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*Analysis of Relative Growth of Piglets Born Prematurely After Hormonal Induction by Sows Fed Standard or Oiled Mixture**

Analiza wzrostu względnego prosiąt urodzonych przedwcześnie, po indukcji hormonalnej, przez lochy żywione mieszanką standardową lub natłuszczoną

Over the last years there have been trials to include hormonal limitation of natural individual variation at reproductive processes through synchronization of their duration as a constant element of technology. However, apart from some favourable effects in organization, some new problems emerge related to short duration of results following the actual interference or more often – degression of reproduction indices. The researches made on reproductive efficiency of gilts subjected to estrus synchronization by Finn S. T. and Didion B. A. (3), Kirkwood R. N. (6), Mariscal D. K. et al. (8) proved practical utility of hormonal interference and safety for both, animal health and the following stages of the reproductive process. The next phase of the reproductive processes stimulation at pigs is hormonal induction of parturitions and shortening their course. So far the examinations and observations have been made among others by Diehl J. R. et al. (1), Jackson J. R. et al. (4), Kirkwood R. N. and Aherne F. X. (5) do confirm usefulness and good results of induction treatment applied to obtain a higher efficiency of parturition service by attendants. Still, attention should be paid to the fact that piglets born prematurely may show lower body weight in proportion to the number of days their prenatal period was cut down.

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The experimental attempts to counteract some undesirable after-effects of accelerated parturition induction on newborns concerned mainly an energetic value increase in feeding stuff for the sows in the final trimester of pregnancy J a c k s o n J. R (4), M i g d a ł W. and K a c z m a r c z y k J. (9), P e t t i g r e w Jr. J. E. (11), S t a h l y T.S. (12), W a l k i e w i c z A. et al. (14).

The objective of the present authors` research was to determine to what extent premature parturition induction causing somatic underdevelopment of newborns influences their growth throughout the raising period as well as to establish to what degree an energetic value increase of feeding stuff(due to plant fat additive) for pregnant sows affects the dynamics of body weight gain up to 42nd day regarded as the weaning date.

MATERIAL AND METHODS

The primigravida sows of similar characteristics (age,body weight,utility) PL breed were used in the experiment. The animals were selected from a breeding herd of 64 pigs and divided into two experimental groups with differentiated feeding levels. Over the consecutive 2nd and 3rd reproductive cycles the sows from both groups were fed a rich mixture balanced according to the standards (1993). What is more, from 90th pregnancy day up to 21st day of the lactation period the sows of 2nd group were administered a mixture oiled with purified rape oil in the amount increasing energetic value of feed by 8% in relation to the base dose. A daily fodder ration for pregnant sows amounted to 3 kg, while during the lactation period it was increased up to 6 kg. The fodder was given twice in equal portions. Among the sows of two groups there were separated 4 sub-groups, 8 pigs each. The sows from 6 analogical sub-groups were subjected to parturition induction with hormone $PGF_2\alpha$ use. The preparation was administered in the amount of 10 mg/individual on 111th, 112th or 113th pregnancy day, respectively. The other two sub-groups were treated as control where parturition had a spontaneous character. All the sows and piglets under observation were provided with permanent veterinary inspection.

Throughout the reproductive cycle the sows were weighed three times,whereas the piglets every seventh day,starting with the 1st day following birth till 42nd day i.e. the weaning day. The numerical data they were worked out statistically with Duncan test with a computer programme SPSS.

DISCUSSION

The induced parturitions took place 24 hours after hormone administration,whereas at sows giving birth spontaneously after 114.8 days of pregnancy. The size of litters from the sows fed a standard mixture (12 MJEM and 120 g digestible protein) is presented in Table 1, while the size after the sows were given oiled mixture (energetic value increased by 1 MJEM) is found in Table 2. Besides, the tables show the data depicting the raising effects and a level of characteristics variation in relation to parturition type and term.

Table 1. Size of litters born after hormonal induction or spontaneously by sows fed a standard mixture

Mention	Induction deliveries in days gestation						Spontaneously deliveries	
	111		112		113			
	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD
Litters size	16	-	16	-	16	-	16	-
Piglets born in litter:								
living quantity	10.81	2.4	11.30	2.1	11.32	1.8	11.10	1.9
stillborn and drop dead in parturition day %	5.04^{a}	0.6	5.22	0.5	4.87	0.4	4.63^{b}	0.3
Size of piglets inlitter with 22 day-quantity	10.29	2.3	10.54	2.0	10.83	1.6	10.79	1.8
Size of piglets inlitter with 42 day-quantity	10.03^{a}	2.1	10.29	1.9	10.58^{b}	1.4	10.56^{b}	1.5
Piglets wastage to 21 day %	4.81^{A}	0.3	6.72^{a}	0.5	4.32^{a}	0.2	2.79^{Bb}	0.2
Piglets wastage to 42 day %	7.21^{A}	0.4	8.93^{a}	0.7	6.53^{a}	0.3	4.86^{Bb}	0.1

A; B – means followed by capital letters are different at $p \leq 0.01$.
a; b – means followed by small letters are different at $p \leq 0.05$.

The data imply that mean number of piglets born in 2nd and 3rd litters from the sows in every group was only slightly differentiated and was equal to the means obtained in domestic breeding piggeries. However, there was marked a significantly, effect of a parturition type and date. In the sub-groups of the sows subjected to induced parturitions on 111th day of pregnancy as compared to those with later induction of parturitions, i.e. on 112th and 113th days, as well as the sows bringing forth spontaneously there occured losses increased by 0.4 – 1.6% due to piglets stillborn or dead on the parturition day. This relation appeared more distinct in group of sows fed with a rape oil additive. The findings prove that in the litters induced the earliest, that is on 111th day newborns fell more often and as a consequence a smaller size of litters by 0.53 – 1.41 individuals on average was recorded. The differences turned out to be significant at the level $P \leq 0.05$. In the experiments done by other authors like K i r k w o o d R. N. (6), W e l k F. and F i r s t N. L. (15), W i e r z c h o ś E. and P e j s a k Z. (16) the findings indicated a danger of higher losses at the perinatal period of piglets born after premature induction. The results presented in Tables 3 and 4

Table 2. Size of litters born after hormonal induction or spontaneously by sows fed oiled mixture with rape oil

Mention	Induction deliveries in days gestation						Spontaneously deliveries	
	111		112		113			
	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD
Litters size	16	-	16	-	16	-	16	-
Piglets born in litter:								
living quantity	10.86	2.2	10.82	1.9	10.80	1.7	10.91	1.9
stillborn and drop dead in parturition day %	6.4^{A}	0.5	5.7	0.3	5.10	0.4	4.8^{B}	0.3
Size of piglets inlitter with 22 day- quantity	9.98	1.7	10.03	1.6	10.01	1.6	10.18	1.1
Size of piglets inlitter with 42 day- quantity	9.93	1.6	9.86	1.9	9.96	1.7	10.11	1.5
Piglets wastage to 21 day %	8.10^{A}	0.8	7.30^{a}	0.8	7.31^{a}	0.6	6.69^{Bb}	0.5
Piglets wastage to 42 day %	9.48^{A}	0.9	8.87^{a}	0.8	7.78	0.7	7.33^{Bb}	0.7

A; B – means followed by capital letters are different at $p \leq 0.01$.
a; b – means followed by small letters are different at $p \leq 0.05$.

Table 3. Body weight changes of piglets in litters born after hormonal induction or spontaneously by sows fed a standard mixture

Body weight of piglet on day	Induction deliveries in days gestation						Spontaneously deliveries	
	111		112		113			
	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD
1st day after birth	1.08^{a}	0.2	1.16^{b}	0.2	1.14	0.2	1.19^{b}	0.2
7th day rearing	2.14^{a}	0.3	2.21	0.2	2.26^{b}	0.3	2.35^{b}	0.4
14th day rearing	3.71	0.8	3.82	0.6	3.94^{b}	0.4	4.09	0.5
21st day rearing	5.44^{a}	1.3	5.60	1.1	5.69	1.2	5.87^{b}	1.1
35th day rearing	7.62	1.8	7.84	1.7	8.06	1.8	8.17	1.9
42nd day rearing	10.28^{Aa}	2.4	10.79	2.1	11.03^{b}	2.2	11.24^{B}	2.3

A; B – means followed by capital letters are different at $p \leq 0.01$.
a; b – means followed by small letters are different at $p \leq 0.05$.

Table 4. Body weight changes of piglets in litters born after hormonal induction or spontaneously by sows fed oiled mixture with rape oil

Body weight of piglet on day	Induction deliveries in days gestation						Spontaneously deliveries	
	111		112		113			
	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD
1st day after birth	1.17	0.2	1.20	0.2	1.22	0.3	1.20	0.2
7th day rearing	2.28	0.4	2.32	0.3	2.36	0.4	2.38	0.4
14th day rearing	3.79[a]	0.8	3.91[a]	0.7	4.07	0.7	4.13[b]	0.6
21st day rearing	5.87	1.3	5.99	1.3	6.04	1.2	6.08	1.3
35th day rearing	8.09	1.7	8.14	1.8	8.26	1.7	8.22	1.6
42nd day rearing	10.74[a]	2.1	11.03	2.3	11.24	2.2	11.38[b]	2.1

a; b – means followed by small letters are different at $p \leq 0.05$.

Table 5. Relative growth indices at piglets after spontaneous or induced parturitions of sows fed a standard mixture

Growth periods	Induction deliveries in days gestation						Spontaneously deliveries	
	111		112		113			
	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD
From birth to 7th day	139.81	24.56	129.30	22.71	140.35	26.22	138.65	24.91
From 8th to 14th days	104.67	17.82	104.07	19.51	106.19	19.70	105.53	17.66
From 15th to 21st day	66.57	8.76	66.49	8.62	63.45	7.98	62.10	8.09
From 22nd to 35th day	57.90	8.21	57.14	8.30	59.40	7.76	55.87	6.94
From 36th to 42nd day	49.87	7.30	53.69	7.82	52.60	6.91	53.61	6.38
From birth to 42nd day	83.76	11.24	82.14	7.92	84.39	8.14	83.15	7.83

Table 6. Relative growth indices at piglets after spontaneous or induced parturitions of sows fed oiled mixture with rape oil

Growth periods	Induction deliveries in days gestation						Spontaneously deliveries	
	111		112		113			
	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD
From birth to 7th day	135.04	22.16	133.33	20.86	132.78	21.04	140.00	22.56
From 8th to 14th days	94.29	10.33	97.84	10.59	103.39	12.86	105.04	14.72
From 15th to 21st day	54.00	8.26	75.96	7.34	69.04	7.12	67.31	6.47
From 22nd to 35th day	46.72	7.69	51.25	6.29	52.48	6.08	50.16	5.77
From 36th to 42nd day	81.68	6.33	50.61	6.71	51.45	6.52	54.86	6.43
From birth to 42nd day	83.76	12.34	81.79	11.23	81.83	11.07	83.47	11.50

inform about the level of mean values and variation range of live piglets weight in relation to the experimental factors. As to piglets birth weight parturition induction proved to be unfavourable and dependant on its realization date. In most comparisons made this dependence was of significant or highly significant character and concerned both, the sows fed standard and with a fat additive. The piglets of lower birth weight due to premature parturitions i.e. induction on 111th day, throughout the raising period were not able to come up to those at the same age but after the spontaneous parturitions. A difference of piglet mean body weight reaching 480 – 960 on 42nd day was statistically significant ($P \leq 0.01$). What draws attention here is a clear more favourable weight values arrangement of piglets raised by the sows fed with a fat supplement.

Actually, irrespective of a parturition date all the piglets born by the sows fed abundantly showed a higher body weight at every weigh term as compared to those coming after the sows fed standard mixture. These relations marked particularly strongly on 42nd raising day because then a difference in to mean body weight of piglets born after induction on 111th day was equal to 460g, whereas in the sub-groups of sows bringing forth spontane usly it was higher by 140g in those fed with a rape oil ingredient. The results and confirmed relations are concurrent to the data published in the papers of other authors F a r m e r C. et al. (2), J a c k s o n J. R. et al. (4), K l o b a s a F. et al. (7), K i r k w o o d R. N. (6), M i g d a ł W. and K a c z m a r c z y k J. (9), P a s c h m a J. (10), T r i t t o n S. M. (13), W a l k i e w i c z A. et al. (14).

On the basis of the data from the subsequent weighs of piglets over the raising period up to 42nd day indices of relative growth were calculated in order to depict the dynamics of body weight changes over week intervals and sub-periods marked with their feeding levels, that is mother`s milk up to 21st day and administering additive feed from 21st to 42nd days. The findings presented in Table 5 and 6 show that dynamics of the newborn growth was concurrent during the first raising weeks with only slight prevalence in the groups of piglets of lower body weight, i.e. after sows fed standard mixture.

At the following age interval,that is from 14th to 21st days the piglets in the litters from sows fed with a fat additive demonstrated decisively more intensive weight gains and then subsequent differentiation was observed consisting in more intensive growth compensation at piglets after sows fed standard and this trend persisted till the end of the raising period. The relations, as the observations showed, resulted from a different response of piglets at the beginning of fattening period. The piglets after the sows fed standard and showing lower mean body weights started to seek and benefit from additional feed earlier compared to piglets that sucked mother`s milk richer in fat as the sows had been fed an oiled mixture. The effect of fat ingredient in the diets of feeding sows on a

fat level was confirmed in numerous experiments by Jackson J. R. (4), Migdał W. and Kaczmarczyk J. (9), Paschma J. (10), Stahly T. S. (12), Tritton S. M. et al. (13), Walkiewicz A. et al. (14).

The analysis of the results of piglets relative growth over the 7-day periods during the raising time was considered in relation to a birth type and did not point to such dependences. Therefore, it may be stated that piglets after premature parturitions induced hormonally show a similar growth rate, yet, due to lower body weight should be provided with a possibility of earlier accesss to a very rich mixture – a milk substitute because at regular conditions up to 42nd day the piglets are not able to obtain the gains that could equal them to the animals at the same age after spontaneous parturitions.

CONCLUSIONS

1. A rape oil additive in the amount of 8% of standard dose energetic value for the reproductive sows did not affect a litter size that figured out at 10.9 individuals on average.

2. The sows administered an oil rape ingredient over 90th pregnancy day to 21st lactation day brought forth to newborns heavier by 50g on average as compared to those fed a standard mixture.

3. Hormonal induction of parturitions on the final days of pregnancy (111th, 112th or 113th days) did not influence the piglet number in a litter in a significant way, although in case of the earliest induction there appeared piglets losses (stillborn or died on the parturition day) increased by 0.4 – 1.6% at perinatal period.

4. Premature parturitions induction significantly influenced newborns body weight and the most substantial somatic under development was recognized in the piglets after induction on 111th day of pregnancy.

5. In the successive weeks of piglets raising there was recorded a differentiated dynamics of relative growth dependent mainly on birth weight and nutritive value of milk consumed. The piglets fed by sows fed with a fat additive showed a clearly better development over 14th to 21st days followed by a decline of growth dynamics. This fact resulted from a poor interest of piglets in additional feed consumption.

REFERENCES

1. Diehl J. R., Godke R. A., Killian D. B., Day B. N.: Induction of Parturition in Swine with Prostaglandin $F_2\alpha$. J. Anim. Sci., 38, 1229-1235, 1974.

2. Farmer C., Robert S., Matte J. J.: Lactation Performance of Sows Fed a Bulky Diet During Gestation and Receiving Growth Hormone-Releasing Factor During Lactation. Journal of Animal Sci., 74, 6, 1298-1306, 1996.
3. Finn S. T., Didion B. A.: Enhancing Superovulation in Swine. Elsevier Science Inc. 655, 51, 1, 1999.
4. Jackson J. R., Wurley W. L., Easter R. A., Jansen A. H., Odle J.: Effects of Induced of Delayed Parturition and Suplemented Dietary Fat on Colostrum and Milk Composition in Sows. J. Anim. Sci., 73, 1906-1913, 1995.
5. Kirkwood R. N., Aherne F. X.: Increasing the Predietability of Cloprostenol Induced Farrowing in Sows. Can. J. of Anim. Repr., 2, 57-59, 1998.
6. Kirkwood R. N.: Pharmacological Intervetion in Swine Reproduction. Amer. Assoc. Swine Practitioners., 7, 1, 29-35, 1999.
7. Klobasa F., Werhahn E., Butler J. E.: Comparison of Sows Milk During Lactation. J. Anim. Sci., 64, 1987.
8. Mariscal D. K., Bergfeld E. Y., Cupp A. S., Kojima F. N., Fike K. E., Sanchez T., Wehrman M. E., Johnson R. K., Kittok R. J., Ford J. J., Kinder J. E.: Concentration of Gonadotropins, Estradiol and Progesterone in Sows Selected on an Index of Ovulation Rate and Embryo Survival. Elsevier Science Inc. Amsterdam, 1, 31-43, 1998.
9. Migdał W., Kaczmarczyk J.: Wpływ oleju rybnego w dawkach pokarmowych dla loch na skład chemiczny mleka i wyniki odchowu prosiąt. Acta Agr. et Silv., 29, 47-57, 1990.
10. Paschma J., Alaviuhkola T., Suomi K.: The Effect Of Vegetable Oils and Animal Fat Supplement in a Diet on the Reproductive Performance in Sows. Rocz. Nauk. Zoot. 23, 4, 199-209, il. bibliogr. rez. streszcz. Zsfassung, 1996.
11. Pettigrew Jr. J. E.: Suplemental Dietary Fat for Peripartal Sows – A Review. J. Anim. Sci., 53, 1, 1981.
12. Stahly T. S., Cromwell G. L., Simpson W. S.: Effects Level and Source of Supplemental Fat in the Lactation Diet of Sows on the Performance of Pigs from Birth to Market Weight. J. Anim. Sci., 51, 352-360, 1981.
13. Tritton S. M., King R. H., Campbell R. G., Edwards A. C., Hughes P. E.: The Effects of Dietary Protein and Energy Levels of Diets Offered During Lactation on the Lactational and Subsequent Reproductive Performance of First-Litter Sows. Animal Sci., 62, 3, 573-579, 1996.
14. Walkiewicz A., Kamyk P., Wielbo E., Stasiak A.: Wpływ dodatku oleju rybnego w żywieniu loch karmiących na zawartość tłuszczu w mleku i wyniki odchowu miotów. Ann. Univ. Mariae Curie-Skłodowska, sectio EE, vol. 13, Lublin 1995.
15. Welk F., First N. L.: Effect of Oxytocin on the Synchrony of Parturition Induced by $PGF_2\alpha$. J. Anim. Sci., 1, 347-351, 1979.
16. Wierzchoś E., Pejsak Z. Induction of Parturition in Sows with Prostin $PGF_2\alpha$ in Commercial Swine Farms. 8-th Int. Congr. Anim. Prod. A. J., Kraków 1976.

STRESZCZENIE

Doświadczenie przeprowadzono na 64 lochach w 2 i 3 cyklu rozpłodowym, podzielonych na 2 grupy oraz 4 podgrupy w każdej z grup. Czynnikami doświadczalnymi były: poziom żywienia

loch (1 grupa żywiona standardowo, 2 grupa z dodatkiem oleju rzepakowego zwiększającym o 8% wartość energetyczną dawki w okresie od 90 dnia ciąży do 21 dnia laktacji) oraz indukcja porodów w 111, 112 lub 113 dniu prośności.

Wykazano, że dodatek tłuszczu w żywieniu loch nie miał wpływu na liczebność miotów, która wynosiła średnio 10,9 szt. Powodował natomiast zwiększenie masy urodzeniowej prosiąt średnio o 50 g w stosunku do grupy loch żywionych standardowo. Indukcja przedwczesnych porodów miała niekorzystny wpływ na liczebność miotów przy urodzeniu, bowiem zwiększyły się o 0,4-1,6% straty okołoporodowe, a także na masę ciała noworodków. Prosięta z urodzeń indukowanych w 111 dniu ciąży miały średnio około 70 g mniejszą masę w stosunku do rodzących się spontanicznie. Rozkład wskaźnika wzrostu względnego prosiąt wskazuje na to, że urodzone przez lochy otrzymujące dodatek tłuszczu w okresie od 14 do 21 dnia rozwijały się szczególnie intensywnie, jednak w następnym okresie następowało osłabienie dynamiki wzrostu, powodowane mniejszym zainteresowaniem prosiąt pobieraniem paszy dodatkowej.