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Effect of Melengestrol Acetate (Mga) on the Metabolic Profile in Heifers

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Abstract

From the analysis of 21 Cebu-Swiss heifers healthy, developing, with 235.55 ± 17.81 kg of body weight (BW), 118.62 ± 3.97 cm and 2.58 ± 0.35 of body condition (BC) scale of 1-5. They were divided into two groups: MGA (n = 10) and control (n = 11). For 55 days were given a constant diet (including 15 days of adaptation), based on concentrate and sorghum straw. The contribution of daily intake was 599.08 g of crude protein and 12.18 Mcal. Blood samples were obtained every 5 days. The concentrations of cholesterol, triglyceride, high-density lipoprotein, low-density lipoprotein, urea, total protein and glucose were measured for spectrophotometric using the enzyme-colorimetric technique in plasma. The daily gain was balanced PV of 603.5 to 232.5 grams and height stopped from day 25. The CC did not show significant changes (P> 0.01). The mean concentration of plasma cholesterol was 107.59 ± 13.38 vs. 109.61 ± 11.72 mg / dl (MGA and control, respectively) with a downward trend more pronounced from day 25. The concentration of triglycerides was 12.61 ± 6.91 vs. 16.19 ± 8.86 mg / dl (MGA and control), no trend in the first 20 days and from day 25 there was an increase compared to the average of the previous days. The concentrations of HDL 63.73 ± 3.26 vs. 63.79 ± 10.27 mg / dl (MGA and control) and 43.56 ± 6.24 vs. LDLc. 46.54 ± 14.89 mg / dl (MGA and control) were irregular, but within normal ranges. The values of total protein were 5.70 ± 0.40 vs. 5.22 ± 0.31 mg / dl (MGA and control), no trend the first 15 days and from day 20 increased in concentration compared to previous surveys. Urea levels were 14.79 ± 5.22 vs. 14.13 ± 4.8 mg / dl (MGA and control) with a tendency to discharge. Glucose levels were 60.06 ± 7.62 vs. 58.24 ± 5.43 mg / dl (MGA and control), with an irregular behavior in the normal range. The consumption of 0.5 mg / dl of MGA for 40 days increased plasma concentrations of triglycerides and total protein, but did not affect cholesterol levels, HDL and LDL cholesterol, urea and glucose.

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1. Introduction

Melengestrol acetate is a synthetic oral progestin that is used to increase weight gain and also to suppress estrus, more specifically in feedlot heifers for its anabolic effects.[1] Some authors mention that the MGA added to the diet for 35 days improves the rate of growth. [2], [3]

In heifers, early onset of puberty is important economically because it has been shown that heifers having their first calf about two years old, produce more calves in their lives than those who have their first breeding three or more years old. [4], [5], [6]

The variation in blood levels of carbohydrates, lipids and proteins is a reflection of metabolic changes experienced by the animal in response to different causes, such as physiological state and nutrition [7] Some authors argue that to assess the nutritional status of animals is important to consider the monitoring of some blood metabolites that indicate the dynamics of nutritional status. [8], [9], [10]

Blood metabolite concentrations represent an integrated index of adequate intake of nutrients with respect to the use thereof, which is independent of the physiological state and allows immediate diagnosis of nutritional status point in time. [11]

Cholesterol, triglycerides, low-density lipoprotein (LDL), high-density lipoprotein (HDL), total protein, urea and glucose, are relevant indicators of the dynamics of the metabolic profile of the female bovine [12] [13].

2. Material and methods

21 heifers were used Creole empty Cebu-Swiss, in good health, with an initial weight of 231.6 ± 16.31 kg, mean height 118.3 ± 3.79 cm in height and body condition (CC) of 2.58 ± 0.35 in the scale 1-5. [22]

Heifers received a constant diet for 55 days, including an adaptation period of 15 days. The feed was offered twice daily (08:00 and 16:00 h). The diet consisted of 2.8 kg of dry matter (DM) concentrate based on corn, wheat bran and chicken manure. To this mixture was added 0,033 g of molasses in MS to give palatability. At the end of the concentrate, heifers received 3.29 kg DM sorghum straw. Protein in the diet was 599.1 g / day and energy intake of 12,181 Mcal / day.

Heifers were divided into two groups at random, representative in terms of weight and CC. The experimental group (n = 10) was treated with 0.5 mg of melengestrol acetate (MGA) orally, mixed with the morning meal. The control group (n = 11) was given the same food without the inclusion of MGA.

Heifers were weighed at an interval of 15 days. Body condition was recorded at the beginning and end of study using the subjective scale of 1 to 5 [22]. The record size and blood sampling was performed every 5 days from the start of the experiment, blood samples (5 ml) by coccygeal vein puncture using vacutainer tubes with EDTA (10%) and frozen until analysis.

We determined plasma cholesterol concentration, triglycerides, high density lipoprotein, LDL, urea, total protein and glucose by commercially available enzymatic reaction by spectrophotometry and colorimetric techniques (Spinreact, Spinlab).

The results of the determination of metabolites were analyzed by comparing means for repeated measures. The model included the effects of treatment, sampling and sampling x treatment interaction. In data analysis was performed using statistical package STADISTICA in (STADISTICA, 2006).

3. Results and discussion

During the study found the size, body condition (BC), initial and final weights and weight gains, with no difference found between these variables.

The diet was constant throughout the study and the energy requirements of animals were increased because the heifers were in a phase of growth and development, but the contributions of protein were always above the requirements of heifers.

From day 15 to 30 of the study, heifers MGA group had a daily gain of 535 g and 672 g in the control group, however, energy needs were increasing and constant supply, so they had to make a metabolic adjustment from day 30 to the end of the experiment which forced them to reduce their weight gain to 188 and 277 g respectively. The results contrast with those of other authors, who report that 35-day treatment with MGA improve growth rates [1], [2].

In this study the steady diet was restrictive in providing energy for the heifers, so the anabolic effect of MGA at a dose of 0.5 mg/día, could be limited, given the increasing energy demand for growth and development of animals , forcing an adjustment in daily gain.

The plasma cholesterol concentration, no significant differences between treatments (P = 0.764) and between samples, no interaction treatment x sampling. The mean values of cholesterol was 107.59 ± 13.38 MGA vs. 109.61 ± 11.72 control mg / dl and showed a downward trend. This variation is considered normal because cholesterol has a wide range of variation influenced by the reproductive and energy status found in the animal [14] [15]. With the results obtained shows that the MGA has no effect on plasma cholesterol concentration in heifers and that its decline was caused by the energy deficit suffered by the animals.

Triglyceride levels showed significant difference between treatments (P = 0.009) (12.61 ± 6.91 MGA vs. 16.19 ± 8.86 Control mg / dl) during the study. There were no differences between samples or sample x treatment interaction.

In the first 20 days triglyceride concentrations were within normal ranges, at day 25 and until day 30 there was an increase in the concentration of this metabolite. Energy deficiency, could force the heifers to metabolic adjustment, mobilizing body reserves to maintain the demands of growth and development, which should have caused an increase in triglycerides.

The control group showed higher plasma triglyceride concentration in the MGA group. It is interpreted that the MGA could reduce the use of reserves available up to 30 days, making more efficient use of triglycerides in a situation of food restriction.

The values of HDL and LDL cholesterol showed no significant difference between treatments (P = 0.866 and P = 0.640), with no difference between samples, or sampling x treatment interaction. An average of 63.73 ± 3.26 MGA vs. 63.79 ± 10.27 mg / dl control (HDL) and 43.56 ± 6.24 MGA vs. 46.54 ± 14.89 mg / dl control (LDL).

The decrease in HDL and LDL is due to a deficiency of energy, related to a decrease in lipid mobilization from the liver to the tissues [16] so that the addition of 0.5 mg / heifer daily MGA does not directly affect plasma concentrations of HDL and LDL.

The values of total protein displayed statistically significant differences between treatments (P = 0.0001), and its value (5.70 ± 0.40 MGA vs. 5.22 ± 0.31 Control mg / dl).

In the first 10 days, total protein concentrations remained unchanged in both groups from day 15 showed a gradual increase until day 35 in the MGA group at day 40 the concentrations decreased in both groups no significant differences .

The MGA may increased the total protein concentration in plasma of heifers, to provide more input for the formation of tissue (muscle). This advantage was observed until 30 days with administration of MGA, despite an adverse situation, as a nutritional deficiency.

There was no significant difference between treatments in plasma urea (P = 0.106) or between sampling, or sampling x treatment interaction, with a mean of 14.79 ± 5.22 MGA vs. 14.13 ± 4.8 mg / dl control. Concentrations remained prone to high in both groups and this increase was greater at day 25.

From day 25 shows a further increase in the concentration of urea in both groups, probably due to excess protein in the diet provided.

Animals fed diets high in rumen degradable protein and non protein nitrogen, such as poultry manure, resulting in high levels of ammonia in the rumen which is then converted to urea [17]. The MGA is not involved in the metabolic factors that determine the concentration of urea.

Plasma concentrations of glucose were not statistically significant between treatments (P = 0.51) or between samples, with an average of 60.06 ± 7.62 vs 58.24 ± 5.43. At the beginning of the experiment glucose had a tendency to decrease and then increase from day 25 to day 35.

Other authors have reported similar results, indicating that the glucose to be under strict non-hormonal regulation varies greatly with the level of power [12], [18], [19], in addition, glucose is not as sensitive to changes in energy balance and other indicators [20].

The accelerated lipid mobilization and excess ammonia may significantly reduce the rate of gluconeogenesis and thereby glycemia [21], although the MGA, being a synthetic progestin, increases gluconeogenesis and glycogenolysis.

4. Conclusions

The dose to 0.5 mg / dl of MGA for 40 days, causes changes in plasma concentrations of triglycerides and total protein, but does not alter plasma concentrations of cholesterol, HDL and LDL cholesterol, urea and glucose.

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