ACTA THERIOLOGICA
Vol. 29, 19: 243—250, 1984

Changes in Protein Fractions Level in Blood Plasma of Female Chinchillas during Pregnancy and Lactation

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Gromadzka-Ostrowska J. & Zalewska B., 1984: Changes in protein fractions level in blood plasma of female chinchillas during pregnancy and lactation. Acta theriol., 29, 19: 243—250 [With 4 Tables & 3 Figs.]

Changes in plasma protein fractions level during pregnancy, lactation and in nonpregnant, nonlactating female chinchillas were investigated. Pregnancy and lactation were divided into following periods: from first to 37th day, from 38th to 74th day, from 75th to 111th day (pregnancy) and from 7th to 20th day, from 30th to 46th day and from 54th to 62nd day (lactation). During pregnancy α_2-globulin level increase whereas β_2-globulin fraction level decrease, both significantly. Changes in other protein fractions level and in total protein plasma concentration during pregnancy were non significant. Pregnant females in comparison to nonpregnant ones have a significant higher level of α_2, β_2, and γ-globulin levels whereas albumins and β_1-globulin levels were significantly lower. During lactation β_1-globulin level decrease from period I to II, whereas β_2-globulin level increase in the same time. In III lactation period β_2 and γ-globulin levels decreased. Lactating females in comparison to pregnant ones have a higher β_1-globulin level and lower β_2-globulin level. A small increase in total protein plasma concentration and albumins level and small decrease in γ-globulin level were also found in lactating females. Pregnant females comparatively to lactating (1.03) and nonpregnant, nonlactating ones (1.27) have lower A/G ratio (0.97).

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1. INTRODUCTION

Chinchillas, rodents belonging to suborder *Hystricomorpha,* are a polyestric animals characterized by long gestation (105—111 days) with a low fertility (Asdell, 1964; Weir, 1966; Weir, 1967; Jarosz & Rżewski, 1969) and long lactation (60 days) as was described by Jarosz & Rżewski (1969).

Physiology of chinchilla pregnancy and lactation has received a very little attention (Jarosz & Rżewski, 1969; Roberts, 1971). Protein metabolism during these physiological events in chinchillas have not been studied.

The present study was undertaken for comparing the plasma protein composition at different stages of pregnancy and lactation in chinchillas with this in nonpregnant, nonlactating ones.

2. MATERIAL AND METHODS

Investigations were carried out on 12 chinchilla females (*Chinchilla laniger* Molina, 1782) from laboratory breeding colony. Females and males were housed in pairs, cages were kept in room at temperature 4°C in winter and 25°C in summer

and at humidity of 90% and 65% respectively. Feeding system was equal to this described by Jarosz & Rżewski (1969) and consisted a stuff food, green forage or fruits and water *ad lib.*

Blood samples were obtained from the same females before mating (nonpregnant, nonlactating females), during pregnancy (pregnant females) and during lactation (lactating females). Blood was taken from the tail end into heparynized glass tubes according to Stoltz & Bendall (1975) at particular days of pregnancy and lactation and 2—3 times in 10 days intervals before mating.

Blood samples collected in particular pregnancy days were grouped in 3 pregnancy periods: samples from first to 37th day, from 38th to 74th and from 75th to 111th pregnancy day. From lactating females blood samples were collected in particular days of lactation and grouped also in 3 periods: from 7th to 20th, from 30th to 46th and from 54th to 62th lactation day. In early lactation (1—6 day) blood samples were not obtained. Plasma was separed by centrifugation and stored at —20°C until assayed.

Plasma proteins were separed by paper electrophoresis method (Dżułyńska *et al.*, 1964). Electrophoretic analysis have been performed with veronal buffer, pH=9.0, 0.1 ionic strenght at 160 V tension during 18 hours. The strips were stained with 5% Amido Black 10B. Percentage of the protein fractions were calculated from the electrophoretic patterns obtained densytometrically (Ostrowski, 1970).

Total plasma protein concentration was determined by the mehod of Lowry *et al.* (1951). Because a small amount of blood was yielded from chinchillas total plasma protein determinations only in a part of samples were made. All protein plasma fractions data were presented as relative values (%).

The data were analysed according to the Student's t test at $p \leqslant 0.05$ and $p \leqslant 0.01$ as differences statistically significant.

3. RESULTS

Plasma proteins of the chinchilla were separed into six bands. The integrating scaner recorded six peaks that were identified as albumin, α_1, α_2, β_1, β_2 and γ-globulins. All six fractions were present in the plasma of each chinchilla.

Electrophoretic diagrams of blood plasma protein fractions in nonpregnant and pregnant female are presented on Fig. 1. Arrows on pregnant female diagram indicate direction in changes of protein fractions level during pregnancy.

Percent concentrations of plasma protein fractions during particular stages of pregnancy are presented in the Table 1 and on the Fig. 2. During pregnancy α_2-globulin fraction level increase significantly from 5.94 ± 0.47% in period I to 7.48 ± 1.16% in period II and $8.64 \pm \pm 0.91$% in period III ($p \leqslant 0.05$). β_2-globulin fraction level decrease from 11.5 ± 1.73% in period I to 9.40 ± 0.78% in period II and stay at the same level till parturition. Changes in other protein fractions were non significant. Total plasma protein concentration not changes significantly during pregnancy and varied between 5.77 ± 0.64 g% and 6.83 ± 0.38 g% with mean value of 6.21 ± 0.34 g% (Table 4). Albumin/globulin ratio increase as pregnancy progressed in period I and II and decrease in period III (Fig. 3, Table 1).

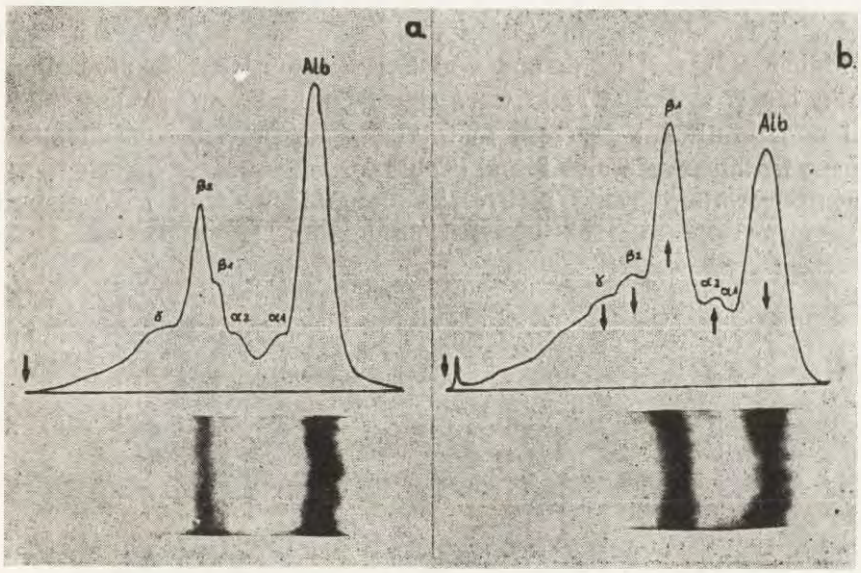

Fig. 1. Electrophoretic diagrams of chinchilla females plasma protein fractions: a) nonpregnant female, b) pregnant female.
Arrows on the diagram indicate direction in protein fractions changes.

Table 1

Plasma protein fractions level (%) changes during chinchilla pregnancy ($\bar{x}\pm$SE). [1] Figure indicate significant differences at $p\leqslant 0.05$. Numbers in paranthesis indicate sample size.

Pregnancy days (n)	Albumins	α_1-glob.	α_2-glob.	β_1-glob.	β_2-glob.	γ-glob.	A/G ratio
1—37 (18)	48.7 ±1.50	6.03 ±0.44	5.94 ±0.47 [1]	11.6 ±1.48	11.5 ±1.73 [1]	15.9 ±1.88	0.93
38—74 (26)	50.8 ±1.76	5.86 ±0.49	7.48 ±1.16	12.9 ±0.84	9.4 ±0.78 [1]	13.5 ±1.16	1.03
75—111 (22)	47.4 ±1.56	6.09 ±0.53	8.64 ±0.91 [1]	13.4 ±1.19	9.7 ±0.86	14.6 ±1.20	0.90

Table 2

Plasma protein fractions level (%) changes during chinchilla lactation ($\bar{x}\pm$SE). [1] Figure indicate significant differences at $p\leqslant 0.05$. Numbers in paranthesis indicate in paranthesis indicate sample size.

Pregnancy days (n)	Albumins	α_1-glob.	α_2-glob.	β_1-glob.	β_2-glob.	γ-glob.	A/G ratio
7—20 (6)	50.3 ±2.76	5 8 ±0.98	7.2 ±1.14	14.8 ±1.08 [2]	7.3 ±1.23 [1]	14.5 ±2.43	1.01
30—46 (5)	48.4 ±3.44	7.0 ±0.89	6.6 ±1.12	8.8 ±1.45 [2]	13.2 ±1.82 [1]	16.4 ±4.49	0.93
54—65 (5)	53.0 ±2.21	7.0 ±0.83	11.0 ±3.11	10.8 ±1.39 [1]	8.8 ±1.93	9 6 ±1.60	1.12

Pregnant females in comparison to nonpregnant ones have a significant higher levels of α_2, β_2 and γ-globulin levels whereas albumins, β_1-globulin levels and A/G ratio were significantly lower (Table 3, Fig. 3). Small non significant decrease in total plasma protein concentration in pregnant females were also found (Table 4).

During lactation (Table 2, Fig. 2) albumins as well as α-globulins fractions not change significantly. β_1-globulin level decreased from

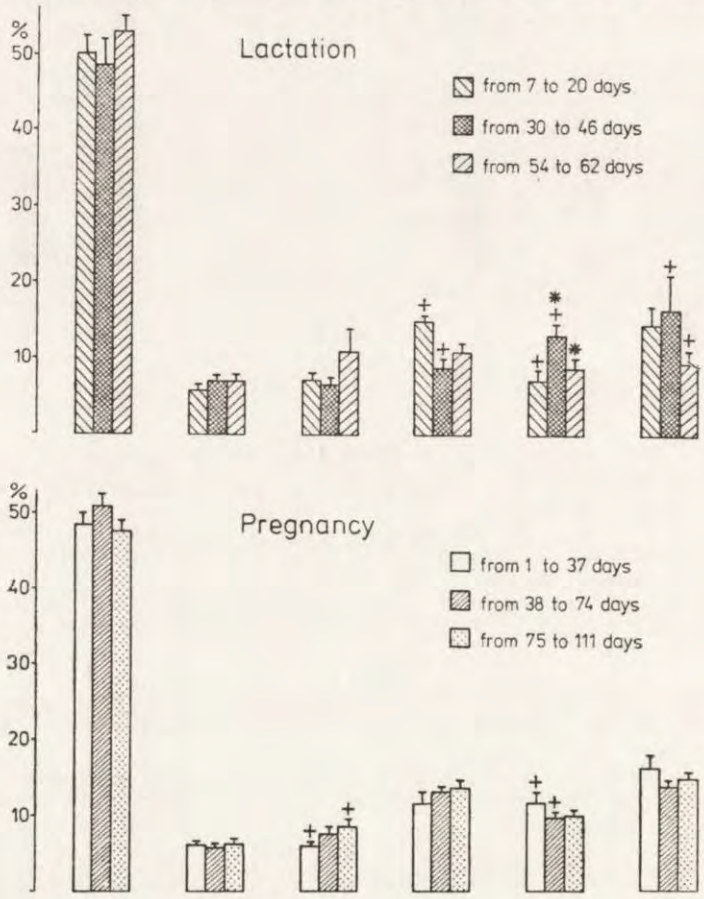

Fig. 2. Changes in plasma protein fractions (%) during pregnancy and lactation of chinchillas.
Vertical bar indicate 1 standard error, symbols above columns indicate significant differences between lactation and pregnancy periods at P=0.05(+) and P=0.01(*).

$14.8 \pm 1.08\%$ in period I to $8.8 \pm 1.45\%$ in period II ($p \leqslant 0.01$) and then a little increased to $10.8 \pm 1.39\%$ in period III. β_2-globulin level increased significantly ($p \leqslant 0.05$) from period I to II ($7.3 \pm 1.23\%$ to $13.2 \pm 1.82\%$) and decrease to $8.8 \pm 1.93\%$ in period III. γ-globulin levels decreased from period II to period III ($16.4 \pm 4.49\%$ to $9.6 \pm 1.60\%$). A/G ratio increase during period I of lactation in comparing with the last pre-

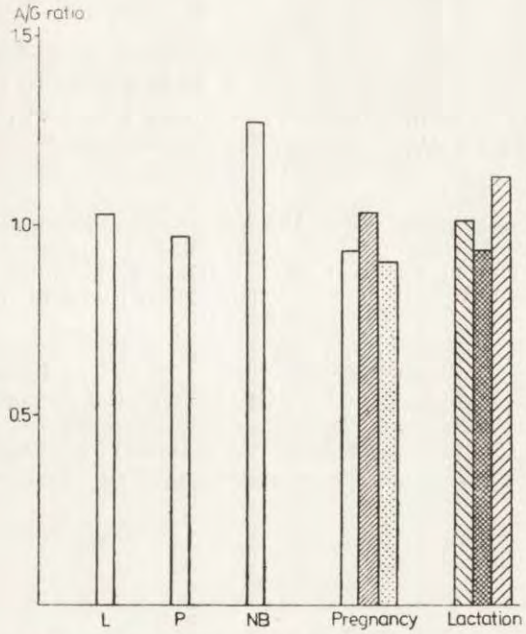

Fig. 3. Albumin-globulin ratio changes during particular periods of pregnancy and lactation and in pregnant (P), lactating (L) and nonpregnant nonlactating (NP) chinchillas.

Table 3

Plasma protein fractions concentration (%) in pregnant, lactating and nonpregnant nonlactating chinchilla females ($\bar{x}\pm SE$).
[1] Figures indicate significant differences at $p \leqslant 0.05$; [2] at $p \leqslant 0.01$. Numbers in paranthesis indicate sample size.

Protein fractions	Pregnant females (66)	Lactating females (16)	Nonpregnant nonlactating females (32)
Albumins	48.9±2.42	50.6±1.60	56.0±2.11
α_1-glob.	6.1±0.72	6.6±0.46	7.5±1.40
α_2-glob.	7.9±1.39 [1]	8.2±1.15	4.4±0.46 [1]
β_1-glob.	10.3±0.88 [2]	11.1±1.17 [1]	15.6±2.36 [2]
β_2-glob.	12.3±1.25 [2]	9.6±1.09 [1]	6.4±1.40 [2]
γ-glob.	14.5±1.28 [1]	13.6±1.78	10.1±2.05 [1]
A/G ratio	0.97	1.03	1.27

gnancy period (0.90), decrease in II lactation period (0.93) and during III period increase again (1.12) towards the level found in nonpregnant nonlactating females (Table 2, Fig. 3).

Lactating, nonpregnant females in comparison to pregnant ones (Table 3) have a higher β_1-globulin level (11.1 ± 1.17% and 10.3 ± 0.88%) respectivelly), and lower β_2-globulin level (9.6 ± 1.09% and 12.3 ± 1.25% respectively). A small rise in α_2-globulin level and small non significant

decrease in γ-globulin level in lactating females were also observed. Total plasma protein concentration (Table 4) as well as albumins level (Table 3) and A/G ratio (Fig. 3) were a little higher in lactating females in comparison to pregnant ones (7.04 ± 0.56 g%, 6.21 ± 0.34 g% and 50.6 ± 3.02%, 48.9 ± 2.42%).

Table 4

Total protein concentrations (g%) in blood plasma during different pregnancy stages, lactation and in nonpregnant nonlactating chinchilla females ($\bar{x}$±SE). Control group — nonpregnant nonlactating females, Numbers in paranthesis indicate sample size.

Pregnancy				Lactation	Control
Period I (4)	Period II (6)	Period III (4)	Average (14)	(6)	group (14)
6.83±0.38	5.77±0.64	6.24±0.82	6.21±0.34	7.04±0.56	6.82±0.30

4. DISCUSSION

The chinchilla is characterized by long gestation and long lactation. The range of gestation is 105—113 days, in most animals the period is 111 days (Asdell, 1964; Weir, 1966; Jarosz & Rżewski, 1969; Roberts, 1971). Lactation is about 60 days (Jarosz & Rżewski, 1969). The long pregnancies of these rodents are due to the extremally slow rate of foetus growth particulary in the early stages of pregnancy (Roberts, 1971).

Plasma proteins of the investigated chinchillas were separated into six fractions. This is a closely agreement with results obtained by others: Stauber *et al.* (1954), Eagle & Woods (1960), Jones & Bunde (1970). The changes in the plasma protein fractions level during pregnancy in chinchillas are generally the same as those occuring during pregnancy in other rodents: rabbits (Prusiewicz-Witaszek & Działoszyński, 1967) and voles (Dobrowolska, 1975; Dobrowolska, 1982). Characteristic for all these rodent species is a small decrease in total plasma protein concentrations as well as albumins level diminution and increase in α_2-globulin level which was due to increase in hormonal secretion, especially in gonadotrophins secretion (Bogdanikowa & Murawski, 1968). This increasing trend in α_2-globulin concentration may represents also a high tournover of minerals, especially iron and copper, during pregnancy (Kitts *et al.*, 1971).

Lactation in chinchillas was accompanied by changes in the plasma β and γ globulin fractions but there were no significant changes in the concentrations of albumins and γ globulins. These protein pattern changes are a little different than those found in rabbit lactation (Jordan & Morgan, 1970). They showed that total protein concentration, albumins and γ globulin concentrations in rabbit plasma increased significantlly

as lactation progressed whereas α and β globulins fractions not changed.

Significant decrease in β_2-globulin levels during pregnancy as well as increase in β_2-globulin levels found during early lactation in chinchillas may be due to the changes in antibody concentrations and may manifest that β_2-globulin fractions in chinchillas are a major immunoglobulins fraction.

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Accepted, April 24, 1984.

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ZMIANY W POZIOMIE FRAKCJI BIAŁKOWYCH OSOCZA KRWI SZYNSZYLA MAŁEGO W CZASIE CIĄŻY I LAKTACJI

Badano zmiany stężenia frakcji białkowych i białka całkowitego osocza krwi zachodzące w czasie ciąży i laktacji szynszyla małego (*Chinchilla lanigen* Molina, 1782). Białko oznaczano metodą Lowry'ego, frakcje białkowe — metodą elektroforezy bibułowej. Okres ciąży podzielono na trzy 73-dniowe podokresy. W czasie ciąży wzrasta istotnie poziom frakcji α_2-globulinowej i obniża się poziom frakcji β_2-globulinowej (Tabela 1, Ryc. 2). Zmiany poziomu pozostałych frakcji białkowych oraz stężenia białka całkowitego (Tabela 4) nie są istotne. Samice ciężarne w stosunku do samic niecięższarnych mają niższy poziom frakcji albumin i β_1-globulin. Niższy jest też stosunek A/G (Tabela 3, Ryc. 3), natomiast wyższe są stężenia frakcji α_2-, β_2- i γ-globulin (Tabela 3). Okres laktacji podzielono także na 3 podokresy: od 7 do 20 dnia, od 30 do 46 dnia i od 54 do 62 dnia. W czasie laktacji wzrasta poziom frakcji β_1-globulin a obniża się poziom β_2-globulin (Tabela 2, Ryc. 2). Zmiany stężenia innych frakcji nie są istotne. W stosunku do samic ciężarnych samice karmiące mają wyższy poziom β_1-globulin, a niższy β_2-globulin (Tabela 3). Nieco wyższe jest też stężenie albumin (Tabela 3) i białka całkowitego (Tabela 4) oraz wyższy stosunek A/G (Tabela 3, Ryc. 3).