www.bircu-journal.com/index.php/birci
Budapest International Research and Critics Institute-Journal (BIRCI-Journal)
Humanities and Social Sciences
ISSN 2615-3076 Online)
ISSN 2615-1715 (Print)
Budapest Institute

# Analysis of Factors Affecting the Success of Handling Ovarian Hypofunction in Cattle in Langkat Regency

**Yuniarti Sitompul[1], Sayed Umar[2], Simon Elieser Sinulingga[3]**
[1,2,3]*University of Sumatra, Indonesia*
*yunitompoel@gmail.com*

**Abstract**
*Handling reproductive disorders aims to increase the beef cattle population and lead to beef self-sufficiency. One of the disorders in reproduction in cows is a case of ovarian hypofunction. In general, this case occupies the highest position in Langkat Regency. This study aims to analyze the factors that influence the successful handling of cattle ovary hypofunction in Langkat Regency. The variables analyzed were body condition score, therapeutic treatment and the type of cow rearing. This research is a non-experimental study using logistic regression method. The data that used in this study were secondary data which was collected with a cross sectional approach. The data was obtained from the documentation of the Department of Agriculture and the Office of Food Security in Langkat Regency. The population was 658 cows that was diagnosed with ovarian hypofunction. The number of samples used in this study were 249 samples calculated by the slovin method. The sampling method was simple random sampling. The results of the analysis showed that the highest score of the body condition of the study sample was moderate. Most therapy in cattle with successful ovarian hypofunction is treatment one and two. The type of cow rearing that used with the highest number is the intensive one. Based on the results of the analysis, it was found that all the independent variables, namely body condition score, treatment / therapy, and type of cow rearing had a P value less than 0.05. So that the overall variables have a significant effect on the success of Ovarian Hypofunction in cattle in Langkat Regency. The variable that has the greatest influence on the success of ovarian hypofunction is the variable of treatment / therapy. Treatment or therapy in cattle is suggested to be a top priority which is always developed by related parties in order to increase production through successful treatment of ovarian hypofunction in cattle in Langkat Regency.*

Keywords
interactive media; macromedia flash; mathematical critical thinking ability

## I. Introduction

Breeding beef cattle breeding business aims to produce calves (calf) is very dependent on the efficiency and effectiveness of the reproductive organs and maintenance of female cows. The first requirement needed in a beef cattle breeding business is to choose a productive female cow. Productive female cattle must have a healthy reproductive system in order to be ready for the mating/insemination process until a live and healthy calf is born.

Activities for handling beef cattle reproductive disorders in Langkat Regency have been carried out since 2017, 2018 and 2019. One of the most common activities for handling reproductive disorders is ovarian hypofunction in cattle. Ovarian hypofunction is a decrease

in ovarian function resulting in the emergence of anestrus for more than one or more cycles of estrus. Ovarian hypofunction is a pathological condition due to impaired secretion of the hormone FSH-LH, so that the concentration of FSH-LH is not balanced. FSH-LH balance disorders occur due to mismanagement of feed, environmental stress and hormone deficiency.

The Body Condition Score (BCS) factor is one of the factors that affect the calving rate (CR). Body condition score (BCS) can be assessed by visual method for energy reserves, so that the relative score describes the level of muscle and body fat reserves of each cow. Body condition score (BCS) is very influential on the emergence of estrus (Sodiq and Budiono, 2012). Several studies have shown that the body condition score (BCS) at birth and at the start of the breeding season is the most important indicator of reproductive performance (Spitzer et al., 1995).

Therapy for animal reproductive disorders is a comprehensive action between hormones, drugs (antibiotics, vitamins and minerals) and feed improvement. Good health will support an adequate immune system to overcome various disease agents in the animal's environment. Hormonal therapy is generally carried out as a causative therapy in reproductive disorders (El-Khadrawy et al, 2015), then supportive therapy is needed to improve normal biological processes in cattle to achieve genetic potential and reduce the negative influence of an uncomfortable environment in reproducing.

The beef cattle rearing system consists of extensive, semi-intensive and intensive rearing systems. Of the three maintenance systems have advantages and disadvantages. An extensive system of all cattle activities is carried out in the same pasture so that monitoring reproductive activities and livestock health cannot be carried out properly. The semi-intensive system is raising cattle by grazing and feed is provided by the farmer, so that the cattle can be monitored for disease management and reproduction. The overall intensive system of cattle activity is in the pen and all feed is provided by the farmer, so that the management of health and reproduction of livestock can be carried out properly.

Cattle that have ovarian hypofunction and are given proper therapy have a real impact and provide benefits for farmers. Based on the above, it is necessary to do research on the analysis of the factors that influence the success of handling ovarian hypofunction in cattle in Langkat Regency.

## II. Review of Literature

### 2.1 Definition of Ovarian Hypofunction

Ovarian hypofunction or underactive ovaries is a condition that does not occur in ovarian development and can cause cases of anestrus. Decreased follicular development is caused by the failure of the anterior pituitary gland to secrete follicle stimulating hormone (FSH). This situation often occurs in heifers before puberty and post partum adult cows or after insemination but no conception occurs. Hypofunctioned ovaries have a smooth surface because there is no growth of follicles and corpus luteum, even though they are of normal size.

### a. Causes of Ovarian Hypofunction

Ovarian hypofunction can be caused by poor feed management, environmental stress and hormone deficiency (Herry, 2015). Poor feed management results in inadequate absorption of nutrients into the body of livestock with the nutrients needed by daily energy use. This causes the condition of the livestock's body to deteriorate so that it interferes with overall body functions, so that in daily feeding, nutrients are needed to support the

reproductive system such as protein, vitamin A and minerals such as phosphorus, iodine and copper (Lukman et al., 2007). An unsupportive environment can trigger stress in livestock so that the body's physiology changes. Cattle in narrow cages with poor air ventilation and poor sanitation will be more prone to stress than cattle placed in a comfortable environment.

High stress levels can cause hormonal cycle disorders. Hormone deficiency occurs when the endocrine glands cannot secrete enough hormones so that the normal functions of the body's organs cannot work optimally. Hormones are secreted by the hypothalamus, anterior pituitary and ovaries resulting in ovarian hypofunction. As a result of these factors reproductive efficiency is disrupted so that productivity decreases. This incident causes a longer calving interval (Deden, 2000) so that it is economically detrimental to farmers. According to Herry (2015), disruption of the work of the anterior pituitary by several factors can cause a decrease in the secretion of gonadotropin releasing hormone (GnRH), followed by a decrease in follicle stimulating hormone (FSH) and luteinizing hormone (LH). Lack of gonadotropin secretion causes follicles to not grow so ovulation does not occur. The absence of ovulation causes the growth of CL in the ovary (Whittier et al., 2015).

### b. Clinical Symptoms of Ovarian Hypofunction

Cattle with ovarian hypofunction do not show symptoms of estrus (anestrus) or show silent heat for a long time because estrogen which plays a role in estrus symptoms is produced in small quantities or has not reached the threshold limit. Another clinical symptom of ovarian hypofunction is that female cattle are not pregnant after repeated insemination (IB) (Deden, 2000). Ovulation in these cattle may be delayed (Ruiqing and Xinli, 2009) due to disturbances in the hormones FSH and LH so that there are no mature enough follicles to ovulate.

The ovaries are hypofunction of normal size, but the surface feels slippery when rectal palpation is performed (Herry, 2015). The ovary was hypofunction measuring 8-15 mm when done twice in seven (7) days and there were no CL or cysts or signs of estrus.

## 2.2 Body Condition Score (BCS)

BCS/SKT is a method of assigning a score or value to the body of an animal. The BCS/SKT assessment is an assessment that is very subjective (very dependent on the person doing the measurement) through visual and tactile techniques to estimate the body fat reserves/reserves of the livestock. Fat stores are energy reserves for livestock that are stored when livestock get sufficient or excess feed. Fat stores will be utilized by livestock when there is a shortage of feed, especially during the dry season, resulting in a decrease in BCS.

Kellogg (2014) revealed that the ideal Body Condition Score (BCS) of livestock depends on the purpose of rearing. Cattle raised for breeding purposes do not need to be overweight (score 5) on a 5 “England and Commenwealth” scale. The ideal body condition score or BCS is 3 or the cattle are not too fat and not too thin.

## 2.3 Therapy and Treatment

Therapy for animal reproductive disorders is a comprehensive action between hormones, drugs (antibiotics, vitamins and minerals) and feed improvement. Reproductive disorders in cattle are influenced by many factors, but environmental factors that cause disruption of normal behavior, poor care and feed are very important to note. Good health will support an adequate immune system to overcome various disease agents in the animal's environment. Hormonal therapy is generally carried out as a causative therapy in reproductive disorders (El-Khadrawy et al., 2015, Kornyat et al., 2015), however, general health problems must also be considered to support the recovery of the reproductive system.

Supportive therapy is an important basic step to support causative success. This type of therapy is a step to improve the condition of animals in general, to increase the strength of immunity and to optimize physiological conditions due to disturbances of various infectious and non-infectious agents. Several studies have shown various therapies for reproductive disorders including the administration of prostaglandins, minerals, vitamins, hormone supplements, GnRH and hCG (Purohit, 2008; El-Khadrawy et al., 2015).

The World Health Organization defines health as a state of complete physical, mental and social well-being and not merely the absence of disease. Thus the measurement of health and health care impact should include not only an indication of changes in the frequency and severity of illness but also an estimate of well-being and this can be assessed by measuring improvements in health-related quality of life. (Agustiansyah, L. et al. 2021)

Ovarian hypofunction can be given vitamin therapy, deworming medicine and premix in improving the condition of ovarian hypofunction in cattle. This supportive therapy is needed to improve normal biological processes in cows to reach their genetic potential and reduce the negative influence of an uncomfortable environment in reproducing.

### 2.4 Feed Management and Cattle Raising

In feeding, it is necessary to pay attention to the nutritional content in the form of protein, vitamins, minerals and crude fiber which are needed in accordance with the physiological conditions of livestock.

Maintenance type:

1. The extensive/pasture system is a cattle rearing activity developed in grazing fields, where cows are released in a fairly large grazing area and require an average of 5-7 hours per day. In this way there is no need for additional rations of fortification feed because the cows have eaten a variety of grasses.
2. The intensive system is a cattle rearing activity developed in cages.
   The semi-intensive system is a cattle rearing activity developed through grazing during the day and being penned in the afternoon. Feeding with intensive/semi-intensive system maintenance, cows are housed every day with an average feed of 10% of body weight and additional feed of 1-2% of body weight.

## III. Research Methods

This research is a non-experimental (observational) survey. To achieve the objectives of this study, the researchers used an analytical test with logistic regression to determine the effect of the independent variables on the dependent variable. This research is a quantitative study with a cross sectional approach, namely one observation of the independent variable and the dependent variable at the same time. Secondary data was obtained from reports on handling reproductive disorders in Langkat Regency in 2019 or in the form of medical records from the Department of Agriculture and Food Security of Langkat Regency. The population in the study was a population of cases of ovarian hypofunction, namely all cows diagnosed with ovarian hypofunction in the treatment/therapy treatment during 2019 as many as 658 cows.

Univariate analysis is used to describe the characteristics of the independent and dependent variables. Bivariate analysis is an analysis used to determine the relationship between the independent variable and the dependent variable by using the chi square test (Kai Quadrat) to determine whether or not there is a significant effect of the independent variable on the dependent variable. Bivariate analysis was performed using the chi square formula. Decision making in this model is to pay attention to the value of chi square if the

value of chi square> 0.05 then H0 is accepted, H1 is rejected. If the value of chi square <0.05, then H0 is rejected, H1 is accepted. Multivariate analysis was used to analyze the effect of the variable on other variables at the same time.

## IV. Result and Discussion

### 4.1. Univariate Analysis (Characteristics of Cattle with Successful Ovarian Hypofunction in Langkat Regency in 2019)

Univariate analysis was carried out to see the frequency distribution of cattle characteristics with successful ovarian hypofunction in Langkat Regency in 2019 which included BCS (Body Condition Score), Treatment/Therapy, and Type of Maintenance.

Data from Body Condition Score (BCS), treatment/therapy, type of maintenance and ovarian hypofunction, each amounted to 249. This means that none of the data was lost when testing in this study.

The average value (mean) of the Body Condition Score (BCS) is 2.0562. The average value (mean) of treatment/therapy is 0.9679. The average value (mean) of the type of maintenance is 2.6024. The mean (mean) of ovarian hypofunction was 0.6627.

#### a. Distribution of BCS (Body Condition Score) Characteristics in Cattle

With the Success of Ovarian Hypofunction in Langkat Kabupaten Distribution of research data showing Body Condition Score (BCS) in cattle in Langkat Regency The highest Body Condition Score (BCS) in cattle was in the "Medium" category, which was 201 heads (80.7%). Meanwhile, in the "Thin" category as many as 17 birds (6.8%) and in the "Fat" category as many as 31 birds (12.4%).

The BCS parameter is used as an indicator of animal health, the ideal BCS value is 2.5-3.5 (scale 1-5). Female cows with a BCS of more than 4 can cause postpartum disorders, retained placenta, dystocia, ketosis and panaritium, while lean body conditions cause decreased milk production and low fat content. According to Kellogg (2014) that the ideal BCS value of livestock depends on the purpose of rearing. Livestock for breeding purposes do not require a body condition that is too fat (score 5) on a scale of 5, the ideal body condition score (BCS) is 3 or moderate.

#### b. Distribution of Treatment/Therapeutic Characteristics in Cattle in Langkat Regency in 2019

Most of the treatment/therapy in cattle was in the category "OBI1 = Still Sick, OBI2 = Healed" as many as 89 heads (35.7%). Meanwhile, in the "OB1 + OBI2 = Still Sick" category as many as 84 birds (33.7%) and in the "OBI1 = Healed" category as many as 76 birds (30.5%).

Therapy according to SOP with a series of treatments and therapies include improving feed with concentrate for maintenance needs, giving oral deworming to eliminate endoparasites in the gastrointestinal tract, giving premixes to meet mineral needs, injection of vitamin ADE for improvement of reproductive organs and injection of GnRH hormone to improve function. -function of the reproductive glands or ovaries (Indahwati A, et al., 2019).

#### c. Distribution of Maintenance Type Characteristics in Cattle in Langkat Regency in 2019

The most common type of rearing is cattle in the “Intensive” category, which is as many as 183 heads (73.5%). Meanwhile, the type of rearing in the "Extensive" category was 33 (13.3%) and the type of rearing in the "Semi-Intensive" category was 33 (13.3%).

The type of cattle rearing in Langkat Regency is semi-intensive, but in this study female cows experienced ovarian hypofunction who were treated using an intensive type to make it easier for farmers to monitor the progress of success in therapy and reproductive management. Cattle are given forage in the form of elephant grass and mini elephants, some farmers also provide additional feed of 200-300 grams per day/head.

### d. Distribution of Ovarian Hypofunction Characteristics in Cattle in Langkat Regency in 2019

The most ovarian hypofunction in cattle was in the "Healed" category as many as 165 heads (66.3%). Meanwhile, ovarian hypofunction in the “Still Sick” category was 84 (33.7%).

The distribution of research data showing ovarian hypofunction in cattle in Langkat Regency in 2019 can also be seen in the following histogram graph:

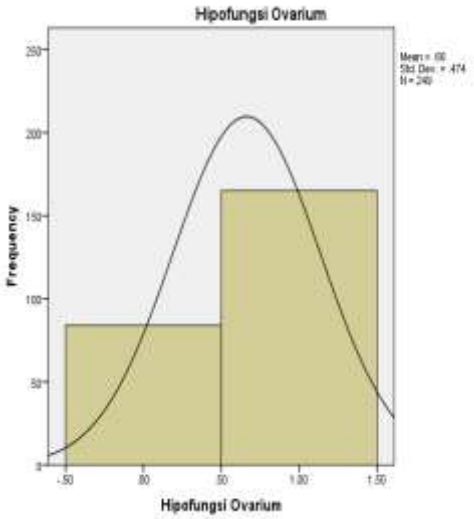


***Figure 1***. *Ovarian Hypofunction Histogram Graph*

### 4.2. Bivariate Analysis (Relationship of Cattle Characteristics with Success of Ovarian Hypofunction in Langkat Regency in 2019)

The analysis used was bivariate analysis using the chi-square test to see the relationship between cattle characteristics and Ovarian Hypofunction Success. The results of the analysis showing the relationship between the characteristics of cattle and the success of ovarian hypofunction can be seen below:

### a. Relationship between BCS (Body Condition Score) in Cattle and Ovarian Hypofunction Success in Langkat Regency in 2019

BCS (Body Condition Score) category "Thin" on the success of Ovarian Hypofunction which is still sick as many as 6 tails (35.3%). While the BCS (Body Condition Score) category "Medium" to the success of Ovarian Hypofunction that is still sick as many as 63 birds (31.3.6%), and BCS (Body Condition Score) category "Fat" to the success of Ovarian Hypofunction who are still sick as many as 15 birds ( 48.4%).

*Body Condition Score* (BCS) in the "Thin" category on the success of Ovarian Hypofunction that recovered as many as 11 (64.7%), while the BCS (Body Condition Score) in the "Medium" category on the success of Ovarian Hypofunction that recovered as many as 138 (68.7%), and Body Condition Score (BCS) category "Fat" on the success of Ovarian Hypofunction that recovered as many as 16 animals (51.6%).

Body Condition Score (BCS) p-value 3.510 < chi square table value 599146, this indicates that Body Condition Score (BCS) has no effect on the success of ovarian hypofunction. And its significance value is 0.173 > 0.05, this indicates that BCS has no significant effect on ovarian hypofunction.

The results of this study are in accordance with Budiawan, et al. (2015) which states that the Body Condition Score (BCS) has a relationship with livestock reproduction, such as fertility, pregnancy, the birth process, lactation, all of which will affect the reproductive system. Various groups of animals body shape (size), age, sex, and offspring will also have a strong influence on the reproductive system. Having a body weight less than ideal will have an impact on the reproductive system

### b. Relationship of Medication/Therapeutic in Cattle with Success of Ovarian

Hypofunction in Langkat District OBI1 + OBI2 = Still Sick" on the success of Ovarian Hypofunction that was still sick as many as 84 heads (100%). While "OBI1 = Still Sick, OBI2 = Healed" on the success of Ovarian Hypofunction that was still sick as many as 0 heads (0%), and "OBI1 = Healed" on the success of Ovarian Hypofunction that was still sick as many as 0 (0%).

"OB1 + OB2 = Still Sick" on the success of Ovarian Hypofunction that recovered as many as 0 (100%). Meanwhile, "OBI = Still Sick, OBI2 = Healed" on the success of Ovarian Hypofunction that recovered as many as 89 animals (100%), and "OBI1 = Healed" on the success of Ovarian Hypofunction that recovered as many as 76 animals (100%).

With p-value = 249.00 > chi square table value = 5.99146, this proves that treatment/therapy affects the success of ovarian hypofunction. Its significance value is 0.000 < 0.05, this indicates that treatment/therapy has a significant effect on the success of Ovarian Hypofunction in cattle in Langkat Regency.

The results of the study are in accordance with Khadraway et al (2015) which states that Ovarian Hypofunction can be cured therapeutically by synchronizing estrus using progesterone given intravaginally or progesterone releasing intravaginal device.

### c. Relationship between Types of Maintenance in Cattle and Success of Ovarian Hypofunction in Langkat Regency in 2019

Cattle whose rearing type was "Extensive" to the success of Ovarian Hypofunction that were still sick were 19 cows (57.6%). Meanwhile, cattle whose rearing type was "Semi-Intensive" to the success of Ovarian Hypofunction that were still sick were 11 heads (33.3%) and cattle whose rearing type was "Intensive" to the success of Ovarian Hypofunction that were still sick were 54 heads (29.5%).

Cattle whose rearing type was "Extensive" on the success of Ovarian Hypofunction that recovered were 14 (42.4%). Meanwhile, cows whose rearing type was "Semi-Intensive" on the success of Ovarian Hypofunction that recovered were 22 heads (66.7%). And cows whose rearing type was "Intensive" to the success of Ovarian Hypofunction that recovered were 129 heads (70.5%).

With p-value = 9.855 > chi square table value = 5.99146, this proves that the type of maintenance has an effect on the success of ovarian hypofunction. Its significance value is 0.007 <0.05, this indicates that the type of rearing has a significant effect on the success of Ovarian Hypofunction in cattle in Langkat Regency.

### 4.3 Multivariate Analysis (Effect of Body Condition Score (BCS), Treatment/Therapy, and Type of Maintenance on the Success of Ovarian Hypofunction in Cattle in Langkat Regency in 2019

Based on the results of the logistic regression test, the regression equation obtained is as follows:

**Y = 5.028 – 0.917 BCS – 0.778 Medication/Therapy – 1.021 Maintenance Type +e**

Based on the results of the analysis above, it was found that all independent variables (BCS (Body Condition Score), Treatment/Therapy, Type of Maintenance had a P value <0.05. BCS (Body Condition Score) (P value = .0.006), Treatment/Therapy (P value) =,0.013), Maintenance Type (P value = 0.000) So that the variables BCS (Body Condition Score), Treatment/Therapy, Type of Maintenance have a significant effect on the Success of Ovarian Hypofunction in cattle in Langkat Regency.

If you look at the OR (Exp.B) value of the results of the analysis in Table 10, it is known that the most influential variable has the highest OR (Exp.B) value, namely the Treatment/Therapy variable of 2,459, this shows that the variable Treatment/Therapy is the most powerful variable. its effect on the success of ovarian hypofunction in cattle in Langkat Regency. This means that cattle using treatment I + treatment II have a 2,459 times greater chance of successful treatment of ovarian hypofunction in cattle than cattle using treatment I alone.

The BCS (Body Condition Score) variable has an OR (Exp.B) value of 2,400. This means that cattle with moderate BCS (2.5-3.5) have a 2,400 times greater chance of successful treatment of Ovarian Hypofunction in cattle than cattle with lean (1-2.25) and fat (4-5). ).

The BCS (Body Condition Score) variable has an OR (Exp.B) value of 2,400. This means that cattle with moderate BCS (2.5-3.5) have a 2,400 times greater chance of successful treatment of Ovarian Hypofunction in cattle than cattle with lean (1-2.25) and fat (4-5). ).

The Maintenance Type variable has an OR (Exp.B) value of 2.360. This means that cattle with intensive rearing type have a 2,360 times greater chance of successfully handling Ovarian Hypofunction in cattle compared to cattle with semi-intensive and extensive maintenance types. The results of the analysis show that the variables BCS (Body Condition Score), Treatment/Therapy, and Type of Maintenance have a significant effect on the Success of Ovarian Hypofunction in cattle in Langkat Regency with the Nagelkerke R-Square value obtained by 57.6%, while the remaining 42.4% is influenced by the following factors: another factor.

## V. Conclusion

Based on the results of the analysis of the factors that influence the successful treatment of ovarian hypofunction in Langkat Regency, it can be concluded as follows:

1. There is a significant relationship between BCS and the success of ovarian hypofunction in cattle in Langkat Regency.
2. There is a significant relationship between treatment or therapy with the success of ovarian hypofunction in cattle in Langkat Regency.
3. There is a significant relationship between the type of rearing and the success of ovarian hypofunction in cattle in Langkat Regency.

## References


Agustiansyah, L. et al. (2021). Analysis of Treatment Profile, Direct Medical Costs, and Quality of Life in Hemodialysis Patients in Hospital X in Banten. Budapest International Research and Critics Institute-Journal (BIRCI-Journal). P. 4317-4330.

Budiawan, A., M. N., Ihsan and S.Wahjuningsih. (2015). Hubungan body condition score terhadap service per conception dan calving interval sapi potong Peranakan Ongole di Kecamatan Babat Kabupaten Lamongan. J. Ternak Tropika, 16 (1): 34-40.

Deden, S. (2000). Teknik Masage Ovari dan Penggunaan Potahormon pada Kasus Hipofungsi Ovarium Sapi Perah di Kabupaten Bogor. Skripsi. Institut Pertanian Bogor. Bogor.

El-Khadrawy, H. H., Wahid, M. A., Zeabal, M. M., and Emtenan, M. H. (2015). Lights on Drugs Used For Treatment of Ovarian Disorders in Farm. Animal Global veterinaria, 14 (3) : 393-399.

Herry A. H. (2015). Pemberantasan Kasus Kemajiran pada Ternak Menuju Kemandirian Dibidang Kesehatan Reproduksi Hewan dan Ketahanan Pangan di Indonesia. Makalah dalam Pidato Guru Besar. Fakultas Kedokteran Hewan Universitas Air Langga 25 April. Surabaya.

Indahwati, A. Setiatini, E. T., Setiadi, A. (2019). Analisis Teknis dan Ekonomis Terapi Kasus Hipofungsi Ovarium pada Sapi Potong di Kabupaten Rembang, Jawa Tengah, Indonesia. Agromedia, 37 (2).

Khadrawy H.H.E., Ahmed W.M., Zaaaal M.M., and Hanafi E.M. (2015). Lights on Drugs Used for Treatment of Ovarian Disorders in Farm Animals. Global Vet 14(3):393-399

Lukman A.S., Wulan C.P., and Dian R. (2007). Petunjuk Teknis Penanganan Gangguan Reproduksi pada Sapi Potong. Grati Pasuruan (ID). Pusat Penelitian dan Pengembangan Peternakan.

Ruiqing, L. Xinli G. (2009). Treating Infertile Milk Cows By Traditional Chinese Medicine. J. Agr Sci, 1 (1): 82-85.

Sodiq, A., and M. Budiono. (2012). Produktivitas Sapi Potong pada Kelompok Tani Ternak di Pedesaan. J. Agripet. 12(1): 28-33.

Soekidjo Notoatmodjo. (2002). Metodologi Penelitian Kesehatan. Rineka Cipta: Jakarta.

Spitzer, J. C., D. G. Morrison, R. P. Wettemann and I. C. Faulkner. (1995). Reproductive Responses, Calf Birth and Weaning Weight as Affected by Body Condition at Parturition and Postpartum Weight Gain in Primiparous Beef Cows. J. Anim. Sci., 73: 1251-1257.

Whittier, J. C. (2015). Reproductive Anatomy and Physiology of the Cow. University of Missoury.