Van Veterinary Journal

https://dergipark.org.tr/tr/pub/vanvetj

Cite this article as: **Koşal V, Gülyüz F, Uslu BA (2021).** Effect of Body Condition Score on Estrus-Ovulation Synchronization and Pregnancy in Cows and Heifers (Field Study). *Van Vet J*, 32 (1), 18-21.
DOI: https://doi.org/10.36483/vanvetj.841059

ISSN: 2149-3359 **Original Article** e-ISSN: 2149-8644

Effect of Body Condition Score on Estrus-Ovulation Synchronization and Pregnancy in Cows and Heifers

Volkan KOŞAL[1,*] Fetih GÜLYÜZ[2] Barış Atalay USLU[3]

[1] *Department of Artificial Insemination, Faculty of Veterinary Medicine, Van Yuzuncu Yıl University, Van, Turkey*
[2] *Department of Animal Science, Faculty of Agriculture, Akdeniz University, Antalya, Turkey*
[3] *Department of Artificial Insemination, Faculty of Veterinary Medicine, Mehmet Aki Ersoy University, Burdur, Turkey*

Received: 15.12.2020 Accepted: 05.02.2021

ABSTRACT The most important factors affecting the success of artificial insemination are the balanced nutrition of the animals and the determination of estrus. Malnutrition causes a decrease in the Body Condition Score (BCS). Low BCS affects the deterioration of the metabolism of cows which has a primary influence on estrus and offspring productivity. In this study, estrus and ovulation synchronization was performed by forming three study groups from cows and heifers with a maximum BCS average of 2.95. Cows that were 3 - 6 years old were included in Group I (n = 12) (BCS: 2.95 ± 0.62), heifers between 18-22 months of age and showing at least 1 estrus were included in Group II (n = 13) (BCS: 2.03 ± 0.37) and heifers between 18-22 months of age were included in Group III (n = 45) (BCS: 1.57 ± 0.38). Progesterone Implants remained in the vagina for 10 days in all groups. One day before removal of implants, 2000 IU PMSG and 5 ml PGF2α was injected to all groups. All animals were injected with 1500 IU hCG 24 hours after the implants were removed. After removal of implants, all animals were inseminated at 48 and 72 hours regardless of estrus symptoms. According to the groups, pregnancy rates of 58.33%, 38.46% and 13.33% were obtained, respectively. When the results were compared, it was found that the BCS rate and pregnancy rates were parallel (P<0.01). In line with these results, the importance of feeding and giving birth before has been revealed.

Keywords: *Body Condition Score, Cattle, Fertility, Synchronization*

ÖZ

İnek ve Düvelerde Vücut Kondisyon Skorunun Östrus-Ovulasyon Senkronizasyonu ve Gebelik Üzerine Etkisi

Suni tohumlamanın başarısını etkileyen en önemli faktörler, hayvanların dengeli beslenmesi ve kızgınlığın belirlenmesidir. Kötü beslenme, Vücut Kondisyon Skorunda (VKS) bir azalmaya neden olur. Düşük VKS, sığırlarda hormon metabolizmasının bozulmasına, kızgınlık tespitinin zorlaşmasına ve döl veriminde azalmaya sebep olur. Bu çalışmada maksimum VKS ortalaması 2.95 olan inek ve düvelerden üç çalışma grubu oluşturularak östrus ve ovulasyon senkronizasyonu gerçekleştirilmiştir. Uygulama grupları; Grup I (n = 12) (VKS: 2.95 ± 0.62), Grup II (n = 13) (VKS: 2.03 ± 0.37) 18 - 22 aylık düvelerde en az 1 doğum yapan 3 - 6 yaş arası inekler, Grup III'de (n = 45) (VKS: 1.57 ± 0.38) en az 1 kızgınlık gösteren 18 - 22 aylık düveler kullanıldı. Tüm gruplarda progesteron implantları vajinada 10 gün kaldı. İmplantlar çıkartılmadan bir gün önce tüm hayvanlara 2000 IU PMSG ve 5 ml PGF2α enjekte edildi. İmplantlar 24 saat sonra çıkarıldı ve 1500 IU hCG enjekte edildi. İmplantlar çıkarıldıktan sonra 48. ve 72. saatlerde östrus semptomlarına bakılmaksızın tüm hayvanlar tohumlandı. Gruplara göre sırasıyla 58.33%, 38.46% ve 13.33% gebelik oranları elde edildi. Sonuçlar karşılaştırıldığında VKS oranı ile gebelik oranlarının paralel olduğu görüldü (P<0.01). Bu sonuçlar doğrultusunda beslenmenin ve daha önce doğum yapmanın önemi ortaya konmuştur.

Anahtar Kelimeler: *Fertilite, Senkronizasyon, Sığır, Vücut kondisyon skoru*

INTRODUCTION

One of the most important criteria determining success in modern dairy farms is keeping the fertility at the optimum level. Many studies have shown that environmental factors (care, feeding, management, etc.) are more effective than genetic factors on total productivity (Ayres et al. 2014; Vasconcelos et al. 1999). In order to keep bovine animals stay healthy; they should be fed with an appropriate diet adapted to their age, weight, behavior, physiological needs, and expected yield (Ergün et al. 2014). Management and nutrition, has a direct effect on the Body Condition Score

✉ *Corresponding author: volkan_kosal@hotmail.com

(BCS) of the animal. BCS is the evaluation of the body structure of dairy cattle according to being weak or excessively fat which is scored between 1 and 5. In this system, 1 refers to cachectic animal and 5 refers to excessively fatty animal. Optimum BCS should be between 2.5 - 3 point. (Wildman et al. 1982). It has been reported that BCS is associated with the increase in calving interval, milk yield, pregnancy rate, calving difficulty, weaning weight (Funston 2010; Varışlı and Tekin 2011).A negative energy balance is observed in animals with the decrease in BCS (Garnsworthy et al. 2008a). These changes in carbohydrate and energy metabolism negatively affect metabolic hormones. The secretion disorders of metabolic hormones impair reproductive hormones and ovary functions (Garnsworthy et al. 2008b; Webb et al. 2004). In cows and heifers with a low BCS rate, a decrease in LH release, estrogen release, no estrus symptoms, ovulation disorders, fertilization problems, early embryonic deaths, and pregnancy rates are observed (Butler 2003; Freret et al. 2005; Froment 2007). Edmonson et al. (1989) created a detailed measurement scale to accurately determine BCS in cows and heifers. According to this:

1- Pelvis bones and *Processus transversus* are seen. Depressions in the *Sacrum* area are evident. There is no fat layer in the pelvis and back area. Pelvis ligaments are prominent.

2- Pelvis bones can be felt. *Processus transversuses* are not very prominent. However, pressure can be felt. *Sacrum* region is hollow and there is a light layer of fat at the bone ends. Pelvis ligaments are less pronounced.

3- Pelvis bones can be felt under slight pressure. *Processus transversuses* can be felt with a strong pressure. The *Sacrum* area is filled with a layer of fat. Pelvis bones are visible, but the triangular-like image formed between them has turned into a round.

4- Pelvis bones can be felt under very strong pressure. *Processus transversuses* cannot be felt. *Sacrum* area is full of fat layer. The back and waist area are straight. The pelvis bones are rounded and filled with a layer of fat.

5- Pelvis bones cannot be felt. Sacrum area is filled with fat layer and it has become round. The back and waist area are straight. The ribs are covered with a layer of fat. The coccyx is not evident (Edmonson et al. 1989).

Exogenous hormone applications and sexual synchronization together with fixed-time artificial insemination applications are offered as an important solution in the absence of estrus and ovulation due to the deterioration of metabolic balance and the disruption of the release mechanisms of reproductive hormones. For this purpose, progesterone, PGF2α, estrogen, eCG, hCG, LH, PMSG, FSH hormones are preferred. With protocols created with different combinations of these hormones, pregnancy can be achieved without the need to detect estrus symptoms (Dhami et al. 2019; Ferreira et al. 2006; Singh et al. 2019; Vale et al. 2011).

This study was conducted in a livestock operation that wanted to sell pregnant heifers and cows to dairy farms. The aim of this study was to investigate the effect of progesterone containing devices and additional hormone applications on estrus and pregnancy rates on heifers and cows who cannot be fed adequately and balanced until puberty and have low BCS.

MATERIAL and METHODS

Animals

Animals material of this study consisted of 18 months and 6 years old cows and heifers in Denizli Province. Animals kept in three different barns within the same enterprise were primarily evaluated according to their BCS and barn-based groups were formed.

The ethics comitte report of this study was obtained from Van Yuzuncu Yil Üniversity Animal Experimentals Local Ethics Committee. (Date:03.12.2020 Decision Number: 2020/11-05)

Animal Groups and Application

The animals in the enterprise are grouped according to their shelters. First of all, the general examination of all animals and then the examination of their genital organs were made. Animals with any disease were not included in the study. The groups are formed as follows; Group I (n = 12) (BCS = 2.95 ± 0.62): The animals in this group were 3 - 6 years old cows. Group II (n = 13) (BCS = 2.03 ± 0.37): The animals in this group consisted of 18 - 22 months old heifers showing at least 1 estrus. Group III (n = 45) (BCS = 1.57 ± 0.38): The animals in this group consisted of 18 - 22 months old heifers that did not show any estrus. BCS of animals according to groups were determined according to the scale of Edmonson et al. (1989) before starting the application. The same synchronization protocol was applied to the animals in all groups (Table 1). The day the implants are placed is determined as day 0.

Table 1. Application schedule.

Days	Application		
Day 0	Placement of Progesterone Implant Intra – Vaginal 1.00 gr, DIB®, Vilsan, Turkey		
Day 9	2000 IU PMSG IM Folligon, Intervet, Turkey	+	5 ml PGF2α IM Dinolitic®, Upjohn, USA
Day 10	Removal of the Progesterone Implant		
Day 11	1500 IU hCG IM Chorulon®, MSD, USA		
Day 13	AI		
Day 14	AI		

*AI: Artificial insemination IM: Intramuscular

Artficial İnsemination And Pregnancy Examination

All animals were inseminated by the same person. Frozen-thawed straws used in artificial insemination. All animals were inseminated at 48 and 72 hours regardless of estrus symptoms. Sperm samples had minimum 70% motility rate and a maximum of 20% abnormal and dead-alive sperm rate. Pregnancy examinations were performed by recto-vaginal method on the 45th day after insemination.

Statistical Analysis

All statistical analysis was performed by using SPSS 22.0 (IBM Corp., Armonk, NY, USA) package program for

Windows. Chi - Square Test was used to evaluate the differences between groups for pregnancy rate. For all comparisons, differences were considered with a minimum of 0.05 significance level.

RESULTS

A total of 70 animals in 3 groups were used in the study. The highest pregnancy was obtained in Group I consisted of 3 - 6 year old cows. The lowest pregnancy was obtained in Group III, that were consisted of heifers aged 18 - 22 months and never showed estrus to date. BCS rates and pregnancy rates were compared, a statistically significant difference was found (P<0.01). It was found that the decrease in BCS decreased the pregnancy rates (Table 2).

Table 2. Pregnancy rates.

Group	Pregnancy (%)	*P*
Group I (n=12)	58.33[a]	
Group II (n=13)	38.46[b]	*P*<0.01
Group III (n=45)	13.33[c]	

*Different letters within the same column demonstrate significant differences (P<0.05)

DISCUSSION and CONCLUSION

Genetic and non-genetic factors affect reproductive performance. Among these factors, the effect of genetics is 20%, while the non-genomic effect accounts for 80%. The most important factors affecting non-genetic factors are environment and nutrition. The effect of nutrition on this rate is around 50% (Ayres et al. 2014; Lotthammer 1991; Vasconcelos et al. 1999).

In this study, fixed-time artificial insemination was performed by synchronizing estrus and ovulation in order to reveal the importance of BCS values related to nutrition. This study demonstrated that, when BCS and pregnancy rates were examined, a correct ratio was found between them and it was determined that the average 1.5 points of BCS difference caused a 45% decrease in the pregnancy rate (*P*<0.01). Likewise, Lopez et al. (2003) reported that a 1 - point decrease in BCS value has negative effects on pregnancy. In addition, Bo et al. (1995) stated that animals with a BCS value of less than 2 have a very low chance of becoming pregnant. The reason for the low pregnancy rates in Group 1 and 2 (38% - 13%) can be explained by these factors.

Kasimanickam et al. (2012) found pregnancy rates in the range of 54.9 - 69.2% in a synchronization study using progesterone, PGF2α and GnRH in heifers with a BCS ratio of 2.5 - 3.5. In a study, Luiz et al. (2017) used progesterone, PGF2α, estrogen, eCG in primiparous and multiparaous animals with a BCS rate ranging from 2.3 - 3 and reported the pregnancy rates in primiparous animals as 33 - 45% and in multiparaous animals as 60-64 %. Williams et al. (2002) in the synchronization study performed in cows and heifers with BCS 2.7-2.9, pregnancy rates were reported as 40% in heifers and 45 % in cows. Guilherme et al. (2004), in a study using Progesterone + Estrogen + eCG + GnRH in study groups with BCS rates of 2 / 2.5 / 3, they found pregnancy rates as 30 / 47.6 / 66.6%, respectively. Although the synchronization protocol used in this study and the protocol applied by Guilerme et al. (2004) were similar, the pregnancy rates showed a parallelism only with Group 1. The fact that the animals in Group 2 - 3 were heifers and their low BCS values explain the big difference between pregnancy rates. Low BCS rates lead to prolongation of anestrus duration (Hess et al. 2005), insufficient LH release, poor oocyte quality (Bo et al. 1995), negative energy balance (Butler 2005), suppression of reproductive hormones (Garnsworthy et al. 2008; Webb et al. 2004). For these reasons, the decrease in pregnancy rate is an inevitable result.

In addition to exogenous progesterone applications, with PMSG and hCG administration, a pregnancy is obtained in cow (58%) and heifers (38% - 13%) even if it is low. For the continuation of estrus and ovulation in a healthy way, the animals should have a BCS value of at least 2.5. Another issue that should be emphasized is that even if pregnancy is achieved in animals with low BCS rates with exogenous hormone applications; the maintenance of these pregnancies in a healthy way and bearing of the metabolism of this burden remain as an important issue that needs to be investigated.

CONFLICT of INTEREST

The authors declare that they have no conflict of interest.

AUTHOR CONTRIBUTIONS

Idea / Concept: VK, FG, BAU
Design: VK, FG, BAU
Supervision / Consultancy: VK, FG, BAU
Data Collection and / or Processing: VK, FG, BAU
Analysis and / or Interpretation: VK, FG, BAU
Literature Review: VK, FG, BAU
Writing the Article: VK, FG, BAU
Critical Review: VK, FG, BAU

KAYNAKLAR

Ayres H, Ferreira RM, Torres-Júnior JRS et all (2014). Inferences of body energy reserves on conception rate of suckled Zebu beef cows subjected to timed artificial insemination followed by natural mating. *Theriogenology,* 82, 529-536.

Bastos G, Brenner RH, Willke FW et all (2004). Hormonal induction of ovulation and artificial insemination in suckled beef cows under nutritional stress. *Theriogenology,* 62, 847-853.

Bo GA, Adams GP, Caccia M (1995). Ovarian follicular wave emergence after treatment with progestogen and estradiol in cattle. *Anim Reprod Sci*, 39, 193-204.

Borakhatariya DN, Panchal MT, Dhami AJ, Hadiya KK, Kalasariya RM (2017). Efficacy of estrus synchronization protocols during summer and winter seasons together with biochemical and minerals profile in anestrus crossbred cows. *IJVSBT***,** 13, 9-16.

Butler WR (2003). Energy balance relationships with follicular development, ovulation and fertility in postpartum dairy cows. *Livest Prod Sci*, 83, 211-218.

Butler WR (2005). Inhibition of ovulation in the postpartum cow and the lactating sow. *Livest Prod Sci*, 98, 5-12.

Dhami AJ, Hadiya KK, Patel JA, Chaudhari DV (2019). Impact of ovulation synchronization protocols in addressing infertility of crossbred dairy cattle. *Haryana Vet*, 58, 56-61.

Edmonson AJ, Lean IJ, Weaver LD, Farver T, Webster G (1989). A body condition scoring chart for Holstein dairy cows. *J Dairy Sci*, 72, 68-78.

Ergün A, Tuncer ŞD, Çolpan L et all (2014). Hayvan Besleme ve Beslenme Hastalıkları. Pozitif Matbaa, Ankara.

Ferreira RM, Rodrigues CA, Ayres H et all (2006). Effect of synchronizing ovulation in cattle administered a norgestomet ear implant in association with eCG and estradiol treatments on pregnancy rate after fixed-time embryo transfer. *Anim Reprod,* 3, 370-375.

Freret S, Charbonnier G, Congnard V, Jeanguyot N, Dubois P, Levert J (2005). Relationship between oestrus expression and detection, resumption of cyclicity and body condition losses in postpartum dairy cows. *3R Congress,* 12, 149-152.

Froment P (2007). Note d'état corporel et reproduction chez la vache laitière [thesis]. École nationale veterinaire d'Alfort: La Faculte De Medecine De Creteil.

Funston R (2010). Nutrition and reproduction interactions. Proceedings, Applied Reproductive Strategies in Beef Cattle, January 28-29, San Antonio, TX.

Garnsworthy PC, Lock A, Mann GE, Sinclair KD, Webb R (2008). Nutrition, metabolism, and fertility in dairy cows: 1. Dietary energy source and ovarian function, *J Dairy Sci*, 91, 3814-23.

Garnsworthy PC, Sinclair KD, Webb R (2008). Integration of physiological mechanisms that influence fertility in dairy cows. *Animal,* 2, 1144-52.

Hess BW, Lake SL, Schollejegerdes EJ, Weston TR, Nayigihugu V, Molle JDC (2005). Nutritional controls of beef cow reproduction. *J Anim Sci,* 83, 90-106.

Kasimanickam R, Asay M, Firth P, Whittier WD, Hall JB (2012). Artificial insemination at 56 h after intravaginal progesterone device removal improved AI pregnancy rate in beef heifers synchronized with five-day CO-Synch controlled internal drug release (CIDR) protocol. *Theriogenology*, 77, 1624-1631.

López-Gatius F, Yániz J, Madriles Helm D (2003). Effects of body condition score and score change on the reproductive performance of dairy cows: A meta-analysis. *Theriogenology,* 59, 801-812.

Lotthammer KH (1991). Influence of nutrition on reproductive performance of the milking/gestating cow in the tropics. *FDCT,* 86, 59-74.

Luiz FMP, Natália AC, Paulo MAN, Jamyle PC, Luiz GBS (2017). Development and validation of an objective method for the assessment of body condition scores and selection of beef cows for timed artificial insemination. *Live Sci,* 197, 82-87.

Singh M, Sharma A, Kapse S, Kashyap A, Kumar P (2019). Efficacy of different estrus synchronization protocols in repeat breeder cows. *IJAN*, 89, 958-960.

Vale WG, Melo PCH, Walter E et all (2011). Fixed timed artificial insemination (FTAI) through the progesterone (CIDR) of 1st, 2nd, 3rd and 4th uses in bovine. I. Conception rate related to reproductive category, related to body condition scoring (BCS), related to calf withdrawal and use of eCG. *LRRD, 23, 205.*

Varışlı Ö, Tekin N (2011). Holştayn ırkı ineklerde vücut kondisyon skorunun fertilite ve bazı reprodüktif parametrelere etkisi. *Ankara Univ Vet Fak Derg*, 58, 111-115.

Vasconcelos JLM, Silcox RW, Rosa GJM, Pursley JR, Wiltbank MC (1999). Synchronization rate, size of the ovulatory follicle, and pregnancy rate after synchronization of ovulation beginning on different days of the estrous cycle in lactating dairy cows. *Theriogenology*, 52, 1067-78.

Webb R, Garnsworthy PC, Gong JG, Armstrong DG (2004). Control of follicular growth: Local interactions and nutritional influences. *J Anim Sci*, 82, 63-74.

Wildman EE, Jones GM, Wagner PE, Bowman RL (1982). A dairy cow body condition scoring system and its relationship to selected production characteristics. *J Dairy Sci*, 65, 495-501.

Williams SW, Stanko RL, Amstalden M, Williams GL (2002). Comparison of three approaches for synchronization of ovulation for timed artificial insemination in Bos indicus-influenced cattle managed on the Texas gulf coast. *J Anim Sci,* 80, 1173-1178.