DEVELOPMENT OF THE ENERGY CONTENT OF SOW COLOSTRUM

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Abstract

Aim of this study was to determine the concentration of gross energy in sow's colostrum. Samples of colostrum were taken from 8 sows (White improved), which were at different farrow (1st to 4th). Sows were fed with feed mixture for lactating sows. Colostrum samples were taken per hand without injection of oxytocin from different mammary glands and in different time periods (0th; 1st; 2nd; 3th; 4th; 5th; 6th; 12th and 18th hour). Than were the colostrum samples lyophilized. The concentration of gross energy (GE) in colostrum samples was performed by Automatic Calorimeter AC500. Values of GE in samples of sows colostrum were analyzed by one-way ANOVA, the differences in average GE concentration of colostrum between different sampling times were tested with T-test ($P<0.05$) using a SAS system. We found statistically significance ($P<0.05$) in dry matter concentration and GE concentration in kg of dry matter between first sample (0.hour - took at time of birth of first piglet) and samples took at 12th hour from birth of first piglet. Concentration of GE in colostrum during parturition to 6th hour of lactation was in range from 5.14 to 5.51 MJ.kg^{-1}. After 6th hour to 18th hour (4.46 MJ.kg^{-1}) we detected decrease in gross energy concentration in colostrum.

Key Words: Sow, colostrum, energy

Animal performance is affected by genetic factors (Trakovická et al. 2005; Gábor et al. 2008; Kováčik et al. 2011), climatic conditions and environment (Mlynek et al. 2012; Lehotajová et al. 2012), health status (Kanka et al. 2014), hormonal status (Kolesárová et al. 2009) and by nutrition and feeding (Gálik et al. 2014). Sow reproductive efficiency is determined according to number of live born and weaned piglets in litter (Rolinec et al. 2013). Survival of piglets during first day after birth is known to depend mainly on a sufficient supply of energy from body reserves and ingested colostrum to meet the pig's requirement for heat production (Close, 1992; De Passillé et al. 1993). Survival of piglets in the first week depend on the concentration of immunoglobulins in colostrum as well (Rolinec et al. 2012). The intake of energy by piglets increased quadratically with the level of colostrum intake. The efficiency of metabolizable energy for energy retention is 91 ± 4% (Le Dividich et al. 1994). Seeing that the survival of piglets during first day depended mainly on the energy intake by colostrum, aim of this study was to determine the concentration of gross energy in sow's colostrum.

Material and Methods

All 8 sows (White improved) were from the Sheep and Pig Farm Žirany (VPP Kolíňany, Slovak University of Agriculture in Nitra). Sows in this experiment were at different farrow (1st to 4th) and were fed with feed mixture designed for lactating sows whit following nutritive parameters: 14.63% of crude protein, 3.74% of fat, 3.20% of crude fibre, 58.89% of nitrogen-free extract, 5.63% of ash and 12.30MJ.kg^{-1} of ME. At the day of parturition, the sows were not fed. All sows received the same feed mixture twice a day, 1.3 kg per 100 kg of live weight. Water intake was *ad libitum*. First sample of colostrum (0. hour) was collected immediately after birth of first piglet. Other samples of colostrum were collected 1, 2, 3, 4, 5, 6, 12 and 18 hours after birth of first piglet. Colostrum samples (approximately 15 to 25 ml) were milked by hand from 4 to 6 different mammary glands, without injection of oxytocin. Samples of colostrum were weighed and frozen in frozen flask at -40°C in deep-freeze cabinet (EVERmed, Italy). The frozen samples were lyophilised (Freeze Dryer Series, ilShin Europe, Netherland). After drying were samples homogenised and the gross energy (GE) of the colostrum samples was determined by Automatic Calorimeter AC500 (LECO Corporation, USA). The determined values of GE in colostrum samples were in normal distribution, which is necessary for following statistical analysis (Schubertová and Candrák, 2014). Values of GE in samples of sows colostrum were analyzed by one-way ANOVA, the differences in average GE concentration of colostrum between different sampling times were tested with T-test ($P<0.05$) using a SAS system 9.1. (SAS Institute Inc).

Results and Discussion

Quality of weaned piglets depend mainly on quality and quantity of colostrum and milk (Kanka et al. 2014; Rolinec et al. 2011). Colostrum has proved to be an efficient route for supply of energy to the pig during the first day after birth (Le Dividich et al. 1991; Herpin et al. 1992). Table 1 shows the gross energy concentration in sow's colostrum in different hours from beginning of farrowing. In the first 6 hours from birth of the first piglet is the gross energy concentration in range from 5.14 to 5.51 MJ.kg^{-1}. But then from 6th hour (5.25 MJ.kg^{-1}) decreased the GE content to 4.93 MJ.kg^{-1} (12thhour) and to 4.46 MJ.kg^{-1} (18th hour). Le Dividich et al. (1997) determined the concentration of GE in sow's colostrum, which contained different percentage of fat and dry matter. The results were as follows: colostrum with 2.5% of fat and 19.50% of dry matter contained 4.35 MJ.kg^{-1} gross energy; colostrum with 5.0% of fat and 21.09% of dry matter contained 5.02 MJ.kg^{-1} gross energy; colostrum with 7.5% of fat and 23.46% of dry matter contained 5.99 MJ.kg^{-1} gross energy and colostrum with 10.0% of fat and 25.16% of dry matter contained 6.78 MJ.kg^{-1} gross energy. It is clear, that mainly fat and dry matter concentration affected the gross energy concentration in colostrum. If we compare concentration of dry matter and gross energy in colostrum with results from Le Dividich et al. (1997), we can say, that our results are similar to their results.

Coffey et al. (1982) published in experiment with sows with different intake of animal fat in the feed mixture, that the average concentration of energy in sow's colostrum during first day of lactation is 1,517 cal.g^{-1} (6.34 MJ.kg^{-1}). Concentration of energy in colostrum in our experiment was at lower range as published Coffey et al. (1982), the reason may by, that the sows in our experiment were fed without addition of extra animal fat. Next finding of Coffey et al. (1982) was, that the energy of colostrum was at or near its highest level during farrowing in all treatment groups, that is similar to our results. In the nutrient requirement for pigs published by Petrikovič et al. (2005) is reported mean energy value of sow's colostrum 5.41 MJ.kg^{-1}, which is similar to our found.

Table 2 reports values for dry matter concentration of sow's colostrum. Dry matter was the highest at the time of birth of first piglet and its concentration decreased significantly to 18th hours from birth of first piglet. This decrease in the percentage of dry matter in the colostrum is similar to that found by Šamanc et al. (2013); Klobasa et al. (1987) and is attributed to a high decrease in the percentage of total protein as they published. In the nutrient requirement for pigs published by Petrikovič et al. (2005) is reported mean dry matter concentration of sow's colostrum 22.3%, which is similar to our results.

Table 1. Development of gross energy concentration in sows colostrum (MJ.kg^{-1})

Hours from birth of the first piglet	Average ± S.D.	Minimum	Maximum	Coefficient of variation
0.hour (n=7)	5.14 ± 0.59	4.51	6.02	11.42
1.hour (n=7)	5.22 ± 0.65	4.50	6.32	12.44
2.hour (n=7)	5.51 ± 0.63	4.61	6.52	11.48
3.hour (n=8)	5.43 ± 0.70	4.14	6.46	12.82
4.hour (n=7)	5.20 ± 0.80	3.78	6.19	15.37
5.hour (n=7)	5.27 ± 0.73	4.01	6.07	13.79
6.hour (n=8)	5.25 ± 0.75	3.84	6.07	14.34
12.hour (n=8)	4.93 ± 0.43	4.08	5.38	8.75
18.hour (n=2)	4.46 ± 0.71	3.95	4.96	16.03

S.D. - standard deviation; P>0.05 - significance was compared between 0.hour to other sampling times

Table 2. Concentration of dry matter and gross energy in dry matter of sows colostrum

Hours from birth of the first piglet	Dry matter (%)		Gross energy (MJ.kg^{-1} of the dry matter)	
	Average	S.D.	Average	S.D.
0.hour (n=7)	22.80	2.13	23.68	0.57
1.hour (n=7)	21.74	2.19	24.50	0.99
2.hour (n=7)	22.25	1.30	24.81	1.68
3.hour (n=8)	21.85	1.72	25.12*	1.32
4.hour (n=7)	21.27	2.18	24.53	1.36
5.hour (n=7)	20.36	2.15	25.07*	1.53
6.hour (n=8)	21.33	2.46	24.65	1.35
12.hour (n=8)	19.35*	1.46	25.44*	0.99
18.hour (n=2)	18.99	3.23	23.47	0.22

S.D. - standard deviation; * P<0.05 - significance was compared between 0.hour to other sampling times

Conclusion

Insufficient intake of energy by newborn piglets is one of the factors of surviving. Just sows colostrum is source of energy for newborn piglets, which have not energy from body reserves. Concentration of gross energy in colostrum during parturition to 6th hour of lactation is in range from 5.14 to 5.51 MJ.kg^{-1}. After 6th hour (5.25 MJ.kg^{-1}) of lactation to 18th hour (4.46 MJ.kg^{-1}) of lactation we detected decrease in gross energy concentration of colostrum.

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