Evaluation of methionine sources on performance and carcass traits of broilers at different dietary sulfur amino acid levels under northern European and middle Eastern conditions

Zeyang Li, Juliano Cesar De Paula Dorigam, Ali Afsar, Andreas Lemme, Gabriel da Silva Viana, Ehsan Musharbash

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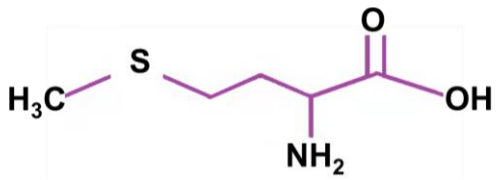
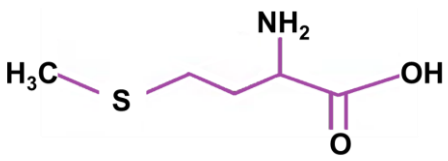
Introduction

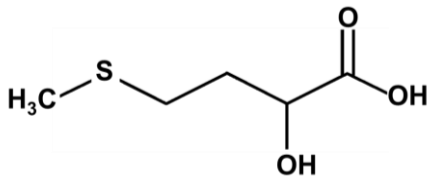
- Methionine (**Met**) is an essential amino acid (**AA**) for broilers
- The Met content provided by the cereal ingredients in practical feeds is insufficient to meet the requirement of Sulfur AA (Met + Cysteine) for broilers
- DL-Met and DL-methionine hydroxy analogue-free acid (**MHA-FA**) have been widely used as the exogenous Met sources in practical broiler feeds
- Relative bioavailability value (**RBV**) for MHA-FA (88%) relative to DL-Met (99%) is recommended to be 65% based on the previous studies[1]
- It is necessary to determine the RBV of Met sources for the optimal growth of broilers and profit of broiler enterprise



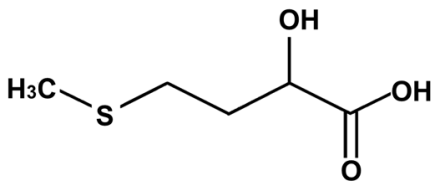
L-Met



D-Met



L-MHA-FA



DL-MHA-FA

[1] Lemme et al *Animals* **2020**, *10*(12), 2240

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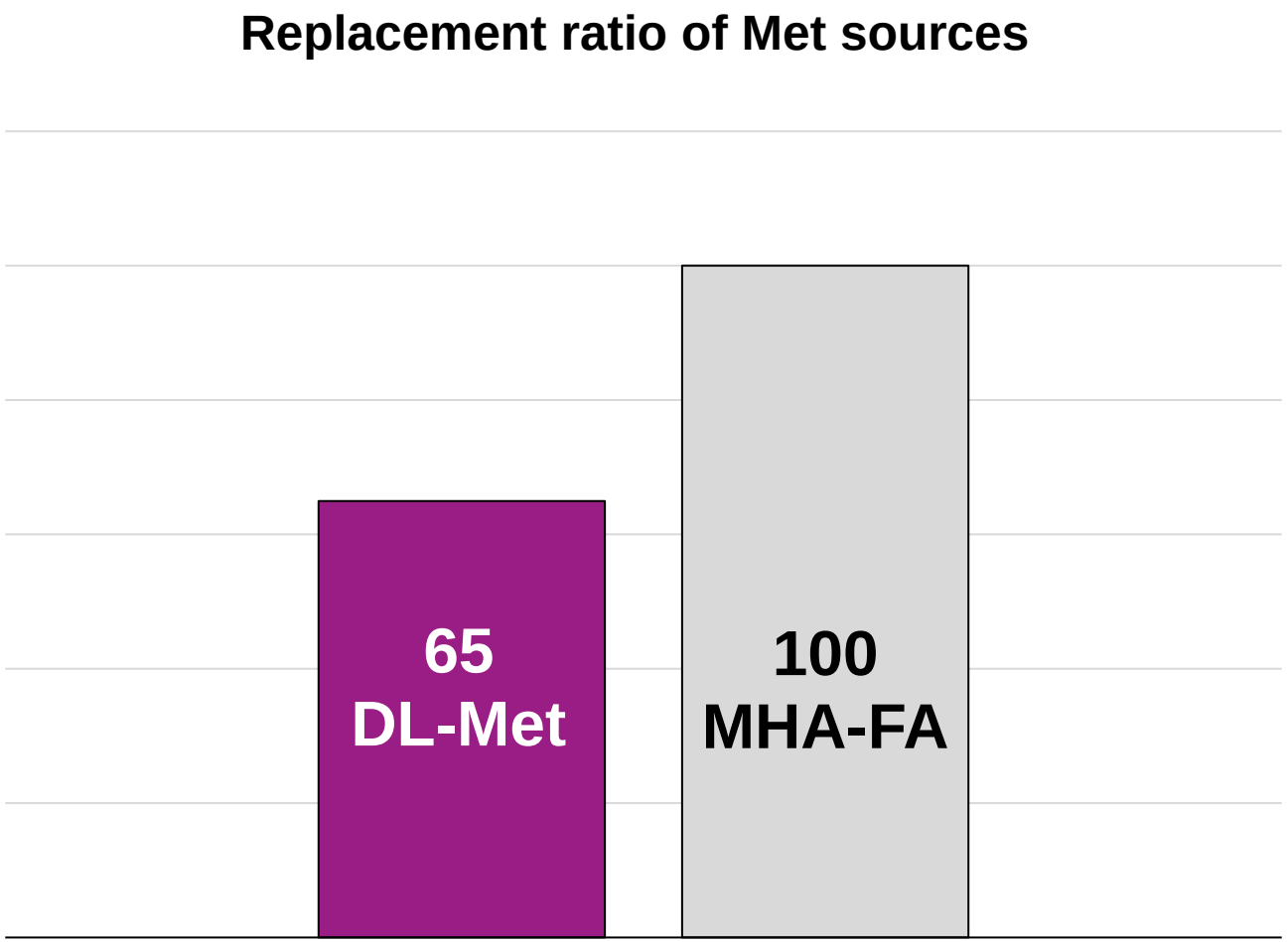
Objectives

This study aimed to

a) validate the concept that MHA-FA can be replaced with DL-Met at a weight-to-weight ratio of 100 : 65 without compromising performance

b) evaluate that this concept works at reduced and optimal dietary Met + Cys levels under different rearing conditions



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Research partners

Trial 1

In collaboration with

Natural Resources Institute Finland (Luke), Helsinki, Finland

(Gabriel da Silva Viana)

Trial 2

In collaboration with

Alestesharia Animal Nutrition, Amman, Jordan

(Ehsan Musharbash)

Experimental design

Animals	Day (d)-old Ross 308® chicks (~ 41 g), **Trial 1:** 720 males; **Trial 2:** 1250 males and 1250 females
Replicates (Pens)	**Trial 1:** 9 pens / treatment, 16 birds/pen; **Trial 2:** 10 pens / treatment, 25 male+ 25 female birds/pen
Trial length	**Trial 1:** 35 d; **Trial 2:** 32 d
Basal diet	3 phase diets formulated to meet nutrition recommendation*, except Met + Cys: **Trial 1:** Wheat-Soybean meal diet, no additional Met source **Trial 2:** Corn-Soybean meal diet, no additional Met source
Measurements	**Trials 1 and 2:** Body weight, feed intake, feed conversion ratio (mortality adjusted) **Trial 2:** Carcass and breast yields

*Recommendation for Ross 308® broilers by Aviagen®

Experimental design

	Code	Met + Cys level % of recommendation*	Product supplementation, relative on weight basis***
1)	BD	60-66%**	-
2)	75 DL-Met	75%	65 parts
3)	75 MHA-FA	75%	100 parts
4)	100 DL-Met	100%	65 parts
5	100 MHA-FA	100%	100 parts

* Recommendation for Ross 308® broilers by Aviagen®

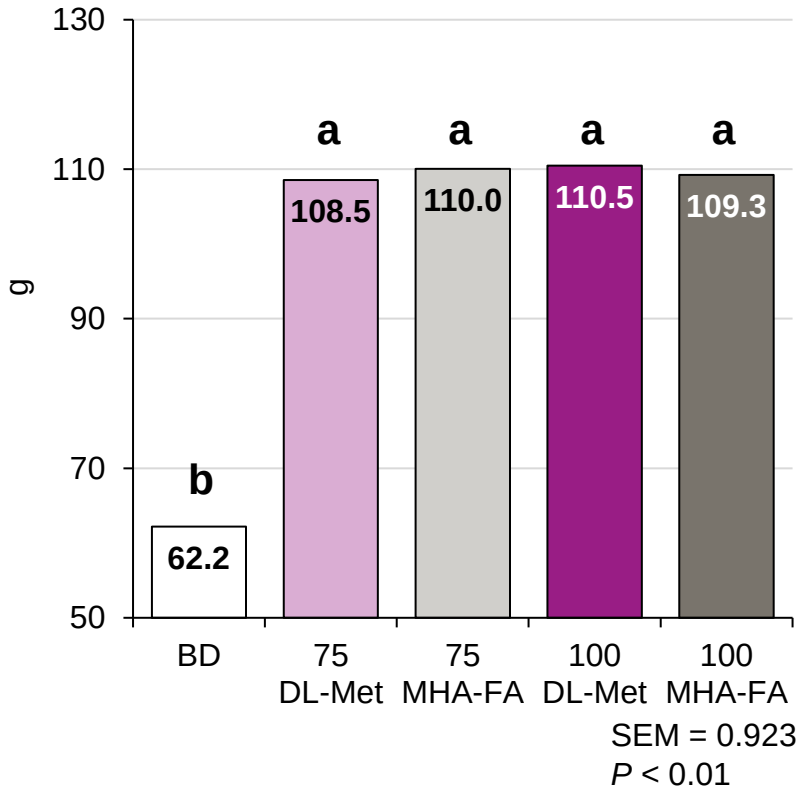
** Varied between phases and trials

*** absolute supplementation differred between phases and trials but 65:100 ratio was always achieved

Trial 1

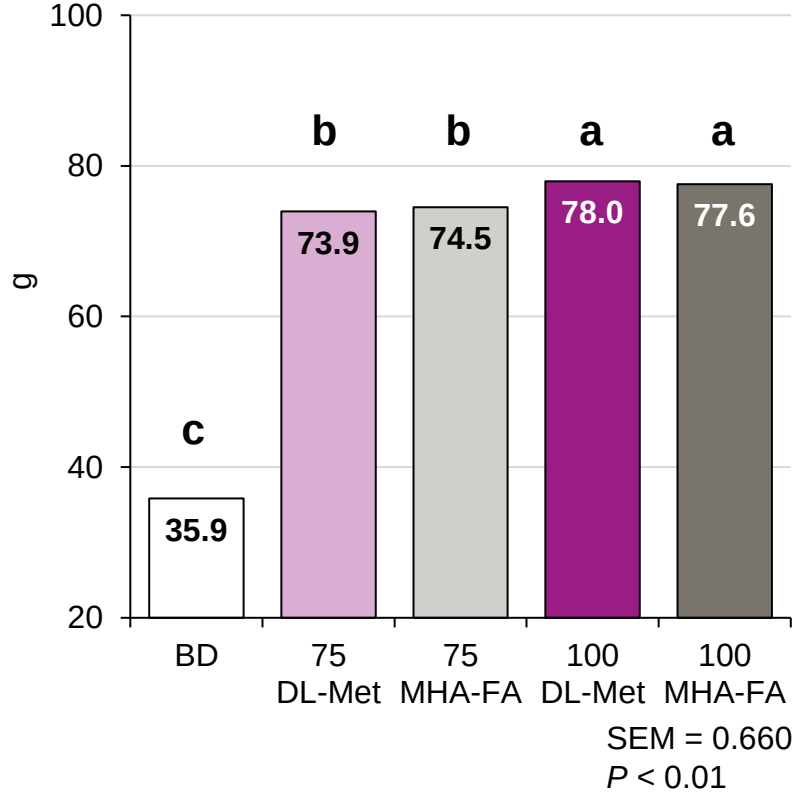
75%-treatments limited growth while there were no differences between Met-sources

Average daily feed intake (d 0-35)



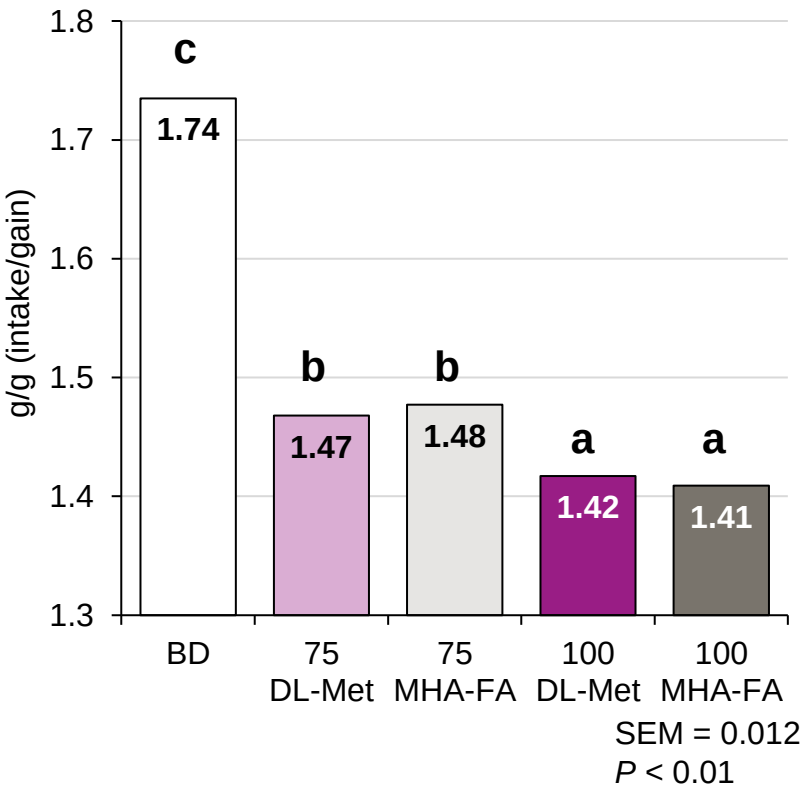
SEM = 0.923
P < 0.01

Average daily weight gain (d 0-35)



SEM = 0.660
P < 0.01

Feed conversion ratio (d 0-35)



SEM = 0.012
P < 0.01

75% Met + Cys level is insufficient for optimal growth performance of broilers as expected

DL-Met can replace MHA-FA at a 65:100 ratio (wt/wt) when feeding the same dietary Met +Cys levels

Values are means and SEM, n = 9; [a-c] values without common letters differ from each other (*P* < 0.05)

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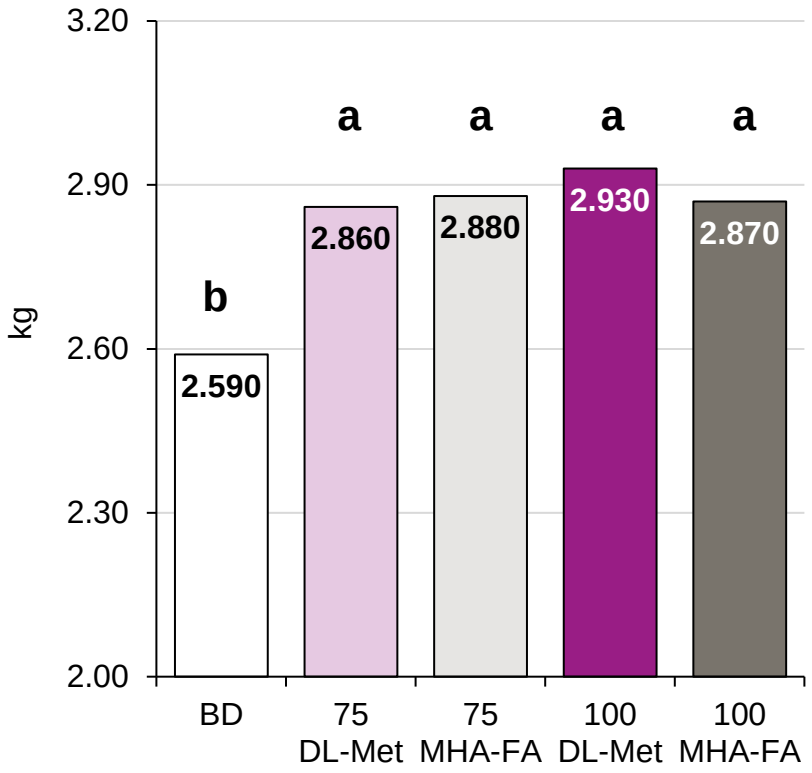
Trial 2

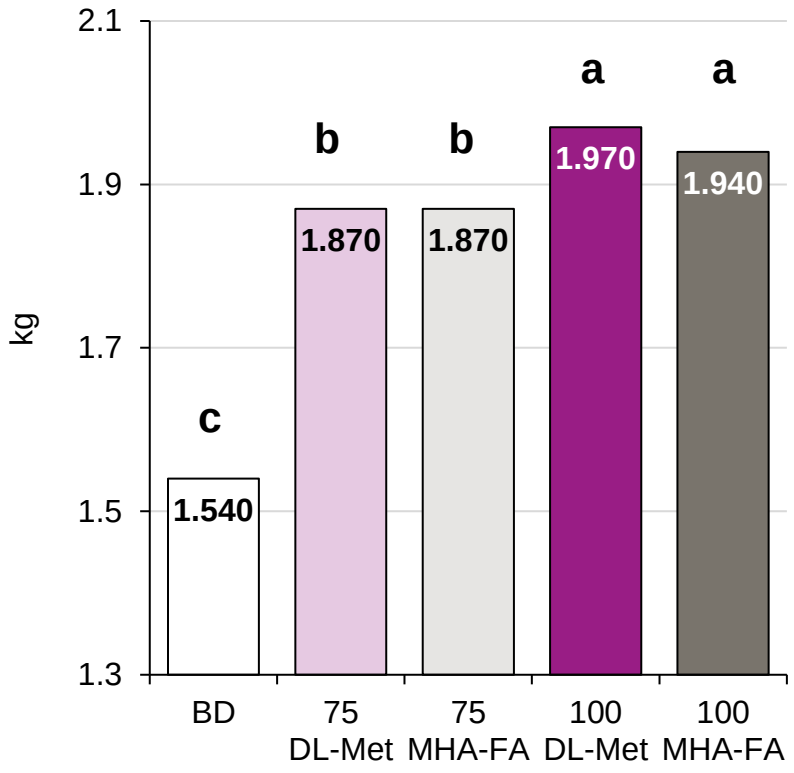
DL-Met and MHA-FA at 65:100 ratio (wt/wt) resulted in same performance

Feed intake (d 0-32)



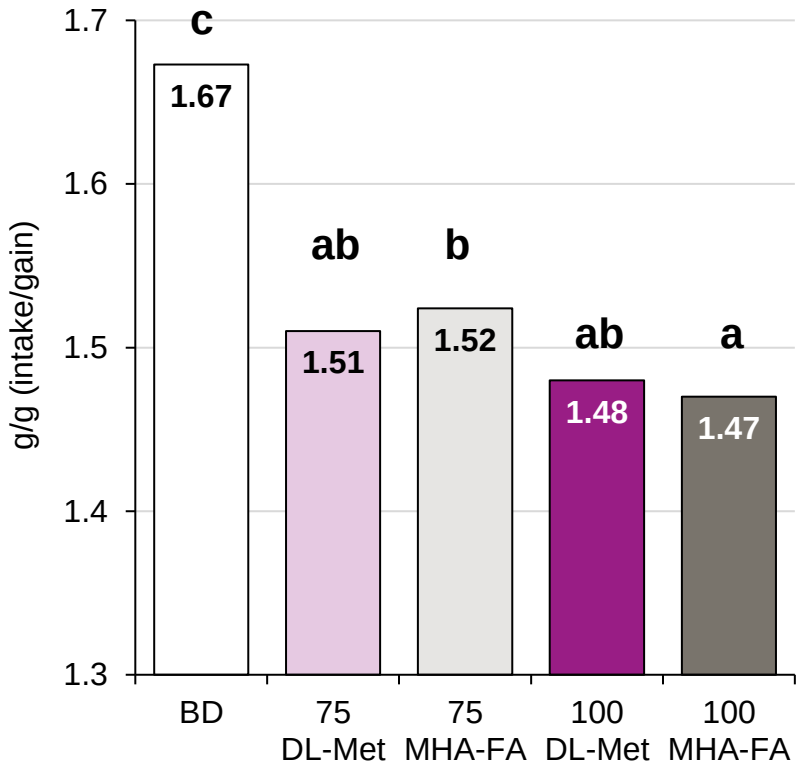
SEM = 22.69
P < 0.01

Body weight gain (d 0-32)



SEM = 16.09
P < 0.01

Feed conversion ratio (d 0-32)



SEM = 0.012
P < 0.01

Confirmed again the findings of trial 1

Values are means and SEM, n = 10; [a-c] values without common letters differ from each other (*P* < 0.05)

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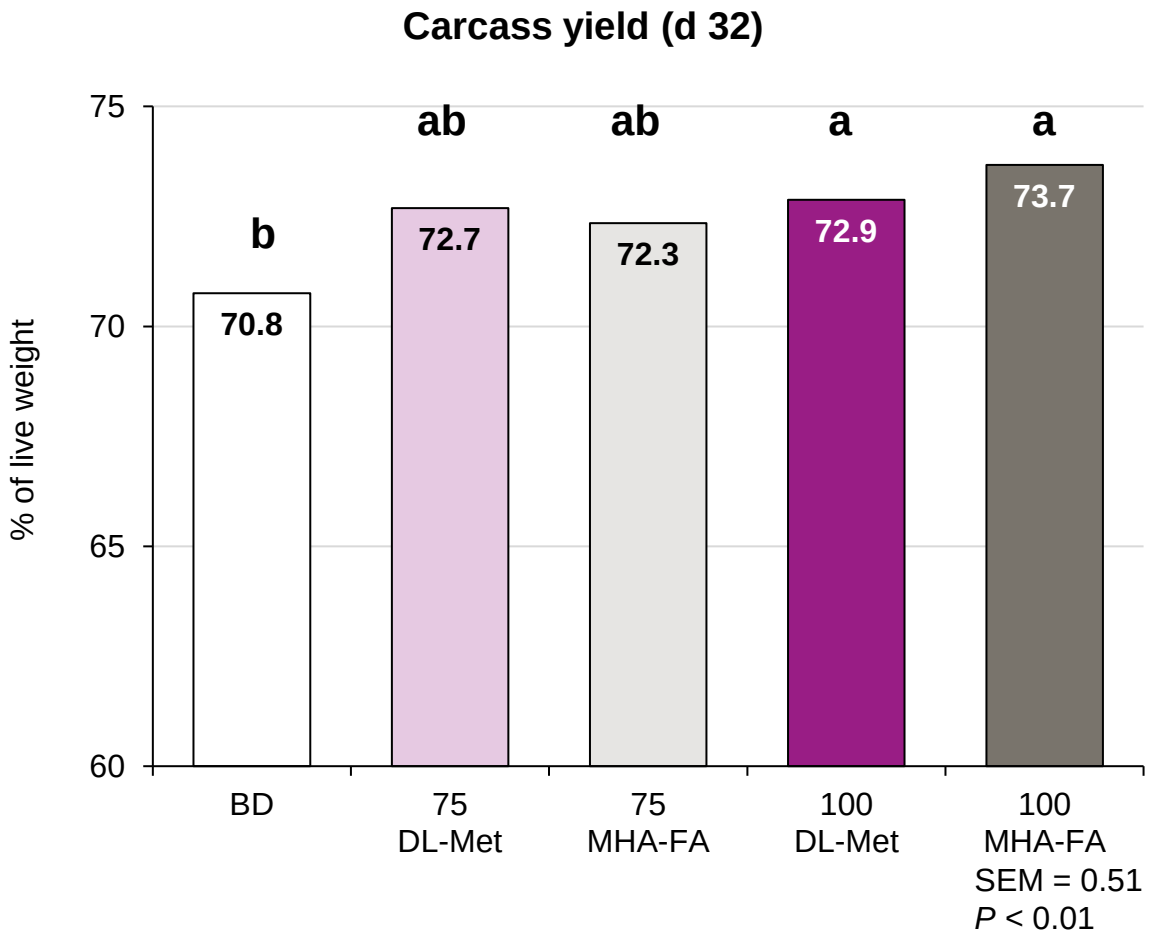
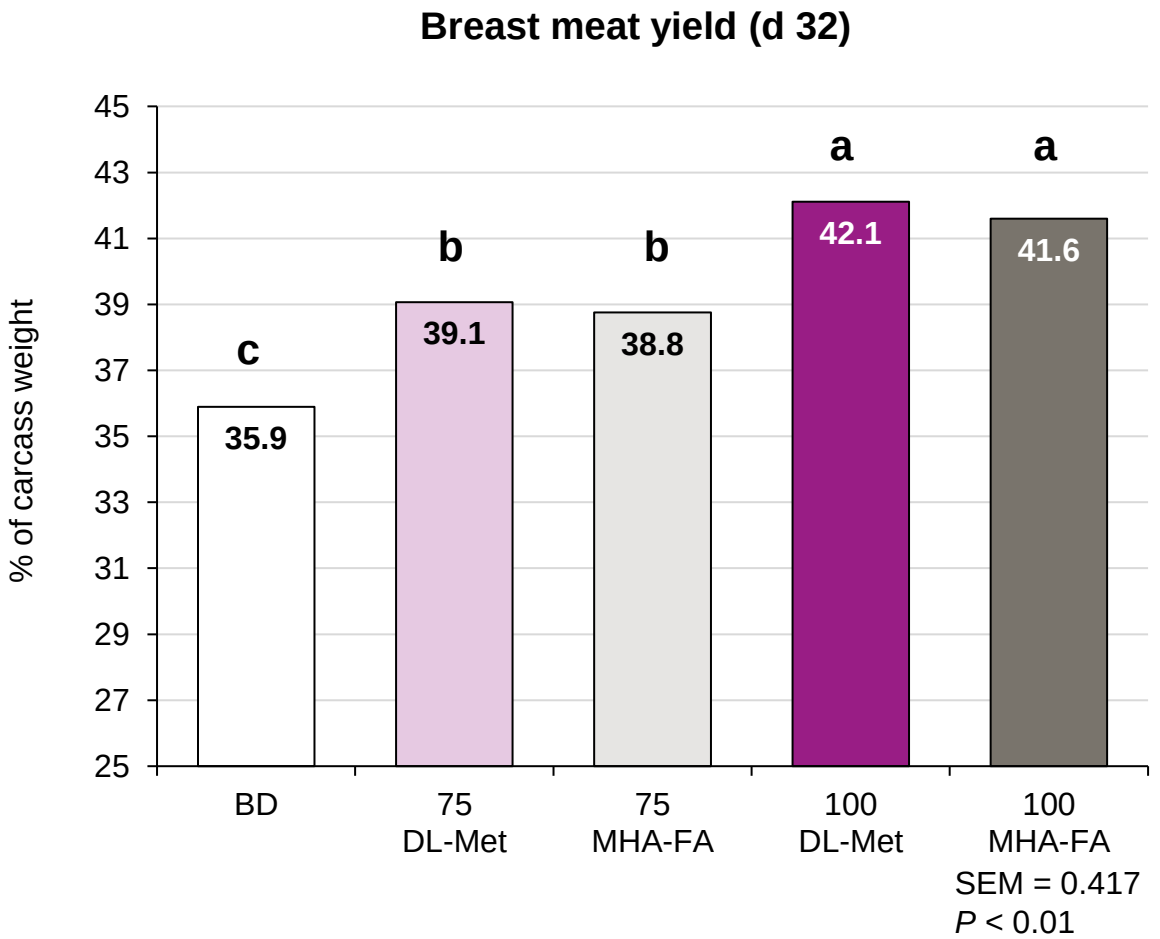
Trial 2

Breast meat yield results confirm that 65:100 concept works at any Met + Cys supply





75% Met + Cys level is insufficient for optimal carcass and breast meat yields as expected

DL-Met can replace MHA-FA at a 65:100 ratio (wt/wt) when feeding the same dietary Met +Cys levels

Values are means and SEM, n = 10; [a-c] values without common letters differ from each other ($P < 0.05$)

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Conclusion

- ✓ Broilers fed with diets containing additional DL-Met (99%) and MHA-FA (88%) showed increase of performance, confirming that both DL-Met (99%) and MHA-FA (88%) are effective Met sources for broilers

- ✓ Broilers fed with MHA-FA (88%) or DL-Met (99%, added at 65% of MHA-FA, wt/wt) showed no difference in growth performance and carcass traits when feeding the same dietary Met + Cys levels, confirming the recommended RBV of 65% for MHA-FA (88%) relative to DL-Met (99%) in a product basis

- ✓ The results of trials are consistent at different dietary Met + Cys levels and under northern European and middle Eastern conditions

THANK YOU !

Contact:
zeyang.li@evonik.com

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Appendix - Experimental Design

Formulation of basal diets (as-is) – Trial 1

Ingredients*, %	Starter 1 to 10 d	Grower 11 to 24 d	Finisher 25 to 35 d
Soybean Meal (48% crude protein)	30.57	25.07	21.71
Wheat grain	50.88	52.22	52.18
Peas	10.80	14.20	16.48
Soybean oil	3.84	4.99	6.39
Monocalcium phosphate	0.97	0.77	0.64
Limestone ($CaCO_3$)	1.48	1.37	1.29
Salt	0.41	0.41	0.41
L-Lysine HCl 78%	0.23	0.20	0.16
L-Threonine	0.17	0.14	0.12
L-Valine	0.04	0.02	0.01
Mineral and vitamin Premix	0.40	0.40	0.40
Choline Chloride 60%	0.20	0.20	0.20
Phytase	0.01	0.01	0.01

Appendix - Experimental Design

Formulation of basal diets (as-is) – Trial 2

Ingredients*, %	Starter 1 to 10 d	Grower 11 to 24 d	Finisher 25 to 35 d
Corn	58.17	62.39	66.43
Soybean Meal	37.00	32.00	26.70
Soya Oil	1.20	2.10	3.33
Limestone ($CaCO_3$)	1.50	1.50	1.50
Monocalcium phosphate	0.70	0.70	0.70
Mineral Vitamin Mix	0.20	0.20	0.20
NaHCO3	0.10	0.10	0.10
Salt	0.25	0.25	0.25
Biolys (62.4% Lys)	0.397	0.267	0.271
ThreAMINO (98.5% Thr)	0.123	0.140	0.144
ValAMINO (98% Val)	0.055	0.048	0.073
Choline Chloride	0.10	0.10	0.10
Phytase	0.01	0.01	0.01
Avizyme	0.02	0.02	0.02
Coccidiostat	0.06	0.06	0.06
Ecobiol	0.01	0.01	0.01
Toxin binder	0.10	0.10	0.10

*Biolys contains > 62.4% Lysine on product basis; ThreAMINO contains > 98.5% Threoine; ValAMINO contains > 98% Valine; Avizyme is a combination of xylanase, subtilisin, amylase.

Appendix - Experimental design

Formulated nutrient values of basal diets in Trial 1 and Trial 2 [1]

	Trial 1			Trial 2		
Nutrient	0-10 d	11-24 d	25-35 d	0-12 d	13-24 d	25-32 d
Crude protein, %	23.69	21.85	20.64	22.0	19.8	18.0
AMEn, Kcal/kg	2950	3050	3150	3000	3100	3200
SID AA, %[2]						
Lys	1.280	1.150	1.060	1.280	1.090	1.010
Met	0.283	0.257	0.240	0.300	0.270	0.250
Met + Cys	0.584	0.540	0.510	0.580	0.536	0.490
Thr	0.860	0.770	0.710	0.820	0.770	0.710
Val	0.960	0.870	0.810	0.960	0.870	0.810
Ile	0.856	0.779	0.730	-	-	-
Leu	1.458	1.334	1.253	-	-	-
Arg	1.393	1.272	1.197	-	-	-
His	0.524	0.480	0.451	-	-	-

[1] Nutrient composition was confirmed by analytic results
[2] SID, Standardized ileal digestibility

Appendix - Experimental design

Supplementation of DL-Met or MHA-FA in feeds of Trial 1 and Trial 2 [1]

	Trial 1					Trial 2				
	BD	75 DL-Met	75 MHA-FA	100 DL-Met	100 MHA-FA	BD	75 DL-Met	75 MHA-FA	100 DL-Met	100 MHA-FA
Starter phase (%)										
DL-Met	-	0.095	-	0.270	-	-	0.120	-	0.356	-
MHA-FA	-	-	0.146	-	0.416	-	-	0.185	-	0.550
Grower phase (%)										
DL-Met	-	0.083	-	0.244	-	-	0.052	-	0.274	-
MHA-FA	-	-	0.128	-	0.375	-	-	0.080	-	0.420
Finisher phase (%)										
DL-Met	-	0.083	-	0.236	-	-	0.083	-	0.263	-
MHA-FA	-	-	0.128	-	0.364	-	-	0.127	-	0.400

[1] MHA-FA (88%) contains 88% of DL-MHA-FA content in the commercial product and was considered to have 65% of relative bioavailability compared with DL-Met according to previous publications; The amount of DL-Met (99%) supplied was at 65% of MHA-FA (88%) product in the 75% or 100% Met + Cys groups.