

SERUM BIOCHEMISTRY IN HYSTRICOMORPHA: AGOUTI (*Dasyprocta prymnolopha*) DURING PREGNANCY

BIOQUÍMICA SÉRICA EM HYSTRICOMORPHA: CUTIA (Dasyprocta prymnolopha, WAGLER, 1831) DURANTE O PERÍODO GESTACIONAL

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ABSTRACT: The aim of this study was to establish the levels of serum total protein, albumin, globulin, alanine aminotransferase (ALT), aspartate aminotransferase (AST), calcium, phosphorus, urea, creatinine, bilirubin and glucose during pregnancy in agoutis. Animals: Twelve pregnant agouti from the Center for the Study and Preservation of Wild Animals (CSPWA) of the Federal University of Piauí (UFPI) were used in this research. After identification of the estrus, the day of the coverage was confirmed by means of vaginal cytology with the visualization of spermatozoa (day zero) and confirmation of pregnancy by ultrasonographic examination after 15 days. Blood samples were collected by lateral saphenous vein puncture after physical restraint, every 10 days until the end of pregnancy, for biochemical analyzes. A completely randomized experimental design was used and the means compared by the Duncan test at 5% probability using the SAS (Statistical Analysis System). The results of the biochemical analysis of total protein, albumin, globulin, urea, creatinine, calcium, phosphorus, serum ALT, glucose, AST, total bilirubin, direct bilirubin and indirect bilirubin in pregnant agouti (*Dasyprocta prymnolopha*) did not differ when compared to nonpregnant females. The serum biochemical levels during pregnancy in agoutis, except for calcium and phosphorus, were unchanged compared to those found in the non-pregnant adult animal, as occurs in other species. The changes during pregnancy reflect the physiology and biology of wild species, elucidating information about the biochemical parameters during pregnancy, thus characterizing the animal as a benchmark for comparisons with other species, extolling its importance both for nature conservation and production in captivity.

KEYWORDS: Biochemical; *Dasyprocta prymnolopha*; Gestation; Serum.

INTRODUCTION

The agouti (*Dasyprocta sp*) is a medium sized mamaly wild rodent, and has gestational period of 103 days (FORTES et al., 2013; LANGE; SCHMIDT, 2007). This animal is being a rich source of protein and hunting target in the region, but is not on the list of endangered animals (BRASIL, 2016). In this way, its production in captivity is expanding, since several research groups are developing studies on its morphology, ultrasonographic and echocardiographic evaluation, as well as a biological model for alternative treatments of chronic diseases (CABRAL et al., 2012; CARVALHO et al., 2015; DINIZ et al., 2013; FORTES et al., 2013; SILVA et al. 2014; SOUSA et al., 2013). Blood is responsible for transporting and micronutrient elements related to metabolism and thus its analysis reflects the physiological situation of individual. Knowledge

about the biochemical parameters in wildlife is important to standardize data, due to the paucity of research and form references to elucidate diseases and contribute to management in captivity (BRITO et al., 2006; KERR, 2003). This information during pregnancy is even rarer, and these data are of relevant importance to monitor and prevent metabolic disorders that may occur during this period. Since the biochemical parameters in the gestational phase are altered, differing from the parameters found in non-pregnant women, mainly because they are influenced by the fetal development, which requires greater energetic demand of the maternal part (FEIJO et al., 2014).

The blood proteins, including albumin and globulin, have different functions in the body such as the maintenance of osmotic pressure and blood viscosity, transport of nutrients, metabolites, hormones and excretion products, blood pH regulation and participation in blood clotting

(THRALL et al., 2007). Alanine aminotransferase (ALT) is a specific enzyme and is distributed throughout the body, liver, skeletal muscle and heart, which indicates a disease and renal or muscle lesions (KERR, 2003).

Minerals such as calcium and phosphorus are structural components of tissues, and are enough required in the final third of gestation for bone growth, tissue development, and hormonal adaptations of the fetus, and for milk production. Calcium plays an important role in the transmission at the neuromuscular junction and impulse propagation muscle contraction, besides being the major component of bone. Calcium deficiency during the gestational period is linked to hypertensive pathology and may affect the bone mineral density of the fetus, in addition to the risk of triggering a preterm delivery (HARK ; CATALANO, 2012).

Urea is analyzed in relation to the level of dietary protein and kidney function. Creatinine, as urea, is a nitrogen degradation product, but it is produced by the endogenous metabolism and is not altered by the animal's diet (KERR, 2003; THRALL et al., 2007). Serum creatinine is excreted only by the kidneys, since it is not reused or reabsorbed by the body, ie, high levels indicate deficiency in kidney function (ARAÚJO et al., 2009). Among various metabolites used as fuel for oxidized respiratory glucose is considered the most important. It is vital to the metabolism of the brain, milk, and blood levels can indicate flaws in homeostase (LANGE; SCHMIDT, 2007).

Aspartate aminotransferase (AST) is an enzyme that is found in the cytoplasm and mitochondria of skeletal muscle tissue, heart and liver cells. When there is damage to these tissues, these isoenzymes are released from the cytoplasm when the injury is mild, or from the mitochondria, when the lesion is more severe. However, its determination is usually used as a routine method to determine general cell necrosis (MOSS ; HANDERSON, 1998). And its activity increases in acute or chronic liver injury in all domestic species (HUANG et al., 2006). Bilirubin is found in plasma by degradation of old erythrocytes by the reticuloendothelial system, especially in the spleen or is derived from the degradation of myoglobin, cytochromes and the immature erythrocytes in bone marrow. The sum of the direct and indirect bilirubins levels indicates total bilirubin (LANGE ; SCHMIDT, 2007).

The objective of the present research was to establish the levels of serum total protein, albumin, globulin, alanine aminotransferase (ALT), aspartate

aminotransferase (AST), calcium, phosphorus, urea, creatinine, bilirubin and glucose during pregnancy in agoutis.

MATERIAL AND METHODS

Twelve female agoutis (*Dasyprocta prymnolopha*) were used from the Center for Study and Preservation of Wild Animals - NEPAS (IBAMA, No. 02/08-618) of the Federal University of Piauí (UFPI) after approval by the Ethics Committee on Animal Experiments (EAEC) UFPI No. 039/2010 and Authorization System and Biodiversity Information - SISBIO No. 24034-1.

The animals were fed with commercial feed, corn, fruit and water ad libitum. Eight agoutis were used for analysis of total protein, albumin, globulin, alanine aminotransferase (ALT), calcium, phosphorus, urea, creatinine, and four agoutis were used to evaluate glucose, aspartate aminotransferase (AST), total bilirubin, direct and indirect. The animals/agoutis were divided in groups of four females for one male. The estrus cycle was accompanied by vaginal cytology and the day of mating (Day zero of pregnancy) was determined by sperm presence on the smears. The pregnancy was confirmed by ultrasound (Digital ultrasonic diagnostic imaging system Mindray, model: DP-2200Vet, microconvex transducer 6.5MHz) about 15 days after determining day zero. After physical restraint, the animals were submitted to collected of blood by saphenous lateral venipuncture every 10 days, from the beginning to the end of pregnancy, with the aid of 3 mL syringe and hypodermic needle 21G.

Blood samples without anticoagulant were centrifuged at 2000 rpm for fifteen minutes to obtain serum. The serum samples were transferred to microtubes, identified and kept frozen at -20 °C until biochemical analysis. The samples were processed at the University Veterinary Hospital, Center for Agricultural Sciences/UFPI. Commercial kits (Labtest ®) were used to perform the biochemical tests and the analytes were read on a spectrophotometer (Tecnal model Bel 1105).

Statistical data were evaluated by analysis of variance for a completely randomized design and the means were compared by the Duncan test at 5% probability using SAS (Statistical Analysis System).

RESULTS

The results of the biochemical analyses of total protein, albumin, globulin, urea, creatinine, calcium, phosphorus, serum ALT (Figure 1; Tables 1

and 2) glucose (Figure 2, aspartate aminotransferase (AST) (Figure 3), total bilirubin, direct bilirubin and indirect bilirubin (Figure 4; Table 3) of pregnant

agouti (*Dasyprocta prymnolopha*) showed no difference compared to nonpregnant females.

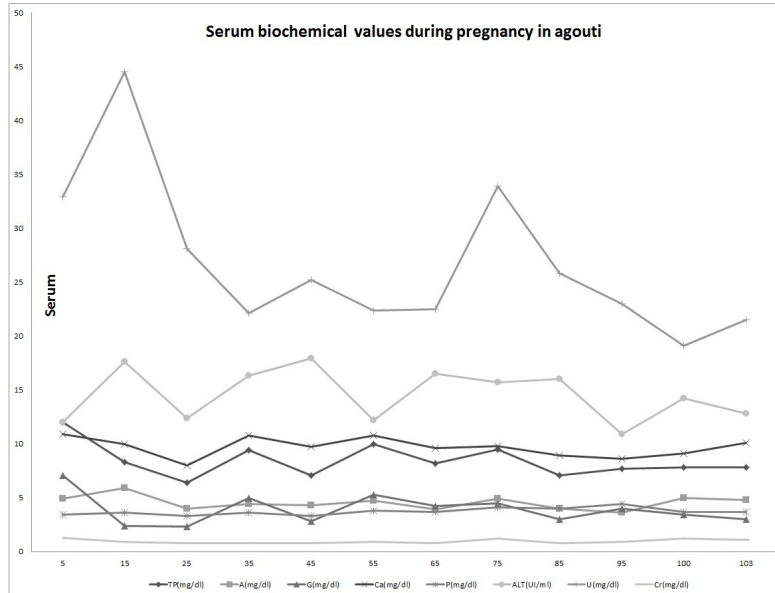


Figure 1. Serum biochemical profile of total protein (TP), albumin (A), globulin (G), calcium (Ca), phosphorus (P), alanine aminotransferase (ALT), urea (U) and creatinine (Cr) in agouti (*Dasyprocta prymnolopha*) during the pregnancy.

Table 1. Serum biochemical profile in agouti (*Dasyprocta prymnolopha*) during the pregnancy.

D.P.C.	TP(mg/dL)	A(mg/dL)	G(mg/dL)	Ca(mg/dL)
5	12.0±5.27a	4.9±0.89ab	7.1±4.40a	10.9±3.18a
15	8.3±4.74b	5.9±1.40a	2.4±3.46b	10.0±3.81a
25	6.4±0.57b	4.0±1.26ab	2.3±0.83b	8.0±1.23a
35	9.4±2.62ab	4.4±1.65ab	5.0±1.38ab	10.8±2.10a
45	7.1±2.36ab	4.3±1.24ab	2.8±1.87b	9.7±1.53a
55	10.0±3.23ab	4.7±1.81ab	5.3±4.06ab	10.8±1.87a
65	8.2±2.12b	3.9±1.13ab	4.2±2.30ab	9.6±1.13a
75	9.5±3.07ab	4.9±1.99ab	4.5±2.74ab	9.8±1.9a
85	7.1±1.78b	4.0±0.50ab	3.0±1.51b	8.9±2.35a
95	7.7±1.82b	3.6±1.07b	4.0±1.84ab	8.6±1.28a
100	7.8±2.59b	5.0±2.08ab	3.4±1.04b	9.1±1.86a
103	7.8±1.17b	4.8±1.04ab	3.0±0.24b	10.1±0.92a

D.P.C, Days post coitum; TP, total protein; A, albumin; G, globulin and Ca, calcium. Means followed by the same letter do not differ significantly by Duncan's test ($P < 0,05$).

Table 2. Serum biochemical profile during the pregnancy in agouti (*Dasyprocta prymnolopha*).

D.P.C.	P(mg/dL)	ALT(UI/mL)	U(mg/dL)	Cr(mg/dL)
5	3.4±0.90a	12.0±5.27a	32.9±21.78ab	1.25±0.62ab
15	3.6±0.70a	17.6±12.35ab	44.5±21.23a	0.9±0.41ab
25	3.3±0.76a	12.4±3.61b	28.1±14.17ab	0.8±0.38ab
35	3.6±0.86a	16.3±4.15ab	22.1±10.32b	0.8±0.14ab
45	3.3±0.80a	17.9±11.06ab	25.2±11.09b	0.8±0.15ab
55	3.8±0.97a	12.2±5.30b	22.4±9.68b	0.9±0.17ab
65	3.7±0.48a	16.5±9.92ab	22.5±12.91b	0.8±0.11ab
75	4.1±1.27a	15.7±3.4b	33.9±17.46a	1.2±0.4ab
85	4.0±1.26a	16.0±5.31ab	25.8±8.38b	0.8±0.04b
95	4.4±1.24a	10.9±2.63b	23.0±5.13b	0.9±0.04ab
100	3.7±0.64a	14.2±7.93b	19.1±14.96b	1.2±0.27a
103	3.7±0.64a	12.8±4.15b	21.5±7.55b	1.10.06ab

D.P.C, Days post coitum; P, phosphorus, ALT, alanine aminotransferase; U, ureia; Cr, creatinine. Means followed by the same letter do not differ significantly by Duncan's test ($P < 0,05$).

Table 3. Serum biochemical profile in agouti (*Dasyprocta prymnolopha*) during the pregnancy.

D.P.C.	GL(mg/dL)	AST(UI/L)	TB(mg/dL)	DB(mg/dL)	IB(mg/dL)
0	173±9.93a	9.60±0.00a	0.40±0.02b	0.10±0.02a	0.30±0.04a
10	143.1±18.71a	9.60±2.92a	0.50±0.15ab	0.10±0.11a	0.30±0.17a
20	157.2±19.17a	9.15±2.01a	0.40±0.05b	0.10±0.06a	0.30±0.02a
30	156.75±16.57a	8.65±3.37a	0.47±0.18ab	0.13±0.06a	0.34±0.12a
40	169.2±38.79a	10.60±6.75a	0.60±0.30ab	0.20±0.01a	0.40±0.29a
50	175.65±23.28a	10.55±2.29a	0.50±0.21ab	0.15±0.06a	0.35±0.18a
60	170.35±52.79a	9.60±5.06a	0.64±0.09ab	0.20±0.05a	0.40±0.10a
70	171.2±27.73a	8.70±0.95a	0.50±0.13ab	0.22±0.07a	0.40±0.14a
80	178.6±64.73a	8.70±0.50a	0.59±0.13ab	0.21±0.09a	0.42±0.11a
90	180.6±17.47a	7.00±2.29a	0.71±0.17ab	0.20±0.05a	0.43±0.18a
100	173.25±20.14a	8.70±1.23a	0.69±0.33a	0.14±0.15a	0.56±0.18a

D.P.C, Days post coitum; GL, glucose; AST, aspartate aminotransferase; TB, total bilirubin; DB, direct bilirubin; IB, indirect bilirubin. Means followed by the same letter do not differ significantly by Duncan's test ($P < 0,05$).

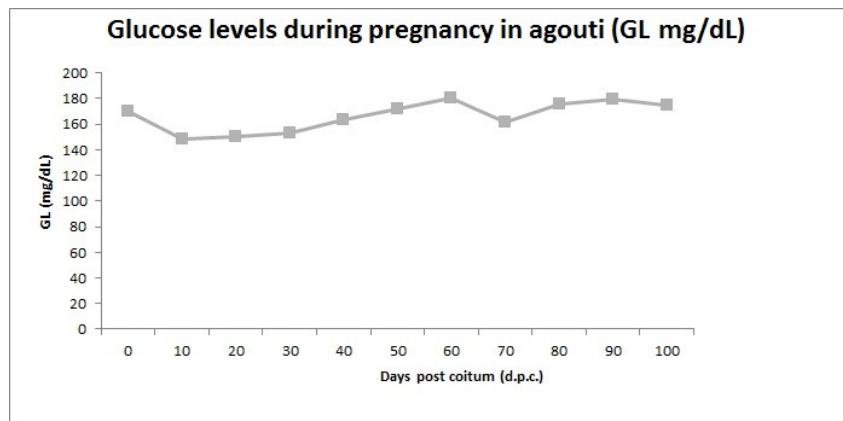


Figure 2. Glucose (GL) levels during pregnancy in agouti.

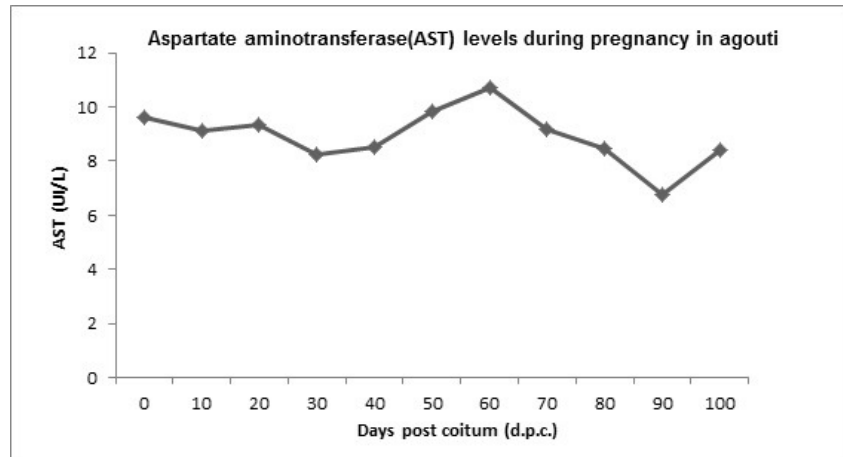


Figure 3. Aspartate aminotransferase (AST) levels during pregnancy in agouti.

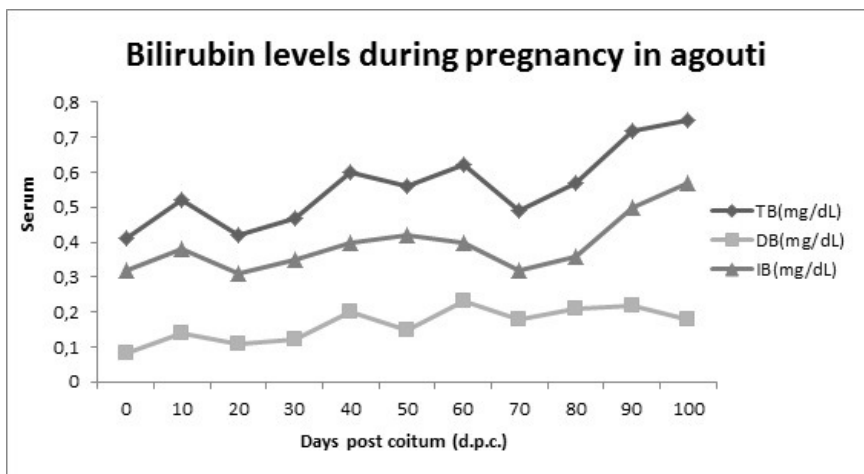


Figure 4. Bilirubin levels during pregnancy, Total Bilirubin (TB), Direct Bilirubin (DB) and Indirect Bilirubin (IB).

Serum total protein, essential for the structural development in the embryo, behaves differently during pregnancy. There is an increase in the initial period until 35 days post coitum (d.p.c.), and at the end of pregnancy, the maternal concentrations of serum proteins decrease.

Albumin values up to 15 d.p.c. increased considerably although there was a decrease in serum in the middle period, followed by significant increase in albumin in late pregnancy. The peak globulin was given until 5 d.p.c. (Table 1). After

The serum creatinine levels increased only at the end of the pregnancy, remaining at lower levels in the other phases. Glucose serum levels observed in the present research were superior to baseline and did not change during the pregnancy in agoutis.

The values obtained for AST were lower than in non pregnant agouti and during the gestational periods the levels were constant, with no statistically significant difference.

this initial stage, there was a decrease followed by an increase at the end of pregnancy.

The serum ALT, also increased in the initial phase and then dropped in the middle period and increased again in late pregnancy. The amounts of calcium and phosphorus during pregnancy were constant with no significant differences throughout the pregnancy. As for urea during pregnancy, there was an increase only in early pregnancy, and these values decreased in the middle and late periods.

The values of indirect and total bilirubin levels decreased or were low during the first two thirds of gestation but increased near to parturition. Direct bilirubin decreased throughout the period in relation to the values for non pregnant agoutis. There was no significant difference for total bilirubin with lower values in the early and middle thirds and higher levels near parturition.

DISCUSSION

During pregnancy factors such as diet, embryonic state and fetal development influence serum biochemistry and micronutrient electrolytes (FEIJO et al., 2014). Analyzing the results (Figure 1, 2, 3 and 4) it can be inferred that the requirements of the agouti embryo in the middle period of pregnancy (25-65 d.p.c.) increased because of embryonic structure development. Fetal growth and maturity occurred between 75 and 100 d.p.c., with increased weight and size, including the development of facial and body features (FORTES et al., 2013). Maternal levels of these elements decreased in this period. Thus when the requirement of the fetus was higher the expression was lower in the maternal peripheral blood.

The increase in total protein in the initial period when compared to non-pregnant agouti (7.43 ± 0.77 g/dL) may have been due to the fact that the maternal body was preparing for the highest embryo requirement (LANGE; SCHMIDT, 2007). Another factor is related to food, as this is rich in protein, and it is known that the total protein in serum is directly related to nutrition and liver function (BRITO et al., 2006). In the middle period of pregnancy the maternal concentrations of serum proteins decrease due to fetal growth and especially because of the use of amino acids from the mother for fetal protein synthesis in muscle, similar to that in, cats, rats and pregnant mares (LANGE; SCHMIDT, 2007; ŞİMŞEK, et al., 2015; SILVA et al., 2008; PICCIONE et al., 2009; OROZC et al., 2007).

Albumin values found in agoutis until 15 d.p.c. increased considerably (Figure 1) above the results observed in non-pregnant adult agoutis (3.84 ± 0.32 g/dL) (LANGE; SCHMIDT, 2007). The decrease in the middle third followed by significant increase in albumin in late pregnancy provided the increased energy requirements for fetal growth (PICCIONE et al, 2009). These results are similar to studies on pregnant ewes, where the largest variations in blood metabolites occur in late pregnancy, which corresponds to times of greater metabolic demand (KERR, 2003).

The peak globulin was given until 5 d.p.c. (Figure 1) resembling the benchmarks (3.59 ± 0.22 g/dL) for non-pregnant animals (LANGE; SCHMIDT, 2007). An increase was observed in bitches in circulating globulin in the first third of pregnancy due to the need for greater supply to deliver proteins and antibody synthesis for lactation (VANNUCCHI et al., 2016).

Serum plasma enzyme ALT increases when there is greater production, increased release or greater clearance of the enzyme. Besides the liver, the rodents have ALT activity in the intestines, kidneys, heart, skeletal muscle, brain, pancreas and tegument (BRITO et al, 2006). Therefore, the ALT levels will only be changed when there is severe liver cell damage or muscle injury (KERR, 2003). The changes during pregnancy in agouti were defined based on reference values in non-pregnant animals (20 ± 4.6 IU/mL for *Dasyprocta prymnolopha* (KANEKO et al., 1997) and 28.08 ± 15.53 IU/mL for *Dasyprocta sp* (RIBEIRO et al., 2008).

The calcium found throughout pregnancy in agouti did not change compared to non-pregnant animals ($7.62 \pm 2:59$ mg/dL) (RIBEIRO et al., 2008). These results corroborated the fact that changes in calcium levels, such as hypercalcemia, only occur when there is increased serum albumin or excessive venous stasis during sample harvesting (KERR, 2003).

The values of phosphorus levels in nonpregnant agoutis reported in the literature are 3.91 ± 1.41 mg/dL (RIBEIRO et al., 2008). In pregnant females, higher values of electrolytes may occur due to greater demand for fetus training (LANGE; SCHMIDT, 2007), as in sheep, where it was observed that in the end of gestation, the concentration of phosphorus was close to the lower limit for the species indicating greater expenditure in these periods (BRITO et al., 2006). However, in the agouti, there was no change in the calcium and phosphorus levels (Figure 1), which can be attributed to the use of different measurement techniques and sample preservation, and even the food restraint, the handling, the forms of containment and the methodologies used in determining serum concentrations.

As to the urea values in the pregnant agoutis, they were equal to the normal baseline urea observed in non-pregnant agouti (2.57 ± 6.34 mg/dL) (LANGE; SCHMIDT, 2007). The high levels of urea in early pregnancy can be attributed to increased protein catabolism, as well as the high energy requirement, as observed in pregnant sheep (PICCIONE et al., 2009). The results of urea values may have been influenced by the type of diet, liver function, gastrointestinal absorption and hydration status (BRITO et al., 2006).

The creatinina values observed in pregnant agoutis were similar to non-pregnant *D. prymnolopha* values (1.4 ± 0.27 mg / dL) (LANGE; SCHMIDT, 2007). The normal values during the early and middle periods of gestation are due to

decreased metabolic rate, as occurs in pregnant mares, since creatinine is the final product of phosphocreatine breakdown. The amount of creatinine formed depends on the total body creatine content, which in turn depends on the food intake of creatine synthesis rate and muscle mass (PICCIONE et al., 2009).

Glucose serum levels found in the pregnant agoutis were greater than the values reported in non-pregnant agoutis (123.1 mg/dL) (LANGE; SCHMIDT, 2007). This increase in glucose levels throughout the gestational period may be related to the large energy demand of pregnant agouti to form and maintain the fetus. Due to this condition in the captive production of this animal of that study there was food supplementation during this period, which may be related to this serum glucose increase in this phase. In rabbits the glucose serum levels fall near to parturition in the final third of pregnancy due to rapid fetal growth in the last weeks of pregnancy, and may even be related to the lactation peak, with the uptake of this metabolite by the mammary gland for lactose synthesis (HANEDA et al., 2010; MIZOGUCHI et al., 2010). The initial hypoglycemia in pregnant sheep is described as pregnancy toxemia (SANTOS et al., 2011) and this fact corroborates our study since during pregnancy in agoutis (Figure 2) no pathological changes were observed.

The values obtained for AST in pregnant agouti were lower than in non-pregnant *D. leporina* (44.47 ± 23.19 IU / mL) and *Dasyprocta prymnolopha* (20 ± 4.6 IU / mL) (LANGE; SCHMIDT, 2007). During pregnancy the levels remained constant, with no statistically significant difference. The pregnant agouti (Figure 3) showed similar results quoted in the literature (WAHAB et al., 2016) that show a decrease in AST values at the end of pregnancy in habbits. In contrast, reduced AST was observed in the final third of pregnancy in mares (MILINKOVIC-TUR, 2005). This occurs because pregnancy and lactation are conditions in which metabolic activity in the body is increased, influencing variations in blood. One of the activities of aminotransferases in blood is to serve as catalyst for reactions that transform amino acids to carbohydrates (KANEKO et al., 1997).

The values of indirect and total bilirubin decreased during the first two thirds of gestation and

increased a few days before birth, and direct bilirubin decreased throughout the period mentioned (Figure 4) compared to reference values for non-pregnant *D. prymnolopha* (0.24 ± 0.12 mg / dL for direct bilirubin, 0.37 ± 0.06 mg / dL for indirect bilirubin and 0.62 ± 0.14 mg / dL for total bilirubin) (LANGE; SCHMIDT, 2007).

However, the statistical difference found within the gestational period can be explained by the fact that the determination of bilirubin total, direct and indirect, enables the diagnosis of disorders responsible for the development of jaundice in numerous species (KANEKO et al., 1997). The findings obtained in this research, i.e., decrease in serum bilirubin levels allow us to infer that there were no infections causing hemolytic or obstructive hepatobiliary (cholestasis) in agoutis. These values of decreased bilirubin are a condition that could be associated with increased fluid accumulation that occurs during pregnancy.

CONCLUSIONS

The determination of biochemical parameters during the gestation of agoutis was possible.

The serum biochemical levels changed during pregnancy in agoutis, except for calcium and phosphorus, when compared to non-pregnant animals, as occurs in other species.

The serum biochemistry in pregnant agouti undergoes changes according to the time of gestation, with the biggest changes in the initial and final phases of pregnancy.

The changes during pregnancy reflect the physiology and biology of wild species, elucidating information about the biochemical parameters during pregnancy, thus characterizing the animal as a benchmark for comparisons with other species, extolling its importance both for nature conservation and production.

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RESUMO: O estudo objetivou estabelecer os níveis séricos de proteínas totais, albumina, globulina, Alanina Aminotransferase (ALT), Aspartato Aminotransferase (AST), cálcio, fósforo, ureia, creatinina, bilirrubina e glicose durante a gestação em cutias. A pesquisa foi desenvolvida utilizando-se 12 cutias fêmeas criadas no Núcleo de Estudos, Produção e Preservação de Animais Silvestres da Universidade Federal do Piauí. Após a identificação do estro, o dia da

cobertura foi confirmado por meio de citologia vaginal com a visualização de espermatozoides (dia zero) e confirmação da gestação por exame ultrassonográfico após 15 dias. Confirmada a gestação, foram coletados 03 mL de sangue mediante punção da veia pudenda interna, após contenção física, a cada 10 dias, até o final da gestação. Foi feita a análise de variância para um delineamento inteiramente casualizado com teste de Duncan para comparação das médias a 5% de probabilidade utilizando-se do programa estatístico SAS (Statistical Analysis System). Os resultados obtidos por meio da análise bioquímica de proteína total, albumina, globulina, ureia, creatinina, cálcio, fósforo, ALT séricas, glicose, aspartato aminotransferase (AST), bilirrubina total, bilirrubina direta e bilirrubina indireta de cutias gestantes (*Dasyprocta prymnolopha*) diferem de forma absoluta quando comparados a fêmeas não gestantes. Os níveis bioquímicos séricos durante a gestação em cutias, com exceção do cálcio, fósforo, sofrem alterações comparadas ao animal adulto não prenhe, como ocorre em outras espécies. Os níveis nas cutias gestantes sofrem alterações de acordo com o tempo de gestação, com maiores mudanças no período inicial e final da prenhez. As mudanças durante a gravidez refletem a fisiologia e a biologia da espécie silvestre, elucidando informações sobre os parâmetros bioquímicos durante a gestação, caracterizando o animal como referência para comparações com outras espécies, exaltando a importância tanto para sua conservação quanto para a sua produção em cativeiro.

PALAVRAS-CHAVE: Bioquímica. *Dasyprocta prymnolopha*. Gestação. Soro.

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