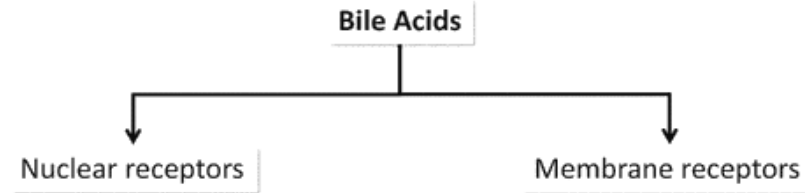
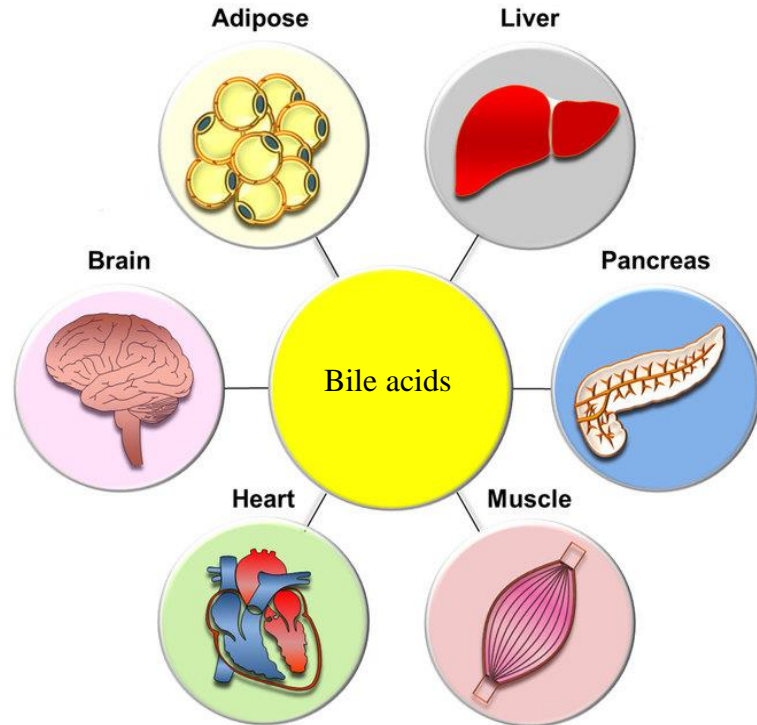




Bile Acid: Unlocking the Core Driving Technology for Efficient Fat Digestion and Enhanced Growth Performance in Broilers



Bile Acids and Their Functions: An Overview



Receptor	Rank of potency	Receptors	Rank of potency
FXR/RXR	CDCA>CA>LCA≥DCA	GP-BAR1 (TGR5)	LCA>DCA>CDCA>CA
PXR/XRX	LCA>CDCA	Muscarinic M3	Agonism/antagonism
CAR/RXR	CDCA>CA>LCA	EGF-R	Transactivation
VDR/RXR	LCA	fMLP-R	Antagonism

(Distrutti et al., J Gastroenterol, 2015)

- Bile acids are the main active component of bile. It is a series of sterols produced in the process of cholesterol metabolism in animals ; It is safe and effective, and it is also an active ingredient necessary for the digestion and absorption of fat in the body of animals.
- Bile acids act as signaling molecules to activate corresponding receptors and exert functional effects, including: ① glucolipid metabolism; ② liver health; ③ antibacterial and anti-inflammatory activities; ④ detoxify and excrete toxins; ⑤ muscle development; ⑥ and maintenance of cholesterol and bile acid homeostasis.



Application Cases of Bile Acids in Poultry Farming



Day-old	Bile Aricds Dosage	Functional Effects	Period	References
1 d, Broiler	200 mg/kg, feed	Enhance Growth Performance ; Promote Lipid Metabolism	42 d	Yin et al., Animals 2021
1 d, Broiler	1500 mg/kg feed	Attenuate Bacterial Invasiveness ; Alleviate the Inflammatory Response	25 d	Bansal et al., Pathogens 2021
1 d, Broiler	1500 mg/kg feed	Enhance Growth Performance; Attenuate the Colonization Ability of Pathogenic Bacteria	28 d	Alrubaye et al., PLoS One 2013
315 d, Layer	30-120 mg/kg feed	Enhance Laying Performance; Maintain Intestinal Health; Promote the Absorption of Fat-Soluble Vitamins	168	Yang et al., Front Nutr. 2023
350 d, Layer	100/200 mg/kg	Enhance Hepatic Lipid Metabolism; Enhance Egg Yolk Coloration	56 d	Sun et al., J Anim Sci. 2023
21 d, Broiler	1000 mg/kg feed	Promote T-2 Toxin Metabolism ; Alleviate Inflammation and Oxidative Stress	4 d	Dai et al., Chem Biol Interact. 2020
7 d, Broiler	250/500 mg/kg feed	Enhance Growth Performance; Promote Fat Digestion	35 d	Alzawqari et al., S Afr J Anim Sci. 2016

Bile acids enhance poultry growth performance, fat utilization efficiency, antibacterial and bactericidal effects, toxin detoxification, and anti-inflammatory effects.



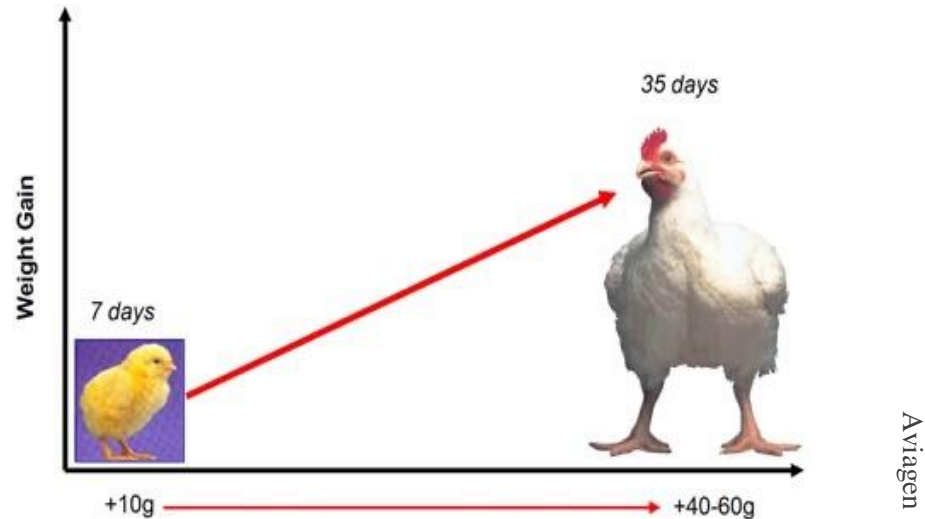
Bile Acids Enhance the Growth Performance and Slaughter Performance of Broilers



Backgrounds



Modern broilers feature a fast growth rate and a short rearing cycle: approximately 5-7 weeks.



https://en.aviagen.com/assets/Tech_Center/Ross_Tech_Articles/RossTechNoteLowBroilerKillWeights.pdf

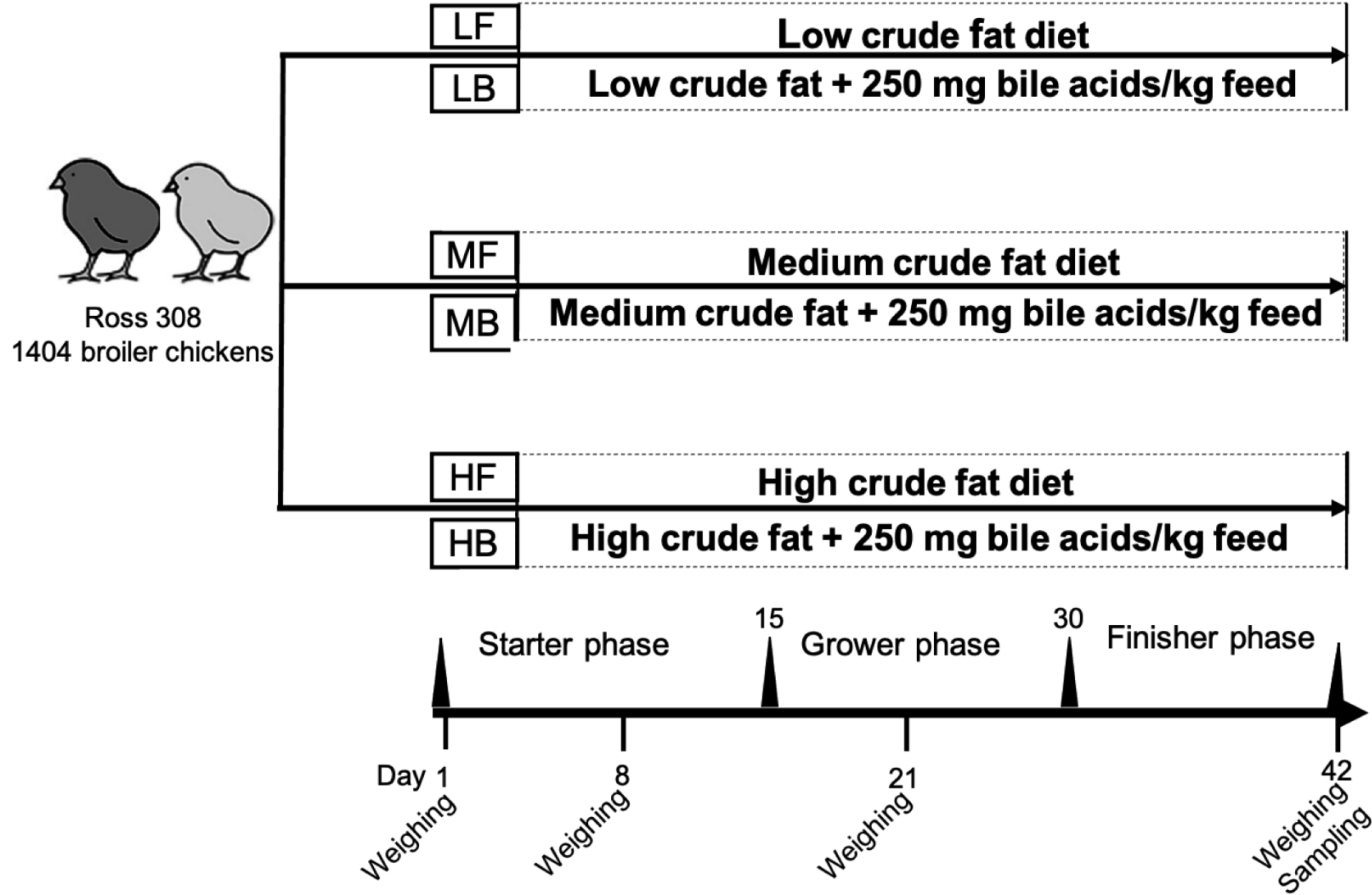


Dr. Arshad

- Modern broilers have high nutritional requirements, especially for energy levels¹
- Increase the fat level in the diet, especially in colder regions²
- However, due to the limitations of their own physiological characteristics², broilers have insufficient fat digestion, absorption and utilization, thus reducing their slaughter performance and economic benefits³.
- Bile acids can improve fat utilization efficiency, can they further improve FCR and slaughter performance of broilers in diets with high crude fat?



Experimental design





Results



Items	Day 1, BW (g)	Day 1-21			Day 21 BW (g)	Day 22-42			Day 42 BW (g)	Day 1-42			
		ADFI, g	ADG, g	FCR		ADFI, g	ADG, g	FCR		ADFI, g	ADG, g	FCR	
Groups	LF	56.70	54.00	42.26 ^b	1.28 ^a	902.00 ^b	123.81	75.02	1.65	2552	90.57	59.42	1.53 ^a
	LB	57.23	53.25	42.29 ^b	1.26 ^{ab}	903.08 ^b	124.96	77.01	1.63	2597	90.81	60.48	1.51 ^{ab}
	MF	57.23	53.61	42.64 ^b	1.26 ^{ab}	910.38 ^b	125.40	78.10	1.61	2628	91.21	61.21	1.49 ^{ab}
	MB	57.15	53.32	43.00 ^b	1.24 ^b	917.83 ^b	125.57	77.66	1.62	2626	91.16	61.15	1.49 ^{ab}
	HF	58.00	53.21	42.66 ^b	1.25 ^b	910.46 ^b	124.57	77.56	1.61	2617	90.59	60.94	1.48 ^b
	HB	57.24	52.89	44.23 ^a	1.20 ^c	942.4 ^a	124.49	78.98	1.59	2680	90.39	62.43	1.45 ^c
SEM	0.21	0.12	0.19	0.01	3.72	0.47	0.58	0.01	14.31	0.28	0.34	0.01	
Main effect													
Bile acids	-	57.03	53.61	42.52	1.26	907.62 ^b	124.59	76.90	1.62	2599	90.79	60.52	1.45
	+	57.46	53.15	43.17	1.23	924.52 ^a	125.01	77.89	1.61	2634	90.79	61.36	1.45
Crude fat	Low fat	57.70	53.63	42.28	1.27	905.13 ^b	124.39	76.02	1.64	2575	90.69	59.95	1.47
	Medium fat	57.20	53.46	42.82	1.25	916.61 ^{ab}	125.48	77.88	1.61	2627	91.19	61.18	1.45
	High fat	57.58	53.05	43.44	1.22	924.46 ^a	124.53	78.27	1.60	2648	90.45	61.69	1.43
P-Value	Bile acids	0.30	0.06	0.07	$P < 0.001$	0.06	0.67	0.40	0.56	0.22	1.00	0.22	0.07
	Crude fat	0.48	0.14	0.03	$P < 0.001$	0.02	0.60	0.25	0.11	0.10	0.58	0.10	0.02
	Interaction effect	0.66	0.69	0.17	0.09	0.16	0.86	0.68	0.41	0.61	0.95	0.62	0.34

Bile acids improve the early-stage Body Weight (BW), Average Daily Gain (ADG), and full-cycle FCR of broilers.



Results



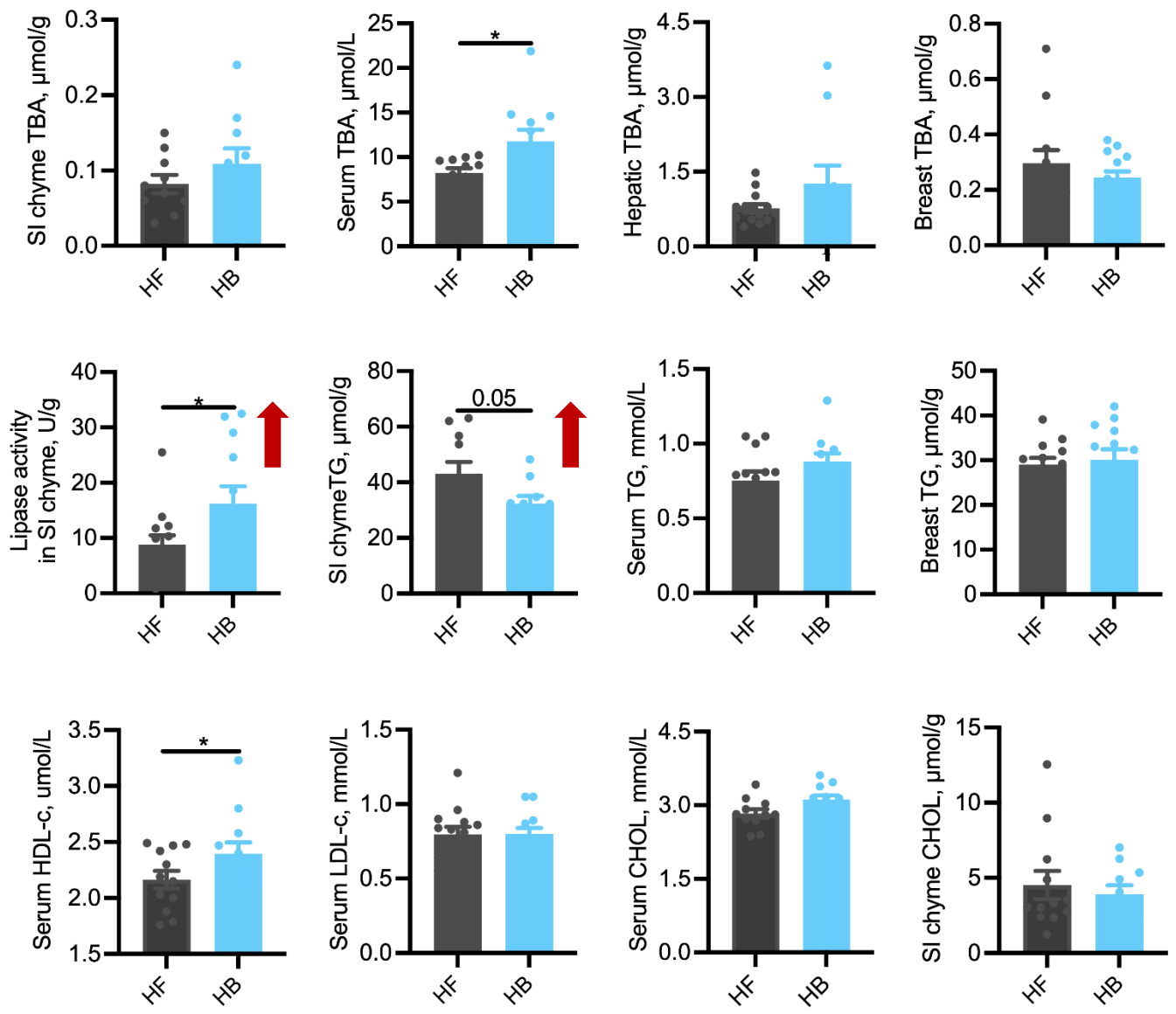
Items	HF	HB	P-Value
Organ weight, g			
Semi-eviscerated weight	2202.25 ± 32.38^b	2337.53 ± 43.21^a	0.02
Eviscerated weight	1868.81 ± 36.71	1956.60 ± 33.83	0.09
Abdominal fat	25.65 ± 1.68	24.93 ± 1.30	0.55
Breast muscle	571.00 ± 13.43	638.00 ± 14.07	0.002
Thigh muscle	407.00 ± 9.74	426.53 ± 11.76	0.22
Liver weight	48.63 ± 1.38	50.27 ± 0.87	0.33
Spleen weight	2.50 ± 0.16	2.60 ± 0.21	0.71
Organ index (%)			
Semi-eviscerated weight / body weight	84.10 ± 0.62	84.45 ± 0.71	0.56
Eviscerated weight / body weight	71.35 ± 0.98	70.70 ± 0.48	0.72
Abdominal fat / (eviscerated weight + abdominal fat)	1.43 ± 0.07	1.20 ± 0.05	0.06
Breast muscle/eviscerated weight	30.62 ± 0.68	32.65 ± 0.65	0.04
Thigh muscle / eviscerated weight	21.81 ± 0.44	21.79 ± 0.44	0.98
Liver weight / eviscerated weight	2.61 ± 0.07	2.58 ± 0.05	0.72
Spleen weight / eviscerated weight	0.13 ± 0.01	0.13 ± 0.01	0.89

HF = high-crude fat; HB = high-crude fat+ bile acids

Bile acids increase the semi-eviscerated weight and breast muscle weight of broilers fed a high dietary crude fat diet.



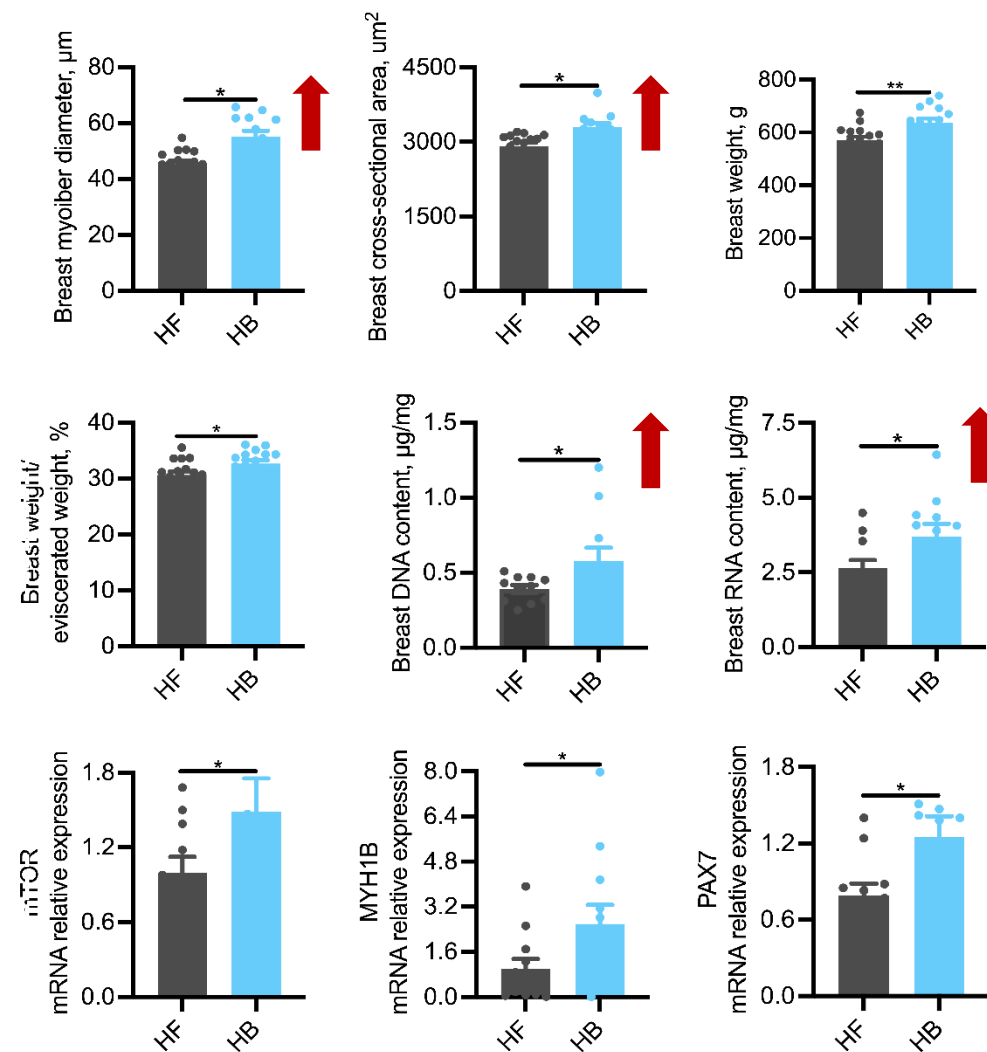
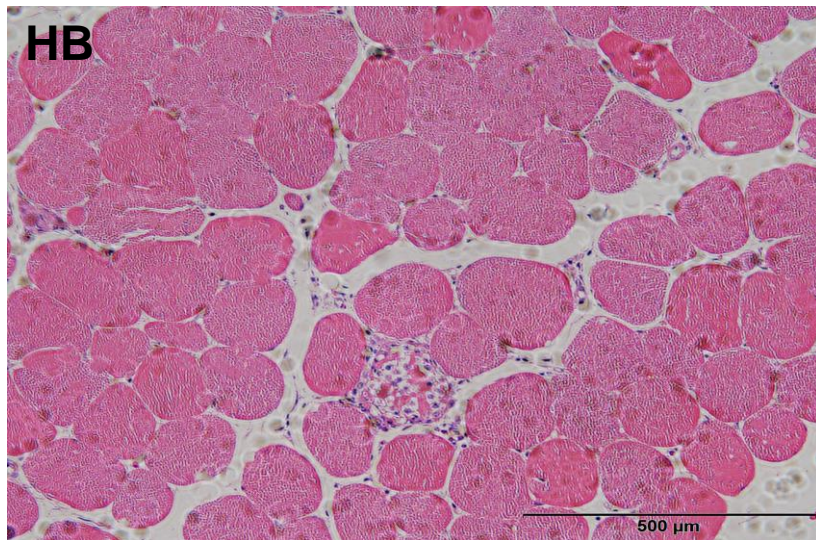
Results



Bile acids increase lipase activity and decrease triglyceride (TG) content in the small intestinal chyme.



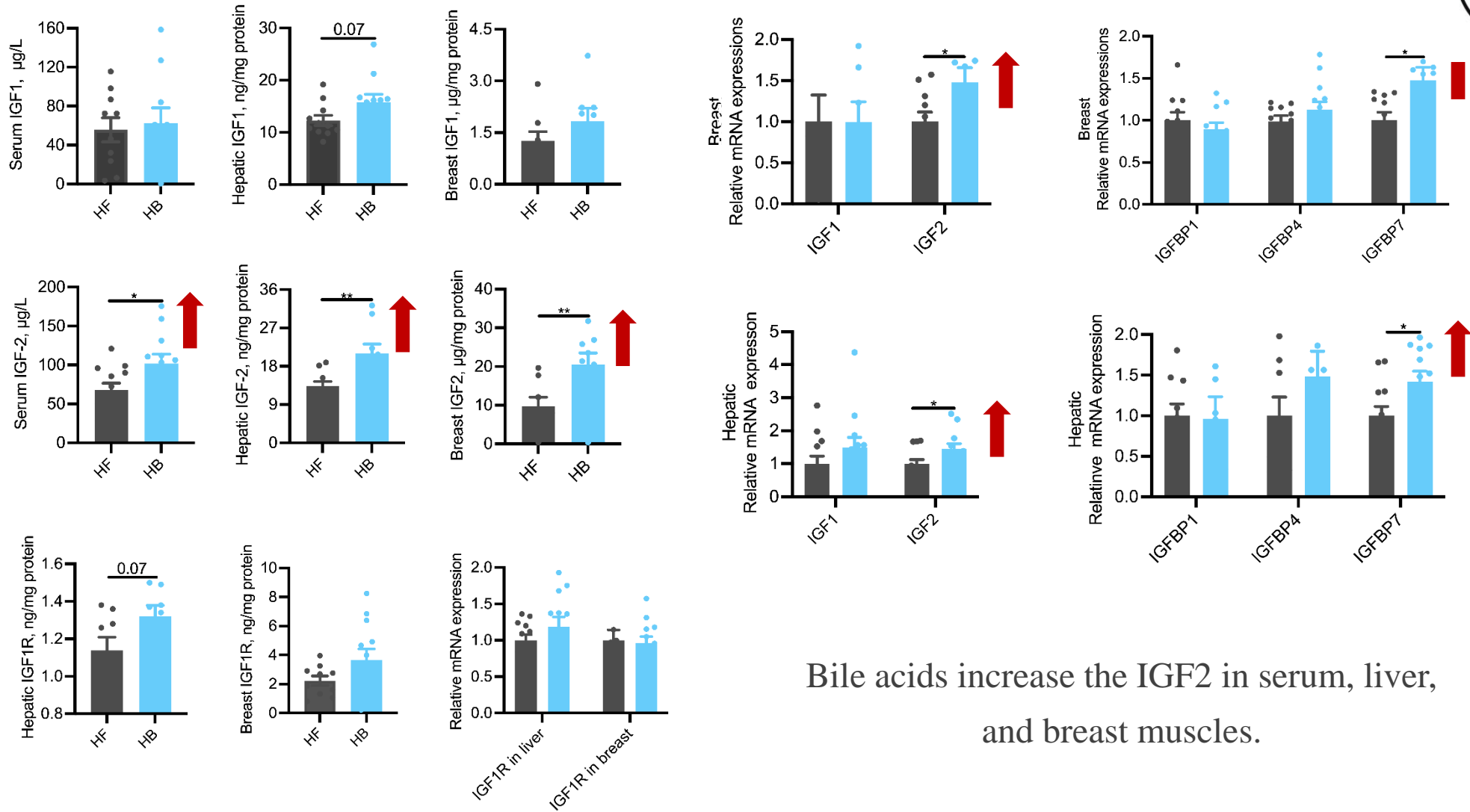
Results



Bile acids increase the diameter, cross-sectional area of breast muscles, and the content of DNA and RNA.



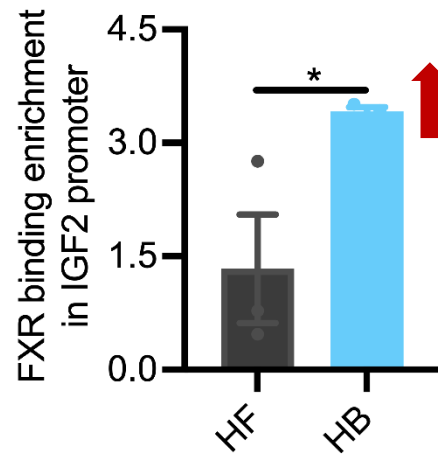
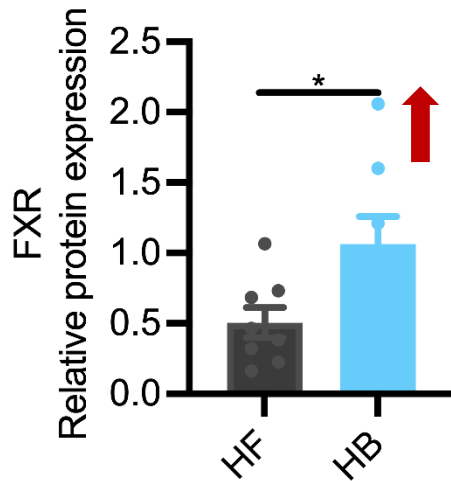
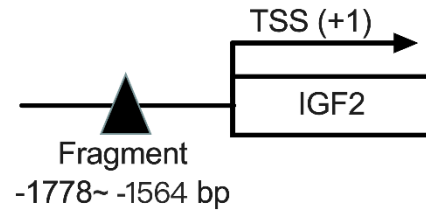
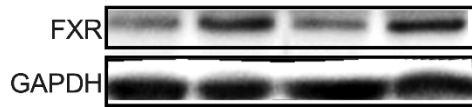
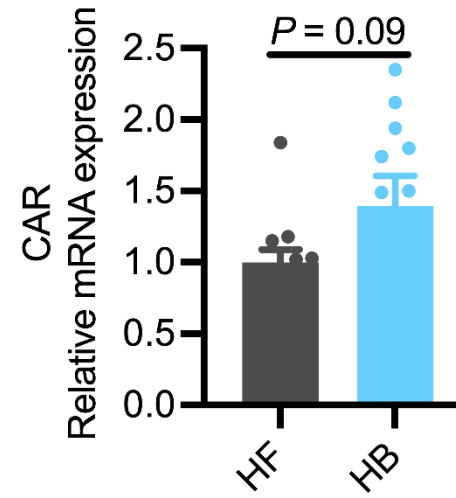
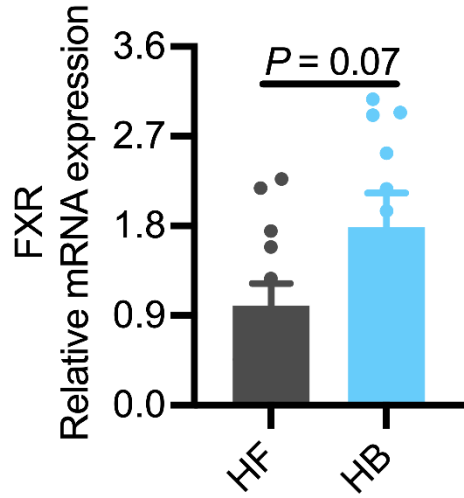
Results



Bile acids increase the IGF2 in serum, liver, and breast muscles.



Results



Bile acids significantly increase FXR expression and its enrichment in the IGF2 promoter region.



Conclusion



Bile acids improve growth performance and carcass characteristics of broilers. Specifically, bile acids promote breast muscle growth possibly through the FXR/IGF2 pathway. This study provides scientific evidences for the application of bile acids as an additive in integrative broiler industry aiming for higher feed efficiency.



Take Home Message



- Bile acid is an active ingredient necessary for the digestion and absorption of fat in the body of animals.
- Bile acids can effectively improve the growth performance and carcass performance of broilers.
- Bile acids increase lipase activity and decrease triglyceride (TG) content in the small intestinal chyme.
- Bile acids increase the IGF2 in serum, liver, and breast muscles.
- Bile acids promote breast muscle growth possibly through the FXR/IGF2 pathway.



THANK YOU

Presenter: Tracy



Nutritional composition of the broilers' diets



Table 1. Nutritional composition of the broilers' diets.

Items	Feeding stages (day posthatching)								
	Starter phase (D 1–15)			Grower phase (D 15–30)			Finisher (D 31–42)		
	LF ¹ /LB ²	MF ³ /MB ⁴	HF ⁵ /HB ⁶	LF ¹ /LB ²	MF ³ /MB ⁴	HF ⁵ /HB ⁶	LF ¹ /LB ²	MF ³ /MB ⁴	HF ⁵ /HB ⁶
Ingredients (%)									
Corn	66.10	65.70	65.30	65.27	64.15	63.75	66.70	66.30	65.90
Soybean meal	30.70	30.70	30.70	30.50	30.50	30.50	27.50	27.50	27.50
Corn gluten meal	2.50	2.50	2.50	0.08	0.80	0.80	0.50	0.50	0.50
Rice bran oil	0.50	0.90	1.30	3.95	4.35	4.75	5.10	5.50	5.90
Premixture to starter ⁷	0.20	0.20	0.20	0.00	0.00	0.00	0.00	0.00	0.00
Premixture to grower ⁸	0.00	0.00	0.00	0.20	0.20	0.20	0.00	0.00	0.00
Premixture to finisher ⁹	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.20	0.20
Calculated composition (%)	100	100	100	100	100	100	100	100	100
ME (kcal/kg)	2985	3035	3055	3065	3085	3105	3170	3190	3210
Crude protein	22.00	22.00	22.00	21.00	21.00	21.00	19.75	19.75	19.75
Crude fat	2.90	3.30	3.70	6.25	6.65	7.05	7.55	7.95	8.35
Calcium	0.89	0.89	0.89	0.67	0.67	0.67	0.56	0.56	0.56
Total phosphorus	0.69	0.69	0.69	0.62	0.62	0.62	0.58	0.58	0.58
Sodium chloride	0.36	0.36	0.36	0.34	0.34	0.34	0.32	0.32	0.32

¹LF = low-crude fat.

²LB = low-crude fat + BA.

³MF = medium-crude fat.

⁴MB = medium-crude fat + BA.

⁵HF = high-crude fat.

⁶HB = high-crude fat + BA, details as shown in [Figure 1](#).