EFFECTS OF A PERINATAL ZEARALENONE DONATION ON REPRODUCTIVE ORGANS FROM SOWS AND FEMALE PIGLETS

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Abstract

On the International Workshop „Research in Pig Breeding“ in 2007 first results from a field experiment working with the mycotoxin zearalenone (ZON) have been presented. The title was “Zearalenone and its effect on sows and piglets”. In this study the effects from a ZON-donation during the last time of gestation and the suckling period was investigated. Therefore several parameters from 15 sows and their 161 life born piglets were collected. Now there are some more results available about the analysis of the bile of sows and piglets and the milk of sows. In addition to that more animals (plus 3 sows and 32 piglets comparing with first article) could be included into different calculations. With regard to the birth weights there were no differences comparing piglets from ZON-sows with CON-sows found. On life day 19 higher values for piglets having ZON influence during lactation time (GL and nGL) were detected. There were no changes looking to the weights from reproductive organs from sows and piglets including more animals. The lab defined zearalenone and their metabolites α- and β-zearalenol (α- and β-ZOL) in the bile and in the milk. For ZON-sows all mycotoxins were detected in the bile, but just ZON in the milk. In the bile from piglets, having no influence from ZON during lactation time (nGnL and GnL), no ZON was found. Just α-ZOL was detected for 2 animals. Piglets, having influence from ZON-sows during lactation (nGL and GL), ZON and also α-ZOL accumulated in the bile.

Key Words: Zearalenone, reproductive organs, sow, piglet

Mycotoxins are toxic secondary metabolites produced from fungi. They occur in plants and especially on cereals like wheat, barley and maize. One category is *fusarium gramminarium* which forms zearalenone and deoxynivalenol (Roth et al. 1990). The development of mycotoxins is influenced by several environmental conditions. So benefit failures while crop rotation, soil management, choice of variety or hybrid and correct fungicide use the growth of fungi (European Commission 2006a).

Mycotoxins are general problematical for animal husbandry. Zearalenone as one type of Mycotoxins has negative effects especially for swine production. The literature characterizes diseases for piglets (e.g. low birth weight, genital-/rectumprolaps), gilts (e.g. retardation of puberties beginning), sows (e.g. enlargement of uterus, cysts on ovaries), boars and fattened pigs (Kuiper-Goodmann et al. 1987 and Schnurrbusch 2006).

In the European Union no limit values for zearalenone concentration in animal feed are defined. There are “just” guidance values for complementary and complete feedingstuff intended for pigs. There should be no more ZON than 0,1 mg/kg for piglets and gilts and 0,25 mg/kg for sows and fattening pigs in the feed (European Commission 2006b).

Material and Methods

The aim of the field study was to find out which influence has an artificial ZON-donation to sows and their piglets in the last gestation and during the suckling period. It was possible to include 15 sows and 139 piglets in the calculations. The sows are originated from a criss-cross bred female based on German Landrace and German Large White breeds and are sired by a Duroc boar to produce a slaughter generation.

The donation of ZON for 7 sows started on 101st day of gravidity and ended on 20/21st day of lactation. Everyday during the time of gravidity ZON was given in the same dosage of 4,5 mg per sow and day. After farrowing the dosage increase in dependency on the feed uptake (after recommendation of the German Agricultural Society) and ranged from 3,75 till 11,25 mg ZON per sow and day.

To look for a transmission from ZON over the milk of sows the piglets were involved in a special cross-fostered system. So piglets from sows getting ZON were transferred to sows without a ZON exposition and vice versa. This generated 4 groups with piglets getting a different ZON influence seen in Table 1.

Recordings of the weight were carried out on the 1st, 7th, 15th and 19th day of life. Also the weights of reproductive organs from sows (uterus, ovaries) and piglets (uterus, ovaries and cervix) were recorded after slaughtering on 20/21st day of lactation. Findings were analysed with Microsoft Excel and Microsoft SPSS.

Results

Eich and Schmidt (1998) and Schnurrbusch (2006) talk about higher mummifications, smaller litter sizes, less life born piglets, a higher mortality rate during the first days of life and lower birth weights. These parameters should cause a higher mortality rate during the whole suckling period. The facts described from different authors did not corroborate with the results of the trail. During the 3 weeks suckling period 19,88% from 171 born piglets died. But no influence from ZON during gravidity ("GL", "GnL") and during lactation ("nGL", "GL") was detected (Table 2).

After Schnurrbusch (2006) a ZON influence should decrease the birth weight from piglets. Looking to Table 3, the trail shows something different. Piglets born from ZON sows (GL and GnL) have equal birth weights compared to piglets born from CON sows (nGnL and nGL). Also there was no influence detected from ZON during the time of lactation. Comparing weights from piglets from all groups at the end of lactation (19th LD) the lowest weights were found for group nGnL (5,44 ±1,19 kg) and GnL (5,39 ±1,02 kg).

Noticeable were higher standard deviations for life weights in every age for piglets were influenced by ZON the whole time (GL). So the variation of weights is much higher. For piglet producers this fact affects adversely. Aim for producers of fattening pigs destined for slaughtering are homogeneous groups with similar weights and meat quality. They are result of good health and development possibilities. But they also result in similar growth during the producing system (Wähner, 2009).

Table 1. Groups of piglets with different ZON-influence, year 2007

group	ZON during gravidity	ZON during lactation	ZON-application	
nGnL	-	-	not not	during gravidity during lactation
nGL	-	+	not	during gravidity during lactation
GL	+	+		during gravidity during lactation
GnL	+	-	not	during gravidity during lactation

Table 2. Mortality rate (in %) for piglets with different ZON influence during the suckling period, year 2007

	nGnL	nGL	GL	GnL
mortality rate	41,2%	11,8%	32,4%	14,7%
n	14	4	11	5

Source: own calculations

Table 3. Comparison of average weight and standard deviation of piglets with different ZON influence, dependingon the age of the piglets, year 2007

groups		weight, 1st day (age)	weight, 7th day (age)	weight, 15th day (age)	weight, 19th day (age)
nGnL (n = 53)	kg	1,36 ±0,29	2,64 ±0,47	4,39 ±0,93	5,44 ±1,19
nGL (n = 23)	kg		2,69 ±0,62	4,49 ±0,87	5,68 ±1,03
GL (n = 38)	kg	1,36 ±0,24	2,78 ±0,69	4,56 ±1,20	5,62 ±1,49
GnL (n = 25)	kg		2,85 ±0,36	4,29 ±0,73	5,39 ±1,02

Source: own calculations

Also the weights from reproductive organs were covered. Naumann (2006) detected in her dissertation much higher uteri for sows getting ZON in a lower rate than this trail (in some extent over 1000 g). The analysis of this experiment showed also higher uterus weights in average (ΔZONsows/CONsows= 99 g) for sows getting ZON before, but it was not statistically confirmed. Interestingly the uterus weights in average from the piglets getting ZON during the lactation ("GL" and "nGL") time are lower in comparison to piglets suckled from CON sows. It seems that growth development of uterus is retarded by ZON.

The weights of ovaries („l"/left and "r"/right) from sows with ZON influence were lower than CON sows (Δ"l"/"r"= 0,69/0,62 g). Looking to the piglets there was no tendency in ovarian weight. Reasons are the low values for all piglets.

As well as for the ovaries there are no trends in the cervical weights of piglets (Table 4).

For this trail the milk and the bile from all sows and the bile from selected piglets of all groups were analysed for Zearalenone and two metabolites (α- and β-Zearalenol). In the milk just Zearalenone was detected for ZON-sows in a concentration of max/min value = 1,97/0,00 ng/ml. In the bile from ZON sows all substances were found. In piglets bile Zearalenone and α-Zearalenole were detected. The concentration of these toxins shows a high variation for sows and piglets (Table 5).

Table 4. Comparison of average weight and standard deviation from reproductive organs of sows and their piglets with different ZON influence, year 2007

sow	uterus (in g)	ovar, left (in g)	ovar, right (in g)
total (n=15)	392 ± 112	4,42 ± 1,23	4,62 ± 1,01
ZON (n=7)	445 ± 127	3,87 ± 1,19	4,08 ± 1,22
CON (n=8)	346 ± 77	4,90 ± 1,12	5,09 ± 0,47
piglet	uterus (in g)	cervix (in g)	ovaries (in g)
total (n=47)	1,35 ± 0,38	0,14 ± 0,05	0,10 ± 0,03
nGnL (n=12)	1,37 ± 0,37	0,16 ± 0,07	0,11 ± 0,03 (n=11)
nGL (n=11)	1,33 ± 0,40	0,13 ± 0,04	0,09 ± 0,03
GL (n=13)	1,24 ± 0,39	0,12 ± 0,03	0,09 ± 0,03 (n=12)
GnL (n=11)	1,49 ± 0,35	0,16 ± 0,05	0,10 ± 0,02

Source: own calculations

* recording datas after slaughtering the sows 22th day of lactation

** recording datas after slaughtering the piglets 20/21th day of life

Table 5. Maximum and minimum values from concentration of Zearalenone, α- and β-Zearalenol (in ng/ml) in the bile from sows and piglets, year 2007

	Zearalenone (Max/Min)	α-Zearalenol (Max/Min)	β-Zearalenol (Max/Min)
CON sows	-/-	-/-	-/-
ZON sows	>1250/614	>1250/1250	38,8/1,67
GL	84,9/0,55	71,85/0,00	-/-
nGL	53,5/1,10	104,1/0,00	-/-

Source: own calculations

Conclusion

In reflection of the findings of mortality and the body weights depending on different ZON donation no influence to the piglets could be identified. There was just a negative influence to the homogeneity of piglet weight at the end of the suckling period.

There are also no statistical significant differences between the weight of reproductive organs from sows and piglets in dependency on a ZON donation. There were just tendencies for higher uterus and lower ovaries weight of ZON sows. There was a low level of information from reproductive organs from selected piglets. Reason was the low single values for uteri, cervix and ovaries.

Zearalenone and their metabolites were detected in different concentration in the milk from sows and the bile from sows and piglets. This fact attests that there is a transfer from Zearalenone from sows to their suckling piglets. Interesting was the high variation from concentration of these toxins in different mediums. It shows a high individual influence to different parameters from single animal to a Zearalenone donation.

It needs to be waited for results from histomorphological researches from sows and piglets specimens (lifer, kidney and genitals) generated.

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