EFFECT OF LACTATION STAGE AND PREGNANCY STATUS ON MILK COMPOSITION

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Abstract - The milk composition (dry matter, fat, protein, albumen, ash, Ca, P, K, Na, Zn, Fe, Cu and Mn) of 70 post-partum pregnant (P) and 54 non-pregnant (E) rabbit does was studied. Lactation stage had a significant effect on concentrations of the chemical components examined. The differences in milk composition of P and E does after the peak of lactation depend on the faster (Group P) or slower (Group E) drying up.

INTRODUCTION

There are many data about the milk composition of rabbits (SCHLEY, 1975; SEKANINA, 1982; VAKULENKO, 1984; KAMAR et al., 1985). Most of the authors cited analysed mixed milk samples. Only some of them (LEBAS, 1975; CSAPÓ et al., 1985; EL-SAYIAD et al., 1994) studied the change of milk composition during lactation. In our experiment the chemical composition of milk of post-partum pregnant and non-pregnant (empty) rabbit does is compared. We would like to determine the effect of pregnancy status, the slow or rapid drying up on milk composition at different stages of lactation.

MATERIAL AND METHODS

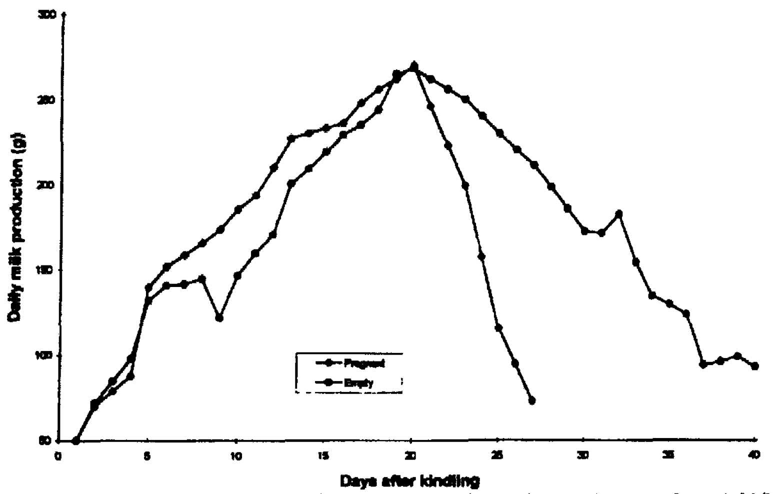
The milk production and milk composition of New Zealand White and Pannon White does were studied. The two breeds were divided into three groups; does nursed 6, 8 or 10 young. All of the does (n = 124) were artificially inseminated post-partum. 70 does became pregnant (Group P) and 54 were left empty (Group E). Milk production was measured by the weigh-suck-weigh method daily except on the days when milk samples were collected. The milk samples were taken on days 1, 3, 7, 14, 21, 24 and 28 from all does, on day 26 from P does and on days 35, 38 and 42 from E does. The milk samples (about 10 cm^3 per animal) were pumped with a special milking machine (vacuum compressor by $0.8x10^5$ Pa) using the anterior first pair of teats at the beginning and end of lactations and only one of the teats was pumped when the milk production was high. The samples were cooled immediately and the composition of milk was determined as described below.

Chemical analysis of samples

The milk samples were stored at -25°C until processed. Just before the chemical analysis, the frozen samples were melted and egalised. The dry matter content was determined by the relevant Hungarian Standard (No. 6830-74). The fat content was analysed by the Gerber method. The determination of total protein was based on the biuret reaction, while the albumen of the milk was determined by the reaction of albumen with bromocresol green. Ash content of samples was determined by burning the samples at 550 °C for 4 hours. The potassium and sodium content was determined by OMSZÖV Digital Flame Photometer using lithium internal standard. The phosphorus content was measured by Eppendorf PCP 6121 photometer. In the case of phosphorus the light absorption of molybdenum blue was determined. In the determination of the microelement content of milk the metal oxides gained were converted to chlorides by hydrochloric acid, after which the metals taken into solution were determined by UNICAM SP-191 type atomic absorption spectrophotometer.
Individual milk samples were examined in the case of protein, albumin, P, K and Na, mixed samples in the case of DM, fat, Ca, Zn, Fe, Cu and Mn.

RESULTS AND DISCUSSION

Figure 1 : Milk production of does



Milk production of does on days when the milk samles were collected were estimated as the average of amount of daily milk yield one day before and after pumping

The milk production of Group P and E does increased until the 20th day of lactation and later, after the peak milk production the post-partum pregnant does started to dry up more quickly than the E does (Figure 1) similarly to the results published by LEBAS (1972), MAERTENS and DE GROOTE (1988) and SZENDRÔ et al. (1985). The breed and litter size had only a slight effect on milk production and for this reason these results are not discussed.

Changes in the chemical composition of milk are shown in Tables 1 and 2. Significant differences were not found between the breeds and size of litters, therefore the averages of the two breeds and three litter sizes are summarized.

Effect of lactation stage

The dry matter (DM) decreased from 314 and 283 g/kg on day 1 to 232 and 227 g/kg on day 21, then rose rapidly thereafter reaching the maximum value on days 28 and 42 (415 and 384 g/kg) in Groups P and E, respectively. The level of DM agreed with those reported by LEBAS (1991), CSAPÓ et al. (1985) and EL-SAYIAD et al. (1994).

The same tendency was observed in the case of fat content with a rapid decline between kindling and the 14th-21st day of lactation and a speed increasing after day 21. The highest values were on day 1 (163 and 157 g/kg) and days 28 and 42 (149 and 176 g/kg in Groups P and E, respectively). The tendency agree with date of LEBAS (1971), CSAPÓ et al. (1985) and EL-SAYIAD et al. (1994), but there are great differences between the published lowest values (90-145 g/kg) and our results (34-43 g/kg). The reason for this is the method of collection of milk samples. The milk was collected manually by gently massing the mammary gland by CSAPÓ et al. (1995) and EL-SAYIAD et al. (1994). LEBAS (1971) used a special milking machine to collect milk samples from all teats. In our experiment a milking machine was also used but the milk samples were collected from the first anterior pair of teats during the beginning and the end of lactation and only from one teat when the milk production was high. The mammary gland was emptied. in this experiment. It is important to collect all the milk of the mammary gland to examine the fat content.

Ash, increased from 16 and 15 g/kg on day 1 to 27 and 29 g/kg on days 24 and 38 in the groups of P and E does, respectively. Our results agreed with those of LEBAS (1971), CSAPÓ et al. (1985) and EL-SAYIAD et al. (1994).

The minimum values of Ca and P content were on day 1 (about 1300-1400 and 1600-1700 mg/kg, respectively) followed by a gradual increase to the maximum on days 24-28 and 38 in Group P and E (Ca: 3650 and 5126, P: 3700 and 4353 mg/kg, respectively). The same tendency was observed by LEBAS (1971).

The changes in Na and K content were the opposite. The concentration of Na decreased from about 1100 mg/kg on day 1 to a fairly constant value of about 700-800 mg/kg on days 7-14 and it increased thereafter reaching the maximum on days 24 and 38 with 2219 and 1849 mg/kg in groups P and E, respectively. The concentrations of K were fairly constant during the first 14 days of lactation, reaching the maximum on day 21 (2595 and 2712 mg/kg) and declining rapidly thereafter to the value of 561 and 658 mg/kg on days 28 and 38 in groups P and E, respectively. A negative correlation (r = -0.62) was established between the concentrations of Na and K in the 5th week of lactation by EL-SAYIAD et al. (1994). The opposite change of Na and K content of milk during the last phase of lactation is explained by osmotic balance.

Table 1: The effect of lactation stage and pregnancy on rabbit milk composition

Lactation stage (days after parturition)	Dry matter g/kg		Fat g/kg		Protein k/kg				Albumin g/kg				Ash g/kg	
	P	E	P	E	P		E		P		E		P	E
	Mean	Mean	Mean	Mean	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	Mean
1	314	283	163	157	101	18	104	17	59	3	59	3	16	15
3	242	237	80	60	103	16	103	19	61	2	61	2	19	19
7	238	243	46	57	113	12	115	10	61	2	62	2	22	22
14	217	227	38	38	117	14	115	15	62	2	62	2	24	24
21	232	227	43	34	119	17	110	9	64	3	64	3	27	24
24	395	-	84	-	138	22	109	13	67	3	64	3	27	-
26	415	-	130	-	145	14	-	-	69	2	-	-	26	-
28	414	260	149	78	143	12	122	13	69	2	65	2	26	28
35		380		111			140	19			67	3		28
38		380		154			141	25			68	2		29
42		384		176			143	16			68	2		27

Table 2 : The effect of lactation stage and pregnancy on mineral content (mg/kg milk) of rabbit milk

Lactation stage (days after parturition)	Calcium		Phosphorus				Sodium				Potassium				Zinc		Iron		Copper		Manganese	
	P	E	P		E		P		E		P		E		P	E	P	E	P	E	P	E
	Mean	Mean	Mean	SD	Mean	S.D.	Mean	SD	Mean	S.D.	Mean	SD	Mean	S.D.	Mean	Mean	Meaan	Mean	Mean	Mean	Mean	Mean
1	1317	1446	1741	702	1566	486	1166	326	1098	226	2114	491	2102	304	25.8	28.6	3,,8	3.0	1.9	1.9	0.45	0.42
3	1916	2833	2171	396	2001	518	1056	257	1008	238	2112	414	2154	306	20.7	20.4	3.1	2.9	2.5	1.7	0.09	0.10
7	2527	2603	2311	483	2335	576	792	319	724	282	2017	441	1792	293	22.3	21.96	3.2	3.2	2.3	2.3	0.11	0.12
14	3480	3217	2912	649	2915	474	730	287	735	268	2046	305	1935	366	18.6	20.5	2.4	2.1	1.5	1.5	0.14	0.18
21	3253	3150	3023	646	2719	365	1200	420	960	154	2595	529	2712	391	15.2	15.3	2.0	2.1	1.4	15	0.26	0.23
24	3650	-	3700	774	3047	559	2219	429	1228	368	896	599	2280	305	11.8	-	2.1		1.7		0.24	
:26	2006	-	3477	736	-	-	2023	273		-	618	565	-	-	7.9	-	1.9		1.4		0.21	
28	4330	410:3	3236	704	3271	915	1999	243	1551	546	561	465	1978	554	12.8	12.7	2.3	1.9	1.8	1.0	0.31	0.23
35		4480			4118	889			1827	480			771	481		12.4		2.0		1.4		0.23
38		5126			4353	661			1849	416			658	441		12.7		2.1		1.4		0.22
42		4943			3699	821			1817	426			780	499		13.2		2.5		1.3		0.25

The microelements (Zn, Fe, Cu) decreased gradually in concentration as lactation progressed. Their values were 26-29, 3.0-3.8, and 1.9 mg/kg on day 1, respectively. They reached the minimum on days 26 and 28 in the groups of P and E. The concentration of Mg in the milk was the highest (about 0.4 mg/kg) on day 1 and the lowest on day 3. This increased slightly from 0.1 mg/kg (day 3) to a fairly constant value of about 0.2-0.3 mg/kg after day 21.

The effect of pregnancy

From the results it is obvious that the difference in milk composition of post-partum pregnant and empty (non-pregnant) does after the peak of lactation is traceable to faster or slower drying up. This theory is confirmed by CALVERT et al. (1985) who weighed the mammary gland and examined change in milk composition 0-120 hours after the last suckling. They stated that by 72 hours mammary weight had fallen indicating the start of involution (similar to drying up); fat, protein and Na content increased while K decreased similarly to our investigation during the second phase of lactation.

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Einfluß der trächtigkeit auf die komponenten der kaninchenmilch während der laktation - Bei 70 post partum trächtigen Häsinnen (P) und 54 p.p. nicht trächtig gewordenen Häsinnen (E) wurden die Milchkomponenten untersucht (Trockensubstanzgehalt, Fett, Protein, Albumin, Asche, Ca, P, K, Na, Zn, Fe, Cn und Mn). Die Zusammensetzung der Milch zeigte im Laufe der Laktation zwischen beiden Gruppen signifikante Unterschiede. Nach dem Höhepunkt der Laktation wurde der Unterschied in den Milchkomponenten zwischen den beiden Häsinnengruppen durch das schnellere (P) bzw. langsamere Trockenstellen (E) bestimmt.
