

Communication

A Survey on Major Infertility Causes in Crossbred Dairy Cattle Farms in Nyala City - South Darfur State - Sudan

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Abstract: The aim of the current survey was to detect the major causes of reproductive disorders in crossbred dairy cattle farms in Nyala City –South Darfur state. A structured questionnaire based on the survey objectives was used and SPSS software was utilized for the statistical analysis. The results of pertinent to the respondents indicated that the majority (69%) of herders ranging between age category (26 – 45) years, then those above sixty represented (15.4 %). Also, the results indicated that (73.1%) of respondents were married and the remaining (29.9%) were single. the major fertility defects identified in the study area were caused by environmental factors (53.8%), Both environmental and genetic factors (42.4%) and Physiological disorders represent (3.8%). In addition, absence of records (42.3%), failure of detecting heat sings (23.1%), absence of artificial insemination (AI) services (11.5%) and breeding bull (23.3%) all were also recorded as causes of infertility in crossbred dairy cattle farms in the area of the study. The study confirmed that nutrition is the major recurrent cause of cattle reproductive disorders in this area, therefore, special attention should be directed through preparation of balanced rations for all nutrients, as well, other infertility causes should be seriously considered.

Keywords: Infertility, Disorders, Crossbreed, Dairy Cattle, South Darfur, Nyala

1. Introduction

Sudan possesses one of the largest livestock populations in Africa and Arabic world, which is estimated to be over 110.6 million, composed of cattle, sheep, goats, and camels [1]. Cattle population is about 40 million, of which most of them are of the local Zebu breeds. According to the Ministry of Livestock an estimated 4,8 million ton of milk per year is produced of which 50% is used for direct human consumption [2, 3]. However, milk production of Sudan increased from 1.97 millionv1000 int. \$ in 2014 to 2.08

million 1000 int. \$ in 2020 growing at an average annual rate of 0.96% [4]. Still a big shortage in milk is found, therefore, annually, Sudan imports about 20,000 tons of milk powder [5]. In the developing countries, milk production based on indigenous cattle breeds would not be a quick and suitable option to meet the increasing demand for milk and milk products [6]. Most genetic improvement in the tropics, has been widely practiced boosting the milk production of indigenous cattle [7]. One of the attempts to increase milk production in Sudan; is improvement of genetic potential of indigenous dairy breeds through cross breeding. It's well

known that these crosses produce and reproduce better than local types [8]. The improvement of milk production of indigenous Sudanese cattle such as *Bos indicus* Butana and Kenana and their crosses with temperate breeds (Holstein) is a major plan of Sudanese decision makers to increase milk yield to fill the shortage in the country [9].

Recently, in South Darfur state (particularly Nyala City) there are many clusters of cross-bred dairy farms producing large amounts of milk supply to meet the continuous milk demand of the city which witnessed a massive population increase last decades due to the conflicts and tribal wars [10]. No doubt, reproductive performance is one of the most important determinants of production efficiency and genetic gain in most dairy production systems [11]. The fertility efficiency of a dairy herd can be determined in various ways, such as by measuring pregnancy rate, percentage of cows calving each year, average calving interval, average number of drying periods, and number of live calves born each year. It is well known that reproductive and other animal performances depend not only on genetic potentials, but also on other factors, like nutrition, management, health, and environment [12]. Infertility is the main problem that affects production in both local and crossbred cows and heifers in Ethiopia [13]. One of the challenges of dairy cross-breeds in tropics is reproductive disorders (infertility) which includes various reasons make cows not resuming pregnancy after breeding. Infertility results in great losses for the breeders in either culling of the cow or increased calving interval which reduces overall production efficiency. Generally, there are

several causes for cattle infertility but, repeat breeding (anestrus), bull infertility, poor estrus detection, a nutritional imbalance, incorrect timing of insemination and improper semen handling are the most common signs of infertility [14]. The present survey is an attempt to detect the major causes of reproductive disorders in the cross-bred dairy farms in Nyala city –South Darfur state to generate base line information contributing to enhancing reproductive efficiency in area of the study.

2. Materials and Methods

2.1. Study Area

The present study was carried out in South Darfur state in Nyala city during the period from (1st January 2022 to 1st July 2022). South Darfur State is one of the biggest western Sudan states; it covers an area of 127,300 square kilometers. The area lying in savanna zone between latitude 9°-30, 13° N and longitude 15°-27, 0- 28°E. The State locates in the south of Sudan's western Darfur region, (Figure 1). The average annual rainfall is 200 mm in the far north of the State, and increasing towards the south, and reaches up to 1,000 mm in Alradoum and Jabal Marrah. The State contains three different ecological zones; a semi-desert area in the north where the annual rainfall ranges between 250 to 400 mm, medium savanna rain fall (400 -600 mm) and in the south heavy savanna rain fall (600 -800mm) [15].

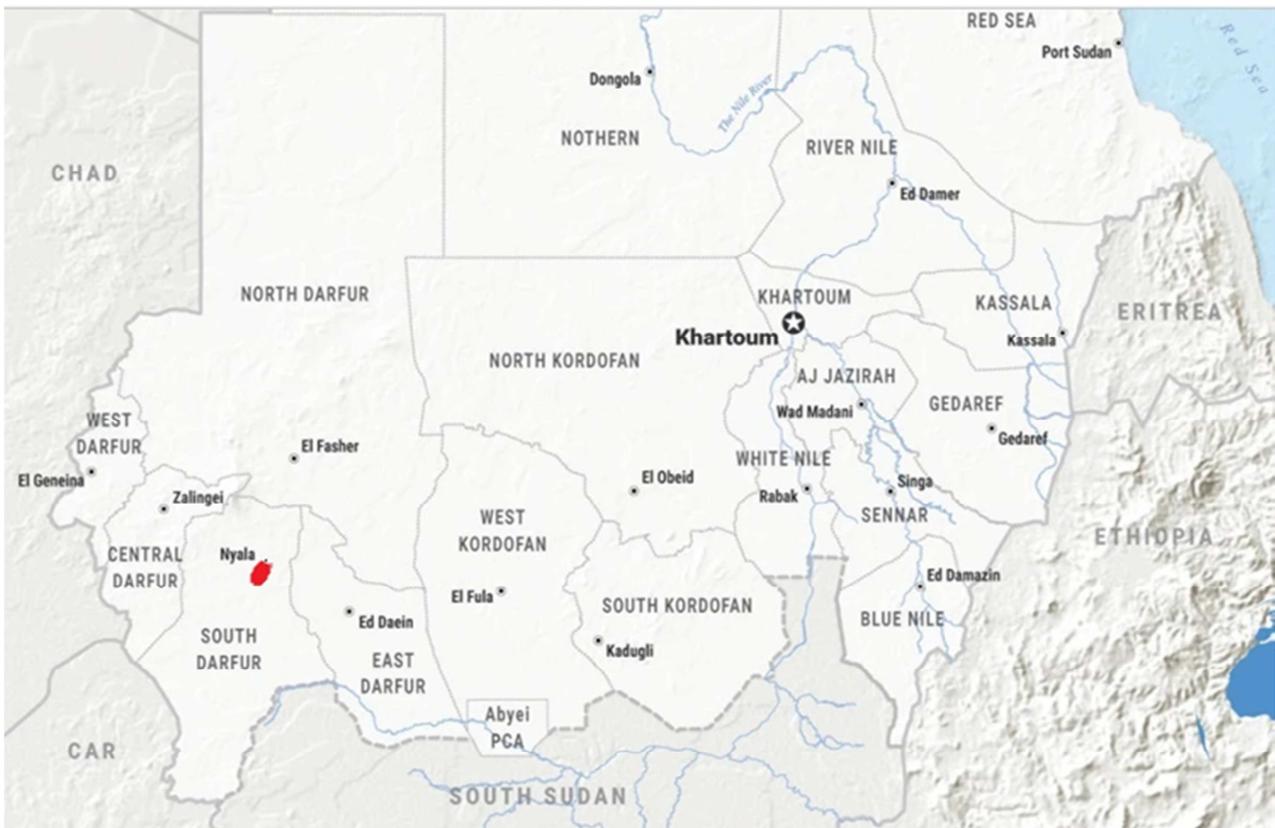


Figure 1. Geographical location of the study area, South Darfur State [16].

2.2. Data Collection

The survey covered clusters of dairy cross-breed cattle located in Mossai (9 kilometers Southern-East to Nyala city), Domayah (about 5 kilometers Western part of the Nyala city) and Majock (4 kilometers east Nyala city). A structured well-designed questionnaire was used for interviewing each dairy farm owner. The questionnaire included questions related to the major causes of infertility problems; environmental, nutritional disorders, diseases, physiological causes, genetic factors, socio-economic data and factors associated with herd management. Although, the targeted dairy farm owners do not keep records; data on infertility problems (repeat breeding, retained placenta and stillbirth) were collected by skilled veterinarian students based on the experiences of the breeders encountering the infertility causes in previous occurrences.

2.3. Statistical Analysis

The collected data were grouped, coded and analyzed using frequencies and descriptive statistics utilizing a software SPSS version. [16, 17].

3. Results and Discussion

3.1. Socioeconomic Characteristics of the Respondents

Data relating to sociosatus of the respondents in this work is presented in table 1, It is found that all (100%) respondents in the area of study were male. The majority (69%) of herders ranging between age category (26 – 45) years, then those above sixty (15.4 %). Also, the results indicated that (73.1%) were married and the remaining (29.9%) were single. The educational levels of the herders reported in the present study disclosed that Khalwa level among the respondents represents (53.8%) while, illiterate represents about (6%) among the breeders, those who completed primary and higher secondary levels were 19.2%and 3.8% respectively.

3.2. Major Causes of Infertility in Area of the Study

Table 2 shows the major infertility disorders in targeted area, the major fertility defects identified in the study area were caused by environmental factors (53.8%), Both environmental and genetic factors (42.4%) and Physiological disorders (3.8%). Moreover, Table 3 identified the specific environmental factors associated with infertility problems in area of the study. The major environmental factors cause reproductive problems found to be imbalanced nutrition (38.5%), adverse climatic conditions (26.9 %), diseases (19.2%) and deficiency of minerals and vitamins (7.7%). The main external environmental factors affect cattle fertility is heat stress, [18] reported that the stress leads to reducing fertility. However, the stress effects are extending to decrease of milk yield and quality of milk or the reduction of reproduction efficiency of cows. This stress includes, oxidative stress, metabolic, heat, and chronic stress [19].

Table 1. Socioeconomic characteristics of the respondents.

Parameter	Frequency	Percentage %
Sex of respondent		
Male	26	100
Female	-	-
Age category		
15 – 25	3	11.5
26 – 45	18	69.2
46 – 60	1	3.8
Above 61	4	15.4
Social status of the respondents		
Married	19	73.1
Unmarried	7	26.9
Educational level		
Illiterate	6	23.1
Khalwa	14	53.8
Primary school	5	19.2
Higher secondary school	1	3.8

Physiological disorders found to be main causes of cattle infertility worldwide. Several physiological events affect the onset of oestrus [20]. Among them level of production, it is found that high producing dairy cows (≥ 39.5 kg/day) have shorter oestrus (6.2 hours vs 10.9 hours), less total standing time (21.7 seconds vs 28.2 hours) and lower serum estradiol concentrations (6.8 pg/ml vs 8.6 pg/ml) compared to lower producing dairy cows.

Table 2. Major causes of infertility in area of the stud.

Parameter	Frequency	Percentage %
Environmental factors	14	53.8
Both environmental and genetic factors	11	42.4
Physiological disorders	1	3.8
Total	26	100

Table 3. Environmental factors associated with cross-bred cattle infertility in area of the study.

Parameter	Frequency	Percentage %
Nutritional	10	38.5
Over-feeding	7.7	26.9
Adverse climate conditions	7	19.2
Deficiency of minerals and vitamins	7	7.7
Diseases	5	7.7
Total	27	100

The relation between nutrition and fertility has long been known to have serious effects on cattle reproductive performance [21]. The nutrition of cattle has a direct impact on metabolism, however, the major causes of crossbred dairy cattle in Ethiopia and found that nutritional imbalances were one of causes of infertility in dairy cattle, moreover, the most common nutritional cause of infertility is inadequate energy in the diet [12]. Energy deficiency in cattle may also induce inactive ovaries, affect conception rate, and lowered progesterone level [14]. Worth mentioning, it is not easy to detect the effect of single nutrient on reproductive disorders, nevertheless, energy balance is probably the single most important nutritional factor related to nevertheless function in animals, [22, 23]. Results of many researches indicated slight

deficiencies or imbalances of either major or minor nutrients may decrease fertility in cattle [12]. All nutritional deficiencies, mostly in lactating cows affect metabolic changes [24]. Deficiency of crude protein intake in cattle ration has been reported to reduce reproductive performance. Recently, it has been found that feeding extra amount of protein more than the actual animal requirements negatively affect cow's fertility [25]. Reproductive performance may be impaired if protein is fed in amounts that greatly exceed the cow's requirements. It is found that over-feeding of crude protein (CP) has been associated with decreased pregnancy rates in female dairy and beef cattle [21, 26]. Mineral deficiencies and imbalances are often reported as major causes of infertility [25]. A deficiency in manganese may affect reproduction activities of estrus, cyclic ovaries and reduced conception rate [27]. Deficiency of vitamin (A) associated with delayed sexual maturity, abortion, the birth of dead or weak calves, retained placenta and metritis [25]. Moreover, results of research elucidated that deficiency of β - carotene in cattle resulted in delayed uterine involution, delayed first estrus after calving, delayed ovulation and increased incidence of cystic ovaries [25].

Genetic factors also, found to be one of the causes of infertility (42.4%) as presented in table 2. The higher incidence of infertility problems reported in Ethiopian crossbred cows (59.6%) than in indigenous zebu cattle (52.6%) [28]. Genetic correlation between cow fertility and milk yield said to be antagonistic [29, 30]. However, high yielding dairy crossbred cattle recently have experienced a decline in fertility [20]. Furthermore, it is well reported that fertility is reduced in lactating cows as compared to non-lactating heifers [31, 32]. A reverse relationship between increase milk yield and presence of fertility disorders; high milk yield reduced estrus length, increased days to first insemination, increased number of services / conception, and reduced progesterone levels post-ovulation that negatively affect herd reproductive efficiency [12]. This decline is attributed to the negative genetic correlation between milk production and reproduction.

The specific disease associated with infertility in area of the study were listed in table4, whereas (42.3%) of respondents claimed that brucellosis is the common disease cause infertility, some (11.2%) of them mentioned ovary cyst where, the majority (46.2%) reported other causes. It is well known that brucellosis in Africa is caused by *Brucella* species which transmitted through contaminated or contacts with infected animals or their discharges and carcasses. This disease has adverse effects on both male and female cattle; it reduces production and reproduction performance causes frequent episodes of abortion, still births, swollen testes, weak calves/lambs and swollen joint [33]. Table 5 introduces different causes of infertility in area of the study included: absence of records (42.3%), observation of heat signs (23.1%), absence of artificial insemination (AI) services (11.5%) and breeding bull (23.3%). The assessment of fertility and infertility in dairy herds requires accurate and complete data that are collected in a timely manner, therefore, absence of records in dairy farm definitely, affect identification of

potential fertility problems. Previous study [34] in the same area indicated that (57%) of dairy farm owners did not keep records. However, good recording system in dairy farm provides opportunity to collect, summarize and analyze reproductive and production data and ensure successful reproductive performance [35]. Unclear estrous signs made the detection of cows for natural breeding or AI more difficult, and hence affect the fertility of the cow. One of the most neglected management practices in dairy farm is breeding bull evaluation. Bull fertility is an important economical trait because it determines the number of calves born into the herd each year. There are various factors that influence bull fertility such as age, health, adverse climate conditions and injury. Therefore, it is very necessary to establish a periodical breeding sound evaluation BSE (which consists of physical examination of the bull, examination of the reproductive organs, measurement of the scrotal size and semen evaluation.) before starting any breeding activity.

Table 4. The Major reproductive disorder in area of the study.

Parameter	Frequency	Percentage %
Brucellosis	11	42.3
Ovaries cyst	3	11.5
Others	12	46.2
Total	100	100

Table 5. Factors associated with herd management.

Parameter	Frequency	Percentage %
Absence of breeding records	11	42.3
Failure of detecting heat sings	6	23.1
Absence of AI services	3	11.5
Breeding bull	3	23.3
Total	26	100

4. Conclusion

No doubt fertility is one of the basic factors that influencing efficiency of dairy herd. It considered one of the main costs of production and also represents an area where significant improvements can be done. Whereas poor fertility results in lower productivity, increased culling, inferior herd genetics and reduced profitability. The major infertility causes recorded with high prevalence in the present survey were environmental factors (nutritional unbalances, brucellosis, and Absence of breeding records). This revealed that nutrition is a major cause of cattle reproductive disorders in this area, therefore, special attention should be paid through preparation of balanced rations particularly for: energy, protein, vitamins and minerals (phosphorus, copper, cobalt, iodine, selenium, zinc, and manganese) to meet nutrient requirements and enhance ovulation activities using recent laboratory techniques. However, concurrently; other infertility causes (like brucellosis, absence of breeding records and breeding bulls care) should also, be seriously considered.

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Conflicts of Interest

The authors declare that there is no conflict of interest in publishing this short communication.

References

- [1] MARF, "Statistical Bulletin for Animal Resources No 19," Khartoum: Ministry of Animal Resources and Fisheries, vol. 19, pp. 21-84, 2009.
- [2] M. Alemu, "Urban and peri-urban dairy cattle production in Ethiopia: a review," *Online J. Anim. Feed Res.*, vol. 9, no. 4, pp. 173-177, 2019.
- [3] S. A. Hassan, H. H. Abdelaziz, and A. H. Ibrahim, "The TECHNICAL EFFICIENCY OF DAIRY FARMS IN SUDAN: A STOCHASTIC FRONTIER APPROACH," *GPH-International Journal of Agriculture and Research E-ISSN 2805-4362 P-ISSN 2805-4340*, vol. 1, no. 12, pp. 01-14, 2018.
- [4] w. d. atlas, "topicsagriculturereproduction," <https://knoema.com/data/agriculture-indicators-production+sudan+milk>, 2020.
- [5] D. q. s. Sudan, "Report for: Rijksdienstvoor Ondernemend Nederland " The Friesian Dairy Development Company a, pp. 18-32, 2016.
- [6] V. Knips, "Developing countries and the global dairy sector part I global overview," 2005.
- [7] K. Getahun, N. Beneberu, and Z. Lemma, "Correlation Measures among Reproductive and Milk Production Traits in Crossbred Dairy Cows at Holetta Dairy Research Farm, Ethiopia: Multitrait Analysis," *Journal of Animal Research*, vol. 12, no. 3, pp. 315-321, 2022.
- [8] R. McDowell, "Crossbreeding in tropical areas with emphasis on milk, health, and fitness," *Journal of Dairy Science*, vol. 68, no. 9, pp. 2418-2435, 1985.
- [9] S. Elzaki, P. Korcuć, D. Arends, M. Reissmann, and G. A. Brockmann, "Effects of DGAT1 on milk performance in Sudanese Butana × Holstein crossbred cattle," *Tropical Animal Health and Production*, vol. 54, no. 2, p. 142, 2022.
- [10] A. E. Hamza, S. S. Eltahir, M. E. Huaiam, and A. G. Makarim, "A study of management, husbandry practices and production constraints of cross-breed dairy cattle in south darfur state, sudan," *Online Journal of Animal and Feed Research*, vol. 5, pp. 62-67, 2015.
- [11] R. Esslemont and E. Peeler, "The scope for raising margins in dairy herds by improving fertility and health," *British Veterinary Journal*, vol. 149, no. 6, pp. 537-547, 1993.
- [12] J. Jemal, "A review on causes of infertility and its averting mechanism in Crossbred dairy cows in Central Ethiopian," *Int. J. Adv. Res. Biol. Sci.*, vol. 9, no. 3, pp. 65-72, 2022.
- [13] A. B. Mekonnin *et al.*, "Assessment of reproductive performance and problems in crossbred (Holstein Friesian X Zebu) dairy cattle in and around Mekelle, Tigray, Ethiopia," *Ethiopia. Anim. Vet. Sci.*, vol. 3, no. 3, pp. 94-101, 2015.
- [14] J. Moellers and R. Riese, "Nutritional causes of infertility in dairy cows," 1988.
- [15] N. A. Elagib and M. G. Mansell, "Recent trends and anomalies in mean seasonal and annual temperatures over Sudan," *Journal of Arid Environments*, vol. 45, no. 3, pp. 263-288, 2000.
- [16] OCH, "South Darfur State Profile," United Nations Office for the Coordination of Humanitarian Affairs, vol. Updated March 2022, 2022.
- [17] A. Bühl, *SPSS 16: Einführung in die moderne Datenanalyse*. Pearson Deutschland GmbH, 2008.
- [18] M. C. Lucy, "Stress, strain, and pregnancy outcome in postpartum cows," *Animal Reproduction*, vol. 16, pp. 455-464, 2019.
- [19] N. Strzałkowska, M. Markiewicz-Kęszycka, J. Krzyżewski, E. Bagnicka, P. Lipińska, and A. Józwick, "Wpływ stresu na wydajność i jakość mleka oraz płodność wysoko wydajnych krów mlecznych," *Med. Weter.*, vol. 70, no. 2, p. 84, 2014.
- [20] S. Walsh, E. Williams, and A. Evans, "A review of the causes of poor fertility in high milk producing dairy cows," *Animal reproduction science*, vol. 123, no. 3-4, pp. 127-138, 2011.
- [21] R. Smith and L. Chase, "Nutrition and reproduction," *Dairy Integrated Reproductive Management*, 2010.
- [22] R. Scaramuzzi and G. Martin, "The importance of interactions among nutrition, seasonality and socio-sexual factors in the development of hormone-free methods for controlling fertility," *Reproduction in Domestic Animals*, vol. 43, pp. 129-136, 2008.
- [23] J. Robinson, "Nutrition in the reproduction of farm animals," *Nutrition Research Reviews*, vol. 3, no. 1, pp. 253-276, 1990.
- [24] C. O. Coroian *et al.*, "Biochemical and Haematological Blood Parameters at Different Stages of Lactation in Cows," *Bulletin of University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca: Horticulture*, vol. 74, pp. 31-36, 2017.
- [25] Y. R. Bindari, S. Shrestha, N. Shrestha, and T. N. Gaire, "Effects of nutrition on reproduction-A review," *Adv. Appl. Sci. Res.*, vol. 4, no. 1, pp. 421-429, 2013.
- [26] T. Blanchard *et al.*, "Effect of dietary crude-protein type on fertilization and embryo quality in dairy cattle," *American journal of veterinary research*, vol. 51, no. 6, pp. 905-908, 1990.
- [27] H. Patterson, D. C. Adams, T. J. Klopfenstein, R. Clark, and B. Teichert, "Supplementation to meet metabolizable protein requirements of primiparous beef heifers: II. Pregnancy and economics," *Journal of animal science*, vol. 81, no. 3, pp. 563-570, 2003.
- [28] N. Moges, "Survey on dairy farm management and infertility problems in small, medium and large scale dairy farms in and around Gondar, North West Ethiopia," *International Journal of Animal and Veterinary Advances*, vol. 7, no. 4, pp. 62-66, 2015.
- [29] H. Kadarmideen, R. Thompson, and G. Simm, "Linear and threshold model genetic parameters for disease, fertility and milk production in dairy cattle," *Animal Science*, vol. 71, no. 3, pp. 411-419, 2000.

- [30] M. Royal, A. Flint, and J. Woolliams, "Genetic and phenotypic relationships among endocrine and traditional fertility traits and production traits in Holstein-Friesian dairy cows," *Journal of dairy science*, vol. 85, no. 4, pp. 958-967, 2002.
- [31] M. Ron, R. Bar-Anan, and G. Wiggans, "Factors affecting conception rate of Israeli Holstein cattle," *Journal of Dairy Science*, vol. 67, no. 4, pp. 854-860, 1984.
- [32] R. Nebel and M. McGilliard, "Interactions of high milk yield and reproductive performance in dairy cows," *Journal of Dairy Science*, vol. 76, no. 10, pp. 3257-3268, 1993.
- [33] P. N. Lokamar, M. A. Kutwah, H. Atieli, S. Gumo, and C. Ouma, "Socio-economic impacts of brucellosis on livestock production and reproduction performance in Koibatek and Marigat regions, Baringo County, Kenya," *BMC veterinary research*, vol. 16, no. 1, pp. 1-13, 2020.
- [34] H. A. E. A. Fatima Mahamoud Ahmed, BhagielTyfourBhagiel Abass Abdurahman Hussein and F. A. Mohammed, "DETERMINATION OF THE CONSTRAINTS FACING CROSSBRED DAIRY CATTLE FARMERS IN MOSSAY AREA (NYALA - SOUTH DARFUR- SUDAN)," *International Journal of Agriculture, Environment and Bioresearch*, vol. 4, no. 5, p. 2456, 2019.
- [35] J. H. Costa, T. A. Burnett, M. A. von Keyserlingk, and M. J. Hötzel, "Prevalence of lameness and leg lesions of lactating dairy cows housed in southern Brazil: Effects of housing systems," *Journal of Dairy Science*, vol. 101, no. 3, pp. 2395-2405, 2018.