**Ветеринария. Текст 1.**

**Biochemical parameters in the blood of Holstein calves given immunoglobulin Y-supplemented colostrums**

\* Corresponding author

Email: [tquezada@correo.uaa.mx](mailto:tquezada@correo.uaa.mx) Viridiana L García-Flor1,† Email: vflor@correo.uaa.mx

Raúl Ortiz-Martínez1,† Email: [ortiz@correo.uaa.mx](mailto:ortiz@correo.uaa.mx) José L Arredondo-Figueroa1,†

Email: [arredondo60@hotmail.com](mailto:arredondo60@hotmail.com) Leticia E Medina-Esparza2,† Email: [lmedinaesparza@yahoo.com.mx](mailto:lmedinaesparza@yahoo.com.mx) Arturo G Valdivia-Flores1,†

Email: [avaldiv@correo.uaa.mx](mailto:avaldiv@correo.uaa.mx) Ana L Montoya-Navarrete1,† Email: any\_withyou@hotmail.com

**Abstract**

**Background**

In any calf rearing system it is desirable to obtain healthy animals, and reduce morbidity,

mortality, and economic losses. Bovine syndesmochorial placentation prevents the direct

transfer of bovine immunoglobulins to the fetus, and calves are born

hypogammaglobulinemic. These calves therefore require colostrum immediately after birth.

Colostrum is rich in immunoglobulins (Ig) and its consumption results in the transfer of

passive immunity to calves. The Ig absorption occurs within the first 12 h after birth.

Immunoglobulin Y (IgY), derived from chicken egg yolk, has been used in the prevention

and control of diseases affecting calves because it is very similar in structure and function to

immunoglobulin G (IgG). In the current study, we sought to establish whether administration

routes of colostrum supplemented with avian IgY affected passive immunity in calves.

**Results**

No significant differences were observed with respect to route of administration for

colostrum. However, we did observe some differences in certain interactions between the

various treatments. Calves fed colostrum containing egg yolk had higher levels of TP, ALB,

and IgG, along with increased GGT activity.

**Conclusions**

Our results suggest that supplementing colostrum with egg yolk has a beneficial effect when

given to calves, regardless of administration route.

**Keywords**

Calves, Colostrum, GGT, IgG, IgY, TP

**Background**

During calf rearing it is desirable to reduce morbidity and mortality, and to lower costs by

avoiding expensive treatments and losses that are a result of late development and delayed

production. To achieve these goals, it is necessary to ensure an adequate intake of colostrum

to calves during the neonatal period, thereby providing passive immunity [1]. The most

important factor in the development of calves is the appropriate and immediate consumption

of colostrum post-partum, as it is the first source of nutrients after birth [2]. This should not

be delayed for more than 9 h after birth. For the adequate transfer of passive immunity *via*

colostrum, different feeding methodologies have been developed that vary in complexity,

accessibility and cost. The transfer of passive immunity is based on different components of

colostrum that are absorbed by the gastrointestinal tract of calves [3]. At the end of gestation

the mammary gland of the cow produces colostrum, achieving maximum production in the

last weeks of pregnancy. Colostrum is an important source of antibodies (Abs) and its

absorption is essential in protecting calves against enteric infections, the main cause of death

during the first weeks of life [4].

**Ветеринария. Текст 2.**

The immunological characteristics of colostrum are high for 4 days after delivery. However,

its most potent immunological qualities are lost at 14 h post-partum [5] because

immunoglobulins (Ig) concentrations progressively decrease [4]. The number of pregnancies

for a cow has a remarkable impact on the volume and quality of produced colostrum. In

multiparous cows, colostrum is richer in Abs, thus providing better immunity to calves.

Another factor affecting colostrum quality is the handling of the dry cow period, where

adequate nutrition and rest between drying off and calving must be ensured [6]. Other factors

such as udder conformation, teat size, maternal instinct and dystocia have been associated

with a failure to transfer passive immunity in calves [7,5].

The function of active Abs in the immune system is to neutralize and opsonize bacteria and

other foreign particles invading an organism [8]. The concentration of Igs in cow colostrum

ranges 50–150 mg/mL [9] and is composed of immunoglobulin G (IgG), immunoglobulin A

(IgA) and immunoglobulin M (IgM). Two subclasses of IgG, IgG1 and IgG2, comprise 80–

85 % of all colostrum Igs, while IgA comprises 8–10 % and IgM 5–12 %. These Ig molecules

provide immunity against a wide variety of systemic infections and diseases in cattle [10].

Colostrum is the only food source that transfers passive immunity until a calf develops its

own active immunity, which takes at least 6 weeks [11]. The absorption of intact Ig

molecules occurs for the first 12 h after birth, after which intestinal tract absorption decreases

significantly until 72 h after birth, when no Igs are absorbed [4]. Kaske et al. [2] reported the

existence of significant changes in Ig absorption that were dependent upon the way colostrum

was fed to calves.

Antibodies are employed in various roles in biomedical studies; they are usually obtained

from mammals [12]. However, in recent years, chicken IgY has been increasingly used [13]

as it can be easily extracted from egg yolks. In addition to aspects related to animal welfare,

the levels of Abs produced by chickens are greater than those obtained from various animals,

in particular rabbits [14]. From an economic point of view, the use of IgY has a unique

advantage. The cost of raising a chicken is no different than that of a rabbit. A significant

amount of IgY can be produced from a single hen, between 17–35 g/bird/year. The relatively

low cost IgY production allows it to be applied to immunotherapy and immunoprophylaxis of

viral and bacterial infections in human and veterinary medicine [12]. Following extraction

and purification from egg yolk, the concentration of IgY ranges 100–400 mg/egg yolk, with

an average yolk volume of 15 mL [11,15,16]. Variations in the concentrations of IgY are

dependent upon chicken strain or breed, and genetics [17-20]. IgY from chicken egg yolk is

an important alternative that could help improve the immune system of Holstein calves.

**Ветеринария. Текст 3.**

**Methods**

**Animal study**

The study was conducted at the “Las Jarillas” ranch facilities in Aguascalientes City,

Aguascalientes, Mexico. The Animal Care Committee of Universidad Autónoma de

Aguascalientes authorized our study in compliance with the Guide for Care and Use of

Laboratory Animals [21]. We selected 30 female calves with the following characteristics:

not born from dystocia; without signs of congenital or acquired problems; and no colostrum

intake. All calves had an average weight of 38.0 ± 3.0 kg, and did not present with signs of

diseases. We used randomized blocks with a factorial arrangement (2 × 3 × 6), resulting in 36

treatments. An esophageal tube or bottle was used to administer colostrum. The amount of

egg yolk used to supplement colostrum was 0, 150, and 300 g, corresponding to 0, 1200, and

2400 mg of IgY, respectively. We sampled blood from calves at six intervals (2, 12, 24, 72,

120, and 168 hours).

There were six regimens that we conducted, with each repeated five times. Treatments 1–3

involved colostrum fed by bottle supplemented with 0, 150 and 300 g of egg yolk,

respectively. Treatments 4–6 involved colostrum administered *via* an esophageal tube

supplemented with 0, 150 and 300 g of egg yolk, respectively.

Calves were weighed and measured immediately after birth and then randomly allocated to

one of the six treatment groups. Animals were house in a single hutch with a soil floor that

was previously disinfected, dried, and roofed. Buckets for water and food were provided. All

calves were fed within the first 2 h after birth with colostrum from their own dam; the amount

of colostrum given was 10 % of their body weight. We obtained 2610 eggs from a single

batch of Hy Line W-36 hens (60 weeks old; average weight, 62.0 ± 3.0 g). The yolks from

these eggs were used to obtain IgY with the aid of an IgY Eggs Press Purification Kit (Gallus

Immunotech Inc., Canada). Yolks were separated from eggs, and pooled to provide 150 g and

300 g egg yolk preparations, placed in plastic bags and diluted 1:1 with tap water, and then

refrigerated until required. Egg yolk preparations were administered at 2, 12, 24, and 72 h

post-partum for the respective treatment groups. We obtained blood samples (5 mL) from

calves by jugular venipuncture at 2, 12, 24, 72, 120 and 168 h post-partum. Blood samples

were centrifuged (3000 rpm, 10 min) and the resulting serum was stored at −20 °C until

analysis.