CREAMINO

ENERGY FOR HEALTHY GROWTH

Creamino® – Alzchems' creatine solution for animal nutrition

BENEFITS FROM A MISSING NUTRIENT
TECHNICAL INFORMATION

alzchem group

Creatine – a lost nutrient in modern animal nutrition

Body-own creatine is a key energy reserve in tissues of vertebrates. Although mostly being found in muscle cells (>95%) various other tissues such as brain, heart as well as immune cells and sperm have a strong demand for creatine. Known for its role in human nutrition creatine prevents low levels of cellular energy by supporting to avoid ATP depletion through immediate provision of high energy phosphates to regenerate the ATP molecule from ADP (Wyss & Kaddurah-Daouk 2000).

Keeping in mind the Greek word 'kreas' (for meat), it's an easy guess where dietary creatine may come from. Vertebrates are evolutionary designed to receive creatine from the diet. In human nutrition, creatine supplementation is recommended in the case of a vegetarian diet or for particular nutritional needs. The situation in animal nutrition, however, is much more complex. The animal's creatine demand cannot be fulfilled from dietary creatine/ from feed. Only very small amounts of creatine are provided from animal by-product containing diets given the instability of creatine during rendering. Due to legislation issues in various countries, hygiene drawbacks as well as high costs of raw materials of animal origin (e.g. fish meal) modern animal nutrition moves towards a plant-based raw material approach and is deliberately sacrificing dietary creatine. Although creatine is also formed by de-novo synthesis involving the amino acids arginine and glycine while producing its precursor guanidinoacetic acid (GAA), a part of the animal's creatine pool is irreversibly lost and excreted as the 'waste' substance creatinine through urine (Wyss & Kaddurah-Daouk, 2000).

How do we now ensure a steady refilling of the creatine pool for our animals instead of giving up and letting this important nutrient vanish?

Alzchem is known as the key supplier for high quality creatine for humans and developed Creamino® consisting of GAA, as a source of creatine for animals. GAA is the immediate precursor of creatine in the body with no other metabolic fate. In contrast to creatine it has been proven to be heat-stable even up to 130 °C during extrusion (Fig. 1) and is the only authorized source of creatine for animal feed. Creamino® is Alzchem´s creatine solution for feed application. Free flowing, made in Germany, dedicated for the animal feed industry.

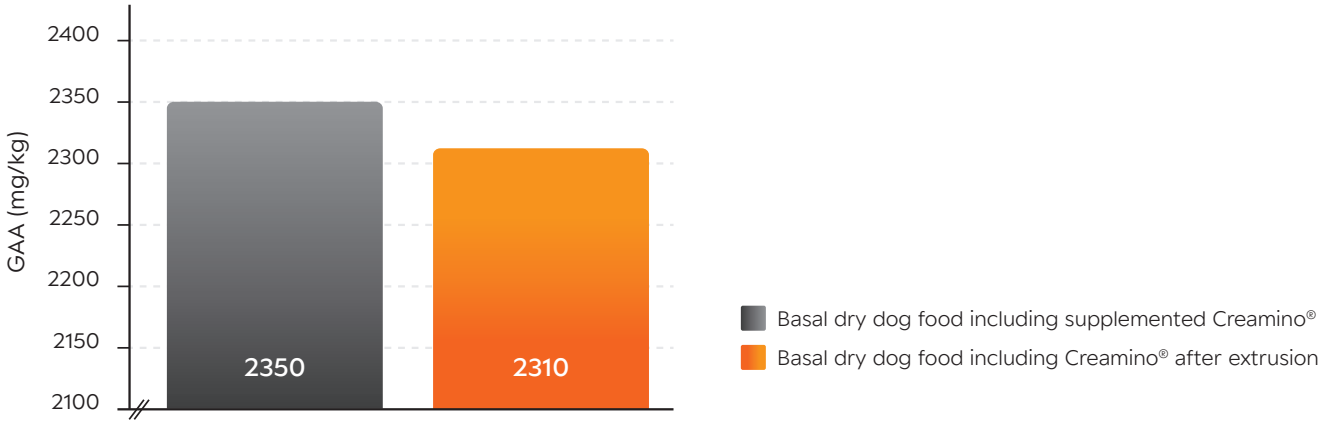


Fig. 1. GAA recovery after extrusion at 130°C in a basal dry dog food supplemented with Creamino®

EXPERTS IN CREATINE ANALYTICS

Alzchem has a long history of analyzing GAA, creatine and creatinine in raw materials, compound feed, premixes and concentrates with several thousand analyses performed since the beginning of research around GAA (Creamino®) in 2003. In addition, Alzchem has extensive expertise for the determination of creatine and GAA in muscle meat, organs, eggs and milk. Through these analyses, we are able to relate improved growth performance, reached after Creamino® supplementation, to the energy status of the cell (e.g. to elevated muscle creatine values).

Reference: Wyss M, Kaddurah-Daouk R (2000) Creatine and creatinine metabolism. Physiol Rev 80:1107-1213.

Broiler Performance Study W/WO FISHMEAL

(LEMME *ET AL.*, 2011)

To show the additional advantage of GAA supplementation on top of a fish meal containing diet, a study had been designed as follows: 540 male day-old Ross 308 broilers were randomly distributed to 54 pens with 10 birds each. Feed and water were supplied *ad libitum* while the lighting and temperature regimes were performed according to breeder's recommendations. The growing period was subdivided into a starter (d0-10), grower (d11-25) and finisher (d26-36) period. A two-factorial arrangement with fish meal inclusion (no fish meal, 5% fish meal only in starter feed, 5% fish meal in all periods) and Creamino® supplementation (no Creamino®, 0.06% Creamino®) as the two factors was selected. The experimental diets were mainly consisting of wheat, corn and soybean meal and the additional inclusion of fish meal contributed about 110 mg/kg creatine to the final feed. Feed consumption was recorded per pen and feeding phase and feed conversion ratio (FCR) was corrected for mortality.

At termination of the trial at day 36, six birds per pen with body weights closest to pen average were selected for carcass evaluation. A sample of breast meat was obtained from two birds per pen for analyses of GAA, creatine, and creatinine.

Overall results (Figure 2) of 5% dietary fish meal inclusion in either the starter/overall period didn't show improved performance on weight gain if compared to the control while dietary fish meal inclusion (5%, overall) showed improved FCR. Supplementing Creamino® to diets devoid of fish meal led to improvements in overall daily weight gain ($p<0.05$) and FCR ($p<0.05$), the same could be found for both fish meal containing diets ($p<0.05$) consequently, the effect of Creamino® was independent of fish meal inclusion.

RESULT: IMPROVED BODY WEIGHTGAIN AND FCR

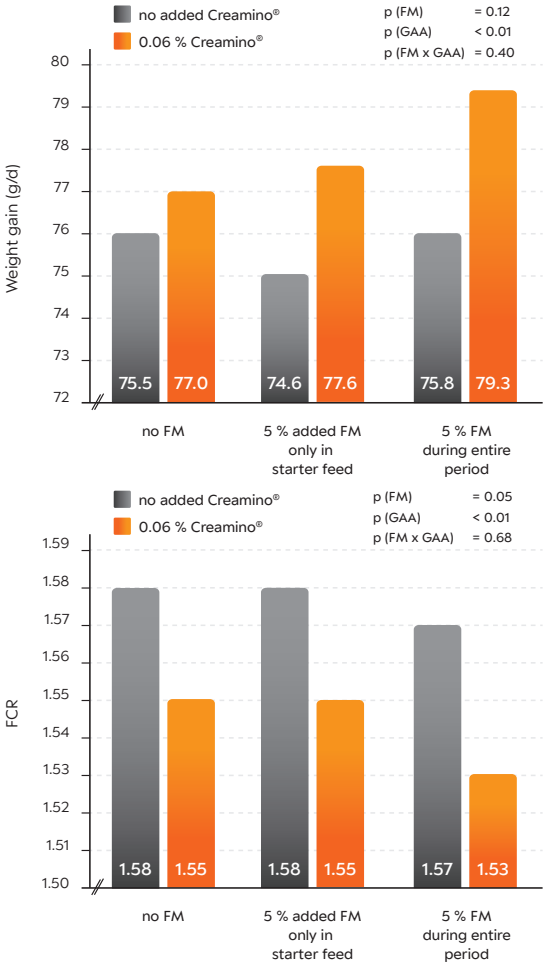


Fig. 2. Overall effects of supplementing fish meal (5%) on weight gain and FCR for different time periods with or without supplementation of Creamino®

RESULT: IMPROVEMENT RELATED TO ELEVATED MUSCLE CREATINE

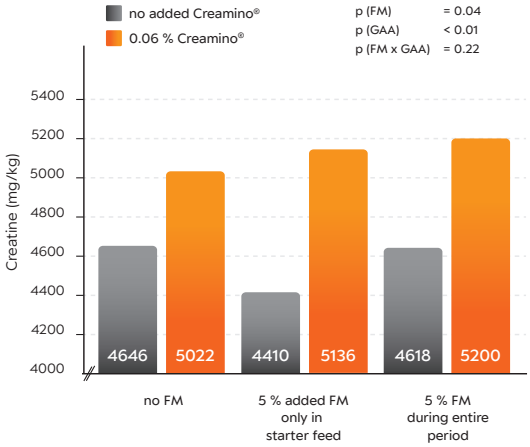


Fig. 3. Overall effects of supplementing fish meal (5%) on muscle creatine levels for different time periods with or without supplementation of Creamino®

In Figure 3 analyses revealed elevated muscle creatine levels ($p<0.05$) after supplementation of Creamino® independent of fish meal supply whereas fish meal supply during either starter phase only or the entire feeding period didn't influence the level of creatine found in muscle meat. In summary the improved muscle creatine concentrations may have contributed to a more efficient utilization of cell-related energy and are therefore backing up the improved performance in terms of weight gain and feed conversion.

Reference: Lemme et al. (2011) 18th European Symposium on Poultry Nutrition. Cesme-Izmir, Turkey.

Broiler Heat-Stress Study

(MAJDEDDIN *ET AL.*, 2017)

To evaluate the effects of supplementing GAA under heat stress conditions, the following setup had been chosen: 720 one-day-old male Ross 308 broilers were allocated to three dietary treatments with 12 replicates (20 birds each). Treatments were either 0, 0.06 or 0.12 % GAA added to a corn-soybean-meal-based diet and fed for 39 days. A chronic cyclic heat stress model (temperature increase to 34°C with 50-60 % relative humidity for 7 hours daily) was applied in the finisher phase (d25-39). Key performance parameters were measured and on day 39 one bird per pen was sampled to determine, among other parameters, levels of creatine in breast muscle biopsies.

RESULT: FCR IMPROVEMENT

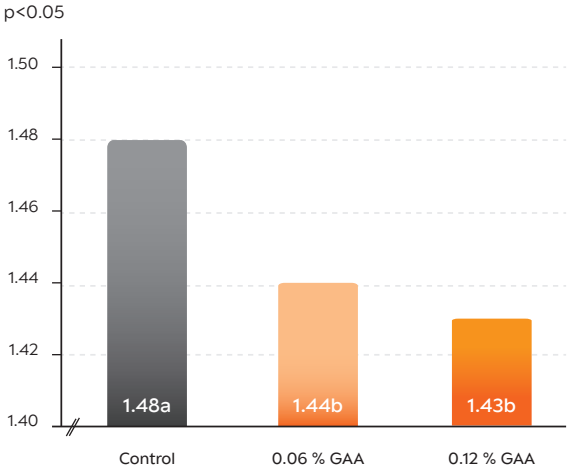


Fig. 4. Overall FCR shown for Creamino® supplementation at different levels after a chronic cyclic heat stress model had been applied in the finisher phase

RESULT: CREAMINO® INCREASES CREATINE CONTENT IN BREAST MUSCLE

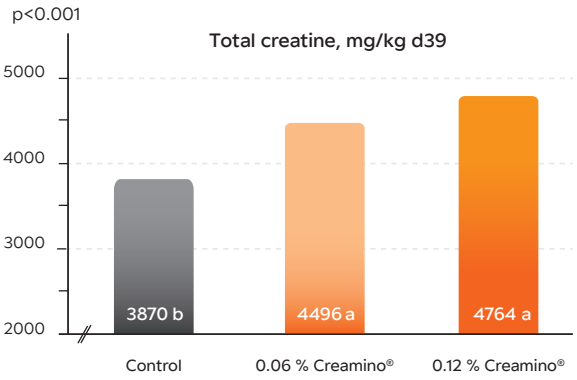


Fig. 5. Overall creatine levels in breast muscle meat shown for Creamino® supplementation at different levels after a chronic cyclic heat stress model had been applied in the finisher phase

Broiler Myopathy Study

(CORDOVA-NOBOA *ET AL.*, 2018)

RESULT: WOODEN BREAST SEVERITY REDUCED (HEAVY BROILERS)

BW (kg)	4.106	4.237	4.016	4.096	p < 0.05
FCR	1.725	1.675	1.723	1.698	p < 0.007

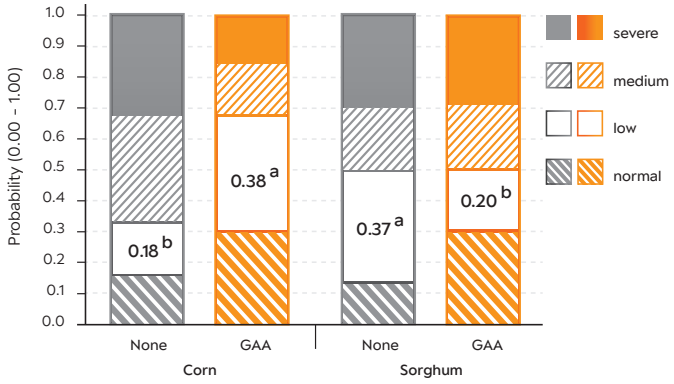


Fig. 6. Wooden breast severity and performance effects after supplementing 0.06% of Creamino® to different diets

The effects of Creamino® supplementation on performance and pectoral myopathies were studied in heavy broilers. The treatments consisted of corn or sorghum-based diets with or without supplementation of 0.06% Creamino®. A total of 800 one-day-old male Ross 708 broiler chicks were randomly allocated to 40 floor pens with 10 replicates (20 birds per pen) per treatment. At hatch, day 14, 35 and 50 body weights and feed intake were recorded.

At day 50 diets containing Creamino® improved FCR and BWG independently of grain type. Broilers supplemented with Creamino® had double breast meat fillets without wooden breast (score 1) compared to broilers fed non-supplemented diets, hence reducing the severity of this myopathy drastically.

In conclusion, Creamino® supplementation improved broiler performance (kept up to 50 d) independentl of grain source and reduced the severity of wooden breast myopathy.

References: Majdeddin et al. (2017) 21st European Symposium on Poultry Nutrition. *Salou/Vila-seca, Spain.* Cordova-Noboa *et al.* (2018) Poultry Science 0:1–15.

Turkey Performance Study
(RINGEL *ET AL.*, 2008)

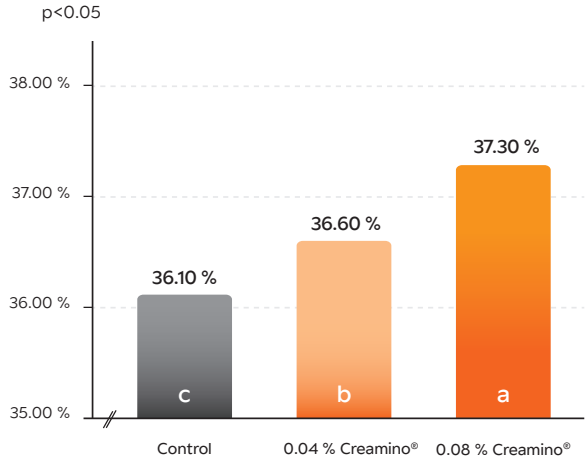
To test applicability of the Creamino® concept in turkeys, the following experiment was carried out: A total of 810 BUT Big 6 one-day-old male turkeys were randomly distributed to 18 floor pens (three dietary treatments, six replicates) with 45 birds each. Feed and water were supplied *ad libitum* while environmental conditions were following breeder's recommendations. The experimental diets were purely vegetable, adequate in terms of energy and nutrient supply and supplemented with 0, 0.04% or 0.08% of Creamino®. These diets were supplied during the entire experimental period in a 6-phase turkey feeding system. Body weight and feed intake were measured per pen on 2, 4, 8, 12, 16 and 20 weeks of age and 0-2, 3-4, 5-8, 9-12, 13-16 and 17-20 weeks of age, respectively. Feed conversion ratio was calculated for each period. After termination of the trial, slaughter yield was determined in all birds in a commercial turkey slaughterhouse.

Treatment	Control	0.04% Creamino®	0.08% Creamino®
Body weight gain (kg)	20.10	20.26	20.03
Feed intake (kg)	54.43[a]	53.35[ab]	53.14[b]
Feed conversion ratio	2.718[a]	2.682[ab]	2.664[b]
Slaughter weight [1] (kg)	15.17	15.13	15.45
Slaughter yield (%)	75.8	78.1	78.1

[ab] Means with different superscripts within lines differ significantly (P<0.05).
[1] Before chilling.

Fig. 7. Overall performance and slaughter characteristics of turkeys receiving either no, 0.04% or 0.08% of Creamino®

BREAST MEAT (%)



CREATINE IN BREAST MUSCLE (MG/KG)

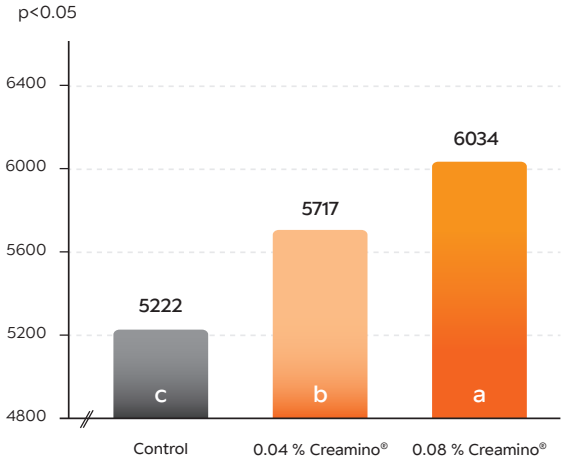


Fig. 8. Overall breast meat yield and creatine in breast muscle of turkeys receiving either no, 0.04% or 0.08% of Creamino®

As shown in Figure 7, total feed intake over the entire 20 week experimental period was reduced with increasing Creamino® inclusion levels resulting in a significant linear Creamino® effect. The highest inclusion level resulted in a 2.4% lower feed intake (p<0.05) compared to the control diet and a 5.4 points lower feed conversion ratio (p<0.05). Response on the 0.04% Creamino® inclusion level was intermediate and not significantly different from both other treatments. Breast meat (as a percentage of carcass weight) linearly increased (p<0.05) with Creamino® inclusion level from 36.1% on the control diet to 37.3% on the 0.08% Creamino® inclusion level while also elevated levels of creatine in muscle could be detected (Figure 8). Dietary Creamino® supplementation to all-vegetable diets improved production performance of growing turkeys by reduced feed intake without affecting body weight gain resulting in an improved feed conversion ratio over the 20 week fattening period. At slaughter, breast meat percentage was improved in the Creamino® supplemented groups. Due to the increase of muscle creatine, it is evident, that GAA from Creamino® was effectively absorbed and transformed to creatine being the underlying mechanism for the observed improved performance.

Reference: Ringel *et al.* (2008) World Poultry Congress, Brisbane, Australia.

Piglet Performance Study

(MORALES *ET AL.*, 2019)

In order to evaluate the effects of Creamino® supplementation to diets for weaned piglets, the following experiment was conducted: A total of 336 piglets (50% entire males, ACMC x Pietrain) were distributed to 56 pens of 6 piglets. The total study duration was 42 days, subdivided into a pre-starter diet (up to 14 days) and a starter diet (up to 42 days). Graded levels of Creamino® (0, 0.06%, 0.09% and 0.12%) were applied. Performance parameters such as body weight gain, feed intake and FCR were evaluated.

AVERAGE DAILY GAIN

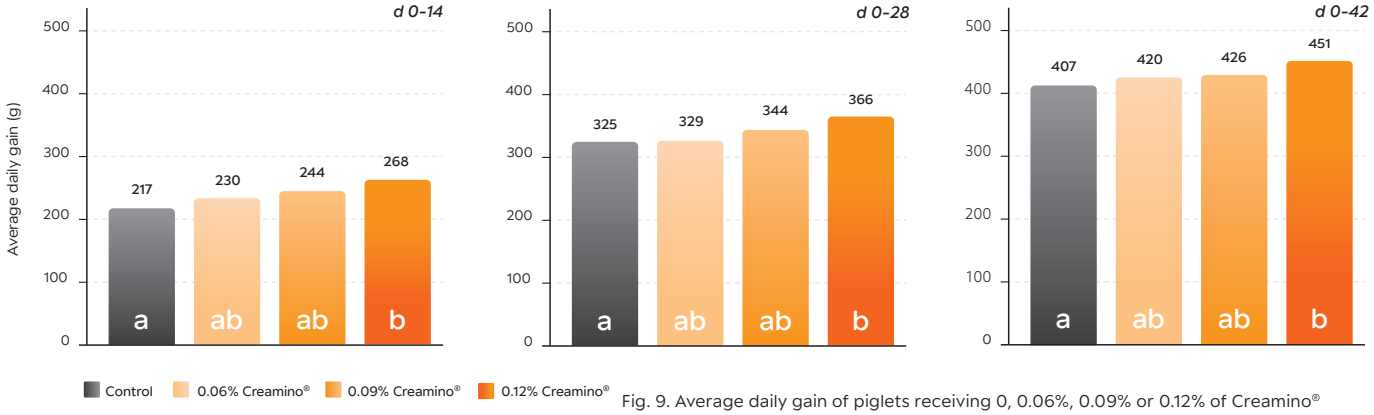


Fig. 9. Average daily gain of piglets receiving 0, 0.06%, 0.09% or 0.12% of Creamino® during the pre-starter and starter phase

The results in Figure 9 show the effects in piglets on daily weight gain in the pre-starter, starter phase and the overall period. Both in the pre-starter and starter phase improvements ($p<0.05$) on daily weight gain can be found by comparing the control diet to a Creamino® supplementation level of 0.12%. In Figure 10 it is shown that feed intake remained at a similar level for the control and all Creamino® groups with a tendency to increased cumulative feed intake at d42.

FEED INTAKE

CREAMINO®	FI 0-14	FI 0-28	FI-042
Control	314.4	467.8	581.7
0.06%	313.6	462.1	600.7
0.09%	340.5	485.9	612.9
0.12%	336.7	472.7	634.1
SEM	13.749	13.648	15.109
P	0.3106	0.5753	0.0903

Fig. 10. Feed intake of piglets receiving 0, 0.06%, 0.09% or 0.12% of Creamino® during the pre-starter and starter phase

FCR

CREAMINO®	FCR 0-14	FCR 0-28	FCR-042
Control	1.459 [a]	1.429 [a]	1.461
0.06%	1.397 [ab]	1.418 [ab]	1.439
0.09%	1.369 [ab]	1.365 [ab]	1.423
0.12%	1.312 [b]	1.335 [b]	1.428
SEM	0.034	0.025	0.016
P	0.0343	0.0279	0.2835

Fig. 11. Feed conversion ratio of piglets receiving 0, 0.06%, 0.09% or 0.12% of Creamino® during the pre-starter and starter phase

As shown in figure 11, the highest performance (FCR) ($p<0.05$) was reached at a level of 0.12% Creamino® supplementation after 14 and 28 days. This may be related to the fact that Creamino® as an energy delivering substance may especially be important in young animal nutrition and needed once it is of high value to provide the piglets with a highly energetic feed (as feed intake may generally be low after weaning).

Reference: Morales *et al.* (2019) 70th EAAP Annual Meeting. Ghent, Belgium.

Swine Performance and Carcass Evaluation from weaning until slaughter

(JAYARAMAN *ET AL.*, 2018)

Two studies were conducted to evaluate the effects of dietary supplementation of guanidinoacetic acid (GAA) on growth performance, carcass characteristics, and meat quality in pigs from wean to finish (Exp 1) and finishing pigs fed GAA at different time periods before slaughter (Exp 2). In Exp 1, a total of 360 weaned pigs (Duroc x [Landrace x Yorkshire]) with an average initial BW of 7.17 ± 0.03 kg were randomly distributed into 3 dietary treatments consisting of 10 replicates per treatment and 12 pigs (6 barrows and 6 gilts) per replicate. Dietary treatments were a control (basal diet), a basal diet +0.08% GAA (0.08% GAA); and a basal diet +0.12% GAA (0.12% GAA). The duration of the experiment was 150 days.

RESULT: CREAMINO® IMPROVED OVERALL PERFORMANCE

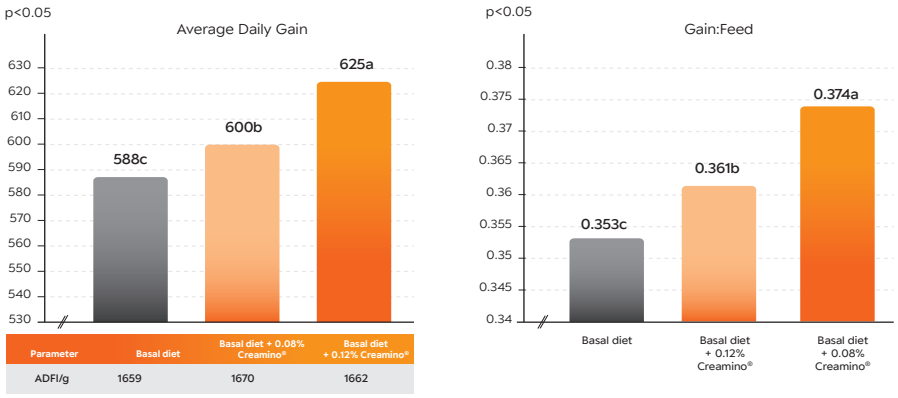


Fig. 12. Average daily gain and gain:feed of pigs receiving 0, 0.08%, 0.12% of Creamino®
Lean meat and back-fat thickness of pigs receiving 0, 0.08%, 0.12% of Creamino®

RESULT: LEAN MEAT AND BACK-FAT THICKNESS IMPROVED

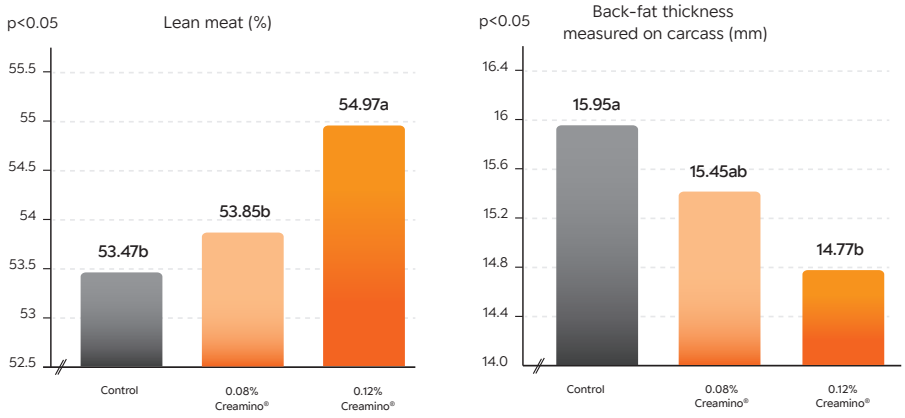


Fig. 13. Average daily gain and gain:feed of pigs receiving 0, 0.08%, 0.12% of Creamino®
Lean meat and back-fat thickness of pigs receiving 0, 0.08%, 0.12% of Creamino®

At the end of the experiment, 20 pigs (10 barrows and 10 gilts) from each treatment were slaughtered for measuring carcass characteristics and meat quality. In Exp 2, 1,440 finishing pigs [(Duroc x (Landrace x Yorkshire)), 56.15 ± 0.10 kg BW)] were randomly allocated to 4 treatments with 18 replicates (20 pigs per replicate). Dietary treatments were a control diet (CON, basal diet), a basal diet +0.12% GAA fed 60 d before slaughter (T1), a basal diet +0.12% GAA fed 40 d before slaughter (T2) and a basal diet +0.12% GAA fed 25 d before slaughter (T3). Body weight was measured at the start (120 d of age) and at the end (180 d of age) of the experiment. At the end of the study, 144 pigs (72 barrows and 72 gilts) from 4 dietary treatments (36 pigs per treatment) were slaughtered for the determination of carcass and meat quality parameters. In Exp1, 0.12% GAA increased (P<0.05) ADG and G:F during starter, grower, finisher and the overall growth period (30 to 180 d of age). Pigs fed 0.12% GAA improved (P<0.05) lean meat yield in comparison with CON.

RESULT: LEAN MEAT AND BACK-FAT THICKNESS IMPROVED AFTER 180 DAYS

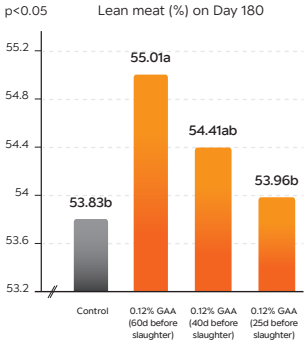


Fig. 14. Lean meat and back-fat thickness of pigs receiving 0.12% of Creamino® for different time periods before slaughter.
Lean meat quality of pigs after receiving 0.12% of Creamino® for different time periods before slaughter

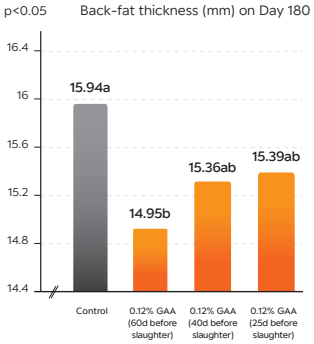
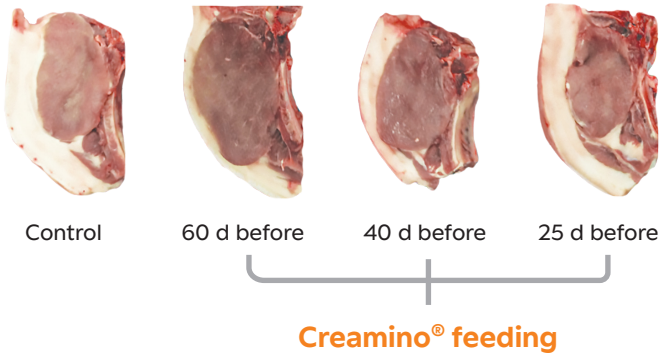


Fig. 15. Lean meat and back-fat thickness of pigs receiving 0.12% of Creamino® for different time periods before slaughter.
Lean meat quality of pigs after receiving 0.12% of Creamino® for different time periods before slaughter

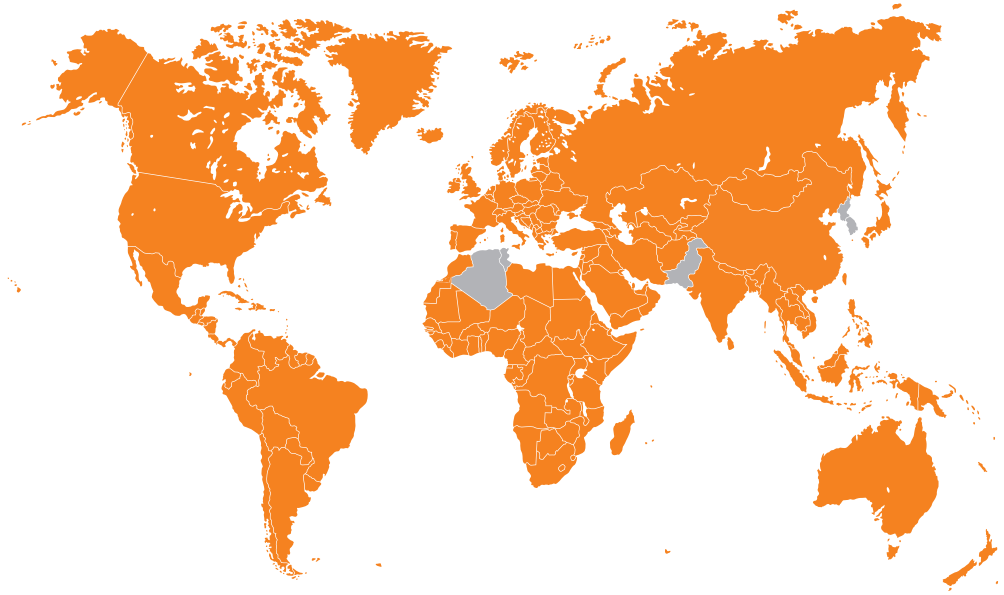
RESULT: CREAMINO® INCREASES LEAN MEAT QUALITY



There was no interaction effect among GAA supplementation and sex of the pigs. Meat quality was not affected by GAA supplementation in pigs. In Exp 2, the final BW, ADG, and lean yield of the pigs fed T1 were higher (P<0.05) than CON and those fed T3. The carcass back-fat thickness of T1 was lower (P<0.05) than CON. In conclusion, 0.12% GAA improved the growth performance and lean meat yield in pigs from wean to finish. Finishing pigs fed diets supplemented with 0.12% GAA 60 d before slaughter improved ADG, feed efficiency, and lean meat yield and reduced back-fat thickness compared with those fed GAA unsupplemented diets.

Reference: Jayaraman *et al.* (2018), Journal of Animal Science.

CREAMINO® IN USE



01/2022 | © Alzchem Trostberg GmbH | This information is based upon our present knowledge and experience and is intended to provide general guidance about our products and their uses. Alzchem assumes no liability for such information, including its suitability for a particular use of the product, or that such use is infringing the intellectual property rights of others. | Image credit: AdobeStock, Alzchem GmbH

Alzchem Trostberg GmbH
Dr.-Albert-Frank-Straße 32
83308 Trostberg, Germany
www.alzchem.com

T +49 8621 86-2904
creamino@alzchem.com
US contact: T 1 678 7806166

QUALITY MADE IN GERMANY

www.creamino.com