



## A study of the level of glucose in fertile and infertile buffalo

J.K. Taher , A.M. Al-Ghareebawi  and R.S. Salman 

Department of Physiology, Biochemistry and Pharmacology, College of Veterinary Medicine, University of Thi-Qar, Thi-Qar, Iraq

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#### Correspondence:

J.K. Taher  
[drjawadkadhim@gmail.com](mailto:drjawadkadhim@gmail.com)

### Abstract

The study's objective is to investigate the link between the serum glucose level and the estrus phases of fertile buffalo also, the research studies serum glucose concentration in productive and fruitful buffalos in comparison to infertile buffalos at the same time and same place. Thirty samples of blood taken from fertile buffalos were selected for the first part of the study to determine the concentration of serum glucose in estrus cycle phases, this part done after determine each phase of estrus. Other 30 buffalos (15 fertile and 15 infertile) were used in the second part of the research. The part two of study aimed to compare between concentration of serum glucose in fertile and infertile buffalos. All Studied animals were chosen from the field in Thi-Qar province, south of Iraq. The results of the study showed a significant elevation of blood glucose level in the estrus phase when compared with the other steps except for diestrus, which appeared to be a non-significant ( $p>0.05$ ) change. In the second part of the research, the results showed a significant elevation in the blood glucose of fertile buffalo as compared to infertile buffalo. The study appointed the use of glucose in the blood as an indicator of differentiation between sterile and fertile buffalo; the second goal of the research was to determine estrus phases by blood glucose concentration and consider it as the simple and available indicator.

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### Introduction

The buffalo take an essential position in the agricultural economy of the Mediterranean and South Asian regions because they produce meat and milk for human consumption, dragging power of farming operations, skins, and other raw materials in manufacturing uses (1). Blood metabolite profiles have been utilized vastly to detect issues and to be used as a guide for dietary reasons for diseases or decreased production (2). The serum biochemical profiles are substantial in estimating animal health conditions and diagnosing different pathophysiological and metabolic disorders in cattle (3,4). Glucose is an essential biochemical factor that regulates and modulates the metabolic functioning of the cell at diverse levels. It also acts at the hypothalamus-pituitary gonadal axis and influences animal reproductive function. Moreover, it is essential to regulate the quality of

oocytes (5,6). It was noted that glucose inside the oocyte adjusts meiotic maturation, and the glucose transporter (GLUT) content increased in rat ovaries following gonadotropin use (7,8). Thus, Glucose is a central nutrient in metabolism and a must for reproductive tract function. The substantial step of dairy management and in operations of managed buffalo is the early and credible detection of gestation. Detection of non-pregnancy before the 2<sup>nd</sup> expected estrus led to aid in management decisions before the subsequent estrus (9). Diagnosis of pregnancy at a later stage led to the loss of an additional 18th-24th days in the case of non-pregnancy buffalo. The conception rate is generally low due to poor awareness of farmers, insemination at the wrong period, and inappropriate heat revelation. Early cyclicity and gestation revelation in buffaloes can increase reproductive efficiency (10). Much evidence indicates that there is inhibition in growth hormone concentration in blood,

but there was an increase in insulin concentration after an extended lactation period in dairy cattle (11). Gestation also led to a significant decrease in milk production of dairy cattle in late lactation from the 5<sup>th</sup> month of pregnancy onwards (12,13). Serum glucose concentration is a suitable biochemical parameter needed for the ordinary reproductive efficacy of buffalo (14). Evaluating serum glucose concentration in lactating cattle during the early postpartum time is critical because cows need high amounts of glucose to run with the need for milk yield. After all, glucose is the main composition of the milk of cows and controls the levels of other blood metabolites (15). Positive relationships between serum glucose concentration and elevated pregnancy rate have been mentioned (16,17). Because glucose in the blood is a good signal of metabolism, provides information for control of GnRH releases, and has a central role in ovary activity (18). Determination of ovary and uterus activity by ultrasound (19).

Most researchers in Iraq study the effect of pregnancy on milk yield and composition, and other biochemical and hematological parameters were investigated depending on dairy cattle data. This information cannot be used as a guide for dairy buffaloes because of the varying species, climate, and farmers' socioeconomic conditions. The current study was conducted to investigate the value of blood glucose levels in the estrus cycle and fertile infertile buffalo under the tropical conditions of this country.

## Materials and methods

### Design of study

Thirty fertile buffaloes' females used to estimation of serum glucose level in different estrus phases. Other 30 buffalo females used to second part of research, the researchers selected 15 fertile and 15 infertile buffalo females.

### Animals

They studied animals selected from fields in the marshes of Thi-Qar province, south of Iraq. Most buffaloes depend on reeds and sedges in the wetlands for nutrition, while a little concentrated ration.

### Detection of fertility

Detection of infertility of buffaloes based on anestrus of studied animals for one year and by ovaries examination by rectal palpation. Older people between 5 - 12 years and births from 1 to 3 estrus cycle periods which were identified by the mucous secretions from the vagina and some simple behavioral changes that appeared on the buffaloes during the estrus, in addition to the rectal palpation of the reproductive system which becomes tense during estrus (estrus at 0 days, metestrus at five days, diestrus at ten days and proestrus at 19 days).

## Samples

Thirty blood samples drawn from jugular vein of fertile buffalo females and other thirty blood samples taken from fifteen infertile and fifteen fertile buffalo were selected for second part of study and all samples kept in gel tubes for 10 minute and then centrifuged 3000 rpm for 15 minutes to obtain the serum to determine blood glucose concentration after a definite diagnosis of reproductive efficacy, Serum stored at -20°C until analysis. Blood serum glucose profiles were analyzed and estimated in serum.

## Statistical analysis

The Statistical Analysis System- SAS program was utilized to detect the influence of various factors on research parameters. The least significant difference (LSD) test, and T-test- was used to compare among means in this research significantly (20).

## Results

As appeared in table 1, the highest significant elevation in the blood glucose occurred in the estrus phase compared with other degrees  $57.99 \pm 2.68$  mg/dl. In contrast to the estrus phase, the blood glucose levels declined significantly from their peak levels reported in the estrus phase. Specifically, glucose levels in the metestrus and proestrus phases were  $51.64 \pm 2.07$  and  $51.08 \pm 1.97$  mg/dl respectively. Remarkably, the only non-significant change in the blood glucose levels among groups was observed in the diestrus phase  $54.88 \pm 2.54$ .

The concentration of glucose of blood in fertile and infertile buffalo was apparent as shown in table 2 in which the high significant value appeared in the productive buffalo group (n=10) which was  $60.11 \pm 3.08$  mg/dl in comparison with infertile buffalo group (n=20) which was  $51.82 \pm 2.18$  mg/dl.

Table 1: Glucose concentration during estrus cycle phases in buffaloes

Estrus phase	Mean $\pm$ SE (mg/dl)
Estrus	$57.99 \pm 2.68$ a
Metestrus	$51.64 \pm 2.07$ b
Diestrus	$54.88 \pm 2.54$ ab
Proestrus	$51.08 \pm 1.97$ b
LSD value	4.592 *

The different letters in the column differed significantly at  $P \leq 0.05$ .

## Discussion

Low reproductive efficiency in the buffalo remains a major economic problem globally due to inherent reproductive problems including delayed sexual maturity, seasonality in breeding, anestrus, long calving interval, silent

heat coupled with poor expression of estrus, low conception rate and high thermal and lactation stress (21-22).

Table 2: Glucose concentration in fertile and infertile buffaloes

Reproductive status	Mean ± SE (mg/dl)
Fertile buffalo	60.11±3.08 a
In fertile buffalo	51.82±2.18 b
T-test	6.441 *

The different letters in the column differed significantly at  $P \leq 0.05$ .

In earlier studies, the blood glucose levels were considered as parameter of energy status of buffalo, so, in order to confirm the energy status in current study, we estimated the blood glucose and are depicted in table 1 and 2. We estimated high level of blood glucose in the estrus phase, as compared with other stage of estrus cycles in buffalo of the current study appeared high level of glucose in buffalo 62.2-64.7 mg/ml in different seasons while, the level of glucose in cyclic and non-cyclic buffalo similar to the present study (14,23-25).

Also, using  $PGF_{2\alpha}$  to synchronize estrus in ewes and recorded a high concentration of blood glucose in the follicular phase 53-60 mg/dl of estrus when compared to luteal degree 41-54 mg/dl. Also, in sheep, other study supposed that the decrement of insulin hormone sensitivity after estrogen administration causes hypoglycemia (26,27).

Previous studies showed that low blood glucose levels in buffalo failed to show cyclic activity till 210 days postpartum (28). The longer calving interval and a more significant number of services to conception in cows with lower levels of glucose and albumin led to negative energy balance, which can result in decreased role of corpus luteum, low progesterone concentration during the luteal phase, and reduced fertility (29,30). Estrogen influenced blood glucose concentration. Those who studied the insulin effect on blood glucose concentration before and after low and high estrogen dose administration in sheep found that the estrogen at low doses did not influence blood glucose levels (27). However, in sheep administered estrogen at high doses, baseline serum, and minimum glucose concentrations were significantly increased. The period needed to reach severe hypoglycemia (1.5 mmol/l) was shorter when using placebo-treated sheep than in sheep treated with estrogen.

Also, the serum glucose concentration increased in pregnant buffaloes more than in non-pregnant buffaloes (31). Another study found higher serum glucose in pregnant buffaloes than non-pregnant buffaloes in Bulgaria (32). Another study showed that serum glucose could impact the subsequent reproductive performance of buffaloes after the synchronization of ovulation treatment (31). The puberty onset significantly changed serum glucose concentrations, probably including a more intensive energy metabolism (33).

Blood glucose level is an important biochemical constituent required for normal reproductive performance of buffalo.

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## دراسة مستوى الجلوكوز في دورات الشبق الفسيوولوجية والمرضية في الجاموس

جواد كاظم ظاهر، أمير مكطوف الغريبوي و رباب شاكر سلمان

فرع الفسلجة والكيمياء الحياتية والأدوية، كلية الطب البيطري، جامعة  
ذي قار، ذي قار، العراق

### الخلاصة

هدفت الدراسة الحالية لاكتشاف العلاقة بين مستوى كلوكوز المصل وأطوار دورة الشبق في إناث الجاموس الخصبة. درس البحث أيضا تركيز سكر المصل في إناث الجاموس الخصبة والغير خصبة في نفس الوقت ونفس المكان. أخذت ٣٠ عينة من دم إناث الجاموس الخصب اختيرت للجزء الأول من الدراسة لتحديد تركيز الجلوكوز في الدم في مراحل دورة الشبق المختلفة وتم ذلك بعد تحديد كل طور من أطوار الشبق بالطرف التقليدية. كما استخدمت ٣٠ عينة دم أخرى من إناث جاموس (١٥ خصبة و١٥ غير خصبة) للجزء الثاني من البحث. يهدف الجزء الثاني من الدراسة إلى المقارنة بين تركيز الجلوكوز في الدم في الجاموس الخصب وغير الخصب. اختيرت كل العينات المدروسة من حقل يقع في محافظة ذي قار جنوب العراق. كشفت نتائج الدراسة زيادة معنوية في مستوى كلوكوز الدم في طور الشبق من الشيعاء عندما قورن ببقية الأطوار ما عدا طور نهاية الشبق والذي لم يظهر أي فرق معنوي. أظهرت نتائج الجزء الثاني من الدراسة زيادة معنوية بكلوكوز المصل للجاموس الخصب عندما قورن بالجاموس غير الخصب. هدفت الدراسة إلى استخدام كلوكوز الدم كدليل للتفريق بين إناث الجاموس الخصبة وغير الخصبة، أما الجزء الثاني فهدف لتحديد طور الشيعاء بواسطة نفس الدليل اعتمادا على تركيز الجلوكوز في الدم واعتباره مؤشر بسيط ومتاح.