BIOLOGICAL EFFECTIVENESS OF MHA-Ca COMPARED TO DL-METHIONINE IN BROILER IN VIETNAM

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INTRODUCTION

Supplementing methionine sources to broiler diets in order to balance the dietary protein in accordance to the broilers demand or the economic optimum is common practice. Various methionine products are available such as DL-Methionine, liquid methioninehydroxy analogue, or methionine hydroxy analogue calcium salt (MHA-Ca). In order to properly use these sources knowledge about the biological effectiveness is needed. Although, for the mentioned sources this questions has been determined in a number of trials it is still being discussed. Simultaneous dose-response trial with subsequent multi-linear or multiexponential regression is an established methodology to determine the bioefficacy of products compared to a standard which is in this case DL-Methionine.

OBJECTIVE

The study aims to determine the biological effectiveness of MHA-Ca in broiler under Vietnamese conditions in an open house system

EXPERIMENTAL DESIGN

Time: from 30th July to 10th September 2010 (raining season). The housing temperature was recorded at 8.00 am and 13.00 pm. The trial was carried out at Binh Thang Pig and Poultry Research Centre, Institute of Agricultural Sciences for Southern Vietnam. Three diets were applied as starter (day 1 to 14), grower (day 15 to 28), finisher (day 29 to 42). 450 male Arbor Acres Plus broilers were allocated into 9 treatments: 1. Control, deficient in dietary Methionine (Met)+Cys, w/o any supplementation of Met sources; 2. Control diet plus 0.03% of DL-Met; 3. Control diet plus 0.06% of DL-Met; 4. Control diet plus 0.10% of DL-Met; 5.Control diet plus 0.15% of DL-Met; 6. Control diet plus 0.03% of MHA-Ca; 7. Control diet plus 0.06% of MHA-Ca; 8. Control diet plus 0.10% of MHA-Ca; 9. Control diet plus 0.15% of MHA-Ca. The experiments have 10 replications. All collected data were statistically analyzed by ANOVA procedure using the Minitab software version 13.0. In order to determine the effectiveness of both MHA-Ca relative to DL-Methionine data were analysed by multi-regression analysis as proposed by Littell et al (1997) in SAS 9.1. The level of significance was chosen at $p<0.05$.

RESULTS

Table 1. Body weight and body weight gain in g

Parameter	Control	DL-Methionine				MHA-Ca			
Addition	**0**	**0.03**	**0.06**	**0.10**	**0.15**	**0.03**	**0.06**	**0.10**	**0.15**
BW day 1	46.6	46.6	46.6	46.6	46.6	46.6	46.6	46.6	46.6
BW day 14	320	333	340	333	338	326	326	330	338
BW day 28	938 ^{b}	993^{ab}	1055 ^{a}	1016 ^{ab}	1066 ^{a}	986 ^{ab}	996 ^{ab}	1029 ^{ab}	1058 ^{a}
BW day 42	1705 ^{d}	1803^{bcd}	1876^{abc}	1898^{abc}	1955^{a}	1777^{cd}	1816^{bcd}	1885^{abc}	1919^{ab}
BWG 1-14	274	287	293	286	292	280	279	284	292
BWG 14-28	618 ^{b}	660 ^{ab}	715 ^{a}	683 ^{ab}	728 ^{a}	660 ^{ab}	670 ^{ab}	699 ^{ab}	720 ^{a}
BWG 28-42	767 ^{e}	810 ^{cde}	821 ^{abcde}	882 ^{ab}	889 ^{a}	791 ^{de}	820 ^{bcde}	856 ^{abcd}	861 ^{abc}
BWG 1-42	1658 ^{d}	1756^{bcd}	1830 ^{abc}	1852 ^{abc}	1908 ^{a}	1731 ^{cd}	1769 ^{bcd}	1839 ^{abc}	1873 ^{ab}

BW: Body weight; BWG: Body weight gain

$^{a.b}$ *means in the same row bearing different letters are different at p<0.05*

Results of the Table 1 showed the body weight at day 14 and weight gain among treatments during the first two weeks were not significantly different. At day 28, the addition of DL-Methionine and MHA-Ca showed better result but not significantly different except the addition of high dose DL-Methionine as 0.15%. At day 42, the addition of 0.06 % DL-Methionine or more and 0.1% MHA-Ca or more resulted heavier weight of birds. With the same volume of addition of DL-Methionine and MHA-Ca, DL-Methionine will showed heavier birds although the difference was not significant.

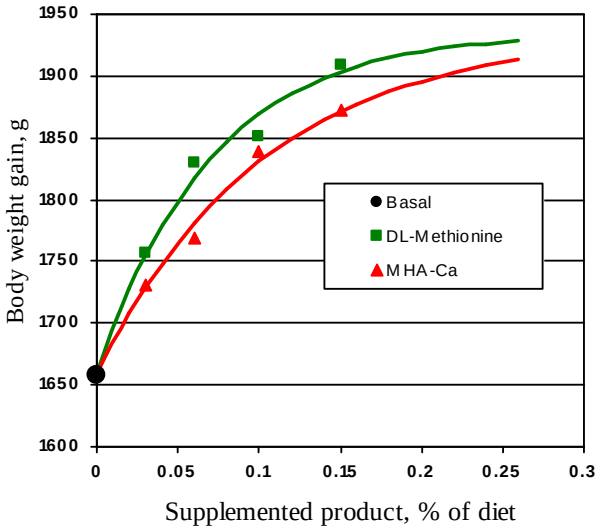

Figure 1. Weight gain of birds at day 42 in response to increasing supplementation of DL-Methionine or MHA-Ca. Relative efficacy for weight gain was determined to be 68% by multi-exponential regression analysis: Y = 1659 + 277 * (1 - EXP(-14.3 DL-Met -9.7 MHA-Ca))

Plotting the data against product inclusion levels demonstrated that the dose responses of both DL-Methionine and MMHA-Ca on weight gain, feed conversion ratio (FCR), carcass weight and breast meat yield were of non-linear nature following the law of diminishing returns (Figure 1, 2 and 3). Therefore, multi-exponential regression analysis was applied to determine the efficacy of MHA-Ca relative to DL-Met. Accordingly, MHA-Ca was 68% and 69% as efficient as DL-Methionine on "as is" basis in order to achieve the same weight gain, FCR, carcass weight and breast meat yield, respectively. The estimates for weight gain and FCR were significantly lower than 84 % which would be the theoretical maximum because of the purity of 84 % of MHA-Ca.

That means to achieve 1900g weight gain it can be calculated that an addition 0.140% DL-Methionine was required while for MHA-Ca the required addition was 0.215%. To achieve 2.15 of FCR, the addition 0.08% DL-Methionine was required while for MHA-Ca 0.13% was required in the diet.

Table 2. Feed Intake in g and Feed Conversion Ratio in g/g

Parameter	**Control**	**DL-Methionine**				**MHA-Ca**			
Addition	**0**	**0.03**	**0.06**	**0.1**	**0.15**	**0.03**	**0.06**	**0.1**	**0.15**
FI 1-14	533	565	545	542	564	525	534	545	563
FI 14-28	1385	1418	1423	1380	1432	1414	1399	1417	1439
FI 28-42	2044	2023	1978	2030	2025	2026	2008	2016	2007
FI 1-42	3692	4006	3946	3952	4021	3964	3940	3978	4009
FCR 1-14	1.95	1.98	1.86	1.89	1.94	1.88	1.91	1.93	1.93
FCR 14-28	2.26^{a}	2.16^{ab}	2.00^{b}	2.03^{b}	1.98^{b}	2.15^{ab}	2.10^{ab}	2.04^{b}	2.00^{b}
FCR 28-42	2.68^{a}	2.51^{abc}	2.41^{bcd}	2.30^{d}	2.28^{d}	2.56^{ab}	2.46^{bcd}	2.36^{cd}	2.33^{cd}
FCR 1-42	2.39^{a}	2.29^{abc}	2.16^{bcd}	2.14^{d}	2.11^{d}	2.29^{ab}	2.23^{bcd}	2.17^{bcd}	2.14^{cd}

FI: Feed intake; d: day; FCR: Feed conversion ratio

$^{a.b}$ *means in the same row bearing different letters are different at* $p<0.05$

Table 2 showed that the feed intake were not significantly different among treatments during the whole experimental time. Since there was difference in weight gain so there was different in feed conversion ratio. The highest feed conversion ratio after 42 days was performed by the control group with lowest methionine level in the diet. The higher addition of DL-Methionine or MHA-Ca in the diet, the lower feed conversion ratio. The lowest feed conversion ratio at trial end was the treatment group with addition of 0.15% DL-Methionine or MHA-Ca in the diet.

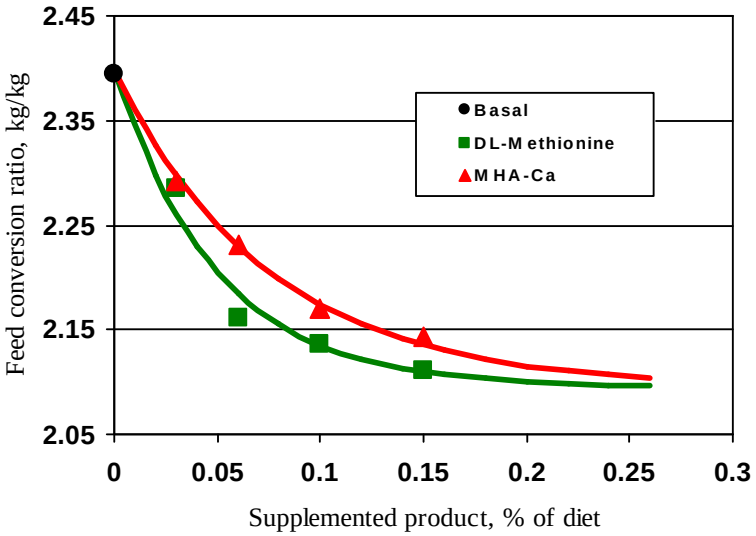

Figure 2. Feed Conversion Ratio (FCR) of birds from 1 to 42 days of age in response to increasing supplementation of DL-Methionine or MHA-Ca. Relative efficacy for FCR was determined to be 69% by multi-exponential regression analysis: Y = 2.68 – 0.43 * (1 - EXP(-17.0 DL-Met – 11.7 MHA-Ca))

Table 3. Carcass quality

Parameter	Control	DL-Methionine				MHA-Ca			
Addition	**0**	**0.03**	**0.06**	**0.1**	**0.15**	**0.03**	**0.06**	**0.1**	**0.15**
CW g	1220^{c}	1260^{bcd}	1350^{ab}	1325^{abc}	1383^{a}	1268^{abc}	1278^{abc}	1295^{abc}	1353^{ab}
CW %	66.3^{b}	66.8^{ab}	67.8^{ab}	67.6^{ab}	68.8^{a}	67.0^{ab}	67.3^{ab}	67.7^{ab}	67.5^{ab}
BM g	365^{c}	390^{bcd}	427^{ab}	421^{ab}	444^{a}	387^{bc}	402^{abc}	402^{abc}	433^{ab}
BM %	29.8^{b}	31.0^{ab}	31.6^{ab}	31.7^{ab}	32.1^{a}	30.5^{ab}	31.5^{ab}	31.0^{ab}	32.0^{a}
AF g	27.6	31.0	30.3	29.3	30.3	30.5	31.8	29.3	27.3
AF %	2.27	2.49	2.24	2.19	2.17	2.40	2.49	2.26	2.00

CW: Carcass weight, BW: Breast meat yield; AF: Abdominal fat

$^{a.b}$ *means in the same row bearing different letters are different at* $p<0.05$

The percentage of Carcass weight and breast meat was lowest in the control group and significantly higher in the groups of addition of 0.15% DL-Methionine or MHA-Ca in the diet. For abdominal fat no significant difference was found between the treatments.

CONCLUSION

- The deficiency of Methionine in the diet for broiler caused lower weight gain and higher feed conversion ratio.
- Based on exponential regression analysis the biological efficiency of DL-Methionine was fount to be higher than MHA-Ca.

- The biological efficiency of weight gain and FCR from 1 to 42 days of age were found to be 68% and 69%, respectively.
- Thus, to achieve 1900g weight gain, the addition 1.140% DL-Methionine was required while MHA-Ca was 0.215%, and to achieve 2.15 of FCR, the addition 0.08% DL-Methionine was required while MHA-Ca was 0.13% in diet.

REFERENCE

LITTELL R.C., HENRY P.R., LEWIS A.J., and AMMERMANN C.B. (1997) Estimation of relative bioavailability of nutrients using SAS procedures. *Journal of Animal Science* **75**: 2672-2683.