Prospect of Nutrition In-Utero on Improvement of Reproductive Performance in Bali Cows Kept Under Smallholder Farms

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***Abstract*—The objective of the present study was to know the future prospect of reproductive performance in Bali cows after treating with nutrition in-utero at different stages of reproductive physiology status. A total of 90 Bali cows were used in the study. All cows were scoring for body condition (BCS; scale 1 - 9) and clinically examined for reproductive function and status. The reproductive statuses were pregnant, cyclic, and anestrous. All cows were treated with nutrition in-utero. Blood urea nitrogen (BUN), creatinine, and glucose concentrations were measured before and during treatment. The results of this study showed that the pregnant and cyclic cows, plasma BUN, creatinine, and glucose concentrations were relatively similar before and after treating with nutrition in-utero. In anestrous cows plasma glucose concentrations were lower before treatment and increased after treatment. Pregnant and cyclic cows were likely to maintain the metabolite status that may improved the BCS of the cows as well as the subsequent reproductive process. Increased plasma glucose concentrations in anestrous cows triggered energy intake and may improved the reproductive status. In conclusion, administration nutrition in-utero on the Bali cows at any reproductive statuses would improve reproductive performance.**

***Index Terms*—bali cows, nutrition in-utero, reproductive performance.**

I. Introduction

Livestock production contributes not only to national economies, but also to sustainability and profitability of agriculture, as well as to the fabric of local societies [1]. Furthermore he stated that efficient and viable animal production systems are dependent upon the effective management of animal reproduction. This due to that reproduction is one of the most crucial factors in determining profitability of a beef cow/calf enterprise [2], because excellent reproductive efficiency is paramount to a profitable and sustainable national beef herd [3], [4].

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Poor reproductive performance in beef cattle is a major problem in many farms, especially in small farms in developing countries. On the other hand, the importance of livestock to developing countries in terms of national economies, not only provide direct financial benefits, but also food, manure, traction, capital investment as well as social status [1]. Efforts to improve the reproductive performance in beef cattle have been widely conducted including improvement of reproductive management. One of the problems that affected reproductive performance is nutrition. Adequate nutrition is vital for cow reproduction, cow and calf health, and growth of all classes of cattle [5]. However, in many cases especially in smallholder farms, the diets do not meet the requirements of cattle both for production and reproduction. Therefore, the objective of this study was to know the future prospect of reproductive performance in Bali cows after treating with nutrition in-utero at different stages of reproductive physiology status.

II. Materials And Methods

A. Animals, Management and Feeding

A total of 90 Bali cows kept under smallholder farms were used in the present study. The cows were raised by the farmers concurrently with all their cattle in the same management. Likewise, the cows were managed without any different treatment including nutritional requirements during pre-calving, postpartum, lactating and pregnant, and gestation. The animals were sent out to the field at the day-time for grazing and they were housed at the nigh-time. Feedstuffs consisted of grass and rice straw; sometimes they were fed rice bran without any concentrate and mineral supplements [6]. For reproductive management, under smallholder farms, estrus detection was conducted by the farmers during grazing time however this detection did not conducted regularly. If the animal shows estrus signs, they were naturally mated with the Bali bull if available at the time of estrus. Otherwise, the owner would seek for the bull of the other farmer. If possible, the farmer asked to the

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inseminator to artificially inseminate (AI) the cow. There was no special attention to the reproductive management performed by the farmers such as recording, estrous synchronization, and the use of artificial insemination (AI).

B. Body Scoring, Clinical Examination and Treatment

All cows were scoring for body condition [7], [8] and clinically examined for pregnancy status (Fig. 1). The cows that did not become pregnant at the time of clinical examination, they were then examined for reproductive physiological status. Palpation per rectum to the reproductive tracts was conducted to assess the uterine and ovarian function such as the presence of follicles, larger than 10 mm in diameter, corpora lutea and/or cysts. The ovarian cyst was defined as one or more follicle-like structures >25 mm in diameter without co-existence of CL or Graafian follicles. The ovaries without any palpable structures of the follicle and/or CL were considered inactive [9]. Reproductive disorders diagnosed at the time of visit were treated.

Figure 1. Reproductive examination of Bali cows kept under smallholder farms.

TABLE I. NUTRIENT COMPOSITION OF NUTRITION IN-UTERO

Content	Composition (%)
Water	26.43
Crude protein	31.23
Crude fat	25.22
Crude fiber	9.33
Nitrogen free extract	10.01
Ash	24.21
Calcium	2.67
Phosphor	1.09

All cows were treated with nutrition in-utero for four months approximately 0.5 kg/d. Administration of nutrition in-utero was conducted as feed additive to the cows in the late afternoon after they went back from grazing. Nutrition in-utero was made as urea molasses multi nutrient block-like (UMMB-like) that consisted of urea, molasses, rice brand, coconut meal, fish meal, cocoa flour, salt, and mineral. The nutrient composition of UMMB-like is shown in Table I.

C. Blood Sampling and Analyses

Blood samples were collected twice at two months interval from all cows in the morning between 08:30 and 10:00 am via jugularis vein into evacuated vacuum tubes containing K_3-EDTA. After collection, a drop of sample were taken for glucose test using Easy Touch® GCU, then the samples were kept at 4 ℃ and were centrifuged within 4 h at 1500 x *g* for 15 min to collect plasma. The plasma was then stored frozen at -20 ℃ until analyzed for blood urea nitrogen (BUN) and creatinine. All data were tabulated and descriptively analyzed using Microsoft Excel for Windows.

III. RESULS AND DISCUSSION

A. Farms Condition

In the present study, the Bali cows used for treatment of nutrition in-utero were provided by the farmers. This condition is mainly and due to that over 90% of raising cattle is conducted by the farmers. Under this condition, many animals suffer from poor nutrition, have poor growth rates, production and reproduction levels, and are susceptible to disease [1]. The way of raising cattle by the farmers in the present study is shown in Fig. 2. Therefore, it is a great chance to improve the cows by involving many aspects.

In this study, nutrition in-utero has been used to provide the cows for improving their reproductive performance. Under small farms where the management of the cattle is conducted extensively, the attention to the cows was relatively low. This suggest that in order to achieve high level of productivity in an extensive raising cattle, it is necessary to involve many factors such as optimizing the role of extension, higher education, and modern technologies [1].

Figure 2. Bali cattle raised by the farmers.

B. Body Condition Score (BCS) of the Cows

Body condition score (BCS) is an indicator of energy reserves in the form of lean muscle and/or adipose tissue that may be used to support physiological processes during times of increased metabolic demands [10]. BCS of the cows during treatment in the present study are shown in Fig. 3.

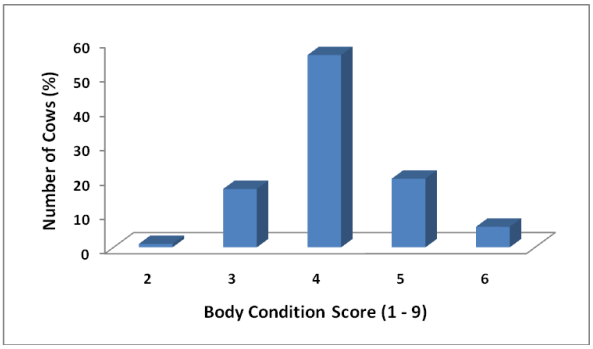

Figure 3. Body condition score (BCS) of Bali cows kept under smallholder farms.

The BCS of the cows are relatively in good condition. The cows with BCS 4 or more was high and reached up to 82% (Fig. 3) and the remaining 18% was the cows with BCS 3 or less. This indicated that the cows in the present study had positive response to the treatment given. The BCS is a very important factor in determining reproductive performance of the cows. For example, cows that calve in good body condition return to estrus sooner and are more likely to conceive during the breeding season than cows that calve in thinner body conditions [11]. Furthermore, the cows in thinner body conditions extend period of postpartum anestrous [10], [12] and subsequently prolong interval from calving to conception as well as calving interval.

C. *Effect of Nutrition In-Utero on Metabolite Status*

The metabolic state of the cow may be described through the levels of plasma metabolites related to the energy metabolism [13]. Administration of nutrition in-utero to the late gestation cows had positive response on metabolite status. Our study confirmed [6] that the concentrations of glucose, blood urea nitrogen (BUN), and creatinine (Fig. 4) did not differ during before and after administration. This might due to that ruminants/cows are obligate herbivores whose evolutionary success has, in large part, resulted from their pre-gastric, fermentative mode of digestion [14]. Furthermore, that ruminant must depend almost exclusively on gluconeogenesis in liver and to a lesser extent, kidneys for their tissue glucose requirements.

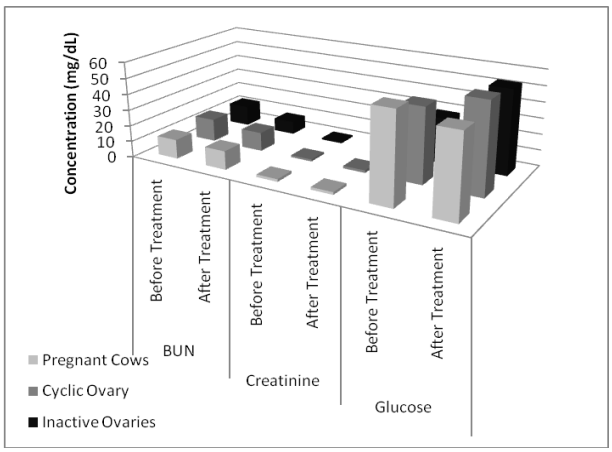

Figure 4. Changes in BUN, creatinine, and glucose concentrations of pregnant, cyclic, and anestrous Bali Cows.

In cyclic cows that showed normal ovarian activity, the concentration of BUN was slightly decreased from 14.2±7.6 mg/dL to 11.8±2.7 mg/dL, however, the concentrations of creatinine, and glucose were increased from 1.3±0.1 mg/dL to 1.6±0.2 mg/dL; and from 46.9±9.2 mg/dL to 56.6±20.5 mg/dL (Fig. 4), respectively. The increased plasma creatinine level during late gestation could be due to higher muscular work for the movement of the dam bearing the growing fetus [13]. This suggests that the utilization of nutrition in-utero as additional feed to the cows had no side effect to the metabolite status.

D. *Improvement of Reproductive Performance of Bali Cows after Nutrition In-Utero Administration*

Nutrition in-utero to the cows is intended to improve the production and reproduction. Our preliminary study [15] confirmed that there is a prospect for improving reproductive performance in Bali cows especially in anestrous cows. Administration of nutrition in-utero in anestrous cows increased the plasma glucose concentration from 27.7±15.0 mg/dL to 53.0±7.1 mg/dL [15]. Low concentration of glucose in postpartum cows tended to increase the interval between calving and resumption of ovarian cycle. After treating the anestrous cows with nutrition in-utero, it may accelerate the ovaries resume to cyclic. This may due to that the level of both energy and protein as well as minerals content in the diet improved the reproductive state of the animals. With greater energy intake, cows have shortened postpartum anestrous [16], [17]. Conversely, inadequate energy intake is associated with delayed onset of puberty, extended postpartum intervals, and decreased conception and pregnancy rates [17], [18]. Energy restriction during the pre-partum period results in thin body condition at calving, prolonged postpartum anestrous, and a decrease in the percentage of cows exhibiting estrus during the breeding season. Pregnancy rates and intervals from parturition to pregnancy also are affected by level of pre-partum energy [19].

In cyclic Bali cows, this administration seemed to improve the signs of estrus. This may due to that the cows used in the present study have improved the nutritional status as well as the body condition and were in positive energy balance. Hess et al. [12] and Lake et al. [10] stated that cows maintained in a negative energy balance during the pre-partum period were in poor body condition at parturition and had an extended period of postpartum anestrous. Maintaining the metabolite status such as glucose is important to the both cyclic and pregnant cows. In pregnant cows, the importance of glucose is the source of fuel for oxidation in fetal and placental tissues [13]. By this mechanism, it is possible to expect the healthiness of fetal growth through one of the functions of glucose is a primary nutrient for conceptus growth and milk synthesis [13]. However, all nutrients required for animals especially for the pregnant cows must be sufficient enough such as protein, energy, vitamins, minerals, and water. This due to that nutrient requirements vary dramatically among animals and are influenced by age, weight, stage of production, rate of

growth, environmental conditions, breed, gender, and other factors [20]. Therefore, combining body weights, body condition scores and blood metabolites increase accuracy of assessing the nutritional state and welfare of beef cattle [21].

In order to achieve a better reproductive performance of Bali cows, strategies to improve the body condition of the animals are necessary. Improvement of feeding quality at any stage of reproductive statuses must be considered. Likewise, although in smallholder farms condition, attention on reproductive management must be paid to achieve higher reproductive efficiency.

In conclusion, administration nutrition in-utero on the Bali cows at any reproductive statuses would improve reproductive performance.

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