

PRELIMINARY STUDY ON THE INTERRELATION BETWEEN SOW MILK QUALITY AND LITTER PERFORMANCE IN RELATION TO THEIR HEALTH

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Abstract

*Our objective was to determine whether the increase through diet of the fatty acids (FA) composition in sows colostrum and milk was associated with litter performances and their biochemical profile. The study was conducted in 4 sows TOPIGS (48 litter) allocated into 2 groups: control and Hemp diets. Litters were divided into two dietary treatments: control diet and control plus 2.5% additive based on *L. acidophilus* (50%) and *L. Plantarum* (50%) bacterial strain. The FAs composition of the colostrum and milk (7 and 21 days) was determined by gas chromatography. The sow and litter biochemical profile was determined with BS-130 automatic analyser. The addition of hemp in feed of Hemp group sows starting the last 10 days of gestation significantly influenced the colostrum and milk composition in polyunsaturated FAs, n-3 and n-6 FAs. In Hemp group α -linolenic FA content in colostrum was 1.4 times higher than in the control group, 1.64 times higher after 7 days of lactation and 1.45times higher after 21 days of lactation compared to control group. The dietary addition of hemp lead to a reduction of ratio n-6: n-3 in milk. This was positive reflected in the litter performances (>3.8% at litter from Hemp group sow compared to C group) and their health. The microbial additive reinforced the positive effects on growth parameters (>20%at litter from Hemp group sow and > 25% at litter from control group respectively). Both sows and piglets serum biochemical parameters were within physiological limit. In conclusion, feed composition can beneficially influence colostrum / milk fatty acids composition in relation to litter performances, biochemical parameters and health. Milk fat quality had positive effects on piglet performance and their health, as shown by the biochemical plasma parameters.*

Key words: sows, fatty acids, milk, litter performance, biochemical parameters

INTRODUCTION

Little is known about the interrelationships between feeding - sow milk quality - litters performances and their health status. In feeding management practices a special attention should be given to nursery-weaning period as a critical stage of piglet development. The feed intake is lower to suckling piglets. Piglets can be weaned prior to the maturity of the immune and digestive systems [5] through progressive introduction of compound feed. Thus, the piglets can be weaned at 21, 28 or 35d, but incomplete development of the enzymatic equipment cause feeding stress, physiological and

immunological disturbances [4], [8], [12]. The piglets' low feed intake required a high energy density of the diet. An increase of lipid level in order to improve energy density of the diet is not recommended because the fat utilisation is limited up to about 35d [4]. The problem raised is related to the structure and quality of lipids in term of fatty acids (FA) composition in sow milk and how piglets are affected of it. The main focus of the previous studies consist to influence of lactating diet on FA profile of the piglets [7], and on the effect of different dietary n-6:n-3 ratio or PUFA as result of different combinations of corn and linseed oil on FA composition and piglets performances [15]. It is well established that the dietary FA composition led to significant changes in FA composition of tissue [1], [7], [9]. This study was performed to determine the effects of

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dietary fat on the FA composition of sow colostrum and milk and response of their litters to milk intake and different diets. The changes in certain serum biochemical parameters in combination with the performance of piglets were assessed.

MATERIAL AND METHODS

The experimental procedures were approved by the by the Ethical Committee of INCDBNA Balotesti.

Animals and diet

At 100 d of gestation 4 multiparous sows TOPIGS were divided into two groups: C diet and Hemp diet. The Hemp diet group received 2% ground hemp seeds included in the compound feed. After farrowing, the compound feed formulation for the sows was adapted to the requirements of lactation. Thus, the Hemp diet group received 5% ground hemp seeds included in the compound feed. The piglets from each group of sows were assigned to two groups, as follows: control diet (C diet) and control plus 2.5% additive based on *L. acidophilus* (50%) and *L. Plantarum* (50%) bacterial strain with enzymatic action (CA diet). Isolation and selection of lactic acid bacteria was carried out using tissue culture medium MRS (Man, Rogosa and Sharpe) + CaCO₃, recognized internationally as being specific for lactic acid bacteria. The determination of the amylolytic activity was based on the hydrolysis of starch by α -amylase at pH 6.9 and a temperature of 30 °C. The method of determination of cellulolytic activity was based on the enzymatic hydrolysis of carboxymethylcellulose and dosing the reducing groups released by dinitrosalicylic reagent.

Both for the sows, in the two physiological states, and for piglets, the compound feeds were tailored according to the feeding requirements specific to Topigs hybrid.

The Jubileu variety of the hempseed delivery by SCDA Secuieni was used.

Sampling and analyses.

The piglets were weighed in the first day after birth, at 7, and 21 days, when they were weaned.

Milk / colostrum samples were collected in the first, 7th and 21st day after farrowing, according to the method described by Noblet [10]. Milk was collected from all functional mammary glands. The milk samples were stored at -20°C until analysed.

Blood samples (10 ml from sows and 6 ml from piglets) were collected from the piglets and sows in the first, 7th and 21st day of lactation, by puncture in the jugular vein, in heparin vacutainers (BD Vac Plastic Lithium Heparin/ Vacutest®, Italy). The samples were processed within one hour from collection. After blood samples centrifugation at 2500 rpm, for 10 minutes, at 4°C (Multifuge 3L-R, Heraeus, Hanau, Germany) the plasma was transferred into tubes and frozen at -80°C until analysed.

The gross chemical composition of the ingredients and compound feed was determined by standardized methods [2].

The fatty acids were determined by gas chromatography using a Perkin Elmer-Clarus 500 gas chromatograph, fitted with Flame Ionization Detector and capillary separation column with high polar stationary phase Agilent J&WGC Columns (method described by Hăbeanu [6].

Statistical analyses

The experimental data are presented as means and standard error of the mean (SEM). The statistical analysis of the data was done with SPSS statistic 20, 2011.

RESULTS AND DISCUSSION

A lot of factors affect the pig's health and survivability in the nursery period. There is a correlation between sow health and their feeding, as factors on which milk quality, thus piglet health, depend.

Diets and sows' milk quality

Previous studies [11] revealed increasing weaned piglets' bodyweight in relation with the sow dietary fat, but there were no data on fat quality. In our study, the 5% hemp included in the compound feed for lactating sows, increased by 53% dietary n-3 PUFA concentration compared to the classical feed, while n-6: n-3 ratio was 52% lower (Figure 1). Figure 2 shows FA composition of piglet feed: 3.83% n-3 PUFA and 51.86% n-6 PUFA which led to a n-6:n-3 ratio of 13.55%.

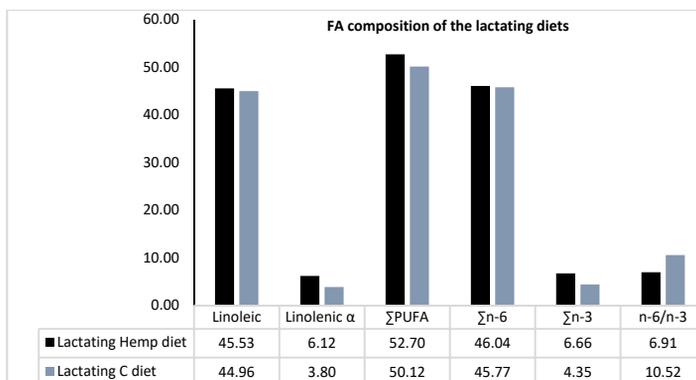


Fig. 1 Centesimal FA composition of the lactating sow diet

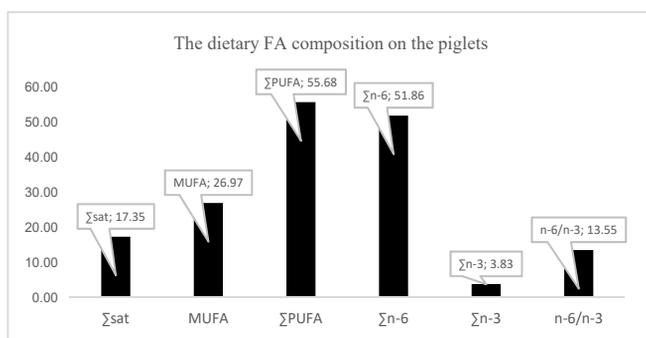


Fig. 2 Centesimal FA composition of the piglet's diet

Previous studies [13] showed that the addition of fats in sow diet improves the negative energy balance and modifies the production and quality of the milk. In our case, as expected, sow diet changed FAs concentration in the colostrum and milk (Figure 3). The fact that the Hemp diet sows received, during the two weeks before farrowing, a compound feed enriched in n-3 PUFA enhanced milk content of FA beneficial to health. Thus, a content of 6.66% n-3 PUFA in the Hemp treatment produced 1.41 times higher n-3 PUFA concentration in the colostrum compared to C diet and 1.46 times lower n-6:n-3 ratio (Figure 3). A similar trend of the sow milk was noticed after 7 and 21 days. In Hemp group α -linolenic FA content in colostrum was 1.4

times higher than in the control group, 1.64 times higher after 7 days of lactation and 1.45 times higher after 21 days of lactation compared to control group (figure 4).

Enzymatic activity of the microbial additive

The microbial additive used in our study in CA diet piglet feeding at a rate of 2.5%, consisted of 50% *L. plantarum* strain and 50% *L. acidophilus*, homogenized additive. The *L. acidophilus* strain didn't produce cellulase but this strain is most known for its effects in reducing gastro-intestinal disorders at the young animal. Instead, the *L. plantarum* strain had 1.5 mg glucose and an enzyme activity of 0.75. We mixed the two strains for synergistic effect in the digestive tract of piglets from CA diet.

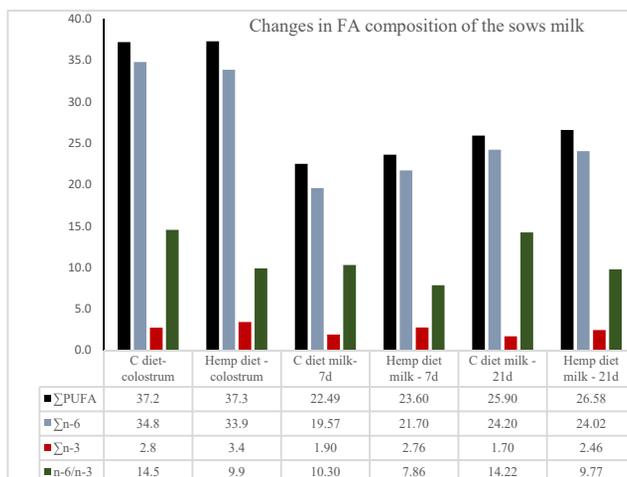


Fig. 3 Centesimal FA composition of the colostrum and milk at 7d and 21d

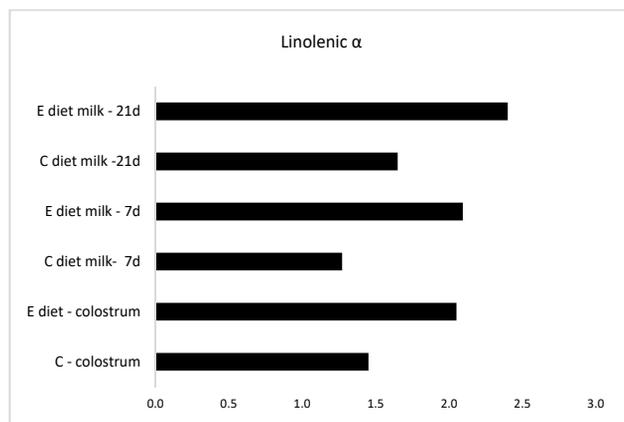


Fig. 4 α -linolenic FA composition of the colostrum and milk at 7d and 21d

Bioproductive performance of the piglets

A positive interrelation we noticed between sow milk quality and the bioproductive performance of the piglets up to weaning. The milk, modified by the diet enriched in PUFA via the dietary hemp seeds, influenced positively piglet's performances and their health state. Table 1 shows the performance (with and without microbial product) of piglets coming from sows fed differently (with and without hemp seeds). The average initial bodyweight of the piglets was rather similar in the four groups (1.57 kg \pm 0.26). Piglets' performances in the first 7 days from birth were significantly influenced by milk quality. Thus, the piglets from the Hemp diet group of sow had an average daily weight gain 1.67 times higher

than the piglets from the C group sow ($P = 0.001$). The same trend was noticed at 21 days (1.02 higher for the Hemp diet piglets), but the difference was not statistically significant. From about the age of 2 weeks, when the piglets started to receive solid food, until weaning, the effect was enhanced by the type of piglet feed. The piglets from the Hemp diet group, treated with the dietary microbial additive, had an average daily weight gain of 0.205 kg, 20.5% higher from the piglets coming from the same Hemp group, but not treated with microbial product, and 1.4% compared to CA piglets coming from C diet group ($P < 0.0001$). The microbial additive potentiated the positive effects on the piglets' performance.

Table 1 Piglet performance until weaning (21 days)

Items	Sow				SEM	P-value
	C diet		Hemp diet			
	Piglets					
	C diet	CA diet	C diet	CA diet		
Body weight:						
- 1 th after farrowing	1.32	1.58	1.84	1.60	0.13	0.12
- 7 th after farrowing	1.97	2.53	2.62	3.42	0.21	0.001
- 21 th after farrowing	4.86	6.02	5.32	6.35	0.24	0.15
Average daily gain:						
- 7 day	0.067	0.095	0.130	0.144	0.01	<0.0001
- 21 day (at weaning)	0.161	0.202	0.170	0.205	0.009	0.09

Biochemical profile

In this study, several parameters which are considered references for the health state, in direct relation with the diet and with milk quality, were evaluated both in the sows and in their piglets (Figures 5 and 6). These parameters ranged within the normal limits for the sows. Both for the C diet sows and for the Hemp diet sows, glycaemia increased in the first day after farrowing, while at 21 days, the values were close in reference with the

starting values during pregnancy. Cholesterol concentration was lower in the Hemp group sows both in the first day after farrowing, and at 21 days, while the triglycerides were lower at 7 and 21 days, irrespective of the treatment. In piglets, glycaemia and cholesterol concentration increased up to 21 days after birth, while triglycerides decreased, but with no significant difference between groups.

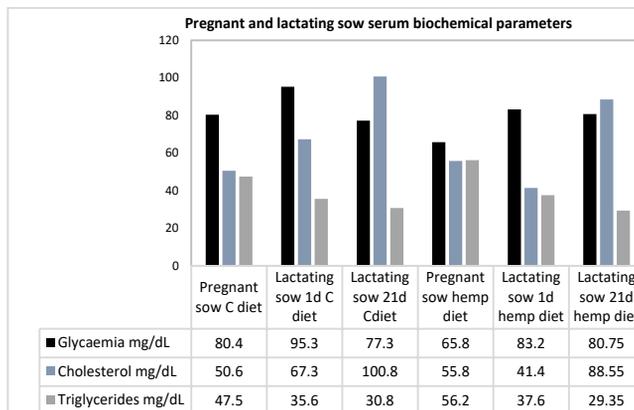


Fig. 5 Changes in certain biochemical parameters in pregnant and lactating sows
 Normal values: glycaemia 55 – 115 mg/dL; cholesterol – 78 – 200 mg/dL;
 triglyceride – 33-50 mg/dL [3], [14]

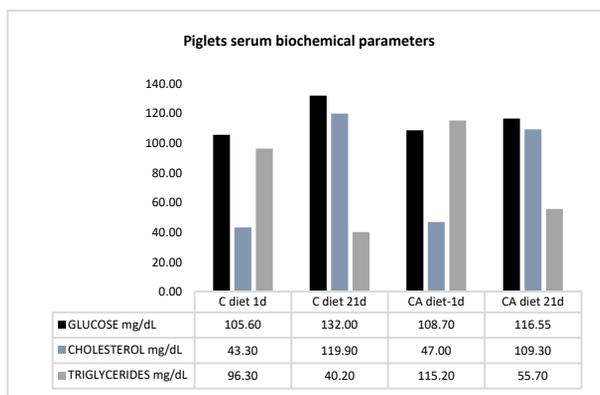


Fig. 6 Changes in certain piglets biochemical parameters at 1d and 7d. Normal values: glycaemia 55 – 115 mg/dL; cholesterol – 78 – 200 mg/dL; triglyceride – 33-50 mg/dL [3]

CONCLUSION

There was a positive interrelation between sow diet quality, milk composition and piglets' performance. A high dietary level of n-3 FA improved milk concentration of n-3 PUFA and decreased n-6 to n-3 ratio. Milk fat quality had positive effects on piglets' performance and their health, as shown by the biochemical plasma parameters.

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