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INFLUENCE OF MILK SUBSTITUTES AND GROWTH ACCELERATOR ON PERFORMANCE AND HEALTH IN WEANING PIGS

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Abstract

A scientific experiment was conducted in Agricultural Institute - Shumen with pigs, divided into three groups. Each group contained three litters, equalized by number of piglets. All animals were fed at will and received the Neopigg Rescuemilk and Neopigg Smooth supplements in I group, Neopigg Rescuemilk + Neopigg Smooth + growth accelerator "AXCLERA-P" (200 g per pig for the entire period up until weaning) - II group, Neopigg Smooth + AXCLERA-P (200 g per pig for the entire period up until weaning) - III group. Throughout the entire experiment, the consumption was reported daily, as well as health and percentage of dropout animals, live weight at birth, at weaning on the 28th day and in the end of the experiment at the 49th day. The addition of Neopigs Rescuemilk, Neopigs Smooth and Axclera-P day had a significant positive effect on average daily gain and weaning weight. When including dairy supplements during the suckling period (0-28th day), live weight at birth should also be taken into account, which is also a significant factor in the animals' development.

Key words: *accelerator, health, milk substitute, pigs, suckling pigs.*

INTRODUCTION

Contemporary pig breeding is implausible without the use of various growth stimulants, especially in young animals with an under-developed digestive and immune systems. In recent years, while assessing the urgency of the problem, scientists around the world have turned to the search of new natural and environmental growth stimulants, replacements for the nutritional antibiotics used today. Numerous feed additives are available on the market to help boost pigs' immune system, regulate the gut micro biota and reduce the negative effects of weaning and other environmental challenges (Yanhong et al., 2018)

A requirement of modern pig breeding is to know the precise nutritional needs of pigs and their breeding to develop adapted nutrition strategies and thus increase their productivity (Brossard et al., 2017).

Commonly used feed additives include acidifying agents, zinc and copper, prebiotics, directly fed germs, yeast, nucleotides and plant extracts that lead to improved pig breeding efficiency or enhanced animal immune function (Yanhong et al., 2018).

Organic acids are also widely used as nutritional supplements. They can cause a decrease in pH in the gastrointestinal tract and thus counteract the germs. Therefore, they are considered to be an alternative to the growth-enhancing antibiotics used for pigs. In addition, they play a role in reducing the ratio of harmful germs in the gastrointestinal tract (Kwak et al., 2017).

Nutritional strategies to improve feed efficiency are of particular interest as their use reduces environmental impact and improves the profitability of pig production. The pig digestive system lacks specific enzymes that break down some of the chemical bonds present in the non-starch polysaccharide fraction of the ration (i.e., arabinoxylans and β-glucans). Supplements are therefore used strategically to improve nutrient absorption and increase growth (Torres- Pitarch et al., 2020).

Energy is one of the most expensive nutrients in feeds. Since lipids are a concentrated source of energy, their incorporation has been known to affect growth rate and nutrition efficiency, but also known to affect rationing, food dustiness and granule quality (Kerr et al., 2015). On a global scale, feed has been reported to account for about 70-80% of the

cost of producing animals. That necessitates the creation of alternative nutrients that are inexpensive and at the same time able to supply the nutrients needed by animals for optimal growth and growth productivity (Achadu et al., 2018).
Such is the supplement AXCELERA-P, which is a complete feed for piglets before weaning. The composition also includes whey powder, whole soybean, oatmeal, palm oil, potato protein, brewer's yeast, wheat, monodicalcium phosphate, magnesium oxide.
Whey contains 20% of total milk protein. It has high biological value with abundant amino acids. Whey proteins consist mainly of α-lactoalbumin and β-lactoglobulin, which have positive health effects. Whey protein supplements improve protein synthesis, mineral absorption and circulation. It has various functional characteristics such as antioxidant capacity and thermal stability (Kim et al., 2016).
Soybean meal (SBM) and other soy based products contribute for the high quality protein in pig rations, because soybean protein is rich in the following limited amino acids: lysine, threonine and tryptophan which have low concentration levels in the most used cereals. Pigs digest amino acids in soybean protein in much higher levels, rather than those in other sources of protein (Stein et al., 2013).
Oat is a grain, rich in fibre, fat (2-12%) and has almost double the amount of lysine, compared to corn, and is rich in Vitamin B1, B2, B6 and Vitamin A, K and E. Oat helps maintain a normal gut function, reduces the risk of constipation and diarrhea and minimizes stressful behavior (Christy, 2018).
An advantage of using palm oil as an energy resource is the high caloric density and lack of fibre (Durán, 1994).
Potato protein concentrate is considered a valuable source of essential amino acids that can replace animal protein in pig production. Potato fibre preparations have been studied as a potential source of functional dietary fibre for feed and food. Dietary proteins and fibre have a great influence on the functional status of the gastrointestinal tract and, accordingly, on the immunology, health and productivity of pigs (Tusnio et al., 2011).
Brewing yeast is an agro-industrial by-product of brewing beer. It is valuable for animal husbandry because of its high protein content (about 45% of dry matter), which is high in amino acids, particularly lysine, vitamins, carbohydrates and fats (Achadu et al., 2018).
Over 40% of produced wheat and barley is used in livestock production. They are the main sources of energy in the ration for breeding and fattening pigs.
Compared to corn, wheat has significantly higher protein content - 12-12.5%. It is rich in starch and energy, but contains small amounts of fats (approximately 2%) and fibres (2-3%). The digestibility is high, superior to barley and oats in this respect, but not to corn (Ball and Magowan, 2012).
The aim of the experiment was to establish the effect of the addition of “Neopigg Rescuemilk” and “Neopigg Smooth” milk substitutes and growth accelerator “AXCLERA-P” on the growth, health and the percentage of dropping out in pigs.

MATERIALS AND METHODS

A scientific experiment was conducted in Agricultural Institute - Shumen with pigs, divided into three groups. Each group contained three litters, levelled by number of piglets. All animals were fed at will and received not only breast milk, but also “Neopigg Rescuemilk” and “Neopigg Smooth” milk substitutes and growth accelerator “AXCLERA-P”, according to the experiment scheme (Table 1).

Table 1. Experiment scheme

Groups	I group	II group	III group
Number of animals	37	36	39
Supplement	Neopigg Rescuemilk +	Neopigg Rescuemilk +	Neopigg Smooth +
	Neopigg Smooth	Neopigg Smooth +	AXCLERA-P (200g per pig for the entire period until weaning)
		AXCLERA-P (200g per pig for the entire period until weaning)	

Throughout the entire experiment, the consumption of milk substitutes was reported daily, as well as health and percentage of dropout animals. Live weight at birth, at weaning on the 28th day and in the end of the experiment at the 49th day were the other controlled traits.

RESULTS AND DISCUSSIONS

The results characterizing the reproductive traits and analysis of the F-test variance are presented in Table 2. The analysis of the results shows that the animals in the study groups were of high live weight at farrowing (1.6 kg) and normal development during the suckling period. The variation of signs was in the low range, with the influence of the trait "group" being reliable for all signs related to the weight dimensions and for the increase from 28 to 49 days (P≤0.05). A low degree of significance was observed for the other traits characterizing the 49th day growth.

Determination coefficients are medium to high in value for most of the reproductive traits (R2 = 62-82%) and show that the study factor accurately reflects the variation in traits in the model of analysis used. Low values were found for the increase from farrowing to the 49th day.

Table 2. Reproductive ability, determination coefficient (R^2) and ANOVA F-test

Traits	No.	Live weight, kg				Average daily gain, g			
		0	21th	28th	49th	0-21	0-28	28-49	0-49
	n=83	At weaning	21th	28th	49th	0-21	0-28	28-49	0-49
$\bar{x}$		1.63	5.39	8.90	13.34	198.25	269.27	243.96	283.87
SD		0.37	1.06	1.59	2.10	96.46	55.05	42.19	63.32
R^2		0.67	0.69	0.78	0.82	0.053	0.055	0.062	0.034
Groups	3	+	+	+	+	n.s.	n.s.	+	n.s.

Significance of differences: * - P≤0.05; n.s. - no significance.

The development results of piglets with the inclusion of various supplements during the suckling and post-weaning periods, expressed in terms of average daily gain and live weight are presented in Table 3.

The highest average daily gain for the period up to the 21st day was in pigs from II group, compared to those from group I (by 21.88%, p≤ 0.05) and group III (by 28.64%, p ≤ 0.01). The higher gain was probably due to the higher live weight at birth of the piglets (1.75 kg in II vs. 1.62 kg in I and 1.52 kg in III) in this group. Regarding the average daily gain on 28th day (at weaning), proven differences between the three experimental groups were reported. The second group with added milk N. Rescuemilk, N. Smooth and Axclera-P had a higher gain of 6.04% (P≤0.05) than the first group and 12.94% (P≤0.05)) compared to those in the third group.

The addition of the three types of milk had a positive effect on live weight at weaning. The live weight of the weaned piglets was highest in group II (9.41 kg), followed by those in group I (8.83 kg) and the lowest live weight was group III (8.30 kg), differences between the second group and the other two experimental groups were demonstrated at P≤0.05-P≤0.001. The trend of development during the period from the 28th to the 49th day remained the same as during the suckling period. Animals in the second group had a higher gain (0.257 kg) and live weight (14.08 kg) compared to those in Group I and III, with differences in both indicators being demonstrated at P≤0.01-P≤ 0.001.

Valuable nutrients are given by milk products when added for breastfeeding pigs. In addition, these nutrients were easily absorbed by the young animal's immature gastrointestinal system. The macronutrients of milk are butterfat, casein and whey proteins and lactose. Also, micronutrients such as minerals (e.g. calcium, phosphate), vitamins (e.g. vitamin A), immunoglobulins and enzymes determine its nutritional value. Nukamel's research reported by Croes (2014) showed that the digestible milk supplement (Nukamix) contained milk and vegetable protein (coconut and milk fats), and in the suckling and post-weaning period, better results were established for gain and feed intake. Considering the positive impact of added dairy products during the suckling period on the development and conservation of piglets, we should also note the significant effect on live weight at birth found not only in our study but in studies by numerous authors. Taking into account the greater farm impact, Pustal et al. (2015) found no effect of including additional milk in suckling pigs. Results from the study by Wolter et al. (2002) indicated that birth weight of piglets has a significantly greater effect on post-weaning gain rather than the increase of nutrient intake by supplemental dairy intake.

Table 3. Average daily gain and live weight

			Live weight, kg				Average daily gain, g				Live weight, kg				Average daily gain, g			
Factors		n	0	21th	28th	49th	0-21	0-28	28-49	0-49	0	21th	28th	49th	0 -21	0 -28	28-49	0-49
LSC		83	1.62 ± 0.40	5.36 ± 0.12	8.85 ± 0.17	13.27 ± 0.23	195.96 ± 10.56	267.51 ± 6.02	242.73 ± 4.59	282.60 ± 6.70								
G	1	30	1.60 ± 0.19	5.32 ± 0.19	8.83 ± 0.28	13.10 ± 0.37	185.67 ± 17.36	267.57 ± 9.89	239.57 ± 7.55	277.97 ± 11.51	**1-2 ***	**1-2 ***	**1-2 ***	**1-2 ****	**1-2 ***		**1-2 ***	
	2	31	1.75 ± 0.65	5.73 ± 0.19	9.41 ± 0.28	14.08 ± 0.37	226.29 ± 17.07	283.74 ± 9.73	256.94 ± 7.43	298.48 ± 11.32	**2-3 ****	**2-3 ****	**2-3 *****	**2-3 *****	**2-3 ****	**2-3 ****	**2-3 ****	**2-3 ***
	3	22	1.52 ± 0.77	5.04 ± 0.22	8.30 ± 0.33	12.64 ± 0.43	175.91 ± 20.27	251.23 ± 11.55	231.68 ± 8.82	271.36 ± 13.44								

Significance of differences: *** - P≤0.001; ** - P≤0.01; * - P≤0.05.

The studies of Václavková et al. (2012) showed that pigs with a live weight at birth of less than 1000 g have a lower average daily increase over the period from birth to weaning, and those weighing more than 1500 g have the highest average daily gain. The authors found that the birth weight of pigs affected their ability to grow. Pigs with a lower live weight had lower gain during all phases of the production cycle and remain lighter until the end of the fattening period.

According to Fix et al. (2010) higher live weight and higher average daily gain in heavier pigs was a result of their greater muscle fibre count and their dominance during the suckling period.

Animals with lower live weight at birth had a reduced number of muscle fibres, an underdeveloped liver and digestive system. This was the result of slower growth during the suckling period and post-weaning period compared to pigs with higher live weight at birth (Gondret et al., 2005).

Similar to our results were the results obtained by other authors. In the study of Ambroziak et al. (2017), mean body weights at 7.21 and 56 days of age differed between group I, II, III and IV. The daily gain in group I-IV increased during the growing period (days 1-7, 8-21, 22-56). The differences between the second and third groups were small (P≤0.05), and those between the first and fourth groups were significant. The correlation coefficient for pigs in group I (lighter at birth) and group IV (heavier at birth) confirmed the relationship between birth weight and weight at 7th (P≤0.01), 21st (P≤0.01) and 56th days of age (P≤0.05), with decreasing trends in the calculations. Birth weight in group I correlated with the average daily gain from day 1 to day 7 (r = + 0.365; P≤0.01) and from day 1 to day 56 (r = + 0.291; P≤ 0.05).

Nevrkla et al. (2017) concluded in an experiment with suckling pigs, that the birth weight of the pigs influenced the growth rate before weaning, after weaning and during the fattening period. Pigs with higher live weight at birth reached slaughter weight earlier, which reduced feed consumption and the costs associated with fattening.

Rehfeldt et al. (2006) found that pigs with a lower live weight at birth grew slower and accumulated more fat until they reached pre-slaughter live weight. This was probably due to the lower myofibrillar hyperflation. The lighter pigs, according to the authors, had a lower meat quality, expressed in greater loss of water and reduced brittleness.

Ambroziak and Rekiel (2017) found a positive correlation between birth weight and weaning weight, as well as between birth weight and slaughter weight.

According to other authors, the live weight at birth of pigs has an impact not only on their development, but also on their dropout rate and their productivity. Mortality in low-live-weight pigs was high. As the average live weight at birth increased, the percentage of surviving pigs increased. The weight at birth of piglets larger than ≥1.60 kg guaranteed a better level of gain and survival (Ambroziak et al., 2017).

According to a study by Pietruszka et al. (2017), weight at birth can influence sperm production in adult boars and can be used as selection criteria to determine replacement animals (boars). Reduced body weight in boars limits their ability to grow through puberty (up to 180 days of age), while higher live weight at birth restricts growth levels only during sperm production.

CONCLUSIONS

The addition of Neopigs Rescuemilk, Neopigs Smooth and Axclera-P in suckling pigs from birth to weaning on the 28th day had a significant positive effect on average daily gain and weaning weight. The inclusion of only two of the additives (Neopigs Rescuemilk + Neopigs Smooth) in the first group and (Neopigs Smooth + Axclera-P in the third group) had a smaller effect on the development. When including dairy supplements during the suckling period (0-28 day), birth weight should also be taken into account, which was also a significant factor in the animals' development.

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