



Vitamin E reduce adipose tissue fibrosis and lipid metabolism disorder in oxidized fish oil-fed pigs

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Outline of the report

1. Research background

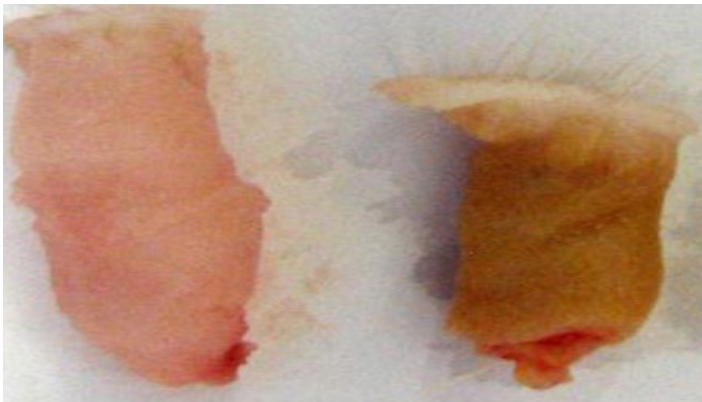
2. Main scientific research work

3. Conclusion

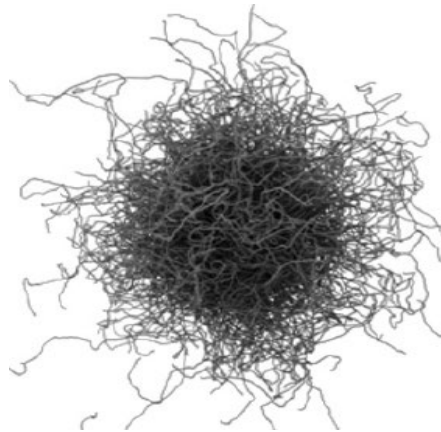


- Yellow fat disease, also known as steatitis, is caused by a disturbance in energy metabolism leading to inflammation of adipose tissue and lipofuscin deposition. The occurrence of yellow fat disease is often only determined post-slaughter; once it occurs, it is difficult to eliminate.

Normal Fat VS Yellow Fat Disease Fat



Lipofuscin Diagram



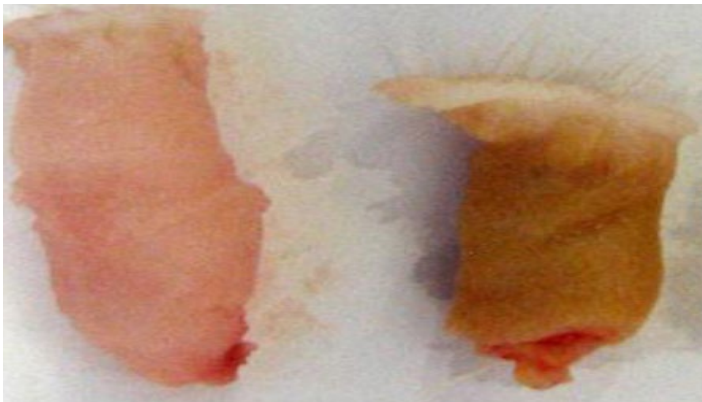
Main Components of Lipofuscin

Main Components	Proportion
Oxidized Proteins	30-70%
Lipids	20-50%
Metal Cations	2%

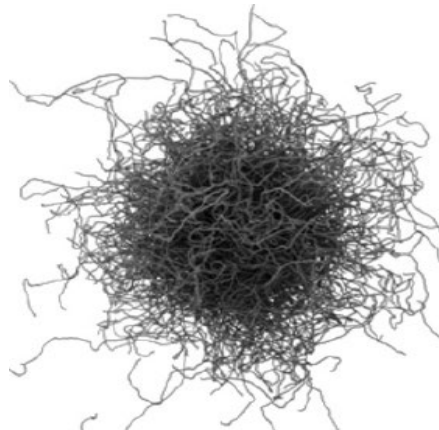


- Lipofuscin is a class of cross-linked products composed of highly oxidized proteins and lipids.
- Due to its wide range of non-specific clinical symptoms, diagnosing yellow fat disease in animals is difficult and often can only be determined post-slaughter.
- Yellow fat disease in animals is characterized by its persistence; even after the causative feed is discontinued, the condition can last for 3-4 months. Currently, reports of yellow fat disease in pigs in China are mainly attributed to the use of aged corn as feed.

Normal Fat VS Yellow Fat Disease Fat



Lipofuscin Diagram



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Groups	Feed composition
CON	basal diet with 2% fresh fish oil
OFO	basal diet with 8% oxidized fish oil
VE	basal diet with 8% oxidized fish oil and 100 mg/kg vitamin E
TBHQ	basal diet with 8% oxidized fish oil and 150 mg/kg TBHQ (Tert-Butylhydroquinone)

Weaning stage

D1-d30

Growing stage

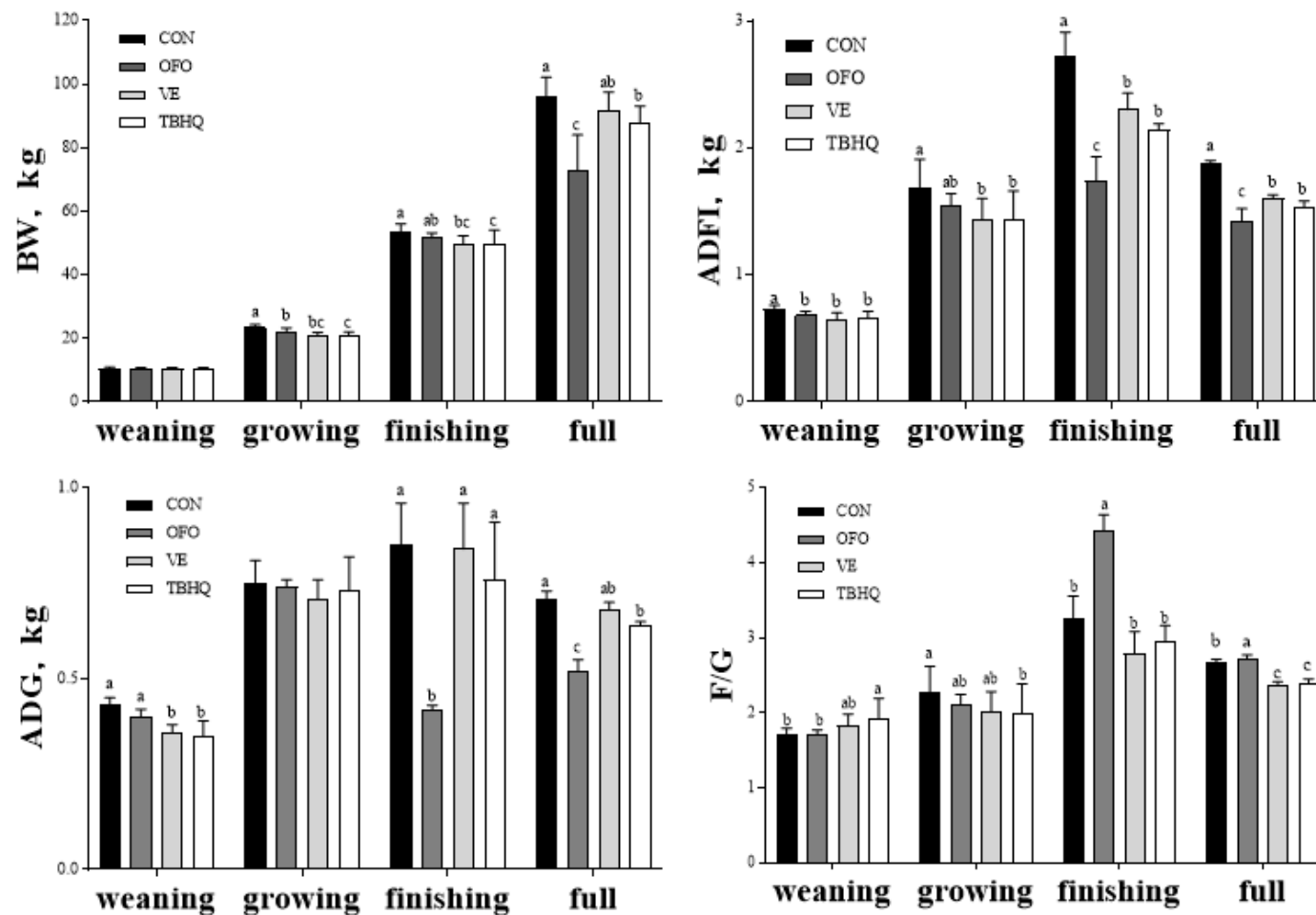
D31-d70

Finishing stage

D71-d120



Growth Performance



- 8% oxidized fish oil decrease the growth performance.
- Compared with the CON group, the OFO group showed a significant reduction in overall ADG and ADFI.
- vitamin E and TBHQ significantly increased ADG and ADFI while reducing feed conversion ratio (F/G).



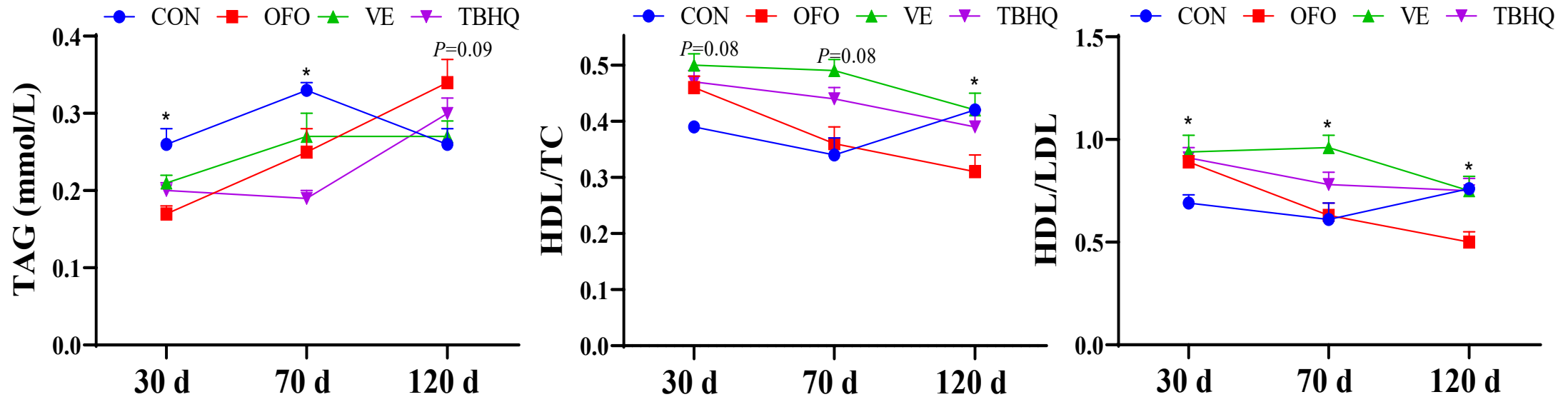
Carcass Traits

Items	CON	OFO	VE	TBHQ	SEM	<i>P</i> value
Carcass weight (kg)	77.20 ^a	57.73 ^b	69.80 ^a	70.13 ^a	0.49	< 0.01
Dressing weight (%)	78.33	79.44	79.89	79.41	0.02	0.37
Carcass fat (%)	21.87	21.82	20.86	21.36	0.03	0.84
Carcass lean (%)	55.76	54.81	55.87	55.39	0.03	0.92
Loin-eye area (cm ²)	35.81 ^a	28.37 ^b	32.36 ^{ab}	32.18 ^{ab}	0.02	0.09
Backfat thickness (mm)	21.34 ^a	15.94 ^b	20.27 ^a	19.40 ^{ab}	0.32	0.05
Carcass length (cm)	94.84 ^a	86.30 ^b	93.26 ^a	93.07 ^a	0.33	< 0.01

- Compared with the CON group, the OFO group showed a significant decrease in body weight, Loin-eye area, back fat thickness, and body length.
- The addition of vitamin E and TBHQ mitigated the decrease in body characteristics.



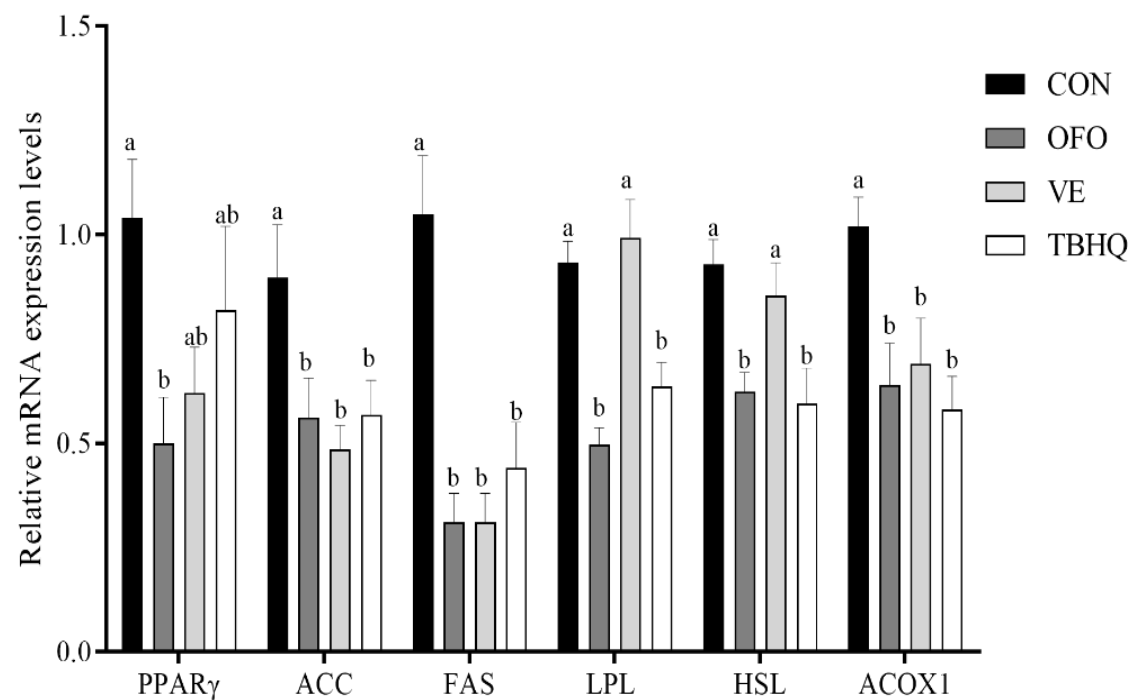
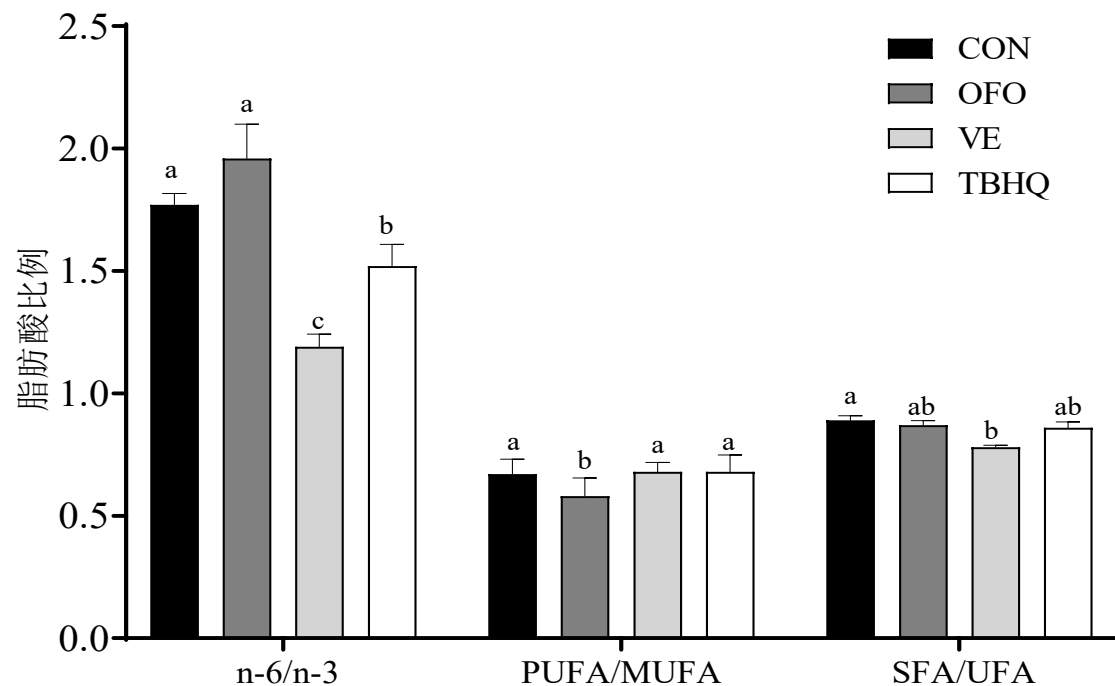
Serum lipid metabolism



- Compared with the CON group, the OFO group exhibited a significant decrease in TAG levels at 30 and 70 days and a significant increase at 120 days, HDL/TC and HDL-LDL ratios decreased significantly at 120 days.
- Compared with the OFO group, the VE group showed a significant increase in serum TAG levels at 30 days and a significant decrease at 120 days, and HDL/LDL ratios significantly increased at all stages

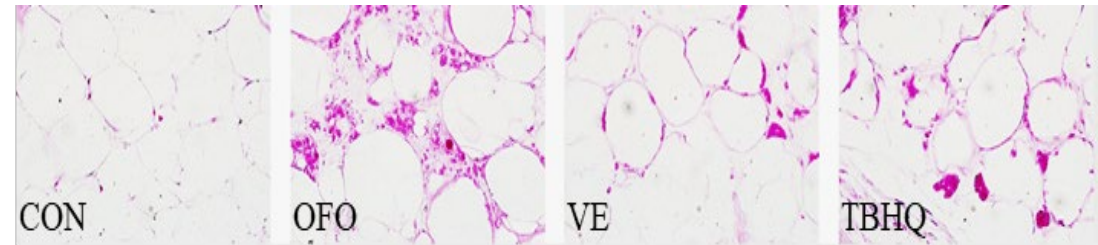
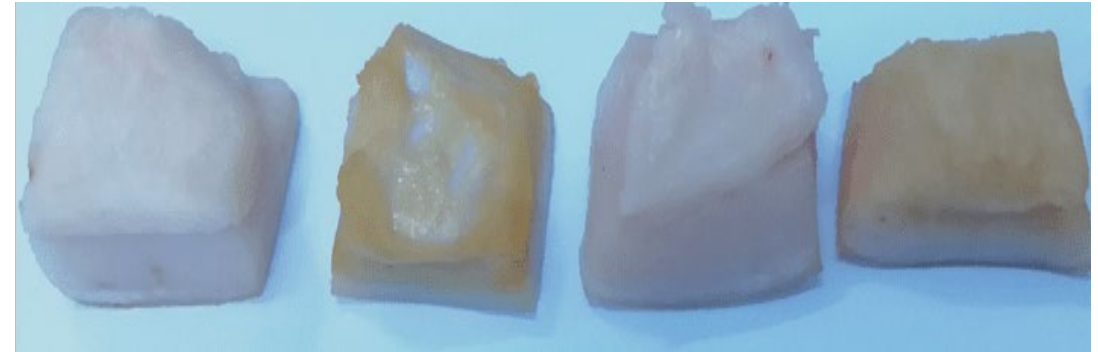
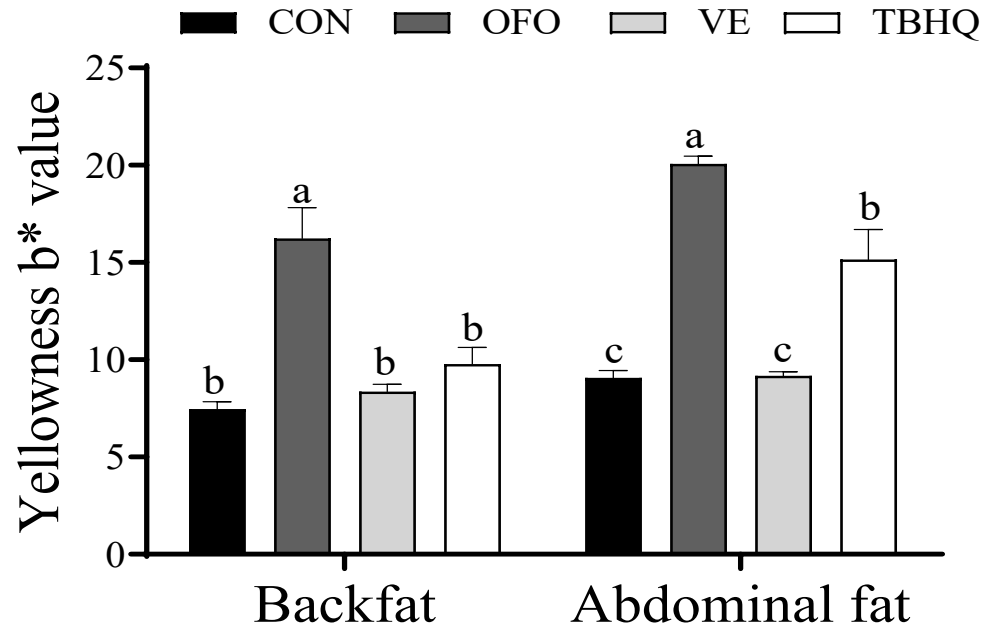


Backfat lipid metabolism



- In the VE and TBHQ groups, the n-6/n-3 ratio decreased, and the PUFA/MUFA ratio increased.
- The VE group showed increased expression of lipid degradation genes HSL and LPL.

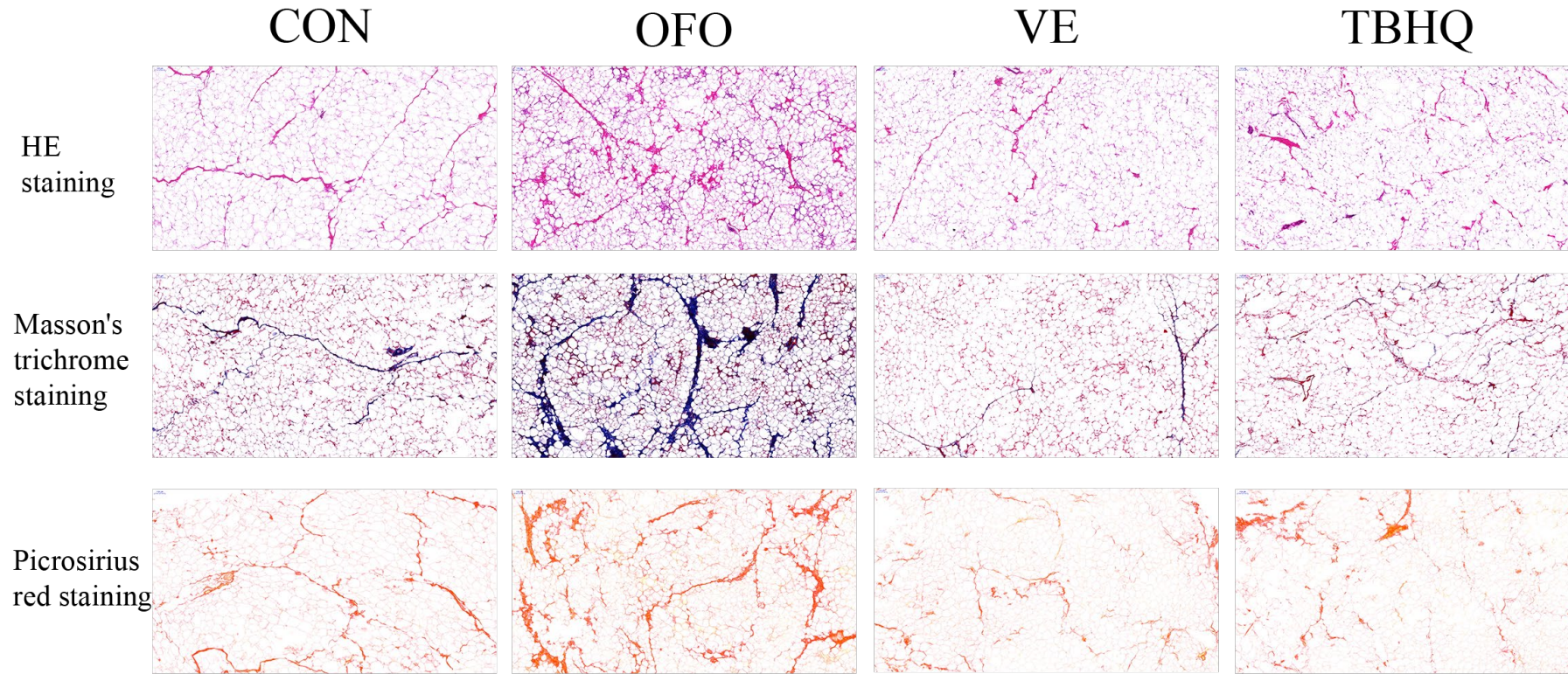
Yellowness of fat



- In the OFO group, the yellowness value of back fat tissue increased, and lipofuscin deposition increased.
- In the VE and TBHQ groups, the yellowness value decreased, and lipofuscin deposition was reduced.



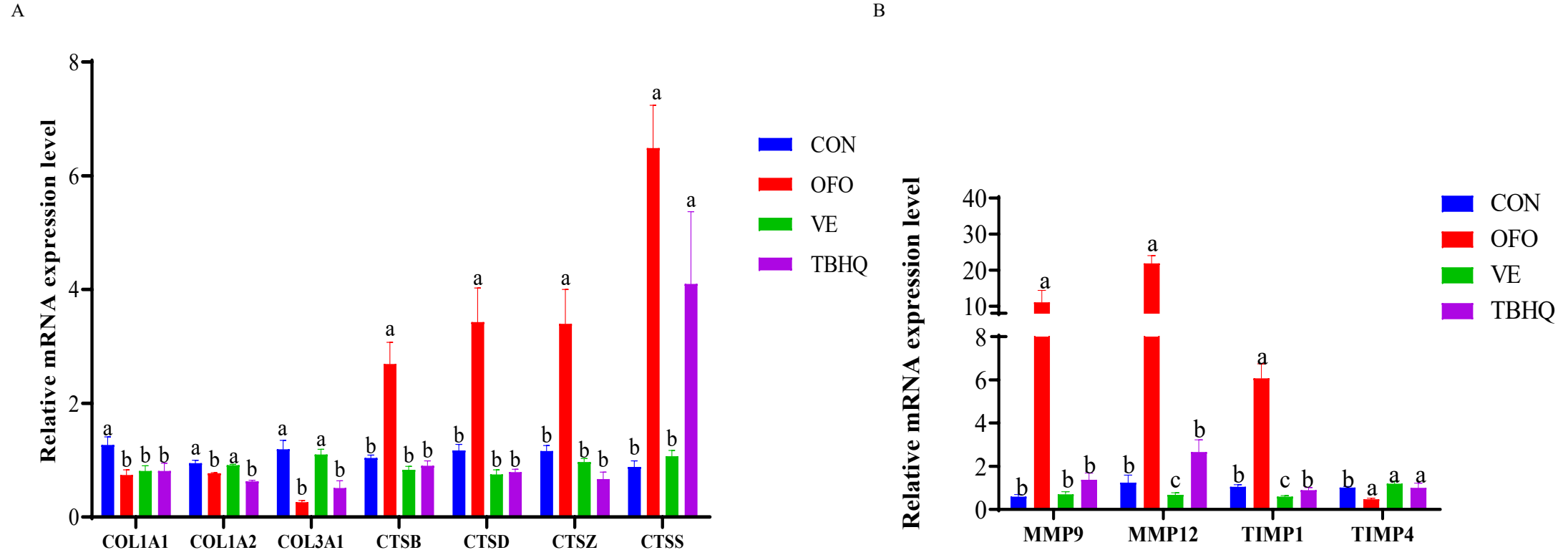
Adipose Tissue Staining



- Picrosirius red and Masson's trichrome staining are specific methods for staining tissue collagen fibers, reflecting the degree of tissue fibrosis.
- The adipose tissue in the OFO group exhibits significant fibrosis, while fibrosis is reduced in the VE and TBHQ groups.



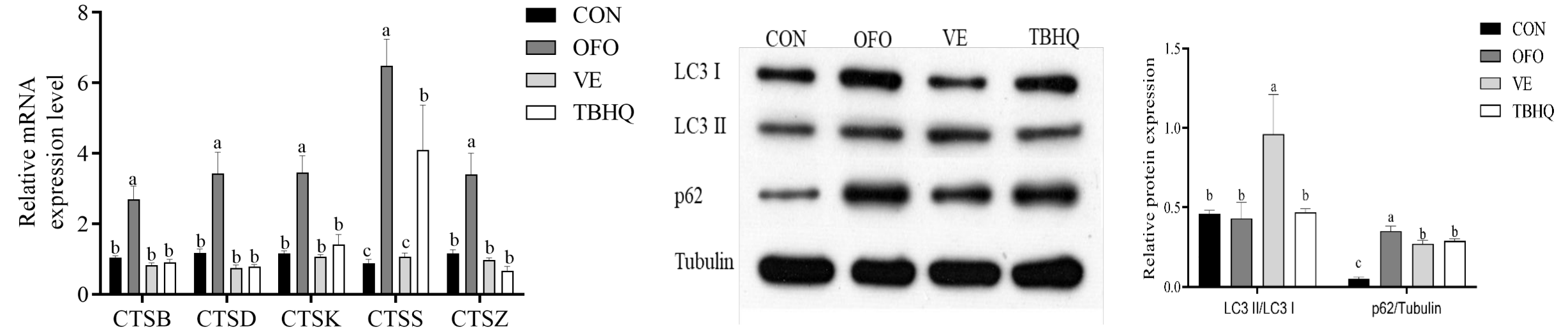
Gene expression of extracellular matrix in backfat



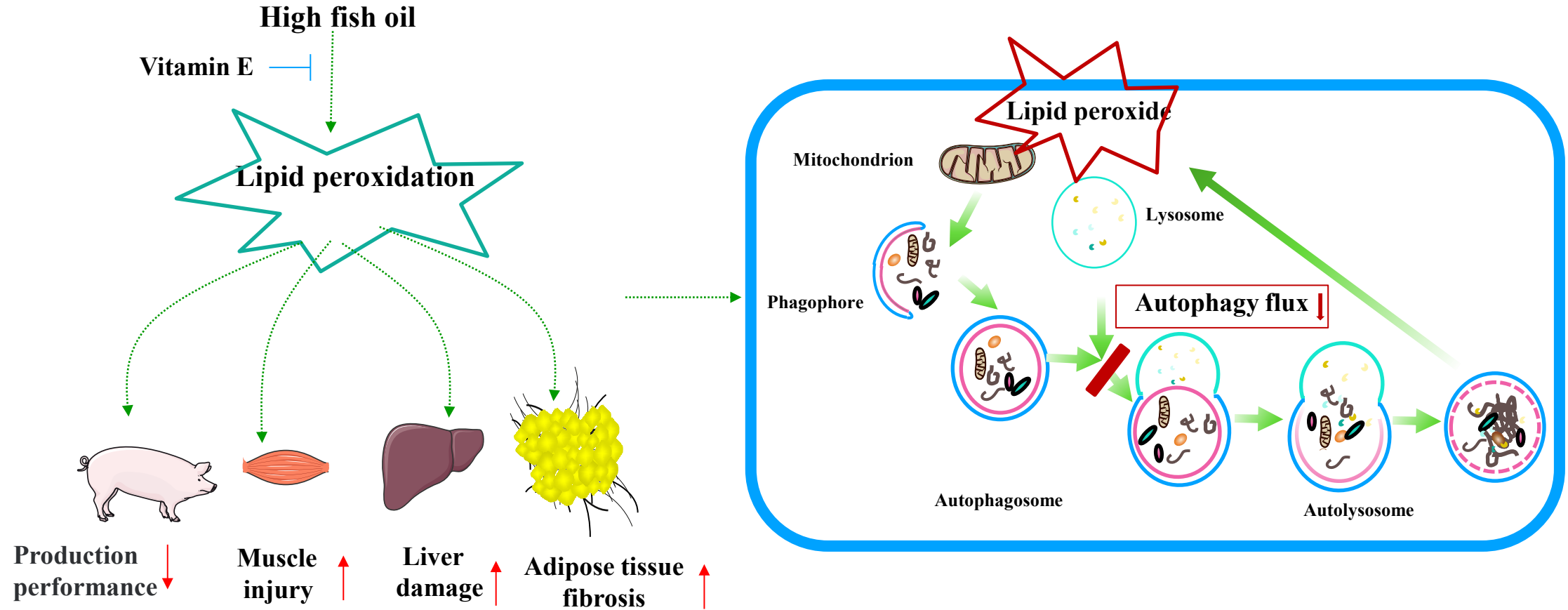
- In yellow fat pigs, there is significant fibrosis and extracellular matrix remodeling in the back fat tissue
- The addition of VE and TBHQ alleviates this process.



Autophagy flux of backfat



- In the OFO group, the expression levels of cathepsin family genes were significantly upregulated;
- In the VE and TBHQ groups, the expression levels of cathepsin family genes were significantly downregulated. Autophagic flux was inhibited in the back fat tissue of the OFO group, while antioxidants increased autophagic flux.



- The effect of 100 mg/kg Vitamin E is superior to that of 150 mg/kg TBHQ.
- In yellow fat pigs, adipose tissue shows significant fibrosis and lysosomal damage, accompanied by autophagy inhibition. The mechanism by which antioxidants alleviate these changes may be through promoting autophagic flux, thereby reducing lipofuscin deposition.



- ◆ Guangdong Provincial Natural Science Foundation surface project -2018A030313143
- ◆ Guangzhou Municipal Natural Science Foundation of Youth Fund -2023A04J0131
- ◆ Talent Introduction Project of Guangdong Academy of Agricultural Sciences-Grade 1 Excellent Doctor
- ◆ Talent Training Program of Guangdong Academy of Agricultural Sciences-Young associate researcher
- ◆ Talent Training Program of Guangdong Academy of Agricultural Sciences-Youth associate researcher

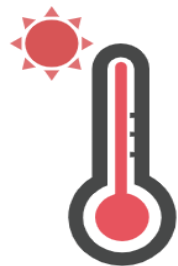




*Thanks
for your time!*

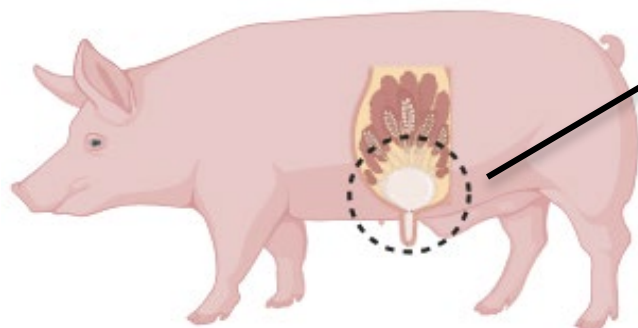


□ Conclusion

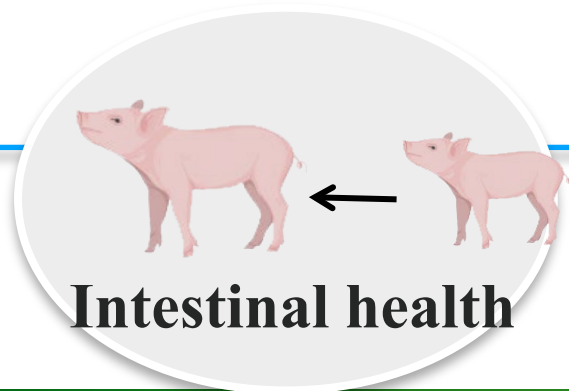


(High summer temperatures)

Resveratrol
(300 mg/kg)



Gestation 75 days to lactation
21 days



Intestinal health

Piglet

