

The Effect of Postpartum Complications on Subclinical Ketosis and Its Relationship with Reproductive Efficiency Criteria in Cows

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Abstract

The aim of this study is to determine the effect of early postpartum complications on subclinical ketosis, including dystocia, placental retention, milk fever, uterine inflammation, mastitis and the relationship between subclinical ketosis on some reproductive performance in cattle. The study were conducted in Salah al-Din province for the period from the October 2021 to December 2022. Fifty cows in a period of lactation (2-8 weeks) were used in the current study (40 cows suffered from subclinical ketosis and 10 healthy cows). All cows were examined using a hand-held digital β -hydroxybutyric acid assay (Epiketon) (Made by Visgeneer INC' China) to diagnos sub clinical ketosis in cattle. The data was monitored and recorded for a period of three months for each experimental animals.

The results of the current study showed that there were no effects of postpartum complications in cows to occurrence of subclinical ketosis except metritis. where the percentage of cows with subclinical ketosis and suffering from metritis was (12%). The percentage of cows that showed estrus first time after birth within 60 days (47.5%) in infected group compared to healthy cows (70%). The results also showed a decrease in both the percentage of cows that succeeded in getting pregnant from the first estrus and cows have open days less than 3 months in infected cows compared to healthy cows. The percentage of sub clinical ketosis increase in the animals which have more number of birth (47.50%) in cow have more than four birth compared with cows with The second and third (32.5%) and the cows with one birth (20.00%).

We conclude from the current study that the uterine infection and the number of births have clear effect on incidence of subclinical ketosis and the sub clinical ketosis lead to decrease reproductive performance in cattle.

Introduction

Dairy cows that are highly productive in the early lactation period are prone to an increased incidence of health disorders that have a direct impact at an advanced stage on animal fertility (Vallejo et al., 2020). Subclinical ketosis is a common metabolic disease in cows in the transitional period in which the energy demands of the fetus's growth and milk secretion process increase in the first weeks after birth and the start of feeding the newborn, accompanied by a lack of dry (rough) feed. and concentrated. (Gianesella et al., 2018). with the high need for energy and protein, as cows must mobilize body fat to meet the needs of lactation, and therefore cows are subject to negative energy balance (Fiore et al. 2017).

Subclinical ketosis is a disease associated with improper feeding and management. It is common and important in dairy cows, as it leads to Other significant economic consequences for the dairy industry and for breeders are due to the lack of milk production and the low reproductive efficiency (Walish et al., 2007)) and its accompanying diseases such as placenta retention, uterine inflammation, Abomasum displacement and delayed estrus, as well as being considered a predisposing factor for other infectious diseases (Villa et al. 2017) Hence the importance of studying the disease, as it is necessary for cows to face metabolic challenges during the transition period, from the dry period to the early stage to support milk production with sufficient supplies of glucose in this critical production stage, which causes metabolic disorders after birth, imbalance and negative energy balance (NEB) leads to damage to animal productivity through metabolic problems and the amount of economic losses resulting from the lack of problems of reproductive activities and reproduction (Baumgard et al., 2017; Deniz et al., 2020), placenta and fetal membranes retention and other previously mentioned complications may occur through more than one path caused by diseased cows in the early postpartum period that delay return In addition to the normal estrous cycle, lower fertilization rates and lower pregnancy rates are associated with an increased incidence of infectious diseases and lower reproductive efficiency in early lactation (Shine et al., 2015). Dietary, also associated with an increased incidence of infectious and metabolic diseases and impaired fertility with the potential for both health and reproductive suffering in early lactation (Leblanc, s.2010) Economic losses for breeders, whether it is the loss of animal exclusion or loss of animal productivity, all of this shows us the importance of conducting research at the national level to use it as a basis for animal health programs. Preventive and related nutritional and administrative needs and opening the way for new research that contains extensive information on the disease, so the aim of this study was to find the effect of postpartum complications with the incidence of sub clinical ketosis and the relationship of subclinical ketosis with reproductive performance in cows.

Materials and working methods

The study included 40 infected cows and 10 healthy cows, most of them were newly born cows (2-8) weeks after birth, in Salah Al-Din province for the period from October 2021 to December 2022, the subclinical ketosis were diagnosed by a digital beta-hydroxybutyric acid test device (Epiketon) (Visgeneer INC' China). The reproductive performance were estimated as: **first estrus after birth** (percentage of animals that exhibit first estrus within 60 days after birth). **Pregnancy from the first estrus** (the percentage of cows that succeeded in pregnancy from the first estrus). **Open days** (the percentage of cows have a period from the date of birth to the date of conception within 90 days).

Statistical analysis

The results were statistically analyzed using the statistical program SAS (2018), which was used to detect the effect of different groups on the study also used the chi-square test to compare the significant ratios. Note that the significant difference of the tests at the level of probability ($P \leq 0.05$).

Results and discussion

The results of the current study shown in Table: 1, that there were no effects of postpartum complications in cows on occurrence of subclinical ketosis except metritis, where the percentage of cows with subclinical ketosis and suffering from metritis was (12%), and this is consistent with (Duffield et al. al., 2009) who indicated that the uterine inflammation in the first week after birth was associated with an increase the incidence of sub clinical ketosis. The current study is in agreement with the findings of (Suther et al., 2013, Rodrigues et al., 2017), who considered that the sub clinical ketosis occurred combined with other metabolic and infectious disorders in European dairy cows, such as mastitis, hypocalcaemia and dystocia and these disorders are the cause of disease.

This was confirmed by (Jae kwan jeong et al., 2017), who showed that the incidence of ketosis increased in dairy farms and the calving season, multiple births and uterine inflammation had a direct effect on the incidence of infection, while complications such as dystocia and placental retention had no direct effect on it. The reason of increasing of sub clinical ketosis in animals suffered from metritis due to loss appetite of animals which lead to break down body fat and increases fatty acid oxidation and production of ketone bodies in the liver as an alternative energy source for all tissues and organs of the body and meets the milk supply of lactose as well as skeletal muscles, heart and kidneys (Ward, 2015; Taton et al., 2017; Vanholder et al., 2015).

Table 1 The effect of some postpartum complications on subclinical ketosis in cows

Samples Complications	Infected animals N=40	healthy animals N=10	Chi-Square (χ^2)
Placental retention	(%15.00) 6	(%10.00) 1	NS 1.75
milk fever	(%20.00) 8	(%10.00) 1	NS 1.06
Metritis	(%12.50) 5	(%0.00) 0	* 4.17
mastitis	(%10.00) 4	(%10.00) 1	NS 0.50
dystocia	(%7.50) 3	(%0.00) 0	NS 1.47
Chi-Square	NS 2.783	NS 2.907	----
* (P≤0.05) , NS: Non-Significant.			

Effect of subclinical ketosis in cows on some parameters of reproductive efficiency

The results of the current study, as shown in Table: 2, showed that the percentage of cows that showed estrus at the first time after birth within 60 days decreased ($p \leq 0.01$) in cows suffering from subclinical ketosis (47.50%) compared to healthy cows (70%). These results agreed with the findings of (Itel et al., 2015), which showed that the incidence of first estrus after birth was lower for infected cows compared to healthy cows and this was confirmed by (Riberio et al., 2011) who revealed decline in reproductive performance and delay of estrus after birth in cows suffered from sub clinical ketosis and the reason for the delay of estrus is

due to the delay animal in the return to a positive energy balance to cover the metabolic requirements completely to express estrus behavior and the cow becomes pregnant.

The results also showed a decrease in the percentage of cows that succeeded in getting pregnant from the first estrus and cows whose have open days were less than 3 months in the cows that were suffering from subclinical ketosis (35.00% and 52.50%, respectively) compared to healthy cows (50.00%, 70.00%, respectively), the results of this study agreed with the findings of (Walish et al., 2007), which showed that the infected cows were less likely to become pregnant from the first estrus than in healthy cows, as the infected cows need a longer time to became pregnancy than healthy cows, and this was confirmed by (Rutherford et al., 2016) who showed that infected cows had less success in pregnancy at the first insemination and longer open days than healthy cows. The reason for the delay in estrus, pregnancy and the length of open days is due to the effect of infection on the reproductive performance of the animal and increases the time interval from the postpartum period to pregnancy because it interferes with the natural estrus cycle by reducing the secretion of gonadotropin hormones, which is something necessary for follicle growth and ovulation (Morris et al., 2011, Butler, 2003)

Table 2 Effect of subclinical ketosis in cows on some reproductive efficiency criteria

Parameter Group	First estrus during 60 day after birth	Pregnancy from first estrus	Open day less than three months
Healthy animal N=10	(70.00%) 7	(50.00%) 5	(70.00%) 7
Infected animal N=40	(%47.50) 19	(%35.00) 14	(%52.50) 21
Chi Square	** 7.051	* 4.896	* 7.382
* (P≤0.05), ** (P≤0.01) .			

* It means there is a significant difference at the level (P≤0.05): ** It means there is a significant difference at the level (P≤0.01)

The effect of the number of births on subclinical ketosis.

The results of the current study, as shown in Figure (1), showed that the number of births had a clear effect on the incidence of subclinical ketosis (P≤0.05), as the incidence of ketosis increased in cows that had four or more births (47.50%) compared with cows. The results of this study agreed with (Robert et al., 2012), where it was found that the incidence of infection in cows increases with the increase in the number of births. also confirmed by Akamatsue et al., 2007) who revealed that the age of the animal had a major role in increasing the incidence of infection, and the highest infection rate was in the 8-9-year-old group in high-production Holstein cows.

Conclusion

uterine infection and the number of births have clear effect on incidence of subclinical ketosis and the sub clinical ketosis lead to decrease reproductive performance in cattle.

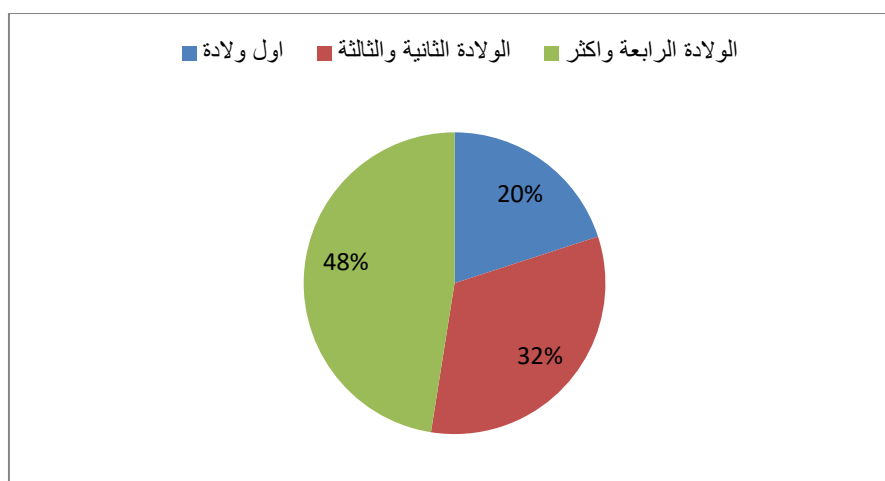


Figure (1) shows the effect of the number of births on the incidence of subclinical ketosis

References

- [1] Akamatsu, H., Saitoh, Y., Serizawa, M., Miyake, K., Ohba, Y., & Nakashima, K. (2007). Changes of serum 3-methylhistidine concentration and energy-associated metabolites in dairy cows with ketosis. *Journal of Veterinary Medical Science*, 69(10), 1091-1093
- [2] Baumgard, L. H., Collier, R. J., & Bauman, D. E. (2017). A 100-Year Review: Regulation of nutrient partitioning to support lactation. *Journal of Dairy Science*, 100(12), 10353-10366
- [3] Butler, W. R. (2003). Energy balance relationships with follicular development, ovulation and fertility in postpartum dairy cows. *Livestock production science*, 83(2-3), 211-218.
- [4] Deniz, A., Aksoy, K., & Metin, M. (2020). Transition period and subclinical ketosis in dairy cattle: association with milk production, metabolic and reproductive disorders and economic aspects.
- [5] Duffield T, Lissemore K, McBride B, Leslie K (2009) Impact of hyperketonemia in early lactation dairy cows on health production. *J Dair Sci* 92(2): 571-580 .
- [6] Fiore, E., Giambelluca, S., Morgante, M., Contiero, B., Mazzotta, E., Vecchio, D., ... & Gianesella, M. (2017). Changes in some blood parameters, milk composition and yield of buffaloes (*Bubalus bubalis*) during the transition period. *Animal Science Journal*, 88(12), 2025-2032
- [7] Gianesella, M., Perillo, L., Fiore, E., Giudice, E., Zumbo, A., Morgante, M., & Piccione, G. (2018). Transition period in healthy and diseased dairy cows: evaluation of metabolic modifications. *Large Animal Review*, 24(3), 107-111.
- [8] Itle, A. J., Huzzey, J. M., Weary, D. M., & Von Keyserlingk, M. A. G. (2015). Clinical ketosis and standing behavior in transition cows. *Journal of Dairy Science*, 98(1), 128-134.
- [9] Jae-Kwan Jeong, In-Soo Choi, Sung-Ho Moon, Soo-Chan Lee, Hyun-Gu Kang, Young-Hun Jung*, Soo-Bong Park* and Ill-Hwa Kim (2017) Risk Factors for Ketosis in Dairy Cows and Associations with Some Blood Metabolite Concentrations :*Journal of veterinary science* 34(4):255-260 pISSN 1598-298X / eISSN 2384-0749 *J Vet Clin* 34(4)
- [10] LeBlanc, S. (2010). Monitoring metabolic health of dairy cattle in the transition period. *Journal of reproduction and Development*, 56(S), S29-S35.

- [11] Morris, M. J., Kaneko, K., Walker, S. L., Jones, D. N., Routly, J. E., Smith, R. F., & Dobson, H. (2011). Influence of lameness on follicular growth, ovulation, reproductive hormone concentrations and estrus behavior in dairy cows. *Theriogenology*, 76(4),
- [12] Ribeiro ES, Lima FS, Ayres H, Greco LF, Bisinotto RS, Favoreto M, Marsola RS, Monteiro APA, Thatcher WW, Santos JEP. 2011. Effect of postpartum diseases on reproduction of grazing dairy cows. *J Dairy Sci*, 94
- [13] Roberts, T., Chapinal, N., LeBlanc, S.J., Kelton, D.F., Dubuc, J. and Duffield, T.F. (2012) Metabolic parameters in transition cows as indicators for early-lactation culling risk. *J. Dairy Sci.*, 95: 3057-3063.
- [14] Rodríguez, E. M., Arís, A., & Bach, A. (2017). Associations between subclinical hypocalcemia and postparturient diseases in dairy cows. *Journal of dairy science*, 100(9), 7427-7434.
- [15] Rutherford A.J, Oikonomou G, Smith R.F.(2016) The effect of subclinical ketosis on activity at estrus and reproductive performance in dairy cattle. *J. Dairy Sci.* ;99(6):4808–4815
- [16] Shin, E. K., Jeong, J. K., Choi, I. S., Kang, H. G., Hur, T. Y., Jung, Y. H., & Kim, I. H. (2015). Relationships among ketosis, serum metabolites, body condition, and reproductive outcomes in dairy cows. *Theriogenology*, 84(2), 252-260
- [17] Suthar, V. S., Canelas-Raposo, J., Deniz, A., & Heuwieser, W. (2013). Prevalence of subclinical ketosis and relationships with postpartum diseases in European dairy cows. *Journal of dairy science*, 96(5), 2925-2938
- [18] Vallejo-Timaran, D. A., Arango-Sabogal, J. C., Reyes-Velez, J., & Maldonado-Estrada, J. G. (2020). Postpartum uterine diseases negatively impact the time to pregnancy in grazing dairy cows from high-altitude tropical herds. *Preventive veterinary medicine*, 185,105202.
- [19] Villa-Arcila, N. A., Duque-Madrid, P. C., Sanchez-Arias, S., Rodriguez-Lecompte, J. C., Ratto, M. H., Sanchez, J., & Ceballos-Marquez, A. (2017). Butyrate concentration before and after calving is not associated with the odds of subclinical mastitis in grazing dairy cows. *Livestock Science*, 198, 195-200.
- [20] Ward.C,(2015). "KetoneBodyMetabolism". Diapedia. doi:10.14496/dia.51040851169.29. Archived from the original on 201811-11. Retrieved 30 September 2019
- [21] Walsh, R. B., Walton, J. S., Kelton, D. F., LeBlanc, S. J., Leslie, K. E., & Duffield, T. F. (2007). The effect of subclinical ketosis in early lactation on reproductive performance of postpartum dairy cows. *Journal of dairy science*, 90(6), 2788-2796.