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(54) **TREATMENT OF POULTRY, PIGS OR FISH FOR REDUCING THE FEED CONVERSION RATIO
OR INCREASING THEIR BODYWEIGHT GAIN**

GEFLÜGEL-, SCHWEINE- ODER FISCHBEHANDLUNG ZUR REDUKTION DES
FUTTERUMWANDLUNGSVERHÄLTNISSSES

TRAITEMENT DE LA VOLAILLE, PORCS OU POISSONS EN RÉDUISANT LE RAPPORT DE
CONVERSION D'ALIMENTATION

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• **SERENA DEL FAVERO ET AL: "Beta-alanine
(Carnosyn®) supplementation in elderly subjects
(60 to 80 years): effects on muscle carnosine
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RESEARCH, SPRINGER-VERLAG, VI, vol. 43, no.
1, 6 December 2011 (2011-12-06), pages 49-56,
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Description

[0001] The present invention relates to a method for the non-therapeutic treatment of animals selected from the group consisting of poultry, pigs and fish in particular for the purpose of increasing the bodyweight gain of the animals or for the purpose of reducing the conversion ratio of the feed used to feed the animals without reducing their bodyweight gain.

[0002] In the meat producing industry, improvements and developments have been made essentially in the breeding technique for phyletic lines of the animals and in the rearing technique for increasing the bodyweight gain thereof. This is especially the case in the broiler and in the pork industry (both for grower and finisher pigs) but also in the fish industry. Much emphasis is put on the bodyweight gain of the meat producing animals and the conversion ratio of the feed used to rear them. A high-calorie feed enables to achieve a lower feed conversion ratio, in particular a lower amount of feed is required to produce a certain amount of animal meat or other production parameters such as litres of milk for dairy, total egg weight for layers or total litter weight for reproduction sows. However, a further reduction of the feed conversion ratio is always desired to reduce the production costs. When lowering the feed conversion ratio it is important that the bodyweight gain is not reduced by the applied treatment.

[0003] In practice, it is indeed of high economical importance to be able to decrease the feed conversion ratio, i.e. the amount of feed required for 1 kg of productivity, being either gain in bodyweight or, in case of sows, production of weaned piglets, without having to use a (more expensive) feed having a higher energy or nutrient value. It is also of high economical importance to be able to increase the bodyweight gain so that the desired final animal weight can be achieved within a shorter period of time, i.e. so that the meat production cycle can be shortened.

[0004] Several additives have already been tried to lower the feed conversion ratio and/or to increase the bodyweight gain of animals.

[0005] WO 2007/107184 and WO 2009/033502 disclose for example the use of dimethyl glycine (DMG) for lowering the feed conversion ratio and increasing the bodyweight gain of respectively pigs and broilers.

[0006] Other additives which have been tested are carnosine (β -alanyl-L-histidine) and β -alanine. Carnosine, and its derivative anserine β -alanyl-1-methyl-L-histidine) are known to function as anti-oxidants and putative neurotransmitters. They may thus influence the brain functions and also the meat quality. Hu et al. (2009) have tested the effect of carnosine on growth performance, carcass characteristics, meat quality and oxidative stability in broiler chickens. Supplementation of the broiler feed with 0.5% of carnosine enabled to improve the chicken meat quantity and quality. Both the weight gain and the feed conversion ratio were improved but not statistically significantly.

[0007] Carnosine is a dipeptide made up of β -alanine and histidine. Several prior art publications disclose that it is possible to increase the carnosine level in different tissues by administering β -alanine instead of carnosine itself to the animal. Since β -alanine is more easy to produce industrially than carnosine, or is in other words much cheaper, it is thus advantageous to use β -alanine instead of carnosine.

[0008] Tomonaga et al. (2005) have demonstrated that orally administered β -alanine increases carnosine concentrations in both the breast muscle and the brains of chickens. They administered 22 mmol/kg bodyweight twice a day for five days to one day old chickens. Calculated based on the feed consumption of the chickens, this amount corresponded on average to about 21000 mg/kg of the feed (wet weight) consumed by the chickens. A drawback of such β -alanine administration was that, although the feed conversion ratio decreased, the feed consumption and the bodyweight gain also decreased. These results were consistent with the results obtained by Jacob et al. (1991), who supplemented the diet of one day old broiler chickens with 2.5 and 5.0% of β -alanine. Such high β -alanine supplementations are therefore not interesting from a commercial point of view. Moreover, although the carnosine level increased in the experiments performed by Tomonaga et al. (2005), the anserine level decreased so that there was no significant increase of the dipeptide (carnosine and anserine) level. Since anserine has even a stronger anti-oxidant activity than carnosine, no effective effects might be obtained by the β -alanine treatment from the point of view of anti-oxidant activity. Finally, due to the fact that β -alanine is an antagonist of taurine (i.e. is a taurine transporter inhibitor), the taurine concentration was found by Tomonaga et al. to be significantly decreased (i.e. was reduced with more than 50%) in the breast muscles.

[0009] In their next publication of 2006, they tried to increase the sum of dipeptides in the muscles by using more moderate β -alanine treatments in chickens. More particularly, they supplemented the feed of 24 days old broiler chickens for 4 weeks with 0.5, 1 and 2% of β -alanine. Carnosine and anserine concentrations in the breast muscles of the chickens were not influenced by this dietary treatment. The β -alanine concentration however significantly increased whilst the taurine concentration significantly decreased. For the higher concentrations of 1 and 2%, the growth performance parameters were negatively affected, namely the bodyweight gain still decreased significantly whilst the feed conversion ratio now increased instead of decreased. For the lowest concentration of 0.5% no significant changes of the bodyweight gain and of the feed conversion ratio were observed.

[0010] From the publications of Tomonaga et al. it thus appears that it would not be possible to reduce the feed conversion ratio in broiler chickens substantially without also reducing the bodyweight gain.

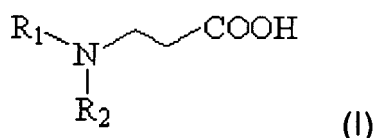
[0011] β -alanine was also supplemented to pigs, namely by Mei et al. (1998) to determine the influence thereof on the oxidative stability of pork. They found out that a supplementation of the pig diet with 0.225% of β -alanine is not an

efficient method to increase the oxidative stability of pork. As to the production parameters, the feed conversion ratio was decreased somewhat by the β -alanine supplementation but the bodyweight gain also decreased somewhat. In combination with histidine, the bodyweight gain decreased even more and the feed conversion ratio increased to become higher than the control. Mei et al. therefore doesn't teach that it is possible to decrease the feed conversion ratio by means of a β -alanine compound without reducing the bodyweight gain nor that it would be possible to increase the bodyweight gain.

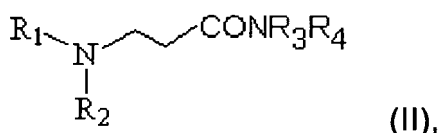
[0012] Supplementation of the diet of fish, more particularly of Japanese flounders, with 8.9 g/kg of β -alanine was done by Kim et al. (2003). The bodyweight gain was increased somewhat but not significantly. The feed conversion ratio (incorrectly designated as feed efficiency by Kim et al.) was however increased significantly by the β -alanine supplementation. This feed conversion ratio, ranging between 1.43 and 1.76, was incorrectly designated as feed efficiency by Kim et al. (as a matter of fact, a feed efficiency measured based on the bodyweight gain cannot be larger than 1). The feed efficiency is indeed the inverse of the feed conversion ratio and thus ranges in the results of Kim et al. between 0.57 and 0.7. This is consistent with the feed efficiency of flounder determined with a same food (protein-to-lipid level which was also 50:10%) by Hebb et al. (2003) to be equal to 0.7.

[0013] An object of the present invention is to provide an alternative non-therapeutic treatment of poultry, pigs or fish which enables to reduce the conversion ratio of the feed used to feed these animals without reducing however the bodyweight gain, i.e. the average weight gain, or which even enables to increase the bodyweight gain.

[0014] In a first aspect, the present invention concerns a method for the non-therapeutic treatment of animals selected from the group consisting of poultry, pigs and fish, which treatment comprises orally administering at least one β -alanine compound to the animals in an amount of between 2 and 55 mmol/kg dry weight of said feed for the treatment of poultry and fish and between 2 and 25 mmol/kg dry weight of said feed for the treatment of pigs, which β -alanine compound corresponds to the following formula (I):

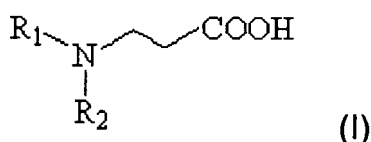


or to a salt or an amide thereof, the amide being of the following formula (II):

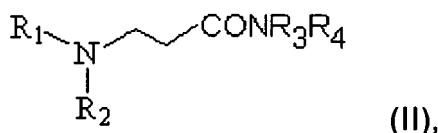


the R_1 and R_2 groups in formula's (I) and (II) being independently hydrogen, an acetyl or a straight or branched alkyl radical containing 1 to 4 carbon atoms, and the R_3 and R_4 groups in formula (II) being independently hydrogen or a straight or branched alkyl radical containing 1 to 4 carbon atoms.

[0015] In a second aspect, the present invention concerns the use of a β -alanine compound for reducing the conversion ratio of feed used to feed animals selected from the group consisting of poultry, pigs and fish, without lowering their bodyweight gain, which β -alanine compound is orally administered to said animals in an amount of between 2 and 55 mmol/kg dry weight of said feed for the treatment of poultry and fish and between 2 and 25 mmol/kg dry weight of said feed for the treatment of pigs, which β -alanine compound corresponds to the following formula (I):

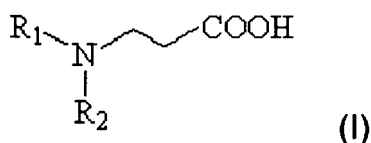


or to a salt or an amide thereof, the amide being of the following formula (II):

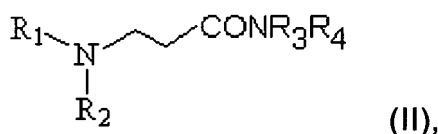


the R_1 and R_2 groups in formula's (I) and (II) being independently hydrogen, an acetyl or a straight or branched alkyl radical containing 1 to 4 carbon atoms, and the R_3 and R_4 groups in formula (II) being independently hydrogen or a straight or branched alkyl radical containing 1 to 4 carbon atoms.

[0016] In a third aspect, the present invention concerns the use of a β -alanine compound for increasing the bodyweight gain of the animals, i.e. the increase of the bodyweight of the animals per time unit, which β -alanine compound is orally administered to said animals in an amount of between 2 and 55 mmol/kg dry weight of said feed for the treatment of poultry and fish and between 2 and 25 mmol/kg dry weight of said feed for the treatment of pigs, which β -alanine compound corresponds to the following formula (I):

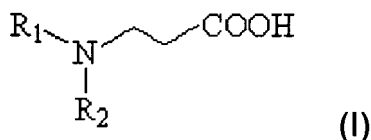


or to a salt or an amide thereof, the amide being of the following formula (II):

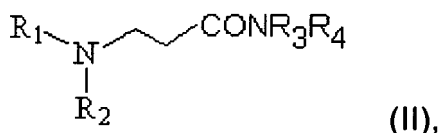


the R_1 and R_2 groups in formula's (I) and (II) being independently hydrogen, an acetyl or a straight or branched alkyl radical containing 1 to 4 carbon atoms, and the R_3 and R_4 groups in formula (II) being independently hydrogen or a straight or branched alkyl radical containing 1 to 4 carbon atoms.

[0017] In a fourth aspect, the present invention concerns a feed for poultry or fish comprising between 2 and 55 mmol/kg dry weight of a β -alanine compound, or a feed for pigs comprising between 2 and 25 mmol/kg dry weight of said β -alanine compound, which β -alanine compound corresponds to the following formula (I):



or to a salt or an amide thereof, the amide being of the following formula (II):



the R_1 and R_2 groups in formula's (I) and (II) being independently hydrogen, an acetyl or a straight or branched alkyl radical containing 1 to 4 carbon atoms, and the R_3 and R_4 groups in formula (II) being independently hydrogen or a straight or branched alkyl radical containing 1 to 4 carbon atoms.

[0018] In a preferred embodiment, the β -alanine compound is β -alanine, N,N-dimethyl β -alanine, N,N-diethyl β -alanine, , N,N-di-n-propyl β -alanine, N, N-diisopropyl β -alanine, N,N-di-n-butyl β -alanine, N,N-diisobutyl β -alanine, N,N-di-tert-butyl β -alanine, 3-acetamidopropanoic acid or mixtures or salts thereof, for example a sodium, potassium, magnesium or calcium salt, the β -alanine compound being preferably β -alanine or a salt thereof.

[0019] A difference with the prior art cited here above is that the reduction of the feed conversion ratio or the increase

of the body weight gain is obtained with amounts of the β -alanine compound which are smaller than those used in the prior art to achieve a reduction of the feed conversion ratio, namely with amounts of the β -alanine compound which are comprised between 2 and 55 mmol/kg dry weight of the feed, when used for the treatment of poultry or fish, or between 2 and 25 mmol/kg dry weight of the feed, when used for the treatment of pigs. Such small amounts of the β -alanine compound do not reduce the bodyweight gain but surprisingly still enable to reduce the feed conversion ratio. Moreover, the smaller the amount of the β -alanine compound, the smaller the cost for the supplementation of the feed with this feed additive.

[0020] In a preferred embodiment of the invention, the preferred amount of the β -alanine compound in the finished feed is at least 5, preferably at least 10 and more preferably at least 15 mmol/kg dry weight of said feed. The maximum amount of the β -alanine compound in the finished feed is preferably less than 50, preferably less than 40 and more preferably less than 30 and most preferably less than 25 or even less than 20 mmol/kg dry weight of said feed, when used for the treatment of poultry or fish, or preferably less than 22, more preferably less than 20 and most preferably less than 17 mmol/kg dry weight of said feed, when used for the treatment of pigs.

[0021] The present invention is applicable to any type of commercial meat production operation. The animals are poultry (i.e. chickens or turkeys), pigs or fish. In commercial pig and poultry production operation the herd is typically under substantial stress. As is well known, normal industry growing conditions include substantial density in the enclosure. Further, the ventilation in such commercial growing operations is often not a precisely controlled operation and the determination of appropriate ventilation including both heating and cooling is a very subjective operation. For broilers, the life span moreover ranges from about 35 to about 49 days whilst the lifespan for turkeys ranges from 12 to 24 weeks. The life span for slaughter pigs is around 6 months whilst sows are usually removed after 3 rounds. Both for poultry and for pigs the whole operation from birth to market in conditions under which growth/reproduction is achieved is therefore very stressful. Moreover, to aggravate the problem, growers will typically push the limits of recommended industry conditions which simply increases the stress on the flock or herd.

[0022] Due to these high performance conditions, the occurrence level of metabolic problems is already quite high in practice and limits the development of new feeds or production methods which causes even more metabolic or oxidative stress. A higher oxidative stress is for example obtained when the feed compositions contain more unsaturated fatty acids, for example more than 2 % by dry weight or more than 3 or even more than 4 % by dry weight of the feed, whilst a higher metabolic stress is obtained when the animals are made to take up more calories to increase performance. The fatty acids contained in the feed compositions are either free fatty acids or fatty acids bound for example in di- or triglycerides.

[0023] Nowadays animal feed compositions are more and more supplemented with fats from vegetal sources, as a cheaper and more sustainable alternative to fish oil and a safer alternative to animal fat. Hence, because of growing customer demand for use of vegetarian diets in meat production in order to avoid potential hazards peculiar to animal by-products such as PCB, dioxin or BSE contamination. A second reason is to increase the amount of PUFA's (poly unsaturated fatty acids) in the meat, improving the nutritional value of the meat without compromising the total energy value of the feed for the animals. As a direct effect of this increased level of vegetal fat in the feed the dietary induced oxidative stress increases, which leads to genotoxicity (DNA damage) and tissue damage.

[0024] The β -alanine compound administered to the animals is preferably β -alanine, N,N-dimethyl β -alanine, N,N-diethyl β -alanine, N,N-di-n-propyl β -alanine, N,N-diisopropyl β -alanine, N,N-di-n-butyl β -alanine, N,N-diisobutyl β -alanine, N,N-di-tert-butyl β -alanine, 3-acetamidopropanoic acid or a salt of these compounds, for example a sodium, potassium, magnesium or calcium salt. The most preferred β -alanine compound is β -alanine or a salt thereof.

[0025] When the β -alanine compound is water-soluble, such as β -alanine itself, it can be dosed in the drinking water of the animals. Most preferably, the β -alanine compound is however administered via the feed. The β -alanine compound can either be added directly to the feed, or to a feed supplement, in particular a so-called premix, which is usually used to prepare the feed. Such a feed supplement generally comprises at least vitamins and minerals.

[0026] The β -alanine compound is preferably administered over a period of 7 days or longer, preferably over a period of 14 days or longer.

Experimental results

Poultry:

Materials and methods

[0027] A group of 252 Ross 308 chickens were randomly distributed over 14 pens with 18 animals each. All chickens were previously housed in identical conditions, and fed the same diet as the control group in the trial. Every other pen was attributed to either a control diet or that control diet supplemented with 500 mg β -alanine per kg (= 595 mg or 6.7 mmol β -alanine per kg dry weight). Water was freely available from drinking cups, and animals were fed ad libitum. The

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control diet was a commercial broiler diet (Vanden Avenne, Braadkip 114MB) with 4% corn oil added to increase the level of oxidative stress, as used in earlier studies (Kalmar et al., 2011). The composition of this diet is summarized in Tables 1 and 2.

Table 1: Ingredient composition of the experimental diet.

Ingredient	Content, g/kg
<i>Wheat</i>	538
<i>Corn</i>	29
<i>Corn oil</i>	40
<i>Toasted soybean meal</i>	228
<i>Toasted soybeans</i>	29
<i>Peas</i>	19
<i>Alphalpha meal</i>	10
<i>Animal fat</i>	58
<i>Soy oil</i>	17
<i>Dicalcium phosphate</i>	10
<i>Limestone</i>	8
<i>Sodium bicarbonate</i>	1.2
<i>Sodium chloride</i>	1.7
<i>Premix*</i>	4.8
<i>L-lysine HCl</i>	3.4
<i>DL-methionine</i>	3.1
<i>L-threonine</i>	1.2
<i>3-phytase</i>	500 (ftu/kg)
<i>Endoxylanase</i>	10 (ftu/kg)
*Premix contains per kg of feed: vitamin A: 9615 IU/kg, vitamin D3: 2404 IU/kg, vitamin E: 38 mg/kg, Cu (Cu sulphate): 7 mg/kg, Fe (Fe sulphate): 33 mg/kg, I (Ca iodate): 2 mg/kg, Mg (Mg oxide): 71 mg/kg, Zn (zinc oxide): 53 mg/kg, Se (sodium selenite): 0.2 mg/kg, BHT: 96 mg/kg.	

Table 2: Nutrient composition of the experimental diet.

Nutrient	Content
<i>Dry matter, g/kg</i>	841
<i>Ash, g/kg</i>	51
<i>Crude protein, g/kg</i>	190
<i>Ether extract, g/kg</i>	132
<i>Crude fibre, g/kg</i>	33
<i>Nitrogen-free extract, g/kg</i>	435

(continued)

Nutrient	Content
<i>Metabolisable energy, MJ/kg</i>	13.52
<i>Methionine, g/kg</i>	5.8
<i>Lysine, g/kg</i>	11.9
<i>P, g/kg</i>	4.6
<i>Ca, g/kg</i>	7.2
<i>Na, g/kg</i>	1.3

[0028] From the age of 24 days to the age of 48 days, the change in bodyweight was measured per bird, but pooled per pen as the experimental unit. At 42 days of age, one male bird per pen was euthanized by intravenous injection of sodium pentobarbital. From the breast and thigh muscle, a sample was dissected and stored airtight at -20°C until analysis. The breast muscle sample was taken at about one third from the distal end of the breast.

[0029] Muscle and thigh samples were analysed for their concentration of anserine, carnosine and taurine by high-performance liquid chromatography.

Results

[0030] No animals died or became ill during the trial. Table 3 demonstrates that muscular anserine concentrations were overall higher than muscular carnosine concentrations. Both anserine and carnosine were higher in breast muscle than in thigh muscle, whereas taurine concentration was lower in breast muscle than in thigh muscle.

[0031] β -alanine supplementation had substantially no effect on the muscular concentrations of carnosine, anserine and taurine, this in contrast to the findings of Tomonaga et al. (2005 and 2006) who used however much higher β -alanine supplementations.

Table 3: Effect of beta-alanine supplementation on histidine-containing dipeptides and taurine concentrations in thigh and breast of broiler chickens.

Beta-alanine, mg/kg	Thigh		Breast	
	0	500	0	500
<i>Carnosine, mmol/kg</i>	4.6	4.8	7.5	7.9
<i>Anserine, mmol/kg</i>	13.8	12.6	34.8	36.9
<i>HCD, mmol/kg*</i>	18.3	17.4	42.3	44.8
<i>Taurine, mmol/kg</i>	5.8	5.6	2.0	2.2
<i>*HCD= Histidine Containing Dipeptides</i>				

[0032] The birds in the β -alanine group tended to have a higher bodyweight at slaughter, and indeed tended to grow faster, i.e. tended to have a higher bodyweight gain.

Table 4: Effect of beta-alanine supplementation on broiler chicken performance between 24 and 42 days of age.

Beta-alanine, mg/kg	0	500
<i>Initial bodyweight, kg</i>	1.350	1.362
<i>Final bodyweight, kg</i>	2.810	2.874
<i>Average daily gain, g</i>	104	108

Fish

Materials and methods

[0033] A group of 24 carps were distributed over 12 aquaria with 2 fish each. All fish were previously housed in identical conditions, and fed the same diet as the control group in the trial. Every other aquarium was attributed to either a control diet or that control diet supplemented with 500 mg β -alanine per kg. Feeding was done at 1.5% of the body weight, during 2 feeding times/day. To increase the level of oxidative stress, the carps were kept at 27°C (4°C above the advised temperature).

[0034] The change in bodyweight after the 14 day feeding experiment was measured per fish, but pooled per aquarium as the experimental unit.

Results

[0035]

Table 5: Effect of beta-alanine supplementation on carp performance during 14 day experiment.

<i>Beta-alanine, mg/kg</i>	0	500
<i>Initial bodyweight, g</i>	201.5	211.1
<i>Final bodyweight, g</i>	213.2	230.1
<i>Average weight gain, g</i>	11.8	19.0
<i>Average feed intake, g</i>	37.5	44.1
<i>Feed conversion ratio, g:g</i>	3.9	2.7

Pigs

Materials and methods

[0036] At 9 weeks of age, 48 pigs (24 gilts and 24 surgical castrated barrows) were divided randomly into groups of four pigs of the same gender. Each group was housed in a separate pen resulting in six pens of four gilts and six pens of four barrows. All pigs were fed the same commercial diet and for three of the six pens of gilts and three of the six pens of barrows their diet was supplemented with 500 mg β -alanine per kg (= 568 mg or 6.4 mmol β -alanine per kg dry weight). Water was freely available and the animals were fed ad libitum. After 6 weeks (age of 15 weeks) all animals were euthanized by sodium-pentobarbital.

Table 6: Ingredient composition of the experimental diet.

<i>Ingredient</i>	<i>Content %</i>
<i>Wheat</i>	38.85
<i>Wheat gluten</i>	12.44
<i>Soybean meal</i>	11.43
<i>Barley</i>	10
<i>Ground cereals</i>	7,5
<i>Wheat bran</i>	5
<i>Sugar beet pulp</i>	4.455
<i>Maize</i>	2.55
<i>Sugar beet molasses</i>	2
<i>Animal fat</i>	1.497
<i>Limestone</i>	0.879

(continued)

<i>Ingredient</i>	<i>Content %</i>
<i>Rapeseed meal</i>	0.833
<i>Lysine HCl</i>	0.738
<i>Acid mixture</i>	0.5
<i>Vitamin-mineral premix</i>	0.45
<i>Salt</i>	0.281
<i>MCP</i>	0.236
<i>L-threonine</i>	0.144
<i>DL-methionine</i>	0.105
<i>C-tryptophan</i>	0.079
<i>Phytase</i>	0.018

Table 7: Nutrient composition of the experimental diet.

<i>Nutrient</i>	<i>Content</i>
<i>Dry matter</i>	880 g/kg
<i>Net energy pig</i>	9,55 MJ/kg
<i>Digestible P</i>	2,7 g/kg
<i>Digestible lysine</i>	8,8 g/kg
<i>Digestible methionine</i>	2,99 g/kg
<i>Digestible methionine + cystine</i>	5,19 g/kg
<i>Digestible threonine</i>	5,365 g/kg
<i>Digestible tryptophan</i>	1,672 g/kg
<i>Digestible valine</i>	6,279 g/kg

Results

[0037] No animals died or became ill during the trial. Table 8 demonstrates that β -alanine increases the overall growth of the piglets. They tend to have a higher bodyweight at slaughter and grow faster, i.e. tended to have a higher bodyweight gain.

Table 8: Effect of beta-alanine supplementation on pig performance between 9 and 15 weeks of age.

<i>Beta-alanine, mg/kg</i>	0	500
<i>Initial bodyweight, kg</i>	18.5	18.7
<i>Final bodyweight, kg</i>	43.2	44.1
<i>Bodyweight gain over 6 weeks</i>	24.8	25.4

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[0038]

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Hu X., Hongtrakul K., Ji C., Ma Q., Guan S., Song C., Zhang Y., Zhao L. 2009. Effect of carnosine on growth performance, carcass characteristics, meat quality and oxidative stability in broiler chickens. *Japan Poultry Science* 46: 296-302.

Tomonaga S., Kaji Y., Tachibana T., Denbow M. D., Furuse M. 2005. Oral administration of β -alanine modifies carnosine concentrations in the muscles and brains of chickens. *Animal Science Journal* 76: 249-254.

Jacob J.P., Blair R., Hart L.E. 1991. The effect of taurine transport antagonists on cardiac taurine concentration and the incidence of sudden death syndrome in male broiler chickens. *Poultry Science* 70 : 561-567.

Tomonaga S., Kaneko K., Kaji Y., Kido Y., Denbow M.D. 2006. Dietary β -alanine enhances brain, but not muscle, carnosine and anserine concentrations in broilers. *Animal Science Journal* 77 : 79-86.

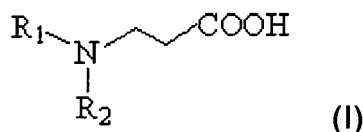
Mei L., Cromwell G.L., Crum A.D., Decker E.A. 1998. Influence of dietary β -alanine and histidine on the oxidative stability of pork. *Meat Science* 49(1): 55-64.

Kim S., Takeuchi T., Yokoyama M., Murata Y. 2003. Effect of dietary supplementation with taurine, β -alanine and GABA on the growth of juvenile and fingerling Japanese flounder *Paralichthys olivaceus*. *Fisheries Science* 69: 242-248.

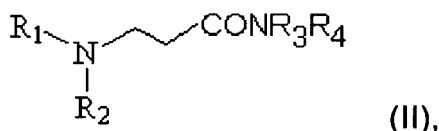
Hebb C.D., Castell J.D., Anderson D.M., Batt J. 2003. Growth and feed conversion of juvenile winter flounder (*Pleuronectes americanus*) in relation to different protein-to-lipid levels in isocaloric diets. *Aquaculture* Volume:221, Issue: 1-4, Pages: 439-449.

Claims

1. A method for the non-therapeutic treatment of animals selected from the group consisting of poultry, pigs and fish, which treatment comprises orally administering at least one β -alanine compound to the animals in an amount of between 2 and 55 mmol/kg dry weight of said feed for the treatment of poultry and fish and between 2 and 25 mmol/kg dry weight of said feed for the treatment of pigs, which β -alanine compound corresponds to the following formula (I):



or to a salt or an amide thereof, the amide being of the following formula (II):

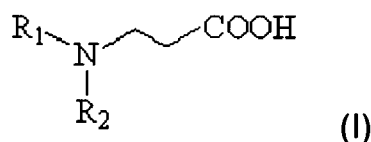


the R_1 and R_2 groups in formula's (I) and (II) being independently hydrogen, an acetyl or a straight or branched alkyl radical containing 1 to 4 carbon atoms, and the R_3 and R_4 groups in formula (II) being independently hydrogen or a straight or branched alkyl radical containing 1 to 4 carbon atoms.

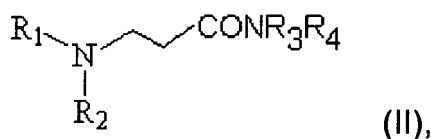
2. The method according to claim 1, wherein the β -alanine compound is selected from the group consisting of β -alanine, N,N-dimethyl β -alanine, N,N-diethyl β -alanine, N,N-di-n-propyl β -alanine, N,N-diisopropyl β -alanine, N,N-di-n-butyl β -alanine, N,N-diisobutyl β -alanine, N,N-di-tert-butyl β -alanine, 3-acetamidopropanoic acid or mixtures or salts thereof, the β -alanine compound being preferably β -alanine or a salt thereof.
3. The method according to claim 1 or 2, wherein the β -alanine compound is administered via said feed and/or via the drinking water of the animals.
4. The method according to any one of the claims 1 to 3, wherein the β -alanine compound is administered in an amount of at least 5, preferably at least 10 and more preferably at least 15 mmol/kg dry weight of said feed.
5. The method according to any one of the claims 1 to 4, wherein the β -alanine compound is administered in an amount of less than 50, preferably less than 40, more preferably less than 30, still more preferably less than 25 and most

preferably less than 20 mmol/kg dry weight of said feed for the treatment of poultry and fish and in an amount of less than 22, preferably less than 20 and more preferably less than 17 mmol/kg dry weight of said feed for the treatment of pigs.

6. The method according to any one of the claims 1 to 5, wherein the β -alanine compound is orally administered to poultry, in particular to poultry that are at least one week, preferably at least two weeks of age.
7. The method according to any one of the claims 1 to 6, wherein the β -alanine compound is orally administered to said animals for the purpose of reducing the conversion ratio of the feed used to feed the animals without lowering their bodyweight gain.
8. The method according to any one of the claims 1 to 6, wherein the β -alanine compound is orally administered to said animals for the purpose of increasing their bodyweight gain.
9. Use of a β -alanine compound for reducing the conversion ratio of feed used to feed animals selected from the group consisting of poultry, pigs and fish, without lowering their bodyweight gain, or for increasing the bodyweight gain of the animals, which β -alanine compound is orally administered to said animals in an amount of between 2 and 55 mmol/kg dry weight of said feed for the treatment of poultry and fish and between 2 and 25 mmol/kg dry weight of said feed for the treatment of pigs, which β -alanine compound corresponds to the following formula (I):

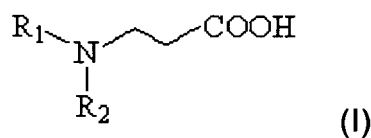


or to a salt or an amide thereof, the amide being of the following formula (II):

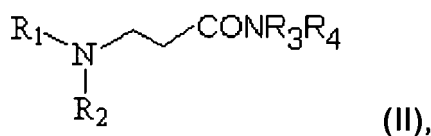


the R_1 and R_2 groups in formula's (I) and (II) being independently hydrogen, an acetyl or a straight or branched alkyl radical containing 1 to 4 carbon atoms, and the R_3 and R_4 groups in formula (II) being independently hydrogen or a straight or branched alkyl radical containing 1 to 4 carbon atoms.

10. Use according to claim 9, wherein said β -alanine compound is added to said animal feed.
11. A feed for poultry or for fish comprising between 2 and 55 mmol/kg dry weight of a β -alanine compound, which β -alanine compound corresponds to the following formula (I):

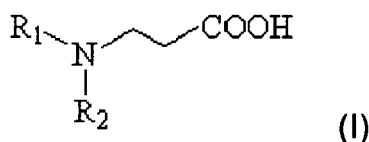


or to a salt or an amide thereof, the amide being of the following formula (II):

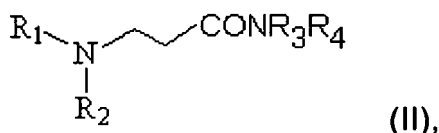


the R_1 and R_2 groups in formula's (I) and (II) being independently hydrogen, an acetyl or a straight or branched alkyl radical containing 1 to 4 carbon atoms, and the R_3 and R_4 groups in formula (II) being independently hydrogen or a straight or branched alkyl radical containing 1 to 4 carbon atoms.

12. A feed according to claim 11, which comprises said β -alanine compound in an amount of less than 50, preferably less than 40, more preferably less than 30, still more preferably less than 25 and most preferably less than 20 mmol/kg dry weight of said feed.
13. A feed for pigs comprising between 2 and 25 mmol/kg dry weight of a β -alanine compound, which β -alanine compound corresponds to the following formula (I):



or to a salt or an amide thereof, the amide being of the following formula (II):

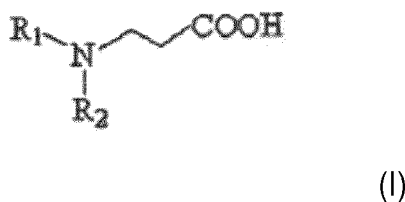


the R_1 and R_2 groups in formula's (I) and (II) being independently hydrogen, an acetyl or a straight or branched alkyl radical containing 1 to 4 carbon atoms, and the R_3 and R_4 groups in formula (II) being independently hydrogen or a straight or branched alkyl radical containing 1 to 4 carbon atoms.

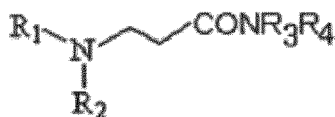
14. A feed according to claim 13, which comprises said β -alanine compound in an amount of less than 22, preferably less than 20 and more preferably less than 17 mmol/kg dry weight of said feed.
15. The feed according to any one of the claims 11 to 14, which comprises said β -alanine compound in an amount of at least 5, preferably at least 10 and more preferably at least 15 mmol/kg dry weight of said feed.
16. The feed according to any one of the claims 11 to 15, wherein the β -alanine compound is selected from the group consisting of β -alanine, N,N-dimethyl β -alanine, N,N-diethyl β -alanine, N,N-di-n-propyl β -alanine, N,N-diisopropyl β -alanine, N,N-di-n-butyl β -alanine, N,N-diisobutyl β -alanine, N,N-di-tert-butyl β -alanine, 3-acetamidopropanoic acid or mixtures or salts thereof, the β -alanine compound being preferably β -alanine or a salt thereof.

Patentansprüche

1. Ein Verfahren für die nicht-therapeutische Behandlung von Tieren ausgewählt aus der Gruppe bestehend aus Geflügel, Schweinen und Fischen, wobei die Behandlung die orale Verabreichung zumindest einer β -Alanin-Verbindung an die Tiere in einer Menge von zwischen 2 und 55 mmol/kg Trockengewicht des erwähnten Futtermittels für die Behandlung von Geflügel und Fischen und zwischen 2 und 25 mmol/kg Trockengewicht des erwähnten Futtermittels für die Behandlung von Schweinen umfasst, wobei die β -Alanin-Verbindung der folgenden Formel entspricht (I):



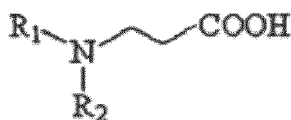
oder einem Salz oder einem Amid davon, wobei das Amid die folgende Formel hat (II):



(II),

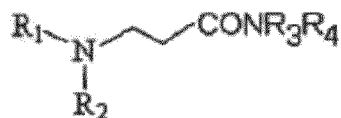
wobei die R₁- und R₂-Gruppen in den Formeln (I) und (II) unabhängig Wasserstoff, ein Acetyl- oder ein gerades oder verzweigtes Alkylradikal mit 1 bis 4 Kohlenstoffatomen sind, und die R₃- und R₄-Gruppen in Formel (II) unabhängig Wasserstoff oder ein gerades oder verzweigtes Alkylradikal mit 1 bis 4 Kohlenstoffatomen sind.

2. Das Verfahren nach Anspruch 1, wobei die β-Alanin-Verbindung aus der Gruppe bestehend aus β-Alanin, N,N-Dimethyl-β-alanin, N,N-Diethyl-β-alanin, N,N-Di-n-propyl-β-alanin, N,N-Diisopropyl-β-alanin, N,N-Di-n-butyl-β-alanin, N,N-Diisobutyl-β-alanin, N,N-Di-tert-butyl-β-alanin, 3-Acetamidopropionsäure oder Mischungen oder Salzen davon ausgewählt wird, wobei die β-Alanin-Verbindung vorzugsweise β-Alanin oder ein Salz davon ist.
3. Das Verfahren nach Anspruch 1 oder 2, wobei die β-Alanin-Verbindung über das erwähnte Futtermittel und/oder über das Trinkwasser der Tiere verabreicht wird.
4. Das Verfahren nach irgendeinem der Ansprüche 1 bis 3, wobei die β-Alanin-Verbindung in einer Menge von mindestens 5, vorzugsweise mindestens 10 und noch besser mindestens 15 mmol/kg Trockengewicht des erwähnten Futtermittels verabreicht wird.
5. Das Verfahren nach irgendeinem der Ansprüche 1 bis 4, wobei die β-Alanin-Verbindung in einer Menge von weniger als 50, bevorzugt weniger als 40, bevorzugter weniger als 30, noch besser weniger als 25 und am besten weniger als 20 mmol/kg Trockengewicht des erwähnten Futtermittels für die Behandlung von Geflügel und Fischen und in einer Menge von weniger als 22, vorzugsweise weniger als 20 und noch besser weniger als 17 mmol/kg Trockengewicht des erwähnten Futtermittels für die Behandlung von Schweinen verabreicht wird.
6. Das Verfahren nach irgendeinem der Ansprüche 1 bis 5, wobei die β-Alanin-Verbindung Geflügel oral verabreicht wird, insbesondere Geflügel, das mindestens eine Woche, vorzugsweise mindestens zwei Wochen alt ist.
7. Das Verfahren nach irgendeinem der Ansprüche 1 bis 6, wobei die β-Alanin-Verbindung den erwähnten Tieren oral verabreicht wird, um die Verwertungsrate des zum Füttern der Tiere verwendeten Futtermittels zu senken, ohne ihre Gewichtszunahme zu reduzieren.
8. Das Verfahren nach irgendeinem der Ansprüche 1 bis 6, wobei die β-Alanin-Verbindung den erwähnten Tieren oral verabreicht wird, um ihre Gewichtszunahme zu erhöhen.
9. Anwendung einer β-Alanin-Verbindung zur Senkung der Verwertungsrate von Futtermitteln zum Füttern von Tieren ausgewählt aus der Gruppe bestehend aus Geflügel, Schweinen und Fischen, ohne ihre Gewichtszunahme zu senken, oder zur Steigerung der Gewichtszunahme der Tiere, wobei die β-Alanin-Verbindung den erwähnten Tieren in einer Menge von zwischen 2 und 55 mmol/kg Trockengewicht des erwähnten Futtermittels für die Behandlung von Geflügel und Fischen und zwischen 2 und 25 mmol/kg Trockengewicht des erwähnten Futtermittels für die Behandlung von Schweinen oral verabreicht wird, wobei die β-Alanin-Verbindung der folgenden Formel entspricht (I):



(I)

oder einem Salz oder einem Amid davon, wobei das Amid die folgende Formel hat (II):

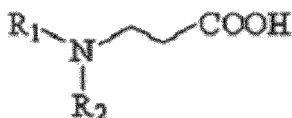


(II),

wobei die R_1 - und R_2 -Gruppen in den Formeln (I) und (II) unabhängig Wasserstoff, ein Acetyl- oder ein gerades oder verzweigtes Alkylradikal mit 1 bis 4 Kohlenstoffatomen sind, und die R_3 - und R_4 -Gruppen in Formel (II) unabhängig Wasserstoff oder ein gerades oder verzweigtes Alkylradikal mit 1 bis 4 Kohlenstoffatomen sind.

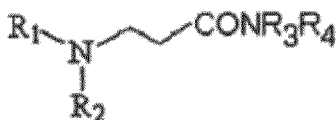
10. Anwendung nach Anspruch 9, wobei die erwähnte β -Alanin-Verbindung dem erwähnten Futtermittel zugesetzt wird.

11. Ein Futtermittel für Geflügel oder Fische, das zwischen 2 und 55 mmol/kg Trockengewicht einer β -Alanin-Verbindung enthält, wobei die β -Alanin-Verbindung der folgenden Formel entspricht (I):



(I)

oder einem Salz oder einem Amid davon, wobei das Amid die folgende Formel hat (II):

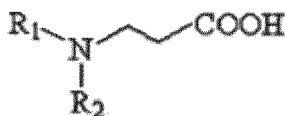


(II),

wobei die R_1 - und R_2 -Gruppen in den Formeln (I) und (II) unabhängig Wasserstoff, ein Acetyl- oder ein gerades oder verzweigtes Alkylradikal mit 1 bis 4 Kohlenstoffatomen sind, und die R_3 - und R_4 -Gruppen in Formel (II) unabhängig Wasserstoff oder ein gerades oder verzweigtes Alkylradikal mit 1 bis 4 Kohlenstoffatomen sind.

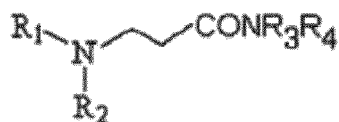
12. Ein Futtermittel nach Anspruch 11, welches die erwähnte β -Alanin-Verbindung in einer Menge von weniger als 50, bevorzugt weniger als 40, bevorzugter weniger als 30, noch besser weniger als 25 und am besten weniger als 20 mmol/kg Trockengewicht des erwähnten Futtermittels enthält.

13. Ein Futtermittel für Schweine, das zwischen 2 und 25 mmol/kg Trockengewicht einer β -Alanin-Verbindung enthält, wobei die β -Alanin-Verbindung der folgenden Formel entspricht (I):



(I)

oder einem Salz oder einem Amid davon, wobei das Amid die folgende Formel hat (II):



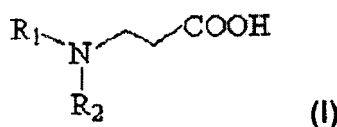
(II),

wobei die R_1 - und R_2 -Gruppen in den Formeln (I) und (II) unabhängig Wasserstoff, ein Acetyl- oder ein gerades oder verzweigtes Alkylradikal mit 1 bis 4 Kohlenstoffatomen sind, und die R_3 - und R_4 -Gruppen in Formel (II) unabhängig Wasserstoff oder ein gerades oder verzweigtes Alkylradikal mit 1 bis 4 Kohlenstoffatomen sind.

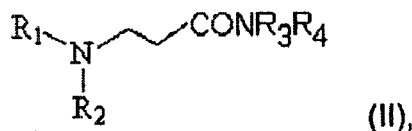
14. Ein Futtermittel nach Anspruch 13, welches die erwähnte β -Alanin-Verbindung in einer Menge von weniger als 22, vorzugsweise weniger als 20 und noch besser weniger als 17 mmol/kg Trockengewicht des erwähnten Futtermittels enthält.
15. Das Futtermittel nach irgendeinem der Ansprüche 11 bis 14, welches die erwähnte β -Alanin-Verbindung in einer Menge von mindestens 5, vorzugsweise mindestens 10 und noch besser mindestens 15 mmol/kg Trockengewicht des erwähnten Futtermittels enthält.
16. Das Futtermittel nach irgendeinem der Ansprüche 11 bis 15, wobei die β -Alanin-Verbindung aus der Gruppe bestehend aus β -Alanin, N,N-Dimethyl- β -alanin, N,N-Diethyl- β -alanin, N,N-Di-n-propyl- β -alanin, N,N-Diisopropyl- β -alanin, N,N-Di-n-butyl- β -alanin, N,N-Diisobutyl- β -alanin, N,N-Di-tert-butyl- β -alanin, 3-Acetamidopropionsäure oder Mischungen oder Salzen davon ausgewählt wird, wobei die β -Alanin-Verbindung vorzugsweise β -Alanin oder ein Salz davon ist.

Revendications

1. Procédé pour le traitement non thérapeutique d'animaux sélectionnés dans le groupe consistant en volailles, porcs et poissons, lequel traitement comprend l'administration par voie orale aux animaux d'au moins un composé de β -alanine dans une quantité comprise entre 2 et 55 mmol / kg de poids sec de ladite alimentation pour le traitement de volailles et de poissons et comprise entre 2 et 25 mmol / kg de poids sec de ladite alimentation pour le traitement de porcs, lequel composé de β -alanine correspond à la formule suivante (I) :



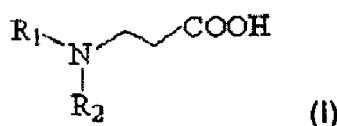
ou à un sel ou à un amide de celui-ci, l'amide étant de la formule suivante (II) :



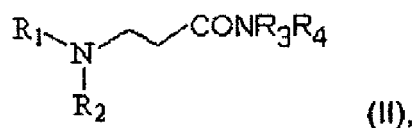
les groupes R_1 et R_2 dans les formules (I) et (II) étant indépendamment de l'hydrogène, un radical acétyle ou un radical alkyle droit ou ramifié contenant 1 à 4 atomes de carbone, et les groupes R_3 et R_4 dans la formule (II) étant indépendamment de l'hydrogène ou un radical alkyle droit ou ramifié contenant 1 à 4 atomes de carbone.

2. Procédé selon la revendication 1, dans lequel le composé de β -alanine est sélectionné dans le groupe consistant en β -alanine, N,N-diméthyl β -alanine, N,N-diéthyl β -alanine, N,N-di-n-propyl β -alanine, N,N-diisopropyl β -alanine, N,N-di-n-butyl β -alanine, N,N-diisobutyl β -alanine, N,N-di-tert-butyl β -alanine, acide 3-acétamidopropanoïque ou des mélanges ou des sels de celui-ci, le composé de β -alanine étant de préférence de la β -alanine ou un sel de celle-ci.

3. Procédé selon la revendication 1 ou 2, dans lequel le composé de β -alanine est administré par l'intermédiaire de ladite alimentation et/ou par l'intermédiaire de l'eau de boisson des animaux.
4. Procédé selon l'une quelconque des revendications 1 à 3, dans lequel le composé de β -alanine est administré dans une quantité d'au moins 5, de préférence d'au moins 10 et mieux encore d'au moins 15 mmol / kg de poids sec de ladite alimentation.
5. Procédé selon l'une quelconque des revendications 1 à 4, dans lequel le composé de β -alanine est administré dans une quantité de moins de 50, de préférence de moins de 40, mieux encore de moins de 30 et même mieux encore de moins de 25 et idéalement de moins de 20 mmol / kg de poids sec de ladite alimentation pour le traitement de volailles et de poissons et dans une quantité de moins de 22, de préférence de moins de 20 et mieux encore de moins de 17 mmol / kg de poids sec de ladite alimentation pour le traitement de porcs.
6. Procédé selon l'une quelconque des revendications 1 à 5, dans lequel le composé de β -alanine est administré par voie orale aux volailles, en particulier aux volailles qui sont âgées d'au moins une semaine, de préférence d'au moins deux semaines.
7. Procédé selon l'une quelconque des revendications 1 à 6, dans lequel le composé de β -alanine est administré par voie orale auxdits animaux dans le but de réduire le taux de conversion de l'alimentation utilisée pour nourrir les animaux sans diminuer leur gain de poids corporel.
8. Procédé selon l'une quelconque des revendications 1 à 6, dans lequel le composé de β -alanine est administré par voie orale auxdits animaux dans le but d'augmenter leur gain de poids corporel.
9. Utilisation d'un composé de β -alanine pour réduire le taux de conversion de l'alimentation utilisée pour nourrir des animaux sélectionnés dans le groupe consistant en volailles, en porcs et en poissons, sans diminuer leur gain de poids corporel, ou pour augmenter le gain de poids corporel des animaux, lequel composé de β -alanine est administré par voie orale auxdits animaux dans une quantité comprise entre 2 et 55 mmol / kg de poids sec de ladite alimentation pour le traitement de volailles et de poissons et comprise entre 2 et 25 mmol / kg de poids sec de ladite alimentation pour le traitement de porcs, lequel composé de β -alanine correspond à la formule suivante (I) :

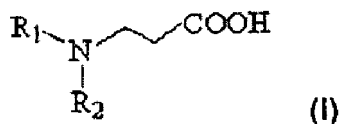


ou à un sel ou à un amide de celui-ci, l'amide étant de la formule suivante (II) :

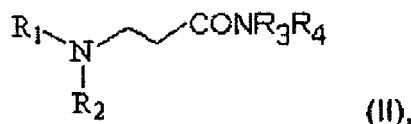


les groupes R_1 et R_2 dans les formules (I) et (II) étant indépendamment de l'hydrogène, un radical acétyle ou un radical alkyle droit ou ramifié contenant 1 à 4 atomes de carbone, et les groupes R_3 et R_4 dans la formule (II) étant indépendamment de l'hydrogène ou un radical alkyle droit ou ramifié contenant 1 à 4 atomes de carbone.

10. Utilisation selon la revendication 9, dans laquelle ledit composé de β -alanine est ajouté à ladite alimentation des animaux.
11. Alimentation pour volailles et pour poissons comprenant entre 2 et 55 mmol/kg de poids sec d'un composé de β -alanine, lequel composé de β -alanine correspond à la formule (I) :



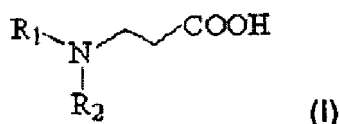
ou à un sel ou à un amide de celui-ci, l'amide étant de la formule suivante (II) :



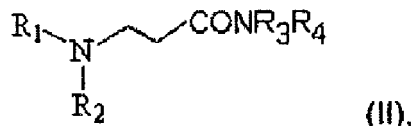
les groupes R_1 et R_2 dans les formules (I) et (II) étant indépendamment de l'hydrogène, un radical acétyl ou un radical alkyle droit ou ramifié contenant 4 à 4 atomes de carbone, et les groupes R_3 et R_4 dans la formule (II) étant indépendamment de l'hydrogène ou un radical alkyle droit ou ramifié contenant 1 à 4 atomes de carbone.

12. Alimentation selon la revendication 11, qui comprend ledit composé de β -alanine dans une quantité de moins de 50, de préférence de moins de 40, mieux encore de moins de 30 et même mieux encore de moins de 25 et idéalement de moins de 20 mmol / kg de poids sec de ladite alimentation.

13. Alimentation pour porcs comprenant entre 2 et 25 mmol / kg de poids sec d'un composé de β -alanine, lequel composé de β -alanine correspond à la formule suivante (I) :



ou à un sel ou à un amide de celui-ci, l'amide étant de la formule suivante (II) :



les groupes R_1 et R_2 dans les formules (I) et (II) étant indépendamment de l'hydrogène, un radical acétyl ou un radical alkyle droit ou ramifié contenant 1 à 4 atomes de carbone, et les groupes R_3 et R_4 dans la formule (II) étant indépendamment de l'hydrogène ou un radical alkyle droit ou ramifié contenant 1 à 4 atomes de carbone.

14. Alimentation selon la revendication 13, qui comprend ledit composé de β -alanine dans une quantité de moins de 22, de préférence de moins de 20 et mieux encore de moins de 17 mmol / kg de poids sec de ladite alimentation.

15. Alimentation selon l'une quelconque des revendications 11 à 14, qui comprend ledit composé de β -alanine dans une quantité d'au moins 5, de préférence d'au moins 10 et mieux encore d'au moins 15 mmol / kg de poids sec de ladite alimentation.

16. Alimentation selon l'une quelconque des revendications 11 à 15, dans laquelle le composé de β -alanine est sélectionné dans le groupe consistant en β -alanine, N,N-diméthyl β -alanine, N,N-diéthyl β -alanine, N,N-di-n-propyl β -alanine, N,N-diisopropyl β -alanine, N,N-di-n-butyl β -alanine, N,N-diisobutyl β -alanine, N,N-di-tert-butyl β -alanine, acide 3-acétamidopropanoïque ou des mélanges ou des sels de celui-ci, le composé de β -alanine étant de préférence de la β -alanine ou un sel de celle-ci.

REFERENCES CITED IN THE DESCRIPTION

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