# DIETARY SUPPLEMENTATION WITH β-ALANINE FAILED TO INCREASE ULTIMATE pH AND TO IMPROVE MEAT QUALITY IN PIGS

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## I. INTRODUCTION

The non-proteogenic amino acid β-alanine forms part of the dipeptide carnosine (β-alanyl-L-histidine), which exerts pH-buffering, carbonyl scavenging and antioxidant properties [1]. A dietary supplementation with carnosine was shown to increase the pH-value at 45 min, 24 h and 48 h post mortem in the longissimus dorsi of finishing pigs [2]. Furthermore, the antioxidative activity was increased in plasma, liver and muscle [2]. β-alanine has been identified as the rate-limiting precursor for carnosine synthesis and its dietary supplementation increased levels of carnosine in human muscle [1]. We therefore hypothesized that a dietary supplementation of pigs with β-alanine could increase ultimate pH and consequently the quality of pork, particularly its water holding capacity.

## II. MATERIALS AND METHODS

The study was conducted at the Swiss Performance Testing Station for Pigs (MLP) at Sempach, Switzerland and was approved by the veterinary service of Lucerne, Switzerland (28866 LU03/17). A special permission to use β-alanine as feed ingredient was given by the official feed control in Switzerland (Agroscope).
A total of 20 siblings of Large White or Swiss Landrace breed were allocated to a β-alanine supplementation group or the control, balanced according to live weight, breed, sex, and litter, and were fattened according to the MLP-guidelines to a target carcass weight of 86 kg. The animals were housed in groups of ten animals and had ad libitum access to feed and water. The feed contained 13.5 MJ digestible energy and 15.5 % crude protein. For the experimental group 2.5 g/kg β-alanine was mixed into the feed; the analyzed content, however, was 1.6 g/kg, while in the control feed no β-alanine was detected (Frank Gutjahr Chromatographie, Balingen, Germany). The β-alanine was provided by Sponsor Sport Food AG, Wollerau, Switzerland and had an analyzed purity of 95.25 %. The supplemented feed was provided to the animals of the experimental group on average during 29.8 ±9.4 days before slaughter (Minimum 20 d and Maximum 41 days). Feed intake was recorded on an individual level using transponder controlled feeders. When the animals reached a live weight of at least 105 kg they were assigned to slaughter in the following week.
During slaughter, carcass weight and lean meat content (Autofom) as well as pH 90 min. p.m. in m.long.dorsi (LD) and m.semimembranosus (SM) (pH-Star, Matthäus, Eckelsheim, Germany) were recorded. The day after slaughter ultimate pH and colour (L*; Minolta Chromameter CM-2500, Konica Minolta Sensing Europe B.V., Dietikon, Switzerland) were measured and a sample of the LD overlaying the 3.-5. last rib was taken to the lab, were intramuscular fat content (IMF; NIRFlex N-500, Büchi, Flawil, Switzerland), driploss, cooking loss and Warner-Bratzler shear force (TA1 Texture Analyzer, Ametek, Meerbusch, Germany) was measured. For the statistical analysis, one animal of the control group was excluded because of extraordinary low daily gains. The statistical analysis was conducted using NCSS 9 Statistical Software (2013, NCSS, LLC. Kaysville, Utah, USA) and applying the glm-procedure with the fixed effects, treatment, sex, and sire. For meat quality traits, the date of slaughter was additionally included as random effect.

## III. RESULTS AND DISCUSSION

The animals fed with the β-alanine supplemented feed showed slightly lower daily gains and unfavorable feed conversion as well as a slightly lower cross-sectional surface area of the LD (Tab. 1). This is not what was expected. The effect of sex, however, well fits the expectations with higher gains and fat accretion and lower

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lean meat content and muscle area for barrows. For meat quality traits, hardly any differences were found. Particularly the ultimate pH did not differ significantly and, by numbers, was even lower in the β-alanine supplemented group. Similarly, no consistent effect of β-alanine supplementation on the oxidative stability of pork was found after dietary administration of 0.225 % β-alanine from 65 to 100 kg live weight [4]. It may be speculated that dosage and application time were too low to exert effects. However, in humans a supplementation of 4-6 g/day over a period of 2-4 weeks was shown to improve exercise performance [1]. A direct dietary supplementation of carnosine did improve oxidative stability, increased ultimate pH and reduced driploss [2]. The use of pure carnosine in pig feed might be too expensive, but it could be worth testing an effect of protein of animal origin, which would provide dietary carnosine as a side effect.

Table 1 fattening performance, carcass composition and meat quality of finishing pigs receiving

| | treatment | | sex | | SE | p-value | | |
|---|---|---|---|---|---|---|---|---|
| out | control | β-alanine | gilt | barrow | | feed | sex | slaughter date |
| n | 9 | 10 | 9 | 10 | | | | |
| weight at start | 25.4 | 27.3 | 26.1 | 26.6 | 1.14 | 0.254 | 0.758 | |
| age at slaughter | 151.1 | 155.2 | 156.0 | 150.3 | 2.35 | 0.235 | 0.105 | |
| carcass weight | 84.7 | 83.9 | 84.2 | 84.4 | 0.89 | 0.580 | 0.819 | |
| daily gain [g/d] | 1023 | 959 | 956 | 1026 | 19.29 | 0.033 | 0.022 | |
| feed conversion | 2.46 | 2.57 | 2.51 | 2.52 | 0.04 | 0.075 | 0.809 | |
| lean meat [%] | 56.5 | 56.4 | 57.4 | 55.4 | 0.57 | 0.928 | 0.026 | |
| area of LD [$cm^2$] | 41.7 | 39.9 | 42.3 | 39.3 | 0.71 | 0.082 | 0.008 | |
| backfat area [$cm^2$] | 16.8 | 16.5 | 16.0 | 17.3 | 0.53 | 0.729 | 0.084 | |
| intram. fat [%] | 2.21 | 2.31 | 2.14 | 2.39 | 0.14 | 0.626 | 0.227 | |
| pH 90 min. (LD) | 6.49 | 6.42 | 6.57 | 6.34 | 0.06 | 0.568 | 0.041 | 0.025 |
| pH 90 min. (SM) | 6.39 | 6.35 | 6.32 | 6.42 | 0.04 | 0.563 | 0.110 | 0.931 |
| pH 24 h (LD) | 5.44 | 5.43 | 5.45 | 5.42 | 0.02 | 0.839 | 0.300 | 0.369 |
| pH 24 h (SM) | 5.55 | 5.52 | 5.53 | 5.53 | 0.01 | 0.365 | 0.900 | 0.314 |
| driploss [%] | 2.32 | 2.49 | 1.97 | 2.85 | 0.30 | 0.792 | 0.119 | 0.196 |
| cooking loss [%] | 28.6 | 28.6 | 28.7 | 28.4 | 0.34 | 0.971 | 0.628 | 0.936 |
| max shear force [N] | 44.2 | 42.2 | 42.4 | 44.0 | 0.89 | 0.308 | 0.328 | 0.006 |
| brightness [L] | 50.3 | 50.6 | 49.4 | 51.5 | 0.95 | 0.892 | 0.222 | 0.170 |

## IV. CONCLUSION

A dietary supplementation of β-alanine did not help to increase ultimate pH or other quality traits in pork. It remains open if carnosine, e.g. provided by feeding processed animal proteins, would be effective.

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