Effect of methionine sources on broiler performances in thermoneutral or cyclic heat stress conditions

Trial: 06 INRA

1. Summary

The aim of this study was to compare the effect of methionine sources on growth performance depending on the environmental temperature conditions. Birds were reared in standard thermoneutral conditions or in cyclic heat stress conditions from 15 to 38 days of age. The dietary treatments differed only by the added methionine sources (DL-Methionine or DL-HMTBA) used at isomolecular level in feed. The results obtained in this study were affected by a room effect detected during the starter period (0 to 14 days) that was probably carried over the other further rearing periods. However, the conclusion of this study was that the 2 methionine sources performed similarly on the overall rearing period whatever the thermal conditions.

2. Material and method

2 treatments x 2 thermal condition x 6 replicates of 40 Broilers

Table 1. Experimental design

	T1 DL-Methionine	T2 DL-HMTBA	T3 DL-Methionine	T4 DL-HMTBA
Starter period 0-14 d	Room 1		Room 2	
	Standard temperature condition (33°C ➔ 25°C)			
Meth. Sources*	0.38%			
Grower period 15-28 d	Room 1		Room 2	
	Cyclic Heat Stress (27°C 12h / 33°C 12h)		Std conditions 25°C ➔21°C	
Meth. sources*	0.20%			
Finisher period 29-38 d	Room 1		Room 2	
	Cyclic Heat Stress (27°C 12h / 33°C 12h)		Std conditions 21°C	
Meth. sources*	0.13%			

DLM: DL-Methionine HMTBA: Hydroxy-methyl-thiobutanoic acid
**Methionine sources incorporation based on Iso-molecular basis*

Management and measurements:
The trial was performed at the Poultry Experimental Unit of INRA, Nouzilly (France). Nine hundred and sixty broiler chicks were weighted and allocated in floor pens with 40 chicks each. During the starter phase period (0 to 14 days), room temperature management followed the

standard conditions from 33°C to 25-24°C. From 15 days of age, temperature in room 1 was differently regulated with a cyclic heat stress applied from 27°C to 33°C every 12 hours. This condition was maintained until the end of the trial at 38 days. In room 2, the temperature condition followed the standard Ross recommendations.
Feeds and water were provided to broilers *ad libitum*. Body weight gain, feed intake, feed conversion ratio and methionine efficiency were measured during the experiment.

Statistical analysis:
Statistical analyses were performed by using variance analysis (ANOVA) where single effects were Methionine source and temperature condition. The interaction between methionine sources and temperature condition had been also tested. Means comparison was tested by the Least Square Procedure of Fisher.

Table 2. Composition and characteristics of the experimental diets

	Starter diet		Grower diet		Finisher diet	
	DL-Met	DL-HMTBA	DL-Met.	DL-HMTBA	DL-Met.	DL-HMTBA
Ingredients (%)						
Corn	55.46	55.46	56.47	56.47	60.77	60.77
Extruded soybeans	3.90	3.90	7.98	7.98	8.00	8.00
Soybean meal 48	33.2	33.2	26.98	26.98	22.35	22.35
Palm oil	1.17	1.17	4.47	4.47	4.78	4.78
Soybean oil	1.17	1.17	-	-	-	-
Calcium carbonate	0.80	0.80	0.80	0.80	0.80	0.80
Dicalcium phosphate	2.00	2.00	2.00	2.00	2.00	2.00
Salt	0.30	0.30	0.30	0.30	0.30	0.30
L-threonine	0.16	0.16	0.05	0.05	-	-
L-tryptophan	0.12	0.12	0.01	0.01	-	-
HCl L-Lysine 98	0.54	0.54	0.17	0.17	0.06	0.06
DL-methionine	0.38	-	0.20	-	0.13	0.13
DL-HMTBA	-	0.43	-	0.23	-	0.14
Vitamins/minerals premix	0.80	0.75	0.57	0.54	0.81	0.80
Calculated analyses						
Metabolizable energy	3 000	3 000	3 150	3 150	3 200	3 200
Protein (%)	22.1	22.1	20.1	20.1	18.1	18.1
Fat (%)	5.7	5.7	8.5	8.5	8.9	8.9
Fiber (%)	3.3	3.3	3.2	3.2	3.0	3.0
Ash (%)	5.4	5.4	5.3	5.3	5.1	5.1
Lysine (%)	1.58	1.58	1.21	1.21	1.00	1.00
Methionine (%)	0.72	0.72	0.52	0.52	0.43	0.43
Cystine (%)	0,35	0,35	0.33	0.33	0.31	0.31
Methionine + cystine (%)	1.06	1.06	0.85	0.85	0.74	0.74
Threonine (%)	0.98	0.98	0.82	0.82	0.70	0.70
Tryptophan (%)	0.37	0.37	0.24	0.24	0.21	0.21

3. Results and discussion

During the starter period, a significant effect of methionine sources (p=0.02) on body weight gain appeared with lower weight of HMTBA fed birds compared to DLM fed birds. This difference between treatments can be partially related to different trends in feed intake (p=0.08) between methionine sources. Moreover, a significant interaction (room x methionine sources) (P=0.02) appeared on feed conversion. During this period, the environment management was supposed to be the same in the two rooms. However, the heating systems could not be strictly the same and some differences in temperature and/or air steaming created some differences between these two rooms, resulting in a significant interaction.

Table 3. Performance results depending on temperature conditions and methionine sources. *Results are expressed as mean for the different treatments and condition. Statistics are expressed through factorial analysis for methionine source; temperature effect and Methionine source x temperature condition interaction. In the same line significant difference (P<0.05) are expressed with different letters.*

	Cyclic Heat Stress		Standard temp.		Temp.*	Met. source	Interaction
	DLM	HMTBA	DLM	HMTBA			
Starter period (0-14 days)							
Weight gain, g	426.81	420.81	428.74	418.33	0.931	0.022	0.51
HMTBA/ DLM equivalence	-	98.6%	-	97.6%			
Feed intake, g	570.03	552.74	556.34	551.20	0.223	0.082	0.332
HMTBA/ DLM equivalence	-	97.0%	-	99.1%			
Feed conversion	1.336 a	1.314 ab	1.298 b	1.317 ab	0.052	0.908	0.02
HMTBA/ DLM equivalence	-	101.7%	-	98.5%			
Grower period (15-28 days)							
Weight gain, g	851.01	858.22	1125.87	1136.80	<0.0001	0.614	0.917
HMTBA/ DLM equivalence	-	100.8%	-	101.0%			
Feed intake, g	1457.77	1457.49	1788.33	1743.85	<0.0001	0.298	0.304
HMTBA/ DLM equivalence	-	100.0%	-	97.5%			
Feed conversion	1.71	1.70	1.59	1.53	<0.0001	0.07	0.34
HMTBA/ DLM equivalence	-	101.0%	-	103.4%			
Finisher period (29-38 days)							
Weight gain, g	445.23 c	487.10 c	1064.97 a	964.17 b	<0.0001	0.22	0.006
HMTBA/ DLM equivalence	-	109.4%	-	90.5%			
Feed intake, g	1199.77 c	1266.00 c	2037.24 a	1958.76 b	<0.0001	0.803	0.007
HMTBA/ DLM equivalence		105.5%		96.1%			
Feed conversion	2.70	2.60	1.91	2.03	<0.0001	0.95	0.105
HMTBA/ DLM equivalence	-	104.6%	-	93.7%			
From 0 to 38 days							
Weight gain. g	3245.33	3286.28	4380.22	4253.55	<0.0001	0.311	0.056
HMTBA/ DLM equivalence		101.3%		97.1%			
Feed intake. g	1745.14 c	1781.83 c	2620.81 a	2519.71b	<0.0001	0.307	0.037
HMTBA/ DLM equivalence		102.1%		96.1%			
Feed conversion	1.86	1.84	1.67	1.69	<0.0001	0.967	0.225
HMTBA/ DLM equivalence	101.0%	99.0%					

**** During the starter period (0-14 day) temperature effect has to be understood as room effect due to similar temperature management in both rooms during the starter phase .***

However, the performance results from 15 to 38 days indicated a clear effect of temperature condition and lower performances under the cyclic heat stress condition compared to the thermoneutral condition ($p<0.0001$). The effect of cyclic heat stress forced birds to lower feed intake (-17% and -38% respectively during grower and finisher phases) in order to limit metabolic rate and heat production. Interestingly, the decrease in body weight gain (-24% and -54% respectively for the grower and finisher periods) was more pronounced than the decrease of feed intake, indicating that beyond the feed intake regulation, heat stress condition could adversely affect growth performances through other mechanism.

No clear effect of methionine sources was observed whatever the thermal condition considered. However, a significant interaction on body weight gain and feed intake was observed during the finishing period. Actually, HMTBA fed birds showed a lower feed intake and lower body weight gain that could be a remaining effect of the starter period and the room effect previously observed. This hypothesis is supported by the lack of significant differences on FCR during this period.

The effect of methionine sources had been largely studied with inconclusive results. Indeed, under high temperature conditions, some researchers have observed that birds fed DL-HMBTA showed better growth, feed efficiency and lower mortality compared to DLM-supplemented chickens (Swick and Pierson, 1988; Swick et al., 1990). In another study, no differences in growth performance were found due to supplementation of either sources in broilers exposed to high temperature (Ribeiro *et al.*, 2006). Conversely, Balnave and Oliva (1990) obtained improved feed efficiency under high temperature conditions with DLM supplementation, but not for DL-HMTBA supplementation. In our study no clear differences has been pointed out between methionine sources irrespective of the temperature conditions on the overall rearing period. Indeed, the relative FCR ratio between methionine sources appeared to be 99.8% and 100.1% respectively for thermoneutrality and cyclic heat stress condition.

4. Conclusions

The results obtained in this study showed that cyclic heat stress conditions decrease drastically bird performance compared to standard conditions. However, the results obtained didn't show significant differences between methionine sources on the whole rearing period whatever the environmental conditions applied.

5. References

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