Background *Jan 30, 2019*

Supporting optimal duck performance

New research looked at ways to improve duck productivity. Previous trials have shown that providing adequate levels of methionine improves the performance of poultry in general and that the bioefficacy of DL-methionine (DL-Met) and hydroxy-methionine (OH-Met) sustains growth in broilers specifically.

New studies looked at the performance, feather growth and carcass traits of ducks fed diets supplemented with different levels of the two methionine sources. Body weight gain was similar for both sources and increased with dose. Along with feather, carcass and breast weight results: the study verified the full efficiency of hydroxy-methionine to achieve optimal performance of ducks. Supplementation with OH-Met shows additional benefits, for example, an increase in ducks' total antioxidant capacity.

Nutritional studies were carried out at Huazhong Agricultural University, China in order to compare the effectiveness of OH-Met to DL-Met in Cherry Valley ducks, as well as determining the bio-efficacy of the two sources. Photo: Dick van Doorn

Worldwide duck production

With an ever-growing population, the focus on producing sufficient, affordable and nutritious food continues. Duck meat is very popular in China, which has 80% of the five billion grower ducks worldwide. Of those grower ducks, 3.8 billion are Pekins. After China, South East Asian countries have the largest population of 280 million Pekin ducks with a production with various industrialisation levels. But there is great potential for growth, with large breeding and feed companies setting up to support these developing markets.

The aim of these operations will be to help their customers exploit the genetic potential of Cherry Valley ducks. Therefore, a nutritional solution that helps to optimise body weights and feather growth will be invaluable. Feathers are a significant part of the profit from duck production. Poor feathering increases condemnations and downgrading of birds at slaughter. Meat yield is a key performance indicator and in China in particular there are very high standards for carcass quality. Therefore, optimal feather cover is essential to maintain profitability.

Importance of methionine

Nutritional studies were carried out at Huazhong Agricultural University, China in order to compare the effectiveness of OH-Met to DL-Met in Cherry Valley ducks, as well as determining the bio-efficacy of the two sources. Photo: Dick van Doorn

Nutritionists are clear that is necessary to supplement poultry diets with methionine to ensure performance objectives are met. Methionine is essential for both growth and feathering; even a slight deficiency will reduce performance and hence economic returns. It plays biological roles beyond protein synthesis, through conversion into other sulphur compounds such as glutathione and taurine, two major cellular non-enzymatic antioxidants.

There are three sources of methionine used in animal nutrition L-methionine, DL-methionine (DL-Met) and hydroxy-methionine (OH-Met). OH-Met is as efficient as DL-Met to sustain broiler growth and this comparison has also been made in ducks. A study published in Poultry Science in 2016, investigated the efficacy of OH-Met and DL-Met in Pekin ducks. Compared to a basal diet, supplementation with methionine improved body weights and was dose dependent. An exponential model of regression revealed a similar efficacy for growth between sources. The researchers suggested that dietary methionine concentrations of 0.37% are required to achieve optimal body weights in the starter period.

Table 1: Methionine level and sources in the control and experimental rations.

Treatment	Methionine Source	Level of supplementation (%). Starter ration	Level of supplementation (%). Grower ration
1	Basal diet	0.00	0.00
2	DL-Met	0.04	0.02
3	DL-Met	0.12	0.06
4	DL-Met	0.15	0.10
5	DL-Met	0.20	0.15
6	OH-Met	0.04	0.02
7	OH-Met	0.11	0.05
8	OH-Met	0.16	0.11
9	OH-Met	0.19	0.14

Feathering and antioxidant properties

Feathers provide insulation to reduce maintenance energy needs as well as prevent skin abrasions and infections. Optimum feathering is considered crucial in modern poultry production to ensure carcass quality. Many studies have reported that cysteine and methionine are involved in the synthesis of feather keratin and are important for feather growth. Cysteine is the major component of keratin and methionine is converted to cysteine. Conde-Aguilera et al. 2016 reported that in case of methionine restriction, feathering is maintained as priority for sulfur amino acid deposition prior to muscle.

OH-Met is more efficiently converted to cysteine and taurine than DL-Met through the trans-sulphuration pathway. Cysteine is then converted to glutathione, that along with taurine, plays fundamental roles in antioxidant mechanisms and improves oxidative status. Therefore, OH-Met may have a higher value to ensure feather growth and antioxidant capacity at the same time.

Table 2: Recommended levels of methionine and some nutritional parameters for Pekin ducks.

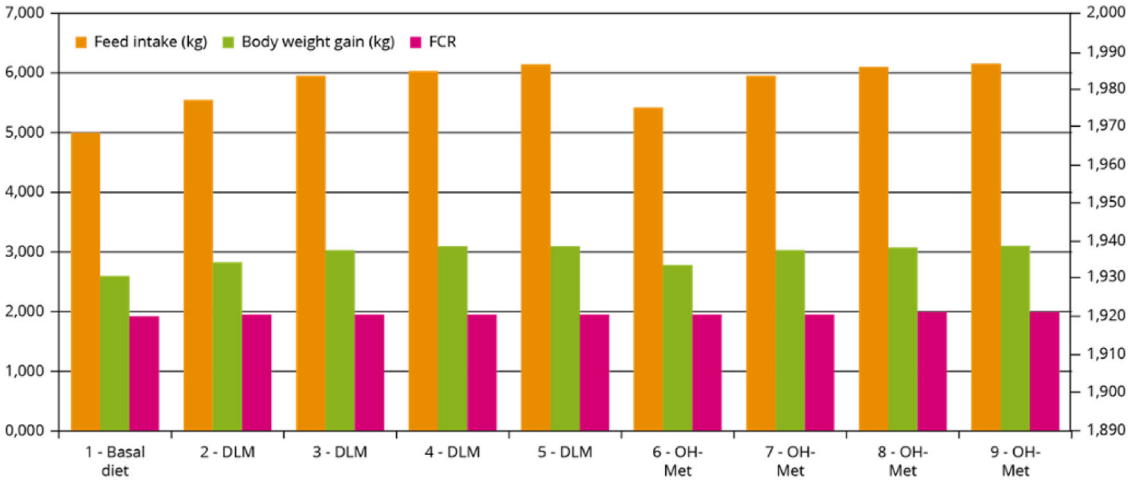
% nutrient	0-14 days. NRC (1994)	Adeola (2006).	Grimaud Frères (2015)	15-49 days. NRC (1994)	Adeola (2006)	Grimaud Frères (2015).
ME (MJ/kg)	12.1	12.0	12.1	12.5	12.8	12.8
CP	22	21	20	16	18	17
Lysine	0.90	0.96	1.00	0.63	0.86	0.8
Methionine	0.40	0.55	0.50	0.3	0.45	0.4
Met+Cys	0.70	0.85	0.85	0.55	0.75	0.7
Threonine	-	0.62	0.75	-	0.56	0.6

Trial in Cherry Valley ducks

Nutritional studies were carried out at Huazhong Agricultural University, China in order to compare the effectiveness of OH-Met to DL-Met in Cherry Valley ducks, as well as determining the bio-efficacy of the two sources. The birds were fed diets supplemented with different levels of OH-Met and DL-Met to create eight experimental treatments; then compared to a basal diet deficient in TSAA (*Table 1*). Starter (0-21 days) and grower (22-42 days) rations were based on corn, wheat and soybean meal and formulated to according to NRC (1994) recommendations.

Feed intake of the basal diet was significantly different from the methionine-supplemented treatments, with no significant difference between sources (*Figure 1*). Body weight gain increased significantly with methionine addition, with similar performance observed for OH-Met and DL-Met. Feed intake increased with the dose of methionine and unexpectedly, feed conversion ratio (FCR) increased with methionine addition, a trend also observed in a previous study.

Figure 1 – Feed intake, Body weight gain and FCR at 42 days.



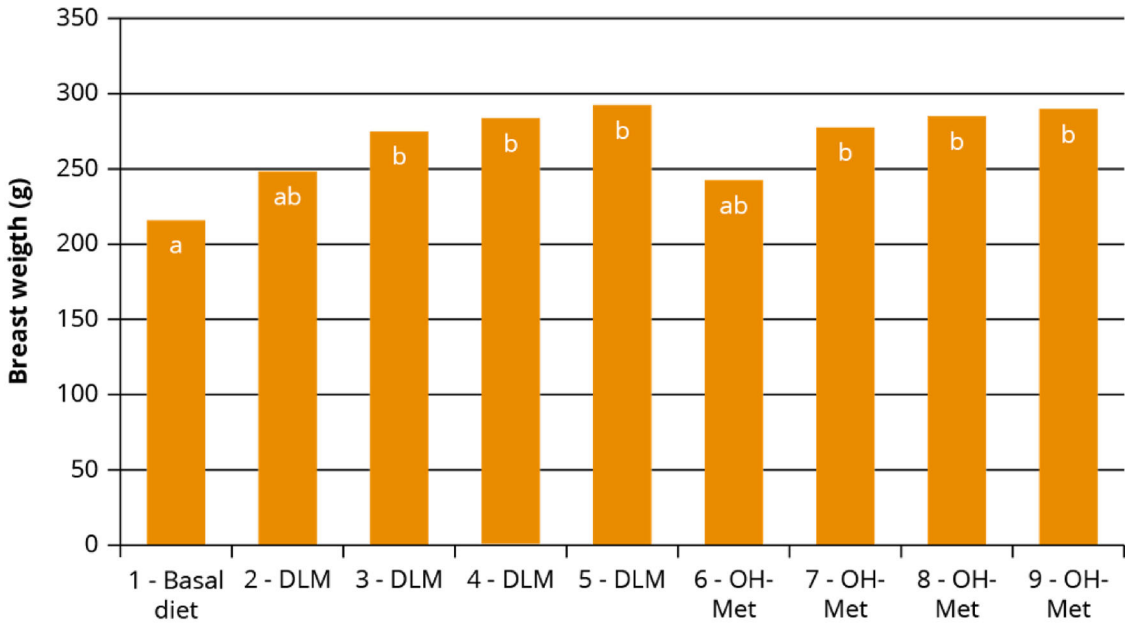
Amino acid recommendations

Total amino acids recommendations for ducks are poorly documented and only some requirements are known (*Table 2*). Researchers have suggested that methionine; along with lysine, threonine and tryptophan are the most limiting amino acids in ducks' practical diets. However, it appears that threonine level in the basal diet used is lower than some recommendations. In addition, the dietary energy levels of the experimental diets were slightly lower than used in previous studies. These slight differences might explain the lack of improvement of FCR for supplemented treatments in comparison to the basal diet. This observation highlights the need to update amino acids recommendations for ducks.

Carcass and breast weights increased with methionine addition, the effect similar between sources (*Figure 2*). Carcass yield and breast yield (expressed relative to body weight) were not affected by treatments. However, a linear regression model performed on the breast meat yield indicated that it increased linearly with methionine addition (P = 0.001).

Feather weight is particularly important in duck production not only for their support of performance and health, but also as a valuable co-product. At 42 days of age feather weight was significantly lower for birds fed the basal diet, compared to those supplemented with either source of methionine. No significant difference of feather weight or yield was observed between OH-Met and DL-Met, suggesting they promote feather growth in the same way.

Figure 2 – Breast weight at 42 days.



Bio-efficacy of methionine sources

Methionine efficacy was calculated as the extra methionine intake per extra weight gain – results were similar between sources. To determine the actual bio-efficacy of OH-Met relative to DL- Met, researchers used an exponential model of the growth rate as a function of the TSAA intake, taking into consideration the differences in feed intake. Body weight gain for the two sources followed the same exponential response, with no significant differences. Bio-efficacy was calculated as a steepness coefficient ratio of 99% with a confidence interval ranging from 86% to 112%. This modelling confirmed that OH-Met and DL-Met have the same bio-efficacy to promote duck performance.

Antioxidant capacity of meat

Concentrations or activities of some redox markers in breast muscle were improved by addition of OH-Met, compared to DL-Met, including total antioxidant capacity of meat, glutathione peroxidase (GPX) activity and concentration of reduced glutathione (GSH) in the breast muscle. Because of the improvement of the antioxidant capacity observed with OH-Met, it is a better candidate than DL-Met to reduce oxidative processes in the meat during post-mortem storage and may result in better duck meat quality.

Implications for profitability

Nutritional expertise, as well as scientific and technical knowledge, should be used to achieve cost-effective feed formulations for ducks. Underestimating the importance of methionine in poultry nutrition can have a huge economic impact. The study, published this year in Poultry Science, concluded that OH-Met is 100% efficient to sustain growth performance and feather development of Cherry Valley ducks, the latter being an important economic parameter of duck production. Moreover, OH-Met confers extra benefits in terms of profitability of duck production. It improved antioxidant capacity of muscle, which would reduce oxidation in meat during storage – contributing to better duck meat quality.

References available upon request.

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