

Evaluation of the Quality and In Vitro Developmental Oocytes Collected from Ovaries of Water Buffaloes at Different Body Condition Scores

^[1] Floredeliz Somoray Obrino, PhD

^[1] Associate Professor IV, Faculty, College of Agriculture, Fisheries and Natural Resources, University of Eastern Philippines, University Town, Northern Samar

Corresponding Author Email: ^[1] fsobrino62@gmail.com

Abstract— This study examines the influence of body condition score (BCS) on ovarian structures, oocyte quality, and in vitro developmental potential in water buffaloes. Two distinct studies were undertaken: Study 1 focused on evaluating ovarian size and structures, while Study 2 investigated oocyte quality and developmental outcomes based on BCS. Ovaries were procured from 50 slaughtered female buffaloes with varying BCS levels across two locations. Essential ovarian parameters were meticulously measured, including length, width, circumference, weight, and follicle count. Positive correlations were discerned between BCS and these parameters for both left and right ovaries. Nonetheless, significant discrepancies surfaced in certain parameters, such as ovarian width and length, as evidenced by varying *p*-values. Moderate correlations were noted between BCS and oocyte maturation rate and subsequent developmental stages. Ultimately, the findings underscore the association between BCS and buffalo reproductive structures' physical and physiological characteristics.

Keywords: Production, maturation, blastocyst, in-vitro embryo, corpus albicans.

I. INTRODUCTION

Reproductive efficiency is a pivotal determinant of productivity in female buffaloes, yet it is often impeded by various factors, including delayed puberty, seasonal calving, prolonged postpartum anestrus, and extended calving intervals. Strategies encompassing proper management, nutrition, and the application of assisted reproductive technologies serve to alleviate these challenges. Notably, nutrition plays a significant role in buffaloes' fertilization and early embryonic development. Artificial insemination emerges as a valuable tool for genetic enhancement, albeit its success hinges upon meticulous attention to the animal's body condition or nutritional reserves, which are gauged through body condition scoring (BCS). Rooted in assessing body fat reserves, BCS serves as a pivotal instrument for ascertaining the nutritional status of a herd and optimizing production efficiency.

Despite the established correlation between BCS and reproductive function across various animal species, the precise influence of BCS on ovarian activity and oocyte quality, particularly in water buffaloes, remains relatively unexplored. In response to the prevailing gaps in knowledge, in vitro embryo production emerges as a strategic approach to evaluate oocyte quality, thereby addressing reproductive inefficiency in buffaloes. This intricate process entails the recovery of primary oocytes, their in vitro maturation, fertilization, and subsequent culturing of resulting embryos. Thus, the primary objective of this study is to meticulously investigate the relationship between body condition score and ovarian function, oocyte quality, and in vitro developmental

potential in water buffaloes.

II. OBJECTIVES OF THE STUDY

This study aimed to assess the relationship between body condition score and various aspects of reproductive physiology in water buffaloes, explicitly focusing on ovarian size, structures, oocyte quality, and subsequent embryonic development following in vitro fertilization. The specific objectives of the study were as follows:

1. To ascertain the ovarian size and structures present in the ovaries of slaughtered water buffaloes across different body condition scores.
2. To evaluate the quality and in vitro developmental potential of oocytes collected from the ovaries of water buffaloes at varying body condition scores.

III. RESULTS AND DISCUSSION

The study explored the relationship between body condition score (BCS) and various reproductive parameters in water buffaloes, focusing on ovarian structures, oocyte quality, and developmental potential. Analysis of ovaries collected from fifty female buffaloes revealed positive correlations between BCS and ovarian parameters, although significant associations were not consistently detected, likely due to the small sample size. Nevertheless, findings align with existing literature suggesting that BCS may influence ovarian structures, indicating the impact of nutritional status on ovary size and weight.

Further examination of the data unveiled variations in ovarian measurements among different BCS groups, with mean length, width, circumference, and weight differing

across categories. Comparable findings in other animal species, such as goats, support the notion of BCS-associated variations in ovarian parameters. Notably, the number of visible follicles positively correlated with BCS, indicating a potential influence of nutritional status on follicular development. However, the presence or absence of corpus luteum/corpus albicans did not exhibit significant differences across BCS groups, suggesting a limited direct impact of BCS on the animals' cyclicity.

Functional corpus luteum denoted normal ovarian function and cyclicity, while corpus albicans signified a previous estrus cycle; neither factor exhibited significant correlations with BCS. Nutrition emerged as a pivotal determinant of in vitro embryo production, underscoring the utility of BCS as a tool for selecting oocyte donors. Studies on dietary energy levels in cows highlighted the nuanced impact of nutrition on reproductive outcomes, emphasizing the necessity of meticulous dietary management in breeding programs for water buffaloes.

Further analysis of the data revealed noteworthy variations in ovarian measurements among different body condition score (BCS) groups. Specifically, mean length, width, circumference, and weight of the ovaries exhibited discrepancies across various BCS categories. This observation aligns with similar findings in other animal species, such as goats, corroborating the notion that BCS may indeed influence ovarian parameters. Notably, a positive correlation was observed between BCS and the number of visible follicles, suggesting a potential impact of nutritional status on follicular development within the ovaries of water buffaloes.

Despite these correlations, the presence or absence of corpus luteum (CL) or corpus albicans (CA) did not demonstrate significant differences across BCS groups. This finding implies that BCS may have limited direct influence on the cyclicity of water buffaloes. Notwithstanding, it is important to note that functional corpus luteum typically indicates normal ovarian function and cyclicity, while the presence of corpus albicans suggests a previous estrus cycle. However, neither factor exhibited significant correlations with BCS, underscoring the complexity of the relationship between nutritional status and ovarian physiology in water buffaloes.

Nutrition emerged as a pivotal determinant of in vitro embryo production, highlighting the significance of meticulous dietary management in breeding programs for water buffaloes. This underscores the utility of BCS as a valuable tool for selecting oocyte donors. Additionally, studies on dietary energy levels in cows underscored the nuanced impact of nutrition on reproductive outcomes, emphasizing the necessity of tailored dietary interventions to optimize reproductive success in water buffalo breeding initiatives.

IV. SUMMARY, CONCLUSION AND RECOMMENDATIONS

The study aimed to elucidate the correlation between body condition score (BCS) and various reproductive parameters in female water buffaloes, encompassing ovarian characteristics, oocyte quality, and in vitro developmental potential. Ovaries obtained from 50 buffaloes with differing BCS (ranging from 1 to 5) were subjected to assessment post-slaughter, evaluating parameters such as length, width, circumference, weight, number of visible follicles, and the presence of corpus luteum/corpus albicans. Study 1 delineated significant disparities in the weight and number of visible follicles of right ovaries among distinct BCS groups, indicating a plausible influence of BCS on these parameters. Conversely, no significant differences were discerned in the presence of corpus luteum/corpus albicans across BCS groups, implying that cyclicity may not be directly impacted by BCS.

The association between BCS and oocyte maturation rate, as well as subsequent developmental stages (cleavage, morula, blastocyst), was scrutinized. Although no significant relationship emerged between BCS and oocyte maturation rate, a moderately strong positive correlation was observed. Likewise, no significant correlation was detected between BCS and the percentage of oocytes attaining various developmental stages, albeit a positive correlation was noted. These findings suggest the potential for a correlation between BCS and oocyte quality and subsequent development, particularly under the premise of a larger sample size.

In summary, the study underscores a positive correlation between BCS and diverse ovarian parameters in female water buffaloes, signifying potential ramifications for reproductive efficacy. Despite the absence of a significant relationship between BCS and oocyte maturation rate or developmental stages, the study intimates a correlation warranting further exploration with larger sample sizes. These insights furnish valuable guidance for breeders and raisers, emphasizing the significance of BCS evaluation in reproductive management decisions, such as the selection of animals for artificial insemination and the assessment of ovarian suitability for collection based on BCS. Further investigations concentrating on follicular stages and ovarian cycles are advocated to deepen comprehension in this realm.

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