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# IMPACT OF PRE AND POST-CALVING BODY CONDITION SCORE CHANGE ON REPRODUCTION TRAITS OF MONTBELIAD COWS IN ALGERIAN SEMI ARID AREA

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## ABSTRACT

This study aimed to determine the relationships between body condition score (BCS) and its change around calving and the reproduction traits. A total of 220 Montbeliard dairy cows reared in four farms whose level of breeding proficiency is acceptable were included in this study. Body condition (BC) in dry and postpartum period was assessed monthly on a scale of 1 to 5. Eight reproductive parameters were recorded or calculated. The results show a significant decrease ($p<0.001$) of BCS from dry period (3.40 points) to the 2$^{nd}$ month of lactation (2.86 points). Reproductive parameters evaluated at 63, 90 days respectively for the intervals from calving to first insemination and conception shows a good command of the reproduction conduct. A complementary analyzes show a relationship between BC before calving and all reproductive parameters ($p<0.001$). The best records are observed in cows with BC at dry ranged from 3 to 3.5 points. The differences are equivalent to one estrous cycle (19 days) for reproduction intervals and 20%, 19% and 9% on pregnancy rates at 60, 90 and 120 days respectively. The postpartum body condition affects only the pregnancy rate at 60 days ($p <0.05$) against the level of post-partum loss of BC poses no significant effect ($p> 0.05$).

**Key words**: BCS, Reproduction traits, Cow, dry, post-partum, semi arid.

## INTRODUCTION

Following the strong demand for dairy products, the Algerian authority has encouraged since independence local production of cow's milk. In fact, thousands of European cows of several breeds have been introduced and implemented throughout the country (Madani and Mouffok, 2008). The aim was the creation of a local productive livestock to limit imports of milk and its derivatives, which cost the country an important bill. Once in place, a differential adaptation was observed. Holstein's Friesian has occupying favorable coastal areas while the Montbeliard cow's has dominated the high cereal plains given its mixed character.

This breed has achieved moderate performance in milk production but good reproduction abilities that are always associated with environmental factors (Mouffok *et al*., 2007; Madani and Mouffok, 2008). The authors attribute this variability to the distribution of food resources and their effects on body reserves recovery needed for postpartum lactation but also to establish the ovarian activity and breeding. For this purpose several authors have linked nutritional status of dairy cows and the resumption of cyclicity and milk production level, but the results are conflicting. Some authors report that body condition affects milk production but it was without effect on reproduction (Waltner *et al* 1993). Against, other confirming the close relationship between reproduction and body condition in pre-calving (Singh *et al*. 2009) and post-calving (Patton *et al*. 2007). Chagas *et al*. (2007) report that energy stores during late gestation, calving, and early lactation affect the length of the postpartum anestrus interval and probability of a successful pregnancy. Nutritional status can be appreciated by Body condition scoring (BCS) which is an accepted, non-invasive, subjective, quick, and inexpensive method to estimate the degree of fatness (Waltner *et al*. 1993; Popescu *et al*. 2009).

Generally, low BCS at any time in early lactation was associated with delayed ovarian activity, infrequent LH pulses, poor follicular response to gonadotropins, and reduced functional competence of the follicle (Chagas *et al*. 2007). Negative energy balance (NEB) can also affect cow reproductive traits through some biological pathway. It can be modified metabolic functions regulated by pituitary-hypothalamic axis as LH, FSH, GH, insulin, leptin, IGF-1, oestrogen and progesterone (Rossi *et al*. 2008). In addition, NEB was involved in interactions between blood metabolites and ovarian activity (glucose, NEFA, BHB) (Meikle *et al*. 2004) and was characterized a relationship between uterine functionality and immune response during pregnancy and transition period (Rossi *et al*. 2008). NEB can also modified reproduction parameters through other metabolic mechanisms. However, insulin, IGF-1 and leptin decrease has direct and indirect effects on follicular development, such as on lower pulse secretion frequency of pituitary LH (Rossi *et al*. 2008), control of the resumption of ovulation (Knop and Cernescu 2009), follicular growth and steroidogenesis (Velazquez *et al*. 2009) and oestrous cyclicity (Velazquez *et al*. 2005). In several studies (Butler, 2006; Wathes *et al*., 2007) it was concluded that the decrease of one point BCS at the moment of post-calving first insemination, can reduce cow reproductive efficiency by 17-38%. Consequently interval from calving to conception can increase over 120-130 days. On the other hand, management of prepartum period is also very important to control because high body condition score (BCS) at calving leads to a greater loss after calving and thus a lower postpartum BCS. This excessively rapid mobilization of fat early in the postpartum period was a major risk factor for prolonged all reproduction interval periods (Knop and Cernescu 2009; Watters *et al*. 2009).

This study for three years aims to analyze reproductive performance developed by dairy cows reared in the semi-arid region and the dynamic evolution of their body condition. The authors then present and discuss the relationship between levels of body condition and dynamics evolution during the different periods on expression of these performances.

## MATERIALS AND METHODS

**Region:** The study was conducted in the Setif region, vast plains of north-eastern of Algeria, covering 365 000 ha of arable land (AL) and holds 150 000 heads of cattle (10% of national livestock). The climate is semi-arid continental with a level of precipitation varies greatly from one year to another and from North to South from 600 to 200 mm per year and average temperatures oscillated from 5° (January) to 26° (July). The average altitude varies between 700 and 1300m.

**Farm characterization and animal conduct:** The researches were conducted in four large farms in two different agro-ecological zones and are characterized by acceptable level of proficiency.

Farms being monitored hold relatively large areas, ranging from 300 to 1800 ha whose main agricultural activity are the production of seeds for cereals and livestock. Livestock farming is characterized by the presence of a flock of sheep whose numbers range from 300 to 500 head and cattle herd with relatively large size (50 to 130 head).

The level of forage autonomy is very high and the purchase of fodder is not reported. In most of grassland (from 8 ha to 70 ha according to farm's), they spend annually a part of the arable land (6-8%) for fodder whose culture is mostly in sec. Silage sorghum is practiced and used as cattle feed during the winter.

The cattle in study farms, is composed exclusively of Montbeliard breed. A cattle feeding is based during the winter (November-February) on the distribution of hay (grassland or oats), sorghum silage and supplementation of a quantity of concentrate purchased from outside. In spring, herds exploit natural grasslands and fallow land, while in summer and autumn residues and aftermath of grassland mowing and / or cereal stubble provide a part of the diet.

Supplementation varies during the grazing season depending on the availability of grazing resources, while in winter period; the concentrate provides 42 to 54% of energy intake (Table 01).

**Variables and data organisation:** During three-year study (2008-2010), we performed body condition scoring monthly from one month before calving to 3 month after parturition using the technique developed by Edmonson *et al*. (1989). The cows were scored via palpation and visual inspection on a five-point scale with quarter point divisions, where score 1 was given to emaciated, score 3 to moderate and score 5 to obese cows.

Data of reproductive events (calving to breeding, drying . etc) of 222 dairy cows are recorded. A total of 13 variables were selected for analysis of the effect of body condition and its dynamic change on reproduction traits in dairy cows.

- BCS one month before calving in points.
- BCS from the 1$^{st}$ month after calving, then regularly in monthly intervals until the 3$^{rd}$ month of lactation in points.
- Calving to first service interval in days.
- Calving to conception interval in days.
- Number of services per conception.
- First service to conception interval in days.
- Pregnancy rate at 60 day (% of total breeding cows).
- Pregnancy rate at 90 d (% of total breeding cows).
- Pregnancy rate at 120 d (% of total breeding cows).
- Pregnancy rate at first service (% of pregnant cows).
- Cow pregnant by three or more service (% of pregnant cows).

For each parameter we used the following sources of variation: (i) the year (3 years), (ii) calving season (4 seasons) and (iii) age (3 classes).

**Statistical analysis:** Several statistical methods were used to process the collected data. First step a descriptive analyzes are used to specify the means and standard errors. A two-step classification was performed to create groups of cows according to body condition in typical period and changes in body condition from pre to post calving period. The distribution of classes was only accepted if the separation index was good (> 0.5). The data are then subjected to deep analysis to test the effect of the selected factors and the cow classes created on the expression of performance. A logarithmic transformation was used for data of reproductive parameters (intervals). In case of homogeneous variances (Levene's test; $p>0.05$), analysis of variance is performed and the LSD (least significant difference) test was used to compare means when a significant difference. Otherwise the Welch statistic was calculated and the T2 test of Tamhane was used to compare means when a significant difference. Number of insemination per conception was tested by Kreskal-Wallis non parametric test (ordinal character).

The Pearson correlation test was conducted to describe the relationship between body condition and reproductive intervals.

Body condition score profile was tested by analysis of variance with repeated measures general linear model procedure (GLM) and intra and inter subjects effect are recorded. All analysis was performed using SPSS 19 (2011).

The z-test (Minitab procedure) was used to compare the proportions of cows' pregnancy rate at different time's period.

## RESULTS

**Means reproduction traits and BC profile:** The results of reproductive performance and development of cows' body condition are summarized in Tables 2 and 3. In fact, cows are inseminated 63 days after parturition and conception was produced 90 days post-calving after 1.74 attempts. However, 36% of cows are considered pregnant at 60 days postpartum, and 79% after 4 months. The success rate of the first insemination was approximately 57% while 15% of cows need three inseminations and more. The evolution of body condition in pre and post-calving stage shows that it was better in dry period (3.40 points), decreases in the first month postpartum by the equivalent of 11%. Loss increases in the 2$^{nd}$ month below 3 points and recovery start again from the 3$^{rd}$ month. Analysis of variance with repeated measures showed an intra-subject significant effect on the evolution of cows' body condition (p <0.001).

### BCS and reproductive parameters

**Effect of BCS before calving:** Three patterns of body condition (Figure 01) were identified according to body condition score at dry (p = 0.000). Obese cows whose average score was always greater than 3.25, the cows with moderate BCS whose average rating between 2.75 and 3.25 and lean females where the average score was always less than 2.75 points. However, wholes profiles were characterized by a loss in the first month and recovery established in the third month of lactation. Loss and recovery were related to precalving BC. Obese and lean cows lose more fat (18%) whose recovery was moderate (90% of BC at dry), while among moderate statue average loss was moderate (13%) and recovery was important (95% of BC at dry).

The analysis of variance shows that precalving BC affects significantly female fertility (Table 04). The best results were recorded in cows which moderate or high BC. These cows earn the equivalent of one estrous cycle compared to lean female (p <0.05). In addition, the pregnancy rate was double at 60 days (41% vs. 21%) and 1.5 times more at 90 days (64% vs. 45%) for females with moderate BC (Figure 2). For other parameters, and although the difference was not significant a slight superiority of cows with moderate BC was always observed. The correlation analysis shows a non-linear link between body condition at dry and reproductive parameters (Table 05). According to the model, body condition at dry affect the first insemination than the conception interval (p<0.05). The best performance was recorded as cows to moderate body condition.

**Effect of BCS after calving:** A significant effect of BCS at one month after calving on the BC profile was observed (Table 6). In fact, three classes were distinguished, cows with low and medium BC were characterized by a similar pattern, a loss in the first month and the recovery of body condition has been restored in the second month postpartum. Females whose high BC (> 3.25), loss persists until the second month of lactation; the BC recovery was late and moderate (Figure 3).

However, the variability of reproductive performance remains minimal for cows with moderate BC (between 5 and 6 days apart). However, the pregnancy rate at 60 days was greater (p <0.05) in cows with good or moderate body condition.

**Effect of BCS change:** Depending on the level of postpartum BC loss, two groups of cows were generated by two-step classification (Figure 4). In dry period, both groups show the same level of body condition (around 3.40). In postpartum, the BCS was distinguished from the first month of calving (p <0.000). The first group loses only 3.3% of pre calving BC against 18.7% in the second group. Loss increases in the second month to reach 4.7% in the 1$^{st}$ and 28.3% in the 2$^{nd}$ group. However, the recovery of BC was established from the 3$^{rd}$ month but with different levels (102% and 81% of pre calving BC respectively for 1$^{st}$ and 2$^{nd}$ groups).

The analysis of variance showed independence of reproductive parameters for the level of BC loss. Averages were quite similar and the differences were weak, 2 to 3 days for intervals (Table 7) and 0% to 6% for pregnancy rate (Figure 5).

**Effect of BCS profile:** The two-step classification of pre calving BC and loss level in post-partum permitted to distinguished six groups (Figure 6). Those of 3 and 4 include females with good BC at dry period (> 4 points). They differ only in the post-partum change. Group 3 does not virtually show any account of BC loss (6.5%) against, the level of loss was important in the fourth group (27.6%). Cows in groups 1 and 2, showed with moderate body condition at dry, and two dynamic evolutions in post calving stage. A low loss was observed in group 1 (4%) with a recovery was early (before 3 months) and a significant loss was recorded in cows of group 2 (23%) with a late recovery (more than 3 months). The last two groups contain females whose body condition at dry was low (<2.5 points) with two different paces always related to the level of loss and recovery. Group 5 has been characterized by stability of BC at first month and an increase from the second month of lactation. However, females in Group 6 recorded a decrease of BC during the two first months of lactation and recovery was late (3rd month).

**Table 01. Characteristics of study farms**

| Farms | Rainfall (means of 10 years) | Arable land (Ha) | Cows (variation of 10 years) | Concentrate Quantity (kg/Cow/year) | grassland surface (Ha) |
|---|---|---|---|---|---|
| F1 | 325 | 927 | 66-90 | 1442 | 70 |
| F2 | 420 | 1445 | 50-65 | 987 | 45 |
| F3 | 250 | 2370 | 22-50 | 1533 | 8 |
| F4 | 500 | 1835 | 20-45 | 1610 | 14 |

**Table 02. Reproductive traits in Montbeliard cows**

| Reproductive parameters | n | Mean | Std Error |
|---|---|---|---|
| Calvin to first service interval FSI (days) | 222 | 63 | 2,26 |
| Calving to conception interval CI (days) | 223 | 90 | 3,55 |
| First service to conception interval SCI (days) | 218 | 23 | 2,36 |
| Number of service per conception SC | 222 | 1,74 | 0,077 |
| Pregnancy rate at 60 d (%) | 81 | 36 | |
| Pregnancy rate at 90 d (%) | 130 | 58 | |
| Pregnancy rate at 120 d (%) | 176 | 79 | |
| Pregnancy rate at one service (%) | 127 | 57 | |
| Cows pregnant at three or more service (%) | 34 | 15 | |

**Table 03. Evolution of BCS around calving**

| Parameters | N | Mean | Std Error |
|---|---|---|---|
| BCS before calving (BC) | 232 | 3,40 | 0,046 |
| BCS at 1 month after calving (BCS1) | 224 | 3,05 | 0,053 |
| BCS at 2 month after calving (BCS2) | 212 | 2,86 | 0,057 |
| BCS at 3 month after calving (BCS3) | 219 | 3,13 | 0,059 |
| Intra subject effect | | *** | |

BCS= Body Condition Score ; *** = Significant difference at p<0.001

**Table 04. Effect of BCS before calving on reproductive traits and BC dynamic change**

| | BCS before calving | | | | | | ***p*** |
|---|---|---|---|---|---|---|---|
| | BCS < 2,75 N= 33 | | BCS 2,75 – 3,5 N=114 | | BCS > 3,5 N= 85 | | |
| | LSM | SE | LSM | SE | LSM | SE | |
| Reproductive traits | | | | | | | |
| FSI (days) * | 77 a | 6,14 | 58 b | 3,36 | 61 b | 3,56 | *0,007* |
| CI (days) * | 101 a | 7,56 | 83 b | 5,26 | 88 ab | 5,73 | *0,015* |
| FSCI (days) | 24 | 5,33 | 19 | 3,08 | 23 | 4,14 | *0,631* |
| NSC | 1,76 | 0,169 | 1,66 | 0,100 | 1,81 | 0,151 | *0,667* |
| Pregnancy rate at 60 d (%) * | 21 a | | 41 b | | 40 b | | *0,018* |
| Pregnancy rate at 90 d (%) * | 45 a | | 64 b | | 59 ab | | *0,050* |
| Pregnancy rate at 120 d (%) | 76 | | 85 | | 76 | | *0,254* |
| Pregnancy rate at one S (%) | 52 | | 57 | | 62 | | *0,286* |
| Pregnant at three or more S (%) | 18 | | 14 | | 17 | | *0,492* |
| BCS | | | | | | | *0,000* |

* = Significant difference at p<0.05; Values bearing different letters in a line differ significantly (P<0.05)

**Table 05. Correlation between BCS before calving and reproductive traits**

| Correlation | FSI | CI |
|---|---|---|
| **Linear** | | |
| **r** | - 0.137 | - 0.050 |
| ***p*** | *0.046* | *0.468* |
| **Quadratic** | | |
| **r** | 0.243 | 0.148 |
| ***p*** | *0.002* | *0.098* |

**FSI=** Calving to First service interval; **CI**: Calving to Conception interval

**Table 06. Effect of BCS at 1st month after calving in reproductive traits and BC dynamic change**

| | **BCS 1st month after calving** | | | | | | ***p*** |
|---|---|---|---|---|---|---|---|
| | BCS < 2,5 N= 40 | | BCS 2,5 – 3,25 N= 105 | | BCS > 3,25 N= 79 | | |
| | LSM | SE | LSM | SE | LSM | SE | |
| **Reproductive traits** | | | | | | | |
| FSI (days) | 66 | 5,97 | 61 | 3,31 | 60 | 3,96 | *0,746* |
| CI (days) | 92 | 7,01 | 87 | 5,33 | 84 | 6,29 | *0,400* |
| FSCI (days) | 26 | 5,33 | 20 | 3,29 | 19 | 4,08 | *0,561* |
| NSC | 1,82 | 0,168 | 1,69 | 0,109 | 1,69 | 0,148 | *0,817* |
| Pregnancy rate at 60 d (%) * | 25 a | | 38 ab | | 44 b | | *0,029* |
| Pregnancy rate at 90 d (%) | 58 | | 59 | | 61 | | *0,733* |
| Pregnancy rate at 120 d (%) | 73 | | 83 | | 81 | | *0,193* |
| Pregnancy rate at one S (%) | 49 | | 58 | | 65 | | *0,128* |
| Pregnant at three or more S (%) | 18 | | 16 | | 13 | | *0,495* |
| BCS | | | | | | | *0,000* |

Values bearing different letters in a line differ significantly (P<0.05)

**Table 07. Effect of BCS loss in reproductive traits and BC dynamic change**

| | **BCS loss** | | | | ***p*** |
|---|---|---|---|---|---|
| | low loss 9,22% N= 105 | | High loss 34,36% N= 102 | | |
| | LSM | SE | LSM | SE | |
| Reproductive traits | | | | | |
| FSI (days) | 62 | 3,35 | 59 | 2,90 | *0,634* |
| CI (days) | 83 | 4,75 | 85 | 4,21 | *0,779* |
| FSCI (days) | 21 | 3,49 | 21 | 2,97 | *0,994* |
| NSC | 1,62 | 0,10 | 1,68 | 0,10 | *0,660* |
| Pregnancy rate at 60 d (%) | 41 | | 35 | | *0,386* |
| Pregnancy rate at 90 d (%) | 60 | | 62 | | *0,774* |
| Pregnancy rate at 120 d (%) | 82 | | 82 | | *1,000* |
| Pregnancy rate at one S (%) | 62 | | 58 | | *0,585* |
| PR at three or more services (%) | 14 | | 14 | | *0,955* |
| BCS | | | | | *0,000* |

For reproductive performance, parameters affected by BC dynamics change were also CFSI, CCI, PR at 60 d, 90 d, 120 d and at one service. The best performances were recorded in females whose best BC at dry with any level of loss and those with medium pre calving BC without postpartum loss (Table 8).

**Table 8. Effect of interaction between BCS at dry and post-partum BC loss on reproductive traits and BCS dynamic change.**

| | Groups of BCS profile | | | | | | p |
|---|---|---|---|---|---|---|---|
| | ML ; n= 48 | MH ; n= 33 | HL ; n= 35 | HH ; n= 42 | LL ; n= 20 | LH ; n= 27 | |
| Reproductive traits | | | | | | | |
| FSI (days) * | 56(4,66)ab | 51(5,09)a | 58(5,08)ab | 60(4,28)ab | 82(8,66)c | 67(5,68)bc | *0,010* |
| CI (days) * | 77(7,22)a | 76(8,33)a | 74(7,10)a | 91(6,70)ab | 114(9,46)b | 85(6,24)ab | *0,012* |
| FSCI (days) | 17(4,55) | 18(5,02) | 19(6,49) | 26(5,34) | 33(8,52) | 15(4.33) | *0,366* |
| NSC | 1,51(0,12) | 1,58(0,14) | 1,61(0,20) | 1,88(0,21) | 1,89(0,22) | 1,52(0,15) | *0,450* |
| PR at 60 d (%) | 46a | 48a | 53a | 31ab | 10b | 26b | *0,000* |
| PR at 90 d (%) | 65a | 60a | 71a | 52ab | 30b | 56ab | *0,005* |
| PR at 120 d (%) | 90a | 88a | 82a | 74a | 65b | 89a | *0,020* |
| PR at one S (%) | 64a | 58a | 69a | 58a | 40b | 59a | *0,028* |
| RB (%) | 11 | 12 | 11 | 20 | 25 | 7 | *0,107* |
| BCS (RM) | | | | | | | *0,000* |
| Loss Level | 11(1,51) | 28(1,72) | 11(1,26) | 33(1,53) | 3(2,80) | 44(2,23) | *0,000* |

M= moderate body condition; L= low body condition; H= High body condition; PR = pregnancy rate ; * = Significant difference at p<0.05; Values bearing different letters in a line differ significantly (P<0.05)

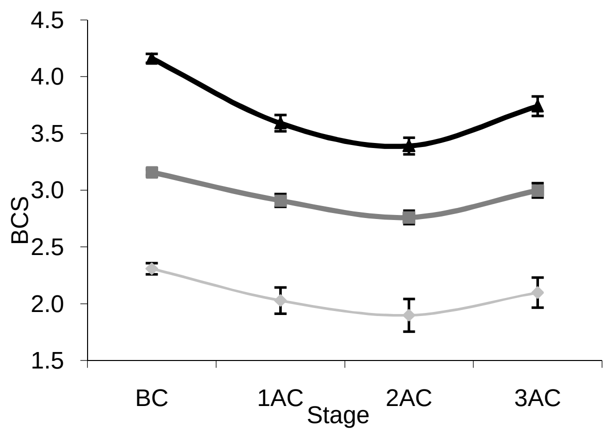


**Figure 01. BCS profile of cows with low (-●-), medium (-■-) and high (-▲-) BC before calving**

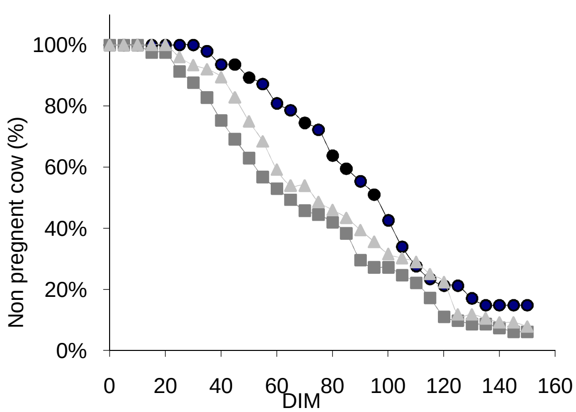


**Figure 02. Part of non pregnant in Obese (-▲-), medium (-■-) and lean (-●-) cows before calving**

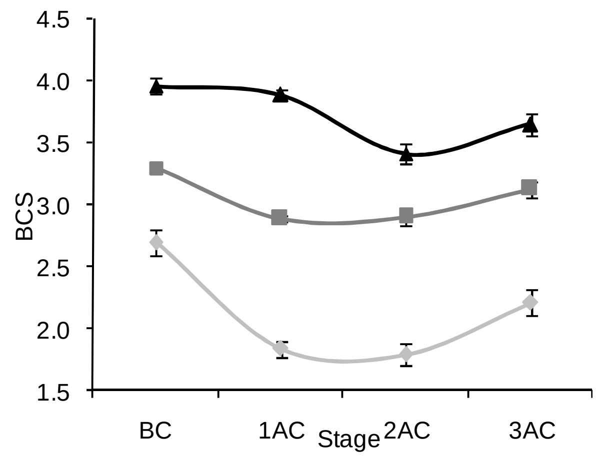


**Figure 03. BCS profile of cows with low (-●-), medium (-■-) and high (-▲-) BC after calving**

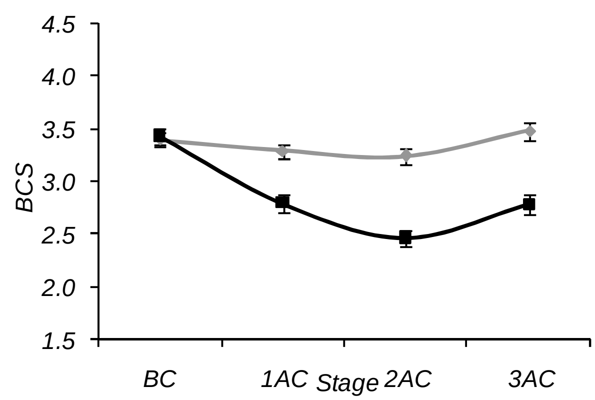


**Figure 04. BCS profile of cow's without (-●-) and with important loss (-■-) after calving**

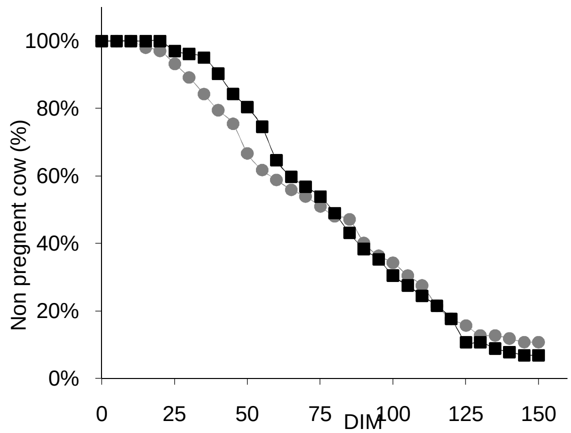


**Figure 05. Part of non pregnant cows between females without (-●-) and with important loss (-■-) after calving,**

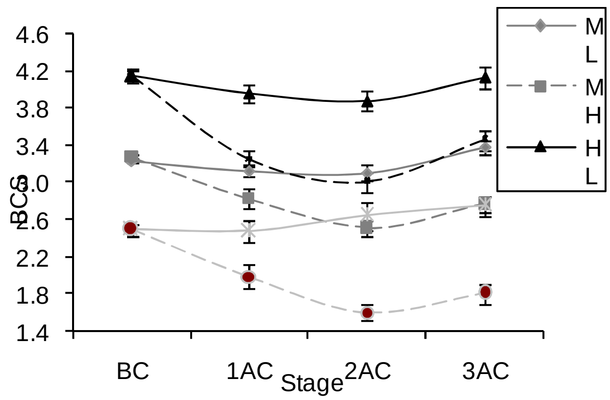


**Figure 6. BCS profile of cows' among BC at dry and level of post-partum loss**

## DISCUSSION

**Reproductive traits:** Analysis of reproductive performance on the Montbeliard cows largely breeding in the study area shows a better adaptation of reproduction function. The averages were quite acceptable and reflect significant efforts to improve the skills of exotic breeds compared to the results obtained in previous years in the same region (Madani and Mouffok, 2008) or in neighboring regions (Sraïri and Baqasse, 2000). These results were comparable to those achieved by the Friesian Holstein in Ireland (Berry *et al*., 2003), Switzerland (Kadarmideen 2004) and Thailand (Rukkwamsuk 2010) but are better compared to those recorded by the Ayrshire and high producing Holstein in Canada (Bastin *et al*. 2010).

**BCS in dry and post-partum period:** The analysis of BC profiles shows that average body condition was high in dry and tends to decrease during the first weeks of lactation to reach the minimum in 60 days postpartum. In fact, the same result was reported by Bastin *et al*. (2010) in Canada but in Czech Republic Maršálek *et al*. (2008) report that in Holstein the minimum value was obtained at the 3$^{rd}$ month of lactation. This reduction in the BC was usually accompanied by a decrease in plasma triglycerides (Moallem *et al*., 2004), T4, T3, IGF-I and leptin (Gamez-Vazques *et al*., 2008; Meikle *et al*. 2004) and high concentration of NEFA (Rukkwamsuk 2010; Giuliodori *et al*. 2011), BHB (Wathes *et al*., 2007), cholesterol (Mouffok *et al*, 2011), and increased risk of infertility and health problems (Waltner *et al* 1993).

Differences in BC profiles were recorded between calving season and age of females. The age effect was important throughout the period followed against calving season affects postpartum only. Primiparous are leaner and present unbalanced endocrine-metabolic profiles compared to multiparous (Meikle *et al*. 2004). Thus, in the Japan Holstein Sakaguchi (2009) report that from preparturition to 3 wk postpartum, there was no difference in BCS between the parity groups and at 4 wk and later, the BCS of Primiparous cows were significantly higher than those of multiparous cows. Because BCS reflects body fat reserves, the results indicate that multiparous cows mobilize more fat for lactation during a longer postpartum period.

However, in pre calving stage, the similarity of food systems of dry cows explains the low variability of BC. In postpartum, feeding differs between season and the response of cows for this situation was also different. Cows calving in summer and autumn lose more of fat responding to climatic conditions and availability of food resources. Against those calving in winter and spring retain their BC sufficient following a good diet.

**Variability of reproductive trait according to pre calving BC:** The dry was a critical period whose nutritional needs are more qualitative than quantitative. Good animal husbandry and food management determines the post-partum performances. Watters *et al*. (2009) show that dry period length affect pregnancy rate at 90 but not at 45 and 60d. In our study, the BC at dry stage influences reproductive parameters in postpartum. The best performance was achieved by cows with body condition ranging between 3 and 3.5. The correlation between pre calving BC and intervals between calving to first insemination and conception was negative in the linear regression model but positive and more significant in quadratic regression model. This shows that the intervals are shorter in females with medium BC but more prolonged than in lean or obese. The same observations were found for the probability of conception when it was high (> 60% at 90 days) to BC of 3.5 to 4 points vs. 2 or 5 points (<45% at 90 days). Similar results have been noted by several authors. Samarütel *et al*. (2006) reports that in Holstein breed no cows in the *fat* group in dry conceived from the first service, other fertility parameters are not significantly different among groups of dry BC investigated. In addition, Kabaðinskienë *et al*. (2008) in Lituanie and Nowak *et al*. (2009) in Poland showed that first service and day open was shorter 20 at 40d and conception rate after 1st insemination is high (>10 à 20%) in cow with moderate BC at dry compared to cow with low and high BCS. However, Singh *et al* (2009) found that the post partum interval to estrus was lowest for the cows having high BCS at calving (28 & 41 d). In addition, Rossi *et al*. (2008) report that in pre-calving stage, low leptin plasmatic levels -directly related to cow's BCS- can serve as reference to highlight a delayed first post-partum ovulation and a longer duration of the calving-conception interval. In contrast, several researches did not confirm these relationships **(**Morrison *et al*., 1999, Gillund *et al*., 2001 and Jilek *et al*., 2008**)**. This researchers reports that BCS before calving is not related to conception to first service, calving to first insemination interval, calving to conception interval, or number of AI per conception. But, Jilek *et al*. (2008) signal that the body condition score influences only the resumption of the oestrous cycle in dual-purpose cattle. In addition, it has been documented that there was no significant effect of BCS at dry in ovulatory and anovulatory cows (Kawashima *et al*. 2007) and on the dynamics of ovarian follicles development especially on the first large ovarian follicle and the corpus luteum (Nowak *et al*. 2009)**.**

The conflicting results of the different studies demonstrate the complex relationships among nutritional management, parity, breed, production level and reproductive performance (Gillund *et al*., 2001). Possible reasons contributing to discrepancies among the studies include the system of milk production, the sample population analyzed the frequency of BCS measurement, the model of analysis, the definitions of both the BCS and reproductive parameters investigated, and variation in the parameters within the sample population (Roche *et al*., 2007).

**Effect of postpartum BC and loss level:** In literature, the postpartum period was the most sensitive to food restricting that affects body condition (Wang *et al*., 2009) by affecting the resumption of females cyclicity and successful insemination (Banos *et al*. 2004). However, Bukley *et al*. (2003) reported that it is the severe energy balance which causes metabolic disorders and impaired fertility. This effect is more remarkable as in Primiparous than multiparous cows (Meikle *et al*. 2004). For this author Primiparous lean cows presented a longer interval from parturition to first ovulation than Primiparous fat cows, but this was not observed for multiparous cows. Other researchers observed no significant effect of the postpartum BC in reproductive performances (Campanile *et al*. 2006 ; Nowak *et al*. 2009 ; Sakaguchi 2009). In our study, the postpartum BC affects only the pregnancy rate at 60 days but the level of loss occurs without significant effect on reproductive traits. However, analysis of BC profiles shows that poor results were always saved in females with a low BC at dry whatever the level of loss, which was consistent with the results of Garnsworthy *et al*. (2009) who observed that for cows with high dietary level at dry and low dietary level in post-calving pregnancy rate to first and all inseminations tended to be higher compared with cows in the other groups.

Bibliographic research reported controversial results. Several researchers observed that the postpartum body condition or positive energy balance are associated with increased probability of short reproductive intervals in Holstein (Patton *et al*. 2007; Ponsart *et al.* 2006; Amer 2008), Flechvieh (Jilek *et al*. 2008) and zebu breed (Abdalla and Elsheikh 2008), higher pregnancy rate (Alam and Sarder 2010; Serin *et al*. 2010) and best performance of oocytes and embryos quality (Fassi Fihri 2005, Nowak *et al.* 2011). These effects are related to parity (Ponsart *et al.* 2006) but independent of the weight of females (Patton *et al*. 2007). From a phenotypic point of view, dairy cows enter a negative energy state in early lactation in which they mobilize fat stores to meet the increased energy requirements of milk production. This mobilization of body reserves, represented by a loss of BCS and diminution on blood Insulin, IGF-I and leptine concentration (Adamiak *et al*. 2005), has been associated with delays in the onset of normal ovarian activity (limiting the number of estrus cycles before breeding) and a reduced conception rate (Bastin *et al*. 2010)**.** However, IGF1 concentrations together with other key metabolic hormones such as insulin are crucial for oestrous cyclicity. The activity of IGF1 in follicular growth and steroidogenesis is critical in the selection of the dominant follicle in cattle (Velazquez *et al*. 2009).

However, others researches report that BCS and its change affect only some reproductive traits and appear without effect on other parameters. Berry *et al*. (2003) and Kadarmideen (2004) shows that cows with good genetic merit for body condition will take a shorter time to reach first insemination after calving. But this is no correlation with conception (Berry *et al*. 2003) and pregnancy rate (Kadarmideen 2004). However, the high level of loss in postpartum stage is associated according Gillund *et al*. (2001) and Ling *et al*. (2003) with longer days open (CCI) but independent for breeding (CFI). While, Ferreira (2005) reported that the decrease of BC from dry to postpartum does not act on the first estrus (46 vs. 55 days) but affects the first insemination and conception.

**Conclusion:** It can be concluded from the present study that reproductive performance recorded by Montbeliard exotic breed express a better functional adaptation for the new environment. However, these performances are widely depending for precalving nutritional statues. The cows show with BC between 3 and 3.5 realize a short intervals and high pregnancy rates. At postpartum, only the pregnancy rate at 60 days was affected by the level of body condition. Moreover, the level of BC loss does not affect postpartum reproductive performance without connecting it to the dry statue. It is concluded that poor feeding practices in dry period largely observed in our farms have a negative impact on the express of postpartum performances.

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