



The maternal B complex vitamin injection improves the plasma biochemical parameters in the Sannen goats and their kids

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Abstract

B vitamins improve animal performance through promote a wide range of metabolic pathways in animals as cofactors. Therefore, the impact of B-complex vitamin injection on plasma biochemical parameters in pregnant Sannen goats and their newborn kids during the transition period was investigated. The pregnant goats (3 years old) were randomly divided into two groups: control (No B complex vitamins injection) and B complex vitamins (5 ml B complex vitamins injection per animal). B complex vitamins were injected twice intramuscularly into goats, according to the manufacturer's recommendation, during five- and three-weeks prior kidding. Blood samples of goats and newborn kids were taken seven days after parturition and measured for plasma biochemical parameters. According to the results, Higher ($P < 0.05$) levels of low-density lipoprotein, very-low-density lipoprotein, and glucose, as well as lower ($P < 0.05$) levels of cholesterol and high-density lipoprotein were observed in goats injected with B complex vitamins than in the control group. However, plasma biochemical factors in newborn kids between the two treatment groups did not differ ($P > 0.05$). These results suggest that B complex vitamin injection is required for optimal pregnant goats.

Keywords: B complex vitamin, Biochemical parameters, Newborn kid, Sannen goat, Transition period.



Introduction

In tropical and developing countries, goats are the most important source of dairy and meat products. Due to their ability to adapt well to various climatic conditions, goats are often irreplaceable by other livestock. In addition, goats can consume forage and pasture that cattle do not (Ribeiro et al., 2010). Environmental parameters, including maternal nutrients, and hormones, as well as inherited genetic profiles, can significantly influence fetal development during pregnancy. These factors may have a long-lasting impact on the health and growth of the offspring throughout life (Geraghty et al., 2015). An increase in inflammation, oxidative stress, adipose tissue mobilization, and metabolic disorders (such as ketosis, fatty liver, and milk fever) are all associated with the perinatal period, i.e., the last three weeks prepartum through the first three weeks postpartum (Coleman et al., 2021). Further, the rapid growth of the uterus and fetus during pregnancy, coupled with lactation, results in a rise in nutrient intake during the transition period (NRC, 2012). It is known that B vitamins are widely distributed in feeds, and their effects can be felt throughout the body. By functioning as coenzymes, they provide energy to the body (Bellows et al., 2012). Therefore, the objective of this study was to examine the effects of maternal vitamin B complex injection on plasma biochemical parameters of the Saanen goat and their offspring during the transitional period.

Materials and Methods

This study was conducted on the farm of the Saanen goats located in Gorgan Province, Iran, in 2023. A total of 40 pregnant Saanen goats (3 years old, 48 ± 2.7 kg), were used in this study. The goats were sonographed prior to treatment. The pregnant goats were housed in individual boxes and were fed with the same diet in the transition period (five weeks before and five weeks after parturition). Goats were fed a diet (Table 1) balanced by NRC (NRC 2012). In the transition period, B complex vitamin was injected intramuscularly in trial animals. Experimental treatments were as follows: control group: without B complex vitamin injection; B complex group: injection of 5 ml of B complex vitamin per animal. According to the manufacturer's recommendation, 5 ml of B complex vitamins were injected intramuscularly twice (five and three weeks before kidding) in each animal. As soon as the kids were born, their navels were disinfected by povidone-iodine and placed in individual pens. 10% of the body weight, the kids were fed through a nipple bottle, colostrum collected in the first hour after birth.

To measure plasma biochemical parameters, blood samples were obtained from the jugular vein of goats and their offspring one week after parturition. Afterward, blood samples were transferred to a tube containing K2EDTA (anticoagulant) (Sarstedt Polska, Warsaw, Poland). Blood samples were centrifuged at 3000 g for 10 min at room temperature to prepare plasma (Toghdory *et al.* 2023). Afterward, the plasma samples were stored at -20 °C until analysis.

Concentrations of cholesterol, high-density lipoprotein (HDL), low-density lipoprotein (LDL), very-low-density lipoprotein (VLDL), triglyceride, insulin, glucose, urea, total protein, albumin, globulin, albumin: globulin were measured in blood plasma of goats and newborn kids using kits manufactured by Pars Azmoun Company (Pars Azmoun, Iran), using a photometric spectrometer (UV-Vis model 365 LAMBDA, Perkinelmer, NY, USA) with the emission wavelength specific for each element (Asadi *et al.* 2022).

GLM procedure of SAS (version 9.1, SAS Institute Inc., SAS Campus Drive, Cary, NC, USA) was used to analyze data collected for two treatments and 20 replicates as a completely randomized design arrangement. Duncan's multiple range test was used to compare means at a probability of 5%.

Results and Discussion

Plasma biochemical parameters of Sannen goats and newborn kids were presented in Table 1. Higher ($P < 0.05$) levels of LDL, VLDL, insulin, and glucose, as well as lower ($P < 0.05$) levels of cholesterol and HDL in the goats receiving vitamin B complex than the control group were observed during the transition period. However, other plasma biochemical parameters (Triglyceride, Urea, Total protein, Albumin, Globulin, and Albumin: Globulin) were unaffected by the injection of vitamin B complex in goats ($P > 0.05$). In addition, mentioned biochemical parameters in kids unaffected by the maternal vitamin B complex injection ($P > 0.05$).

Table 1- The impact of maternal B complex vitamin injection on plasma biochemical parameters.

Parameters	Control	B complex	SEM	P-Value
Goats				
Cholesterol (mg/dl)	55.44 ^a	47.71 ^b	0.681	0.0001
High-density lipoprotein (mg/dl)	34.61 ^a	30.01 ^b	0.499	0.0019
Low-density lipoprotein (mg/dl)	7.97 ^b	9.02 ^a	0.068	0.0487
Very-low-density lipoprotein (mg/dl)	4.22 ^b	4.70 ^a	0.711	0.0062
Triglyceride (mg/L)	24.55	26.74	1.889	0.6889
Insulin (ng/mL)	0.56	0.59	0.062	0.8014
Glucose (mmol/L)	7.26 ^b	8.44 ^a	0.299	0.0012
Urea (mg/L)	35.86	36.08	2.986	0.4189
Total protein (g/dl)	7.74	8.09	1.007	0.5501
Albumin (g/dl)	4.76	4.95	0.749	0.7448
Globulin (g/dl)	2.98	3.14	0.701	0.6267
Albumin: Globulin	1.59	1.57	0.088	0.4127
Kids				
Cholesterol (mg/dl)	62.41	59.76	1.251	0.6002
High-density lipoprotein (mg/dl)	34.64	35.84	0.862	0.6445
Low-density lipoprotein (mg/dl)	8.17	8.22	0.890	0.6849
Very-low-density lipoprotein (mg/dl)	4.92	4.99	0.011	0.8890
Triglyceride (mg/L)	23.33	24.42	1.842	0.2421
Insulin (ng/mL)	0.51	0.54	0.041	0.4248
Glucose (mmol/L)	7.06	7.29	0.801	0.5182
Urea (mg/L)	32.26	33.01	2.001	0.6460
Total protein (g/dl)	7.04	7.21	0.987	0.5462
Albumin (g/dl)	4.11	4.25	0.626	0.6864
Globulin (g/dl)	2.93	2.96	0.455	0.4971
Albumin: Globulin	1.40	1.43	0.056	0.4127

Different letters indicate significant differences ($P < 0.05$) between groups.

As enzymatic cofactors or metabolic constituents, all B vitamins play an important role in metabolic processes, including Kreb's cycle, gluconeogenesis, carbohydrate, fatty acid, and protein metabolism (McDowell, 2000; Zimmerly et al., 2001; Al-Abbasy, 2013). In this regard, possible mechanisms involved in the increase of plasma glucose in goats injected with vitamin B complex can be as follows: Biotin is a cofactor for the enzymes propionyl-CoA carboxylase and pyruvate carboxylase (McDowell, 2000), which are involved in glucose synthesis that increases glucose production (Zimmerly et al., 2001). Furthermore, this increase may relate to the niacin's role plays in increasing energy use and blood sugar levels (Al-Abbasy, 2013). Maintaining normal blood glucose levels is possible with pyridoxine. To maintain normal blood sugar levels when caloric intake is low, pyridoxine converts stored carbohydrates into glucose (Herrmann et al., 2007; Albert et al., 2008). Additionally, thiamine is a co-factor in the Krebs cycle, which is responsible for the metabolism of carbohydrates. This role enables the conversion of



blood sugar (glucose) into biological energy (Vijayalakshmy et al., 2018). In agreement with our results, plasma glucose levels significantly increased in goat plasma that received biotin supplementation (Habeeb et al., 2019). In addition, glucose levels were higher in Holstein cows that were received niacin compared to the control (Karkoodi et al., 2009).

B vitamins are effective in fat metabolism. But there is slight information about their exact mechanisms in ruminant fat metabolism. Based on recent studies, treatment with niacin for six weeks resulted in a decrease in the concentration of total cholesterol and LDL cholesterol and an increase in HDL cholesterol in rabbits' plasma (Yang et al., 2008). According to Ashen et al. (Ashen and Blumenthal 2005), niacin therapy reduces free fatty acids, triacylglycerols, lipoproteins, and LDL cholesterol while increasing HDL cholesterol significantly.

Conclusions

The results demonstrate that B complex vitamin could be used as a maternal injection for improving plasma biochemical parameters in goats and their offspring. Consequently, in this study, the use of 5 ml B complex vitamin injected in pregnant goats is recommended.

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