



Immunocastration of boars in Slovenian conditions

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ABSTRACT

Four groups of pigs: boars (B), gilts (G), surgical castrates (SC) and immunocastrates (IC) were tested in groups with 24 animals between ages 80 and 167 days. The group IC was vaccinated against gonadotropin-releasing hormone with commercial Improvac® (Pfizer Inc.) vaccine at ages 70 and 130 days. The IC animals grew faster (1022±66 g/day) than G (922±70 g/day, $P<0.05$), SC (998±62 g/day, N.S) and B animals (1044±87 g/day, N.S). IC animals (54.83±4.35 kg) produced more meat than SC animals (51.04±3.80 kg, $P<0.05$). The feed:gain conversion ratio (kg feed per kg gain) was statistically significantly lower ($P<0.05$) in IC (2.99±0.18) in comparison to the SC animals (3.23±0.28). The income for every single pig was calculated according to Austrian paying scheme and based on 21-months average noted price. The feed costs and castration costs were calculated from the internal data of the company where the experiment was done and in the same time period. The total disadvantage of SC comparing to G animals was 11.70 EUR. The immunocastration would cover that gap. The difference between the G and IC animals is only 0.35 EUR in advantage of G animals. The results show enormous advantage of immunocastration, but inadequate realisation of relatively complicated subcutaneous application can cost all the advantage of immunocastration, because of boar taint.

(Keyword: pig, immunocastration, profitability)

INTRODUCTION

Individually penned boars grow faster and are leaner than barrows due to anabolic effect of testicular hormones (Xue *et al.*, 1997). Pauly *et al.* (2008) found, that the boars eat less (1.88 versus 2.23 kg per day) and have better feed:gain conversion ratio (2.43 versus 2.69 kg feed per kg gain) than barrows. When the animals grow in a group, the sexual mature boars are socially more active, they eat less and grow more slowly than barrows (Cronin *et al.*, 2003). In some countries immature boars are slaughtered as normal fatteners, but not in Slovenia. The average slaughter weight of fatteners in Slovenia was 91.80 kg in year 2009 with an estimated meat percentage of 60.03 (Kovač *et al.*, 2010). Surgical castration of male pigs is a common praxis in Slovenian pig production.

The meat of sexually mature boars has specific taint. The immunization against gonadotropin – releasing hormone has a long term effect on hormonal profile (Zaramatskaia *et al.*, 2008). Immunised animals do not produce testosterone. Animals are called immunocastrates. The vaccination also eliminates the boar taint and improves growth performances of boars (Dunshea *et al.*, 2001). The consequence of immunocastration is faster and cheaper growth of leaner male animals without boar taint.

The positive effect on growth, feed:gain conversion and body composition of immunocastration was confirmed in many studies, but not in Slovenian conditions. The

aim of this study is to find out if the immunocastration of boars would improve the profitability of pig industry in Slovenia.

MATERIALS AND METHODS

The experiment was done on Slovenian pig farm Ihan. It consisted of four groups: gilts (G), surgical castrates (SC), immunocastrates (IC) and entire males – boars (B).

Experimental animals were born in time interval of 14 days or two weeks. Animals were organised in two week groups. Fifty boars, twenty five castrates and twenty five gilts were selected every week. Animals were organised in two groups (first and second week of birth). Twenty four animals per group, twelve per week, were randomly chosen in the experiment before first vaccination. The IC group was vaccinated the first time with 2 ml IMPROVAC® (Pfizer Inc.) *subcutaneous* at the average age of 70 days. Animals were weighted first time at average age of 80 days. The second weighing was done at average age of 130 days and the third 37 days later at the age of 167 days or one day before slaughtering. At the second weighing (37 days before the end of the experiment or fifty days (seven weeks) after first vaccination) IC group was vaccinated the second time with the same quantity of vaccine. After first weighing animals were housed individually and fed *ad libitum*. Feed consumption was measured.

Two different feed formulations were used during the experiment: the first one between ages of 80 and 130 days (BEK 1) and the second between age of 130 days and the end of experiment (BEK 2). Both formulations based on maize and soya bean. BEK 1 consisted of minimum 16.5% crude proteins, minimum 1.00% lysine and 12.89 MJ of metabolic energy per kg feed. BEK 2 consisted of 15.0% crude proteins, 0.90% lysine and 12.60 MJ of metabolic energy per kg of feed. The feed prices in this study are from internal feed price list in the company.

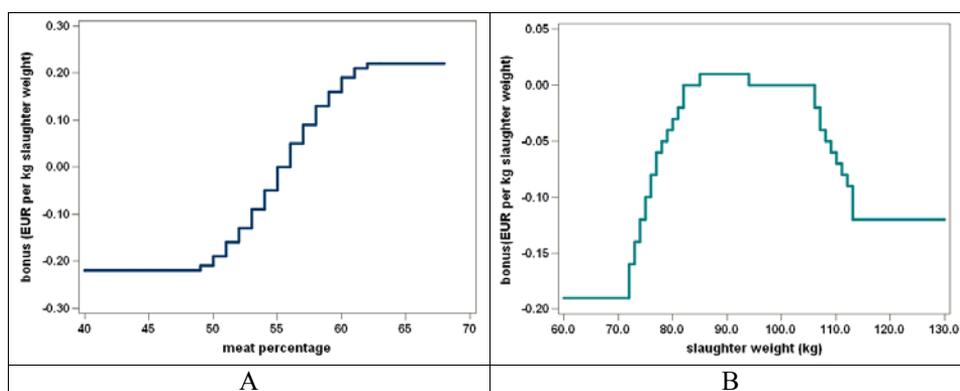
Animals were slaughtered at the end of the experiment. The carcasses were weighed just after slaughtering (slaughter weight). The meatiness of pigs was estimated according to Slovenian official method (*Pravilnik*, 2005). The revenue for every single pig was calculated according to Austrian noted price and Austrian paying scheme which are both widely used in Slovenia. Because of small production and because the majority of imported pig meat is coming from Austria and because a significant part of Slovenian pigs are slaughtered in Austria, pig prices are the same in Slovenia as in Austria. The bonuses for meat percentage and for slaughter weight according to Austrian paying scheme are presented in *Figure 1*.

Figure 1 shows the bonuses on top of basic price. Basic price is calculated as noted price reduced for ten eurocents. The noted price is an estimated average price for kg of slaughter weight of pig, slaughtered in Austria. Austrian paying scheme prefers heavy pigs with slaughter weight between 82 and 106 kg. Lightweight pigs are heavily penalized. Pigs heavier than 106 kg are also penalized, but not so highly. The bonus for meat percentage increases between 56 and 63 percent of meat. The bonus for meatiness over 63% is the same as for 63% of meat. The price for pigs with meatiness under 56% is reduced. The noted price in this study is an average noted price between April 8th, 2008 and December 31st, 2009. The average price of feed was calculated in the same time period. Longer time interval would be better, but that period was chosen because the Austrian paying scheme was slightly changed on April 8th, 2008. The average noted price in that period was 1.431 € per kg slaughter weight. The average price BEK 1 (growth period between ages 80 and 130 days) was 0.199 and average price for BEK 2 (growth period between ages 130 and 167 days) was 0.180 EUR per kg feed. The feed

prices were relatively high in that period because of the high level of cereal prices on international market. The costs of surgical castration at the age of 3 days was estimated on 0.30 € per animal. The costs of immunocastration were estimated (IMPROVAC® and labour) on 3.70 EUR per animal.

Figure 1

Austrian paying scheme (bonuses) for meatiness (A) and slaughter weight (B)



The data were evaluated with SAS-STAT, procedure ANOVA program with simple 1-way model in which the effect of group (SC, IC, G and B) was included.

RESULTS AND DISCUSSION

In the *Table 1* the results from analysis of variance and the group means tested with the Scheffe's multiple-comparison test are presented. Sales revenue for boars is hypothetical because boars are not classified as fatteners. The real price for boars is 0.60 EUR per kg slaughter weight. The calculated sales revenue for boars is used only for comparison of growth and feed efficiency of boars with the other groups of animals in the study.

The SC animals were at the age of 80 days slightly lighter than animals from other groups, but the difference was not statistically significant ($P < 0.05$). At the end of experiment SC animals (117.1 kg) were heavier than G animals (112.1 kg) ($P < 0.05$) and lighter than B (122.3 kg) and IC animals (121.0 kg, $P < 0.05$). Slaughter weight shows the same pattern as weight of animals. The weight of the last two groups did not differ at that age. SC group grew slightly more slowly than B and IC groups, but the difference between those two groups was not statistically significant ($P < 0.05$). Group G grew statistically significantly ($P < 0.05$) more slowly than the other three groups (922 g per day comparing to B group with 1044 g per day, IC group 1022 g per day and SC group 998 g per day). This can be explained with the small quantity of feed, which was consumed per day by G animals. Animals from group G (gilts) were in the last period of the experiment sexually mature. Faster growth of group B and better feed: gain conversion ratio comparing to G and IC group was often found (*Dunshea et al.*, 1993). It is expected, that the individually penned boars grow like in our experiment, where they grew faster than any other male castrates (*Cronin et al.*, 2003).

Table 1

The probability for effect of group in model

	Model group (P)	Mean (group)			
		B (Means for groups boars)	IC (Immuno-castrates)	SC (Surgical castrates)	G (Gilts)
Weight 1, kg (at age 80 days)	0.4335	31.3±4.5a ¹	31.6±4.4a	29.8±4.1a	31.5±3.9a
Weight 2, kg (at age 167 days)	<0.0001	122.3±8.8a	121.0±6.7a	117.1±4.7ab	112.1±5.8b
Gain, kg (between ages 80 and 167 days)	<0.0001	90.9±7.3a	89.3±5.4a	87.3±5.7a	80.6±6.1b
DG, g/day (daily gain in the same period)	<0.0001	1044±87a	1022±66a	998±62a	922±70b
Slaughter weight, kg	0.0005	94.95±7.59a	93.31±6.01a	90.98±4.00ab	87.96±5.06b
Meat %	<0.0001	60.01±2.60a	58.75±2.36a	56.11±3.54b	60.33±2.76a
Meat, kg (quantity of meat)	<0.0001	56.93±4.52a	54.83±4.35ab	51.04±3.80c	53.05±3.60bc
DFC, kg (daily feed consumption in the period)	0.0007	2.94±0.31b	3.06±0.24ab	3.21±0.17a	2.98±0.19b
FCR (feed:gain conversion ratio in the period)	<0.0001	2.82±0.16b	2.99±0.18b	3.23±0.28a	3.24±0.22a
FC, EUR (feed costs in the period)	<0.0001	48.53±4.26b	50.68±2.96ab	53.18±3.40a	49.44±3.33b
FCC, EUR (feed and castration costs)	<0.0001	48.53±4.26b	54.38±2.96a	53.48±3.40a	49.44±3.33b
FC/kg, EUR (feed costs per kg gain in the period)	<0.0001	0.568±0.034b	0.568±0.031b	0.662±0.053a	0.614±0.042c
Revenue/kg, EUR (revenue per kg slaughter weight)	<0.0001	1.47±0.09a ²	1.43±0.09a	1.33±0.13b	1.46±0.08a
Revenue / pig, EUR	<0.0001	138.99±11.56a ²	133.38±12.80ab	121.14±13.39b	128.79±10.55ab

¹ the groups with the same letter are not statistically different (P<0.05); ² the revenues for boars are hypothetical; the boars are not classified fatteners

Meat percentage of B (60.01), G (60.33) and IC animals (58.75) did not differ (P<0.05) between the groups. Meatiness was in that groups statistically significantly larger than in SC group (P<0.05). The effect of surgical castration was expected and positive. As a consequence of slightly higher slaughter weight (statistically nonsignificant) and higher meatiness, the quantity of meat was in IC animals more than 2.5 kg larger than in surgical castrates. The quantity of meat, produced by IC animals was smaller than the quantity, produced by B, but the difference was not statistically significant (P>0.05). The lower daily feed consumption of boars comparing to any other sex or castrates and better

feed:gain conversion ratio was found in most studies like *Fuchs et al.*, 2009, *Dunshea et al.*, 2001, and *Dunshea et al.*, 1993.

Differences between groups for sales revenue, feed costs (FC) and costs for feed and castration per pig (FCC) are presented in the *Table 2*.

The calculated hypothetical revenue of IC comparing to B animals was 5.61 EUR lower. The difference was not statistically significant ($P < 0.05$). The revenue of IC animals was 4.95 EUR higher than the revenue of G and 12.94 EUR larger than the revenue of SC animals. The last difference was statistically significant ($P < 0.05$). The revenue by gilts was also 7.64 EUR larger than by surgical castrates, but the difference was not statistically significant ($P < 0.05$). If we suppose that half of the born animals are males and half females, the average price per kg slaughter weight would increase from 1.40 on 1.45 EUR and the average revenue per pig from 125.0 EUR for 6.1 EUR on 131.1 EUR. The turnover for the farm like Ihan, which produces 110 thousands pigs per year, would increase for more than 670 thousands EUR.

Table 2

Differences between groups

	Difference					
	IC-B [†]	IC-G	IC-SC	G-B [†]	G-SC	SC-B [†]
Sales revenue / pig	-5.61	4.59	12.24*	-10.20*	7.65	-17.85*
FC (costs for feed)	2.14	1.24	-2.51	0.90	-3.75*	4.65*
FCC (costs for feed and castration per pig)	5.84*	4.94*	0.89	0.90	-4.05*	4.95*
Total 1 (total benefit from revenue and feed costs (EUR))	-7.75	3.35	14.75	-11.10	11.40	-22.5
Total 2 (total benefit from revenue, feed costs and castration costs (EUR))	-11.45	-0.35	11.35	-11.10	11.70	-22.8

[†] the revenues for boars are hypothetical; * the boars are not classified as fatteners

The effect of feed cost is much weaker. The feed costs for IC were 2.51 EUR lower than for SC group and 1.24 larger than in gilts. The differences were not statistically significant ($P < 0.05$). When the costs for feed and castration were summarized (FCC), the differences between B and IC (B group 5.84 EUR less costs) and between G and IC (G group 4.94 EUR less costs) became statistically significant ($P < 0.05$). The difference between B and IC groups is however only hypothetical because the boars in Slovenia are never categorised and paid as fatteners.

Differences between groups for summarized benefits from revenue and feed (Total 1) and for summarized benefits from revenue, feed and additional castration costs (Total 2) are presented in *Table 2* and *Figure 2*. The results are not statistically evaluated. The total benefit of immunocastration was compared to surgical castration +14.75 EUR (Total 1) or +11.35 EUR (Total 2). The benefit of immunocastration covered the gap between the SC and G groups; IC group and G group were on the same benefit level.

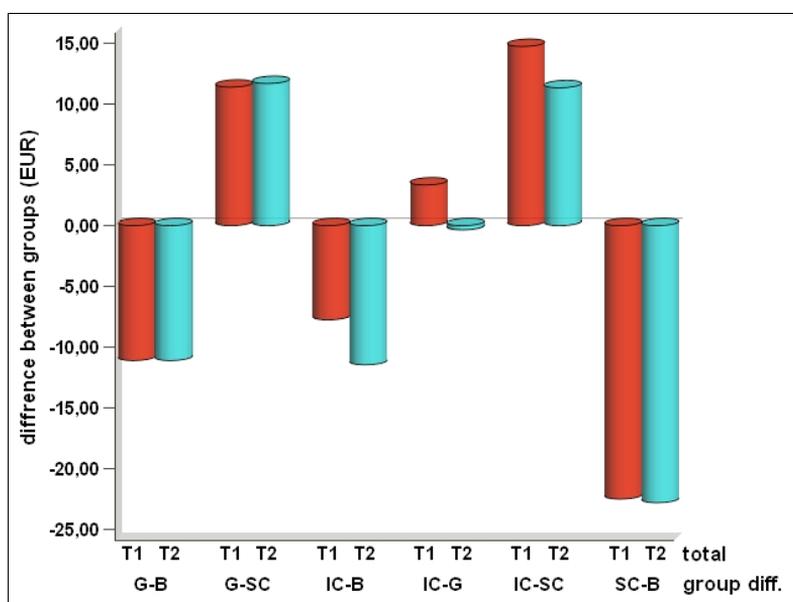
The results from the study show that the immunocastration is enormously superior method compared to classical surgical castration. The animals grow faster, they have better

(leaner) body composition and convert feed in body mass better than surgical castrates – more meat for less money. Unfortunately animals were not tested in production conditions where it is expected ten to twenty percent lower daily gain for castrates and gilts and adequate change of feed: gain conversion ratio. The experiment in production conditions without observation of individual feed intake will be done in the near future.

If the effect of castration will only be partial, the economic efficiency of immunocastration could be heavily affected. Such small batch of animals was very carefully injected. It is difficult to secure one hundred percent successful subcutaneous administration of vaccine in production conditions, where hundreds of animals would be treated daily. Only one smelling animal, classified as boar, would cost the benefit of seven to eight successfully immunocastrated animals. The reaction of consumers on immunocastration in Slovenia was not studied and is unknown.

Figure 2

The differences between groups B, G, IC and SC for Total 1 and Total 2



CONCLUSIONS

Castration of male pigs is a common praxis in European countries where heavier pigs are slaughtered. The castration is a common praxis also in Slovenia. Surgical castrates grow more slowly than boars. They have higher feed:gain conversion ratio and are fatter than gilts. The new commercial vaccine against gonadotropin – realising hormone, Improvac® is already registered in European market. In an experiment where the gilts, boars, immunocastrates and surgical castrates grew in individual pens from age of 80 to 167 days, immunocastrates grew faster ($P < 0.05$, 1022 g/day) than gilts (922 g/day). The daily gain of boars (1044 g/day) and surgical castrates (998 g/day) was not statistically different from the daily gain of the immunocastrates. Immunocastrates produced in live

period 2.5 kg more meat in carcasses ($P < 0.05$) than surgical castrates. The feed:gain ratio (kg feed/kg gain) in immunocastrates was only 2.99 ± 0.18 comparing to 3.23 ± 0.28 in surgical castrates. The means were statistically different ($P < 0.05$).

The income for every single pig was calculated according to Austrian noted price and Austrian paying scheme which are both widely used in Slovenia. The immunocastration has a positive effect on revenue and on costs per animal. When the costs of castration are included, the total benefit of immunocastration brings the efficiency of immunocastrates on the level of gilts. The total benefit of more efficient growth and better body composition of immunocastrates comparing to surgical castrates was 11.35 EUR per animal. Such benefit can be secured only if the realization of problematic *subcutaneous* administration is done successfully.

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