nucid

Gut Health & Performance Solutions

nuevo

Organic acids

Organic acids are an effective means to support gastrointestinal functionality, prevent growth of pathogens and reduce the use of antibiotics. Their action is related to reducing the pH of the intestinal digesta and affecting the gut ecosystem in numerous ways. Intestinal microbiota can be altered as a result of the remarkable antibacterial activity of organic acids and the growth enhancement of non-pathogenic beneficial microorganisms, due to exclusive competition. Antibacterial activity has been widely reported for many poultry pathogens, such as Salmonella spp., Escherichia coli, Clostridium perfringens, Campylobacter sps., both in vitro and in vivo. Apart from the microbiota, diet supplementation of organic acids has trophic effects on the intestinal mucosa, modifying the morphologic characteristics of intestinal villi and crypts and maintaining epithelial integrity.

Short Chain Fatty Acids

- Formic, Acetic, Propionic
- Reduce pH and affect directly Gram- bacteria
- Fumaric, Citric, Malic, Lactic, Butyric
- Indirect effect on the bacterial population by pH reduction, acting mainly on stomach

Medium Chain Fatty Acids

- Capric, Caprylic, Lauric
- Direct and strong antimicrobial effect on Gram+ and Gram- bacteria

The role of acidifiers in livestock nutrition & health

An important objective of the inclusion of organic acids in diets is the inhibition of intestinal bacteria which complete with the host for available nutrients, and the reduction of possible toxic bacterial metabolites. As a result, nutrient digestibility is improved, specific and non-specific immunity is enhanced and performance is better. Short-chain fatty acids, medium-chain fatty acids and other organic acids have well-known antimicrobial activity, depending on both the concentration of the acid and the bacterial species that are exposed to the acid.

pKa values of SCFA & MCFA

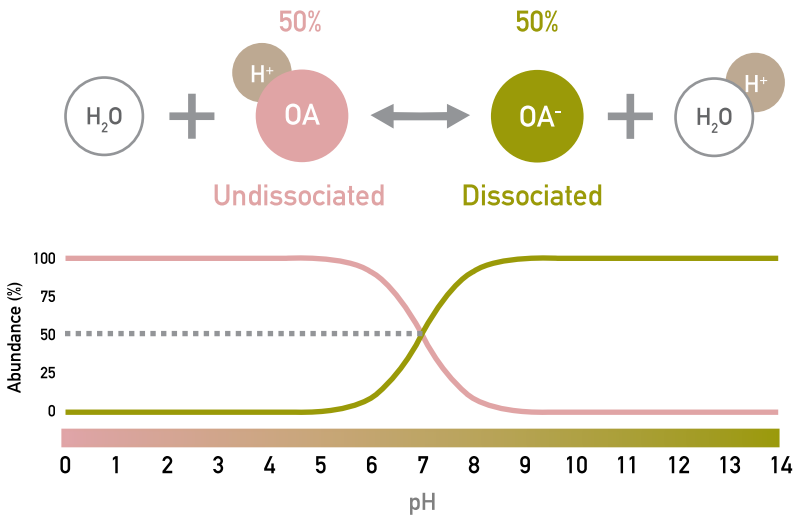
Common name	IPAC name	Chemical Formula	Common location or use	pKa Value
Formic Acid	Methanoic acid	$HCOOH$	Insect stings	3.75
Acetic acid	Ethanoic acid	CH_3COOH	Vinegar	4.76
Propionic acid	Propanoic acid	CH_3CH_2COOH	Body odour	4.86
Butyric acid	Butanoic acid	$CH_3(CH_2)_2COOH$	Butter	4.82
Valeric acid	Pentanoic acid	$CH_3(CH_2)_3COOH$	Valerian	4.82
Caproic acid	Hexanoic acid	$CH_3(CH_2)_4COOH$	Goat fat	4.85
Caprylic acid	Octanoic acid	$CH_3(CH_2)_6COOH$	Coconut and breast milk	4.89
Lauric acid	Dodecanoic acid	$CH_3(CH_2)_{10}COOH$	Coconut oil	5.30

Acidifiers improve the digestibility of nutrients and increase the absorption of minerals. The incorporation of organic acids also leads to thinning of the intestinal lining which facilitates better absorption of nutrients and their efficient utilization. However, their effect will not be similar for all types of organic acids as their mechanism of activity is based on its pKa value.

Strong & weak acids

Organic acids with a high pKa value are weaker acids and therefore more effective preservatives for feed, as, being present in the feedstuff with a higher proportion of their un-dissociated form, can protect feed from fungi and microbes.

Therefore, the lower the pKa of the organic acid (the higher proportion of dissociated form), the greater is its effect on the reduction of stomach pH and the lower its antimicrobial effect in the more distal portions during its transit through the digestive tract.

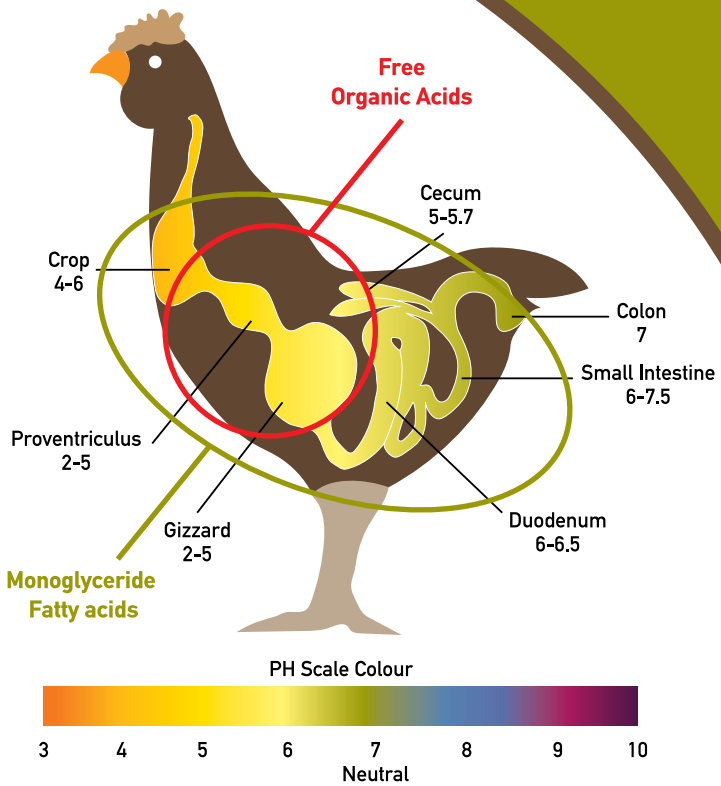


Mode of action

Organic acids are active at a low pH in un-dissociated form only. Antibacterial effects provided mostly up to pH 5.5, i.e. in the crop, stomach and the very beginning of duodenum.

Glycerides of organic acids

When organic acids are bound in a form of stable esters with glycerol (covalent bond), then their antibacterial effect is not pH dependent. The active ingredients work in the entire gastrointestinal tract (GIT) including intestines.

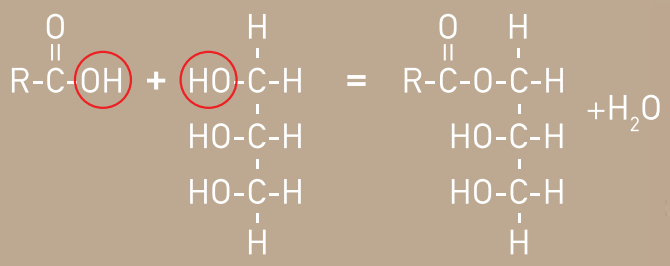


Advantages of Glycerides

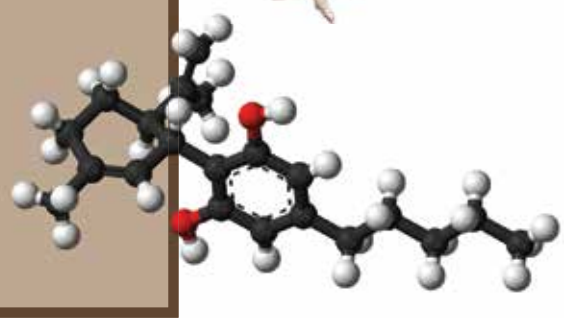
- pH independent
- No smell
- Neutral taste
- Amphiphilic
- Heat stable
- Active in entire GIT
- Non-corrosive
- Non-votatile

Glycerides

Glycerides are composed of a fatty acid linked to a glycerol by an ester bond. Their antimicrobial effects are well established.



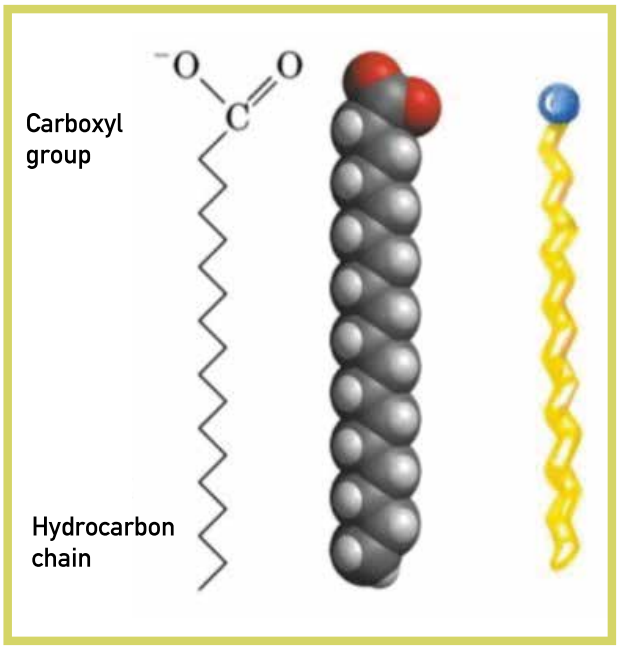
Fatty acid Glycerol α-monoglyceride



Differences between Glycerides and Salts of acids

	Glycerides of Organic Acids	Ca/Na Salts of Acids
Active Component	Monoglycerides of organic acids with short & medium chains	Calcium or sodium salts of organic acids
Need of encapsulation	**no**	**Yes** hydrolysis by water
% of dissociation - pH 3	**0 %**	**0%** Encapsulation is dissolved until in small intestine – pH about 6
Efficiency at pH 3 Antibacterial effect	**yes**	**No** Encapsulation is dissolved until in small intestine – pH about 6
Time of dissociation of organic acid after hydrolysis at pH 7	**never**	**<1 second** immediately after hydrolysis
% of dissociation - pH 7	**0 %**	**98% - 99%**
Efficiency in high pH – 7 Antibacterial effect	**yes**	**no**

Fatty Acid Structure



Glycerides of butyric, valeric, lauric acid

Glycerides of butyric acid:

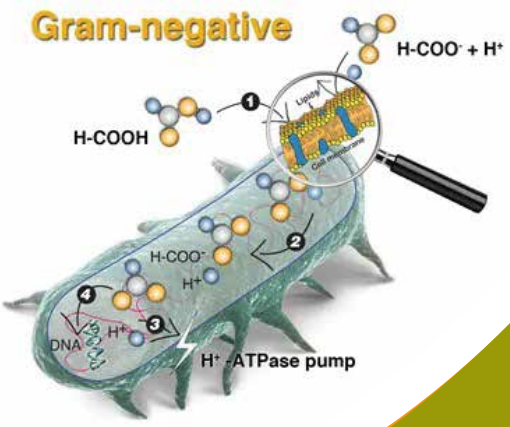
Monobutyrin shows antibacterial effect against Gram-negative bacteria (Salmonella, E.coli) and Cl. perfringens.
Di-and Tri-butryrin improve villi morphology, increase digestive enzyme levels, increase immunoglobulin levels, decrease pro-inflammatory cytokines and overall promote growth.

Monovalerin added to broiler feed can increase body weight, decrease feed conversion rate, positively affect the morphology of the intestinal mucosa, increase the density of GLP-2 producing L-cells, and reduce the incidence of necrotic enteritis.

Monolaurin acts against the fat enveloped viruses such as ND, IB, AI.

Influence of organic acids on gastrointestinal tract

Organic acids have demonstrated the capability to enhance poultry performance by altering the pH of the gastrointestinal tract (GIT) and consequently changing the composition of the microbiome. In addition, organic acids, by altering the composition of the microbiome, protect poultry from pH-sensitive pathogens. Protection is further provided by the ability of organic acids to enhance the morphology and physiology of the GIT and the function of immune system.



Influence of organic acids on gastrointestinal tract of pigs

The intestine is not only critical for nutrient digestion and absorption, but also is the largest immune organ in the body. However, in pig production, inflammation induced by numerous factors, such as pathogen infection and stresses (e.g., weaning), results in intestinal mucosal injury and dysfunction, and consequently results in poor growth of pigs. Dietary fatty acids not only play critical roles in energy homeostasis and cellular membrane composition, but also exert potent effects on intestinal development, immune function, and inflammatory response.

Natural Phytobiotics

The phytogenic component of nucid BH, is a natural phytobiotic-prebiotic combination for maintaining gut balance: Hop extract (Humulus lupulus) has bactericide and immunestimulating effects. Wheat germ extract (Triticum aestivum) has prebiotic and antioxidant effects, Chicory root (Cichorium intybus) has natural prebiotic effects.

Effect of cinnamaldehyde on GIT

Cinnamaldehyde is known for its widespread beneficial effects,
supporting gastro-intestinal health by affecting the microbial population in the gut.
Cinnamaldehyde stimulates the excretion of digestive fluids,
thereby having a positive influence on digestion.
It is highly potent against E. coli, Staphylococcus, Salmonella, and Clostridium.

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Gut Health & Performance Solutions for all animal species

nucid BH

Ingredients: **Monobutyrin & Natural phytobiotic**
Dosage: 0.5-1 kg / ton of feed

nucid BVL

Ingredients: **Monobutyrin, monovalerin, monolaurin**
Dosage: 0.5-1 kg / ton of feed

nucid forte

Ingredients: **Blend of salts of organic acids, salts of organic acids & cinnamaldehyde**
Dosage: 0,5-2 kg / ton of feed

nucid 4Sal

Ingredients: **Blend of organic acids**
Dosage: 0.5-3 kg / ton of feed

nuforce 4M

Ingredients: **Blend of organic acids for D.W.**
Dosage: 0.5 L / 1.000 L water

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Schimatari Viotias, 320 09, Greece
tel: +30 22620 57200-202
fax: +30 22620 59325
e-mail: info@nuevo-group.com

13 Railway Road, Cavan,
H12 YF85 Co. Cavan, Ireland
tel: +353 (0) 49 430 4638
e-mail: office@nuevo-group.com

www.nuevo-group.com