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# EFFECT OF ACIDIFICANTS IN FEED ON THE GROWTH PATTERN OF PIGS DURING THE PRE-FATTENING PERIOD

# DJELOVANJE ACIDIFIKANATA U HRANI NA RAST SVINJA U PREDTOVU

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SUMMARY

The aim of the study was to determine the effect of two different acidificants on the growth pattern of piglets during the period from weaning until the attainment of 30 kg body weight. A total of 336 pigs were included in the study, divided in two equal groups (Fra Acid, n=168; Acidad Dry®, n=168). On the basis of weaning weight, piglets were divided into "light" (L = 6 kg) and "heavy" (H = 8 kg) groups. Two acidificants, which varied in organic acid content, were used in the piglet diets. Feed was supplemented with Fra Acid at a concentration of 0.65, 0.60 and 0.40 %. The second supplement, Acidad Dry®, was added at concentrations of 0.35, 0.30 and 0.20 %. Piglets were individually weighed at weaning, on the 23rd day of age and again each time the feed was changed (at days 35, 49 and 82 of age). The experimental groups did not differ significantly in body mass during the experimental period. Piglets with Acidad Dry® achieved higher daily gains than piglets fed with Fra Acid, but again, the relationship was not statistically significant. "Heavy" piglets in the Acidad Dry® supplemented treatment had significantly higher daily gains in the period from 49 to 82 days of age in comparison to those in the Fra Acid treatment (567 ± 80g; 507 ± 140 g, *p=0.044*).

Key words: pigs, growth rate, organic acids, tannin

## INTRODUCTION

Early weaning is often followed by a disruption in the growth trajectory which is accompanied by *diarrhea*. Organic acids in the feed improve both digestibility and pig growth (Lallès et al., 2007). They increase the activity of proteolyses enzymes, thereby improving protein digestibility and also reduce the proliferation of pathogenic cells in the digestive tract (Kim et al., 2005; Kil et al., 2006). Furthermore, they are thought to increase the passage time of digesta

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in the intestine, appear to be a source of energy, are involved in chelating minerals and stimulate digestive enzymes. Despite these positive effects, the high financial cost of supplements has led breeders and feed producers to attempt to find alternative compounds with the same effects (Kil et al., 2006). The addition of tannin to feed in conjunction with organic acids has been found to promote the growth of weaning piglets (Essel and Huber, 1998) whilst having no negative influence on added enzymes (Salobir et al., 2005).

## MATERIAL AND METHODS

The experiment was performed according to the Slovenian Law Regulating the Protection of Animals (1999).

### Animals

In each treatment group (Acidad Dry®, Fra Acid) 168 pigs were used in the experiment. All animals were crossbreeds (Swedish Landrace x Large White) and were ear tagged and weighed on days 23, 25, 49 and 82 of age. From each treatment group piglets were selected into two groups (6 kg, 8 kg) on the basis of the weaning weight.

### Dietary treatments

Acidad Dry® was composed of the water extract of sweet chestnut *(Castanea sativa Mill)* wood, formic acid, lactic acid, *DL-citric acid* and *DL-malic acid* (Tanin, Slovenia). Fra Acid LFM LIQUID consisted of formic acid (59.8%) and lactic acid (19.2%), but lacked tannin (Tanin, Slovenia).

### Feed mixtures

Six different feed mixtures (three for each group of piglets) were used in the experiment, the chemical composition of which is presented in Table 1. Fra Acid fed piglets had three different concentrations of the additive Fra Acid in basal diets, which is not the same as the additive in the Acidad Dry® fed group of piglets.

### Housing and management

Groups of 25 piglets were housed in pens measuring 2.3 x 3.0 m with plastic-coated perforated floors with apertures of 1 x 5 cm. *Ad libitum* feeding was performed by dosing machines (turbomat). The pens received both natural and artificial light (60 lx) and piglets had *ad libitum* access to water through automatic nipples. Additional heat and ventilation was provided to allow the temperature of 28 ºC at weaning and a reduction of one degree during each subsequent week.

**Table 1. Declared chemical composition of the experimental feed and quantities of supplement added to these basal diets**

**Tablica 1. Utvrđen kemijski sastav pokusne hrane i količine dodatka u osnovnim obrocima**

| Ingredients - Sastojci | Feed - Hrana | | |
|---|---|---|---|
| | Lipovital | PU-starter | PU-grover |
| Raw protein - Sirove bjelančevine (%) | 17.50 | 18.00 | 18.00 |
| Raw fat - Sirova mast (%) | 4.50 | 4.50 | 4.00 |
| Raw fiber - Sirova vlaknina (%) | 5.00 | 3.70 | 3.50 |
| Raw ash - Pepeo (%) | 6.00 | 4.49 | 4.26 |
| Lysine - Lizin (%) | 1.28 | 1.30 | 1.15 |
| Metabolic energy - Metabolička energija (MJ/kg) | 13.60 | 13.60 | 13.60 |
| | | | |
| Additives - Dodaci | | | |
| Fra Acid (kg/t) | 6.5 | 6.0 | 4.0 |
| Acidad Dry® (kg/t) | 3.5 | 3.0 | 2.0 |

### Data analysis

Differences within and between groups were analyzed using the SPSS 14.0 statistical package. Analyses of variance were performed using ANOVAs and mean differences were tested with independent sample *t*-tests.

## RESULTS AND DISCUSSION

The weaning weight of the Acidad Dry® ***fed*** piglets at 23 days of age was 7.30 kg whilst that of the Fra Acid control group was 7.13 kg (Table 2). At the first recording point at 35 days of age, pigs in the Fra Acid group weighed 9.06 kg and those in the Acidad Dry® group weighed 9.08 kg (*p=0.919*). By 49$^{th}$ day of age, animals in the Acidad Dry® treatment were heavier than those in the Fra Acid group, but not significantly (13.57 kg, 13.54 kg, *p=0.937*). Weights on day 82 showed a greater difference between treatments, amounting to 0.91 kg. Piglets in the Fra Acid treatment grew 10g/day faster between days 23 and 35 than those in the alternative treatment, but this difference was not statistically significant *(p=0.208)*. In the following period (days 35-49) the difference between treatments in ADG was smaller and the means were associated with greater standard deviations.

During the third period (days 49-82) there was a tendency towards better growth in the Acidad Dry® group than the Fra Acid group (0.535 ± 0.120 g/day, 0.511 g/day ± 0.128, *p=0.085*). Considering the whole experimental period, the Acidad Dry® group tended to achieve a higher ADG in comparison with the Fra Acid group (*p=0.097*).

By day 35 of age, piglets weaned at 6 kg BW in the Fra Acid group had a higher body weight than those in the Acidad Dry® group (7.91 ± 0.74 kg, 7.63 ± 0.69 kg, *p=0.186*). In the following period (day 49) Fra Acid piglets were found to be 0.59 kg lighter than the Acidad Dry® supplemented ones, but this difference was not significant *(p=0.287)*. On the final weighing day, animals in the Fra Acid group weighed 0.80 kg more than those in the Acidad Dry® group, but again, the difference was not statistically significant (*p=0.583)* probably as a consequence of the high SDs.

From Table 3 it is also evident that the piglets from the Fra Acid group tended to gain 61g/day less than those in the Acidad Dry® treatment during days 35-49. This difference did not affect the ADG for the whole experimental period.

**Table 2. Body weight (BW) and average daily gain (ADG) of piglets fed Fra Acid and Acidad Dry®**
**Tablica 2. Tjelesna masa (BW) i prosječan dnevni prirast (ADG)praščića hranjenih Fra Acidom i Acidad Dry®**

| Age/Period<br>Starost/razdoblje | Fra Acid | | Acidad Dry® | | Sig. |
|---|---|---|---|---|---|
| | n | | n | | |
| *BW (kg)* | | | | | |
| Day - Dan 23 | 168 | 7.16 ± 1.31 | 168 | 7.30 ± 1.16 | 0.283 |
| Day - Dan 35 | 167 | 9.06 ± 1.83 | 168 | 9.08 ± 1.36 | 0.919 |
| Day - Dan 49 | 166 | 13.54 ± 3.34 | 168 | 13.57 ± 2.23 | 0.937 |
| Day - Dan 82 | 163 | 30.33 ± 5.43 | 167 | 31.24 ± 5.21 | 0.119 |
| *ADG (g/day)* | | | | | |
| Days - Dana 23 – 35 | 167 | 0.158 ± 0.076 | 168 | 0.148 ± 0.070 | 0.208 |
| Days - Dana 35 – 49 | 166 | 0.324 ± 0.162 | 168 | 0.320 ± 0.119 | 0.813 |
| Days - Dana 49 – 82 | 163 | 0.511 ± 0.128 | 167 | 0.535 ± 0.120 | 0.085 |
| Days - Dana 23 – 82 | 163 | 0.392 ± 0.083 | 167 | 0.407 ± 0.080 | 0.097 |

Sig. – probability, n – number of animals in trial
Stg - vjerojatnost, n - broj životinja u pokusu

**Table 3. Body weight (BW) and average daily gain (ADG) of weaned piglets of Fra Acid and Acidad Dry® "light" piglets at 6 kg of initial BW**

**Tablica 3. Tjelesna masa (BW) i prosječan dnevni prirast (ADG) odbitih "lakih" praščića Fra Acid i Acidad Dry ® početne tjelesne mase 6 kg**

| Age/Period<br>Starost/razdoblje | Fra Acid | | Acidad Dry® | | Sig. |
|---|---|---|---|---|---|
| | n | | n | | |
| *BW (kg)* | | | | | |
| Day - Dan 23 | 20 | 6.00 ± 0.00 | 28 | 6.00 ± 0.00 | 1.000 |
| Day - Dan 35 | 20 | 7.91 ± 0.74 | 28 | 7.63 ± 0.69 | 0.186 |
| Day - Dan 49 | 20 | 11.40 ± 2.06 | 28 | 11.99 ± 1.56 | 0.287 |
| Day - Dan 82 | 20 | 28.01 ± 5.44 | 28 | 27.21 ± 4.04 | 0.583 |
| | | | | | |
| *ADG (g/day)* | | | | | |
| Days - Dana 23 – 35 | 20 | 0.159 ± 0.061 | 28 | 0.135 ± 0.057 | 0.180 |
| Days - Dana 35 – 49 | 20 | 0.251 ± 0.127 | 28 | 0.312 ± 0.096 | 0.081 |
| Days - Dana 49 – 82 | 20 | 0.501 ± 0.129 | 28 | 0.463 ± 0.119 | 0.297 |
| Days - Dana 23 – 82 | 20 | 0.372 ± 0.092 | 28 | 0.360 ± 0.069 | 0.633 |

Sig. – probability, n – number of animals in trial
Stg - vjerojatnost, n - broj životinja u pokusu

**Table 4. Body weight (BW) and average daily gain (ADG) of weaned "heavy" piglets in the Fra Acid and Acidad Dry® groups at 8 kg of initial BW**

**Tablica 4. Tjelesna masa (BW) i prosječan dnevni prirast (ADG) odbijenih "teških" praščića u skupinama Fra Acid i Acidad Dry® početne tjelesne mase 8 kg**

| Age/Period<br>Starost/razdoblje | Fra Acid | | Acidad Dry® | | Sig. |
|---|---|---|---|---|---|
| | n | | n | | |
| *BW (kg)* | | | | | |
| Day - Dan 23 | 25 | 8.00 ± 0.00 | 31 | 8.00 ± 0.00 | 1.000 |
| Day - Dan 35 | 25 | 10.15 ± 0.95 | 31 | 9.73 ± 0.86 | 0.090 |
| Day - Dan 49 | 25 | 14.31 ± 3.11 | 31 | 14.02 ± 1.73 | 0.660 |
| Day - Dan 82 | 24 | 31.13 ± 5.12 | 31 | 32.78 ± 2.58 | 0.126 |
| | | | | | |
| *ADG (g/day)* | | | | | |
| Days - Dana 23 – 35 | 25 | 0.179 ± 0.079 | 31 | 0.144 ± 0.072 | 0.090 |
| Days - Dana 35 – 49 | 25 | 0.303 ± 0.196 | 31 | 0.306 ± 0.090 | 0.934 |
| Days - Dana 49 – 82 | 24 | 0.507 ± 0.137 | 31 | 0.567 ± 0.076 | 0.044 |
| Days - Dana 23 – 82 | 24 | 0.391 ± 0.087 | 31 | 0.421 ± 0.044 | 0.129 |

Sig. – probability, n – number of animals in trial
Stg - vjerojatnost, n - broj životinja u pokusu

When weighed on day 35, piglets in the Fra Acid group that were weaned at 8 kg were 0.42 kg heavier than those in the Acidad Dry® group (tendency; *p=0.090*; Table 4). At the following weighing point, the difference between the groups was reduced (Fra Acid 14.31 ± 3.11 kg, Acidad Dry® 14.02 ± 1.73 kg, *p=0.660*), but, on the final weighing day (day 82), those in the Acidad Dry® group had a non-significantly higher body weight than those in the Fra Acid group.

In the same piglets weaned at 8 kg, supplementation with Acidad Dry® resulted in a faster growth rate than Fra Acid, with the exception of the period between days 23-35. However, the difference between the treatments only reached a significant level between days 49 and 82 when the Acidad Dry® group gained 567 ± 76 g/day and the Fra Acid group gained 507 ± 137 g/day (*p=0.044*).

## CONCLUSIONS

1. Animals in the Acidad Dry® group finished the experimental pre-fattening period with a higher ADG (407 g/day) and a higher BW (31.24 kg) as compared to pigs in the Fra Acid group (*p=0.097)*.

2. Those animals weaned at 6 kg achieved a non-significantly higher (61g/day) ADG when supplemented with Acidad Dry® than with Fra Acid between days 35-49 (p=0.081).

3. Pigs in the Acidad Dry® *group weaned at 8 kg achieved a significantly higher (p=0.044) ADG between days 49 and* 82 compared to those in the Fra Acid treatment despite Fra Acid being associated with a better ADG from days 23 to 35.

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## SAŽETAK

Cilj rada bio je odrediti djelovanje dvaju različitih acidifikanata na rast praščića u razdoblju od odbica do postizanja tjelesne mase od 30 kg. U istraživanje je bilo uključeno 336 svinja podijeljenih u dvije jednake skupine (Fra Acid, n = 168, Acidad Dry K n = 163). Na temelju tjelesne mase pri odbiću praščići su podijeljeni u "laku" (L = 6 kg) i "tešku" (H = 8 kg) skupinu. U obrocima praščića upotrijebljena su dva acidifikanta različitog sadržaja organske kiseline. U hranu je dodavan Fra Acid u koncentraciji od 0,65, 0,60 i 0,40%. Drugi dodatak, Acidad Dry K, dodavan je u koncentracijama od 0,35, 0,30 i 0,20%. Praščići su pojedinačno vagani pri odbiću, zatim 23. dana starosti i opet svaki puta kad je promijenjena hrana (35., 49. i 82. dan starosti). Pokusne skupine nisu se značajno razlikovale u tjelesnoj masi za vrijeme pokusa. Praščići s Acidad Dry K postigli su veće dnevne priraste od praščića hranjenih s Fra Acidom, ali povezanost nije bila statistički značajna. "Teški" praščići u tretmanu *s* Acidad Dry K imali su značajno više dnevne priraste u razdoblju od 49. do 82. dana starosti u odnosu na one u Fra Acid tretmanu (567± 80 g, 507± 140 g, p = 0.04).

Ključne riječi: svinje, stopa rasta, organske kiseline, tanin