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RESEARCH ARTICLE

MASTITIS STRESS AND REPRODUCTION IN COWS

*,[1]Alejandro Córdova-Izquierdo, [1]Adrían Emmanuel Iglesias Reyes, [1]Claudio Gustavo Ruiz Lang, [2]Juan Eulogio Guerra Liera, [2]Jorge Fabio Inzunza Castro, [3]Edmundo Abel Villa Mancera, [3]Maximino Méndez Mendoza, [3]Ruben Huerta Crispín, [4]Ma de Lourdes Juárez Mosqueda, [5]Armando Gómez Vázquez, [6]Jaime Olivares Pérez, [7]Valente Velázquez Ordóñez and [1]Román Espinosa Cervantes

[1]Departamento de Producción Agrícola y Animal, Universidad Autónoma Metropolitana Unidad Xochimilco, México, D.F.
[2]Facultad de Agronomía. Universidad Autónoma de Sinaloa, México
[3]Facultad de Veterinaria. Benemérita Universidad autónoma de Puebla, México
[4]FMVZ-UNAM
[5]División Académica de Ciencias Agropecuarias. Universidad Juárez Autónoma de Tabasco, México
[6]Unidad Académica de Veterinaria. Universidad Autónoma de Guerrero, México
[7]Centro de Investigación y Estudios Avanzados en Salud Animal, FMVZ-UAEM

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ABSTRACT

Because of the undeniable advances in genetic and nutrition, dairy industry can produce great amount of milk per cow per year more efficiently nowadays. However, these improvements may be overshadowed by the emergence of problems regarding low reproductive performance of animals. Both in its clinical and subclinical forms, mastitis is linked to stressin dairy cattle, and such association undermines their reproductive performance. Livestock producers should give preferential attention to the task of improving the environmental conditions and management of their production units, since such conditions are largely responsible of animal health detriment, and affect the incidence of reproductive disorders, increasing significantly production costs of dairy industry.

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INTRODUCTION

The udder health is crucial for good reproductive performance of females, mainly specialized in the production of milk. It is known that the prevention of mastitis in early lactation improves the reproductive efficiency of animals in terms of days to first postpartum service, days to conception, services per conception and calving interval day (Schrick *et al*., 1999). Mastitis entered before the service, whether clinical or subclinical, may reduce the conception rate to about 50%. Thus, it can be stated that there is a negative correlation between the presence of mastitis and reproductive performance, especially in high-producing cows (Moore *et al*., 1991). Endotoxins generated by Gram agents negative producers mastitis, may favor the synthesis of prostaglandin F2 alpha, causing disturbances reproductive abnormalities associated with the estrous cycle, altered estrus intervals and shorter duration of the luteal phase of the estrous cycle, whose impact is related to hormonal disorders in 162 patterns, shorter duration of life corpus luteum (luteolysis), follicular development, presence of early embryonic deaths and environmental uterine commitment (Cullor, 1990; Moore and O'Connor, 1993; Oliver *et al*., 2000). Units specialized in animal production in milk production, it is crucial to have good hygiene and health program management in all areas, comfortable facilities and proper functioning of the milking equipment. Mastitis and animal reproduction, two aspects are of great importance in dairy cattle. In this regard, in a

****Corresponding author: Alejandro Córdova-Izquierdo***
Departamento de Producción Agrícola y Animal, Universidad Autónoma Metropolitana Unidad Xochimilco, México, D.F.

retrospective study over 15,000 records from 26 units producing dairy cows that had mastitis were evaluated, they discovered that cows who suffered such condition in early lactation had a longer interval from calving to first service (Eicker *et al*., 1996). Cows with mastitis in early lactation had delayed first estrus and first ovulation postpartum compared with cows did not suffer (Huszenicza *et al*., 1998). fertility in another study of about 9,000 dairy cows was assessed emerging mastitis than those who suffered the 20-40 days before the service, showed 45% fertility; being found 36% of fertility for those animals recorded mastitis in the period prior to 20 days of service and 29% fertility in animals that suffered mastitis within the first three weeks after service 17's first days postpartum service impacting on open days, are also altered by the presence of mastitis. In research data first postpartum service 94 days for cows that had mastitis within the first five months postpartum and 71 days for the presented after service 2 indicated. Was also evident that the days open were 114 days for cows that had mastitis before first postpartum service, 137 days to those who suffered mastitis between first service and gestation and 92 days for healthy cows. Data suggest that reproduction of dairy cows is affected not only by clinical mastitis but also subclinical. An investigation open for 85 days reported healthy cows, 108 for those who suffered subclinical mastitis prior to first postpartum service, 91 days later when suffered; 110 days when they had clinical mastitis prior to service and 144 days when disease have occurred after 28 Furthermore, the change of subclinical clinical mastitis also affects the reproductive performance. 101 days open when this occurs prior to service and 196 if later. The presence of mastitis, either subclinical or clinical units in milk production, also has an impact on the occurrence of abortions, especially during the first month of gestation, at which time cows can be twice as susceptible to this reproductive failure (Risco *et al*., 1999).

Stress in impaired reproductive performance

Stress is the result of confinement and a little ambitious and humanitarian vision of the man who usually guided by the interest of improving production, even attempted to domesticate species that could not adapt to the environment healthy tax. Today it has been concluded that stress is one of the environmental management factors most affecting animal production to be closely related pathogens that threaten the health of animals. The man plays a very important role in the generation of stress, it can provide the means to alleviate, remove or modify any potential stressor (Coubrough, 1985). Some of the criteria that have been used to indicate the presence of animal stress levels are of thyroid hormones, plasma or urinary corticosteroids, catecholamines and / or their metabolites, lactic acid, serum enzymes, blood glucose levels, impaired respiratory or heart rate and somatic cell count in milk. Mammals respond to environmental change through adaptation mechanisms regulated by hormones such as ACTH, glucocorticoids and catecholamines. Under stress, there is a negative feedback on the luteinizing hormone progesterone, cortisol levels rise, prostaglandin F2 and ACTH. Increases in epinephrine and norepinephrine values of 5 are also recorded. These changes adversely affect reproductive function in mammals (Dobson and Smith, 1995). Stress can be caloric, nutritional or handling.

Heat stress

Solar radiation, wind speed, air temperature and humidity are factors that have to do with the presentation of heat stress. The first reproductive responses to heat stress are decreased intensity estrus and-as a consequence-low fertility. It is known that mammalian females are more sensitive to heat stress during the 12 days prior to estrus, increasing this sensitivity during the two days before the same (Gilad *et al*., 1993). Other studies found that high temperatures cause lack of libido and also affect the amount and semen quality (Coubrough, 1985). Additionally, reduce heat and presentation when present, are less intense and of shorter duration. If the female was impregnated, the possibility is high embryonic mortality (Rodríguez, 1997). The existence of a delayed effect of heat stress in the follicular steroidogenesis, and a decrease in steroidogenesis, 20 and 26 days later, medium sized preovulatory follicles 25 states. Addition, theca cells were found more sensitive than granulosa cells and they expressed low estrogen production in middle size follicles and low viability in preovulatory follicles. In terms of production of steroids, theca cells appeared to be consistently susceptible to heat stress and expressed transport effect on androgen production in both types of follicles.

When body temperature exceeds 40 ° C, developed follicles can suffer severe damage and become nonviable (Dave, 1999); turn increases progesterone inhibit release of LH during estrus, interrupting the ovulation process 16. Investigations revealed that heat stress reduces the size of dominant follicles for the first and second follicular wave (Roth *et al*., 2001). We hypothesize that exposing domestic mammalian females to heat stress during estrus alters follicular dynamics and follicular dominance decreases in the following estrus. The preovulatory follicle is a key component in the reproductive system and the deterioration of its function during stress heat can trigger other effects such as distortion in the secretion of gonadotropins and underdevelopment of the corpus luteum and embryo, changes that result in low fertility (Wolfenson *et al*., 1997). Experiences in vitro suggest that exposure of pregnant females to domestic high ambient temperatures and humidity, common during the summer months, can disrupt the balance between endometrial and biochemical factors responsible for the maintenance of pregnancy. The lipid composition of the membranes of oocytes deteriorates more frequently in summer than in winter (Roth *et al*., 2001). A relevant to counter the effect of heat stress on oocyte quality and embryo development aspect is the possible use of antioxidants to increase the strength of both the oocyte and embryo. Thyroxine and triiodothyronine may decrease the effects of heat stress (Lee,1993). Cows subjected to cold temperatures for a few days after gestation, improved pregnancy rates compared with females who suffered heat stress (Ealy *et al*., 1993). Has been shown that in periods of severe heat stress, only 10-20% of the inseminations can be in normal pregnancies 7. In Israel, conception rates during the winter months reaching over 50%, while during the summer can lose up to 20% 31. It is claimed that the Jersey breed is more tolerant to heat stress than Holstein. Work performed in the United States indicate that Holstein and Jersey cows laid in warm places, expressing signs of estrus for only 12 to 13 hours, which means a difference of 5-6 hours less than the normal duration of estrus animals (Yabuta and Kunio, 2000) temperate locations. Dairy cows with black layer absorb more heat from sunlight, cows of white layer (Madison, 1996; Mazzucchelli and Tesouro, 2000). In this regard, it is known that environmental temperature during which affected the reproductive efficiency of cows ranges from 21.1 to 32.2°C; therefore the Cows need to be "cooled" as much as possible during the summer, in order to increase fertility (Wolfenson *et al*., 1997). In Florida, the heat and humidity of summer can own up to 10% lower pregnancy rate (Ambrose *et al*., 1999). Ensures the best estimates to control the effects of heat stress include physical modification of the environment, genetic improvement aimed at achieving less sensitive to heat stress and good nutritional management (Yabuta and Kunio, 2000).

Nutritional stress

In cattle, the stress during transport has a detrimental effect on the physiology of the animal that the stress caused by lack of food and drink, for a period of equal length. This is because blood flow is diverted from internal organs to the peripheral tissues, in an attempt to reduce body temperature by increasing the pérdidade heat (Zapiola, 1998). This mechanism causes a diminished blood supply intended for internal organs such as uterus, fallopian tubes and ovaries; such a reduction implies limited availability of nutrients to these organs and therefore impairs the functional capacity (Mazzucchelli and Tesouro, 2000). females in nutritional reasons stressed by the corpus luteum is lighter and changes in the chemical constituents of allantoic fluids are detected, as well as degeneration of embryos malnourished females (Lee, 1993) females consume less food during the warm seasons; consequently there may be insufficient nutrients available after milk production and therefore, the ovaries do not work during the first 6 weeks of lactation (Varner, 1998). Moderately Vitamin E may decrease the effects of heat stress during the hot months, but not necessarily increases fertility (Ealy *et al*., 1994). A proactive factor could be the provision of adequate food in quantity and quality, which have direct effects on reproduction and on the changes caused by the indirect effects of nutritional stress (Dobson *et al*., 2001).

Stress management

Consists of negative interactions that exist between the animals and their keepers (Dobson *et al*., 2001). How to maneuver the cattle can cause stress by improper handling, which can affect the biology of reproduction and the immune response (Mazzucchelli and Tesouro, 2000). It is known that electric chopped, freezing and other stresses handling, weaken the reproductive performance of females. There are many situations that can causes tress management seriously affecting there productive, such as excessive mobilization before being inseminated females, the use of aggressive driving in the separation of the processor animals, animals immobilizing leave with management and other purposes (Varner, 1998). The time when stress management produces higher adverse effects on reproduction occurs shortly after the onset of estrus (Mazzucchelli and Tesouro, 2000). Depending on your temperament, cattle can be classified as follows: (1) stands still while it is subject, (2) is restless, (3) strongly shakes leave management, and (4) shakes violently leave management and tries to escape. In general terms, copies of Bosindicus have a more aggressive and nervous temperament Bostaurus (Zapiola, 1998).

Effect of stress on the reproductive process

Cattle are one of the most adaptable species and has homeocinéticos mechanisms for maintaining critical body functions at the expense of changes in other physiological functions such as reproduction, so that reproductive function is largely determined by the environment (Yabuta and Kunio, 2000). The reproduction is primarily influenced by environmental stress (Córdova *et al*., 2003) and management (Dobson and Smith, 2000). The first includes outside temperature, cold and / or heat, wind and humidity, while the second covers the density and flow of animals, interaction between animals of the same or different species and existing social conditions as states of non specific psychological distress, noise, and other physical trauma. The combination of both types of stress severely compromises homeostasis (Coubrough, 1985). They should be added to some types of physical stress (inadequate transportation, psychological harm, isolation of animals) and physiological (hypoglycemia, changes in blood pressure), all capable of generating reproductive days function in mammals (Dobson and Smith, 1995). Maintenance of the normal body temperatures known as homeotermiaandisvital to the functioning of the brain tissues importance. In cattle, the diurnal variation in body temperature should be0.6 to 1.2°C. A further increase is a sign of illness or poor adaptation to the thermal lift. This temperature range is called comfort zone and varies according to the species and animal breeds. When the body temperature is below or above their level of comfort, the metabolic rate decreases or increases, presenting an imbalance in animal welfare. Body heat is removed through the mechanisms of radiation, conduction, convection and evaporation (Yabuta and Kunio, 2000). The effects of stress on reproductive activity vary according to the sex of the animals.

Effects on the male

Environmental stress can cause low semen quality, which is closely related to the reduced fertility of females, probably due to a combination of low fertilization rates and increased embryonic mortality (Chemineau, 1993; Coubrough, 1985). Direct exposure of the testis to high temperatures, causes changes in critical stages of spermatogenesis, which is also directly related to the quality of the ejaculate. Recent studies suggested that the effect of heat stress on sperm quality can be overlooked with the implementation of technology seminal freezing; however, the uterus of female heat stress may represent sperm (Rutledge, 2001).

Effects on the female

Sexual behavior and fertility rates are the main reproductive indicators negatively affect females by environmental stress.

Programs undertaken in order to increase the fertility of domestic females, are less successful in hot weather than in temperate (Chemineau, 1993). Increased uterine temperature of 0.5°C during hot days, caused a decrease in the rate of fertilization. In cattle, heifers exposure to 32°C for 72 hours after artificial insemination inhibits embryonic development. However, it is known that 48% of females kept at 21°C, it can be fertilized without any problems. If heat stress occurs after 10 days of service, fertility is not affected. Fertility in lactating cows vary by season. In winter decreases about 50%; 20% in summer and autumn is lower than in the winter. Some years ago it was reported that conception rates in Israel fell from 52% in winter to 24% in the summer 14. In the warm season, 80% of estrus may be undetectable (Ambrose *et al*., 1999). Furthermore, it has been indicated that when the rectal temperature of the animals increases from 38.5 to 40 °C at 72 hours after service or insemination, pregnancy rates can decrease by up to 50% (Ryan *et al*., 1992). Studies in heifers and cows have shown that the decline in oocyte quality early postpartum period is associated with negative energy balance and low body condition, which is expressed in increased underdeveloped and abnormal embryos, with the consequential loss embryo in the hottest months of the year (Wolfenson *et al*., 1997). It states that in cattle, embryonic development is highly sensitive to high temperatures, in the top three to eleven days after service, acquiring high temperature tolerance as pregnancy progresses period (Ambrose *et al*., 1999; Ealy *et al*., 1993; Ealy *et al*., 1994). The embryos obtained by in vitro fertilization, are more susceptible to heat stress than those obtained in natural conditions. The greatest loss of bovine embryos from in vitro fertilization, occurs before 42 days, when females are under heat stress (Ambrose *et al*., 1999).

Recommendations for Managing Stress

To avoid heat stress should provide a ventilation system that controls body temperature, implement water sprinklers, protect animals against direct and indirect solar radiation through appropriate shadows or ceilings, providing shade in feeding and drinking to increase feed intake in animals with heat stress, animals provide bathrooms spray in the hottest hours of the day, try to have animals with white fur as they dissipate heat better than the black layer and therefore are less sensitive to heat stress, develop genetic adapted animals since they may become less sensitive to heat stress, frozen embryos implanted with frozen semen and inseminate at the time less hot. To minimize handling stress is desirable to have free areas shaded in the production unit, provide the required area per animal for your comfort, bathing females before the service and 3-5 days, or to inseminate service in less warm periods, implementing estrus synchronization programs to schedule inseminations or services and not isolate females long before artificial insemination or service. To overcome nutritional stress should be properly balanced diets, providing the energy needed to offset any reductions in food intake, reduced fiber intake and increase protein and energy. In general, they shall ensure that animal welfare, avoiding stress management through good hygiene and health and nutritional status. Diagnose and prevent the timely presence of mastitis, through the use of a good milking routine, careful hygiene and good milking machines and using good sealants. The dietary management should consider supplementing with minerals like selenium, calcium and phosphorus as well as vitamins A, C and E, the antioxidant is essential for maintaining the health of animals.

Conclusion

The presence of both subclinical and clinical mastitis in dairy farms, is linked to the stress of the animals. Such combination is detrimental to the reproductive performance of cows, increasing the days of calving first service interval, decreased fertility, increased days open and services per conception and increases susceptibility to early abortion, so the period deliveries extending significantly.

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