management. Cattle in KPSBU Lembang generally used intensive maintenance. Cattle with intensive rearing tend to experience higher cases of dystocia than those with extensive rearing because the cows are less mobile [11]. According to Mekonnen and Nibret [12], exercise can reduce the risk of developing dystocia. Muscles that are often trained will strengthen contractions during childbirth [11].

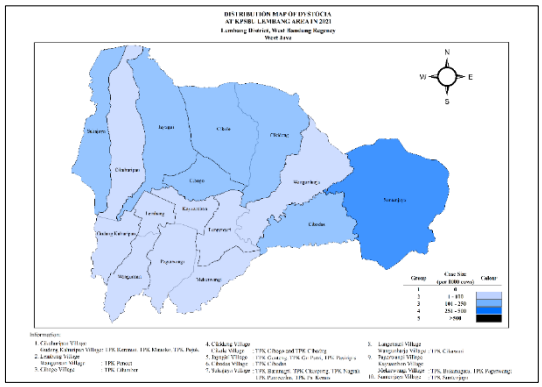

Figure 5. Distribution map of dystocia at KPSBU Lembang in 2021.

The distribution of dystocia cases is shown in Figure 5. Most villages had case numbers that belonged to group 3 with a ratio of 101–250 cases per 1000 cows, namely Sukajaya Village, Jayagiri Village, Cikidang-Cikole Village, Cibogo Village, and Cibodas

Village. Meanwhile, there were four villages: Cikahuripan-Gudang Kahuripan Village, Lembang-Wangunsari Village, Pagerwangi-Kayuambon-Sukajaya Village, and Langensari-Sukajaya Village were included in group 2 with a ratio of 1-100 cases per 1000 cow. Only Suntenjaya Village had the highest percentage of dystocia cases in group 4. Based on the distribution map, there were no areas belonged to group 1 or group 5.

The highest percentage of endometritis cases in 2019–2021 respectively TPK Suntenjaya (144 cases), TPK Cilumber (98 cases), and TPK Ciater (100 cases). Meanwhile, TPK with the lowest percentage of endometritis cases were TPK Cikawari and TPK Kampung Baru (4 cases) in 2019, TPK Gunung Putri and TPK Pasir Halang (5 cases) in 2020, and TPK Pagerwangi (5 cases) in 2021.

The average BCS of cows in TPK Suntenjaya, below the ideal value, increases the risk of endometritis. According to Phillips [8], low BCS can cause a negative energy balance which increases the risk of animals getting infected. This condition happens because in cows deficient in nutrients such as vitamin E and selenium, lymphocytes, and neutrophils will reduce the ability of lymphocytes and neutrophils in cell phagocytosis, cell proliferation, and the ability of the immune response [10]. In the study of Ohtsuka *et al.* [13], it was shown that under low BCS conditions, cows have a higher number of lymphocytes circulating in the body compared to cows with ideal BCS.

Cases of endometritis were higher during the rainy season, as shown in Figure 2. However, no studies have stated that season is the leading risk factor for endometritis cases. Research conducted by Judi *et al.* [14] stated that there was no relationship between the increase in endometritis cases and the season factor at KPSBU Lembang. Other studies also support the statement that season is not a risk factor for endometritis cases [15,16].

The high cases of endometritis during the rainy season may be related to the poor sanitation of the cow sheds during the rainy season. According to Judi *et al.* [14], wet environmental conditions and standing water increase the risk of bacterial infection. This condition is exacerbated when cows experience retained placenta, injuries during childbirth, wounds during mating, and contamination during treatment of the reproductive tract [17]. This condition may also be the reason for the high percentage of endometritis cases at TPK Cilumber, even though the average BCS was 3.5, which was considered ideal according to Phillips [8].

The distribution of endometritis cases was shown in Figure 6. Most villages had cases in group 2 with a ratio of 1–100 cases per 1000 cows. Only Suntenjaya Village, Cibodas Village, Sukajaya Village, and Cibogo Village were included in group 3, with a ratio of 101–250 cases per 1000 cows. Based on the distribution map, there were no areas with the number of cases that fall into group 1, group 4, or group 5.

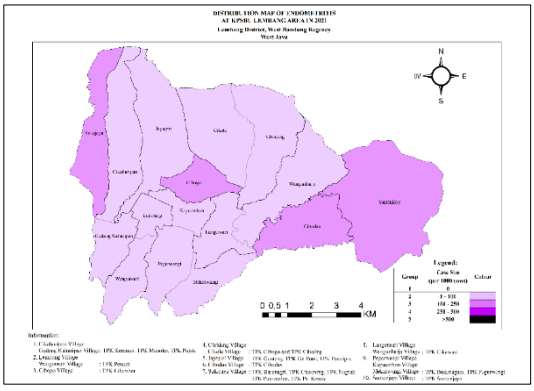

Figure 6. Distribution map of endometritis at KPSBU Lembang in 2021.

The highest percentage of cases of ovarian function disorder in 2019-2021 were TPK Cibodas in 2019 (172 cases) and TPK Pojok in 2020 and 2021 (149 and 170 cases). The percentage lowest cases of ovarian function disorder in 2019–2021 were consecutively TPK Kampung Baru in 2019 (2 cases), TPK Cijanggel in 2020 (1 case), and TPK Nagrak in 2021 (4 cases).

Based on Figure 3, the average BCS of cows at TPK Cibodas and TPK Pojok had values below the ideal (3.5–4.0) [8]. On the other hand, the average BCS of ideal cows, such as those aimed at TPK Kampung Baru, TPK Cijanggle, and TPK Nagrak, were 3.5, which had a lower percentage of cases. Poor nutritional intake is characterized by low BCS, which can reduce the ability to stimulate Gonadotropin-releasing hormone (GnRH).

The ability to stimulate GnRH is influenced by the acetic acid content in the body [18]. Acetic acid is one of the fly fatty acid substrates produced from the fermentation of organic matter in the rumen, for example, concentrate [19]. Decreased GnRH stimulation will reduce FSH and LH levels in the blood [18]. Decreasing levels of FSH and LH result in a decrease in the ability of the ovaries to form follicles and the corpus luteum [20].

Figure 2 shows that cases of ovarian function disorder were more common in dairy cows during the dry season compared to the rainy season. This condition may be related to cows experiencing heat stress, which reduces their appetite [11]. This condition means that seasonal factors also affect cow BCS. According to Long *et al.* [21], stress can trigger an increase in the hormone cortisol, adrenocorticotropic hormone, or the hormone progesterone above normal levels, which can delay or inhibit the secretion of GnRH and LH, thereby inhibiting follicular development.

Another factor that may affect cases of ovarian function disorder was the cow maintenance. Dairy cows at KPSBU Lembang used an intensive system with a rope tied to the cow's neck. According to Hermadi *et al.* [20], intensively reared cattle will increase the risk of decreased ovarian function. Research by Long *et al.* [21] The results show that cows kept with their necks tied can cause a decrease in the fertility rate of cattle.

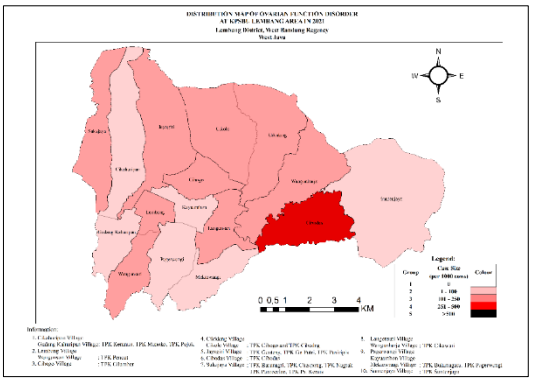

Figure 7. Distribution map of ovarian function disorder at KPSBU Lembang in 2021.

The distribution of cases of ovarian function disorder (follicular cysts and cysts of the corpus luteum) is shown in Figure 7. The majority of areas with a percentage of cases of impaired function belonged to group 3 with a ratio of 101–250 cases per 1000 cows. Cikahuripan-Gudang Kahuripan Village, Kayuambon-Pagerwangi-Mekarwangi Village, and Suntenjaya Village belonged to group 2 with a ratio of 1-100 cases per 1000 cows. Meanwhile, Cibodas Village had the highest percentage of cases of ovarian function disorder by entering group 4 with a ratio of 251–500 cases per 1000 cows. Based on the distribution map, there were no areas belonged to group 1 or group 5.

Based on the four maps of the distribution of cases of reproductive disorders, it can be seen that all regions experienced cases of reproductive disorders. The distribution map also shows no areas with a ratio of more than 500 cases per 1000 cows. In this study, no spatial relationship was discussed between the high cases of reproductive disorders on the distribution map and the distribution area. The housing system [6] and cow rearing [21] carried out by breeders may influence the magnitude and distribution of cases of reproductive disorders.

CONCLUSION

The reproductive disorders in dairy cows at KPSBU Lembang are retained placenta, dystocia, ovarian function disorder (follicular cyst and corpus luteum cyst), and endometritis. Dystocia and retained placenta are the highest cases in KPSBU Lembang during the dry and rainy seasons. Areas that had dairy cows with unideal BCS became the highest area of each type of reproductive disorder cases.

CONFLICT OF INTEREST

The authors declare no conflict of interest with any financial organization regarding the material discussed in the manuscript.

ACKNOWLEDGMENTS

The authors would like to thank Padjadjaran University Veterinary Medicine, KPSBU Lembang, and all parties involved so that this research can be carried out.

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