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**Congress 2023**

Lyon, France - August 26<sup>th</sup> / September 1<sup>st</sup>, 2023

# **Odd chain fatty acids improved the intestinal development of milk powder-fed piglets**

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**A u g u s t 3 1<sup>th</sup> 2 0 2 3**

**Antibody**

**Saccharides**

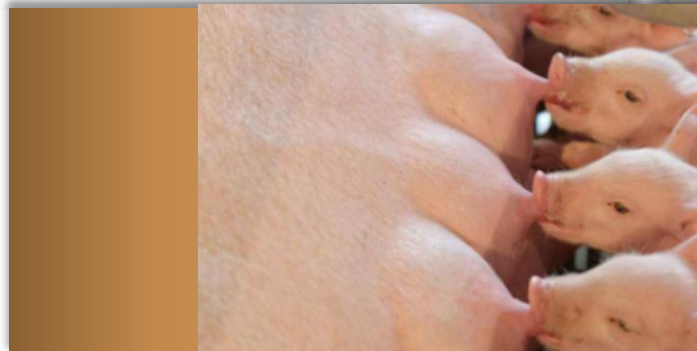
**Vitamin**

**Protein and whey  
protein**

**various minerals  
and trace elements**

**Fat**

**Sow milk**



# Benefits of breastfeeding



**Immunity**  
Provide the earliest  
immune substances  
for piglets



**Nutrition/Growth**  
Provide all nutritional  
requirements for piglets  
during the same period  
of growth and  
development



**Promote the  
development of the  
nervous system**  
Promote the  
development of smell,  
taste, hearing, etc

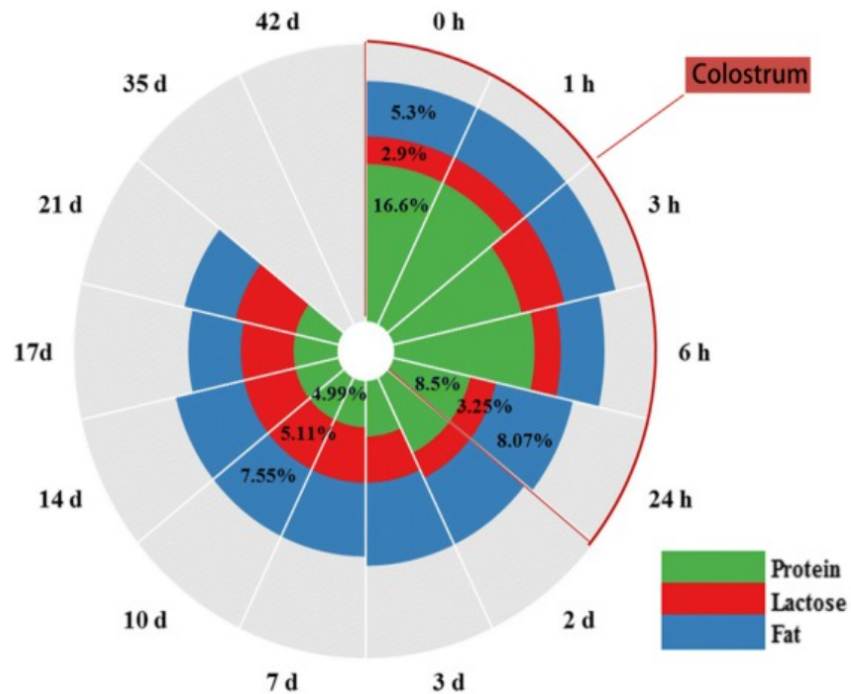


**Promote  
gastrointestinal  
development**  
Improve the digestion,  
absorption, and  
utilization of nutrients



**Reduce metabolic  
diseases in adult  
offspring**  
Obesity,  
hypertension, etc

◆ Sow milk plays an essential role in the survival and growth of piglets.



Protein synthesis

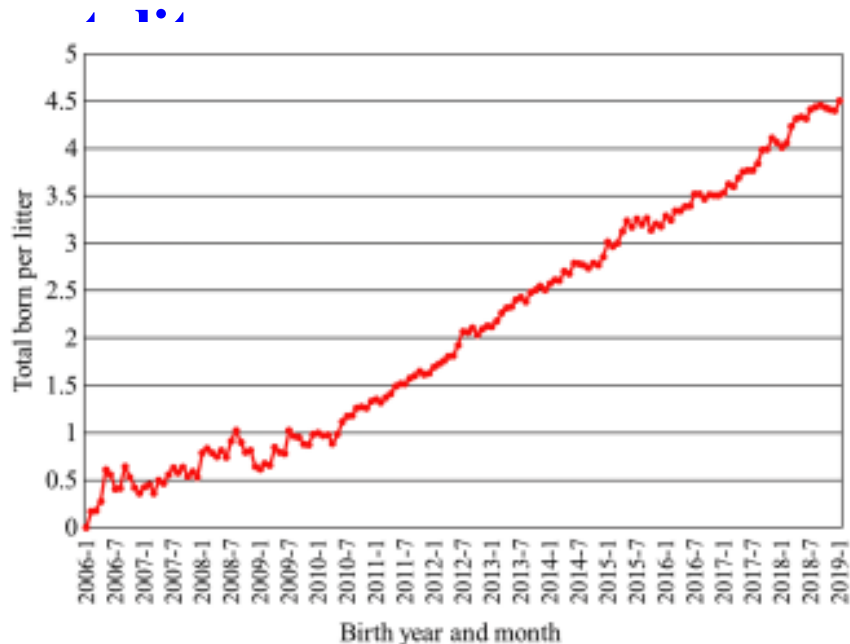
Immune protection

Heat production

Weight gain

Organ development

- ◆ However, with the rapid development of animal husbandry, sows have a large number of litters, and their milk production can not meet the actual growth and development needs of each piglet.
- ◆ This often causes some weak piglets to lose weight, intestinal barrier dysfunction, poor growth performance, increased diarrhea, morbidity and



**Figure 1** Genetic trend for total pigs born per litter at the nucleus level from Genus PIC (M. Culbertson, personal communications, 12 February 2019).

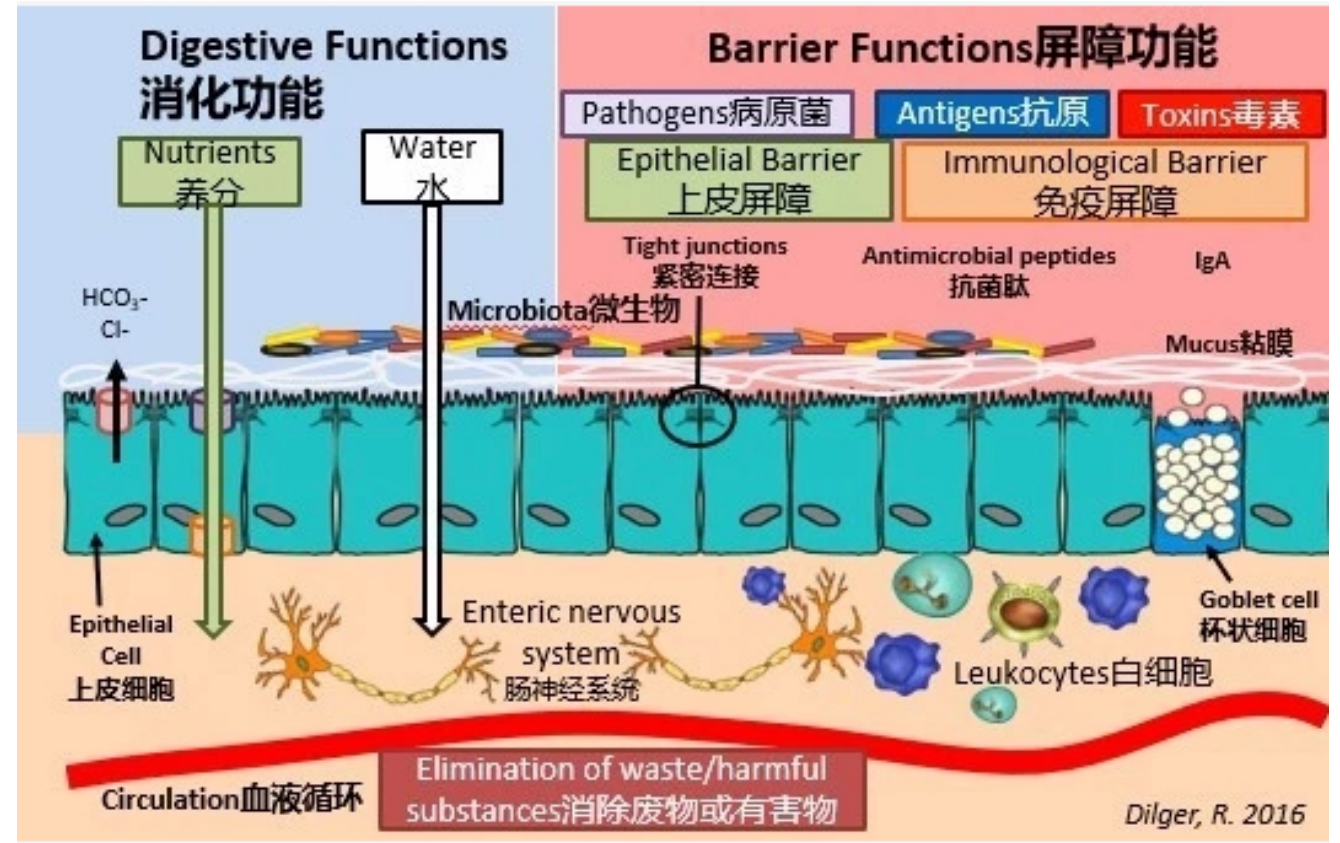


- ◆ To achieve the maximum growth potential and body weight (BW) at weaning, and again at the transition from the weaner to grower-finisher unit, new solutions and alternative management strategies are needed.
- ◆ Artificially rearing in combination with provision of a milk replacer is considered as an alternative strategy.



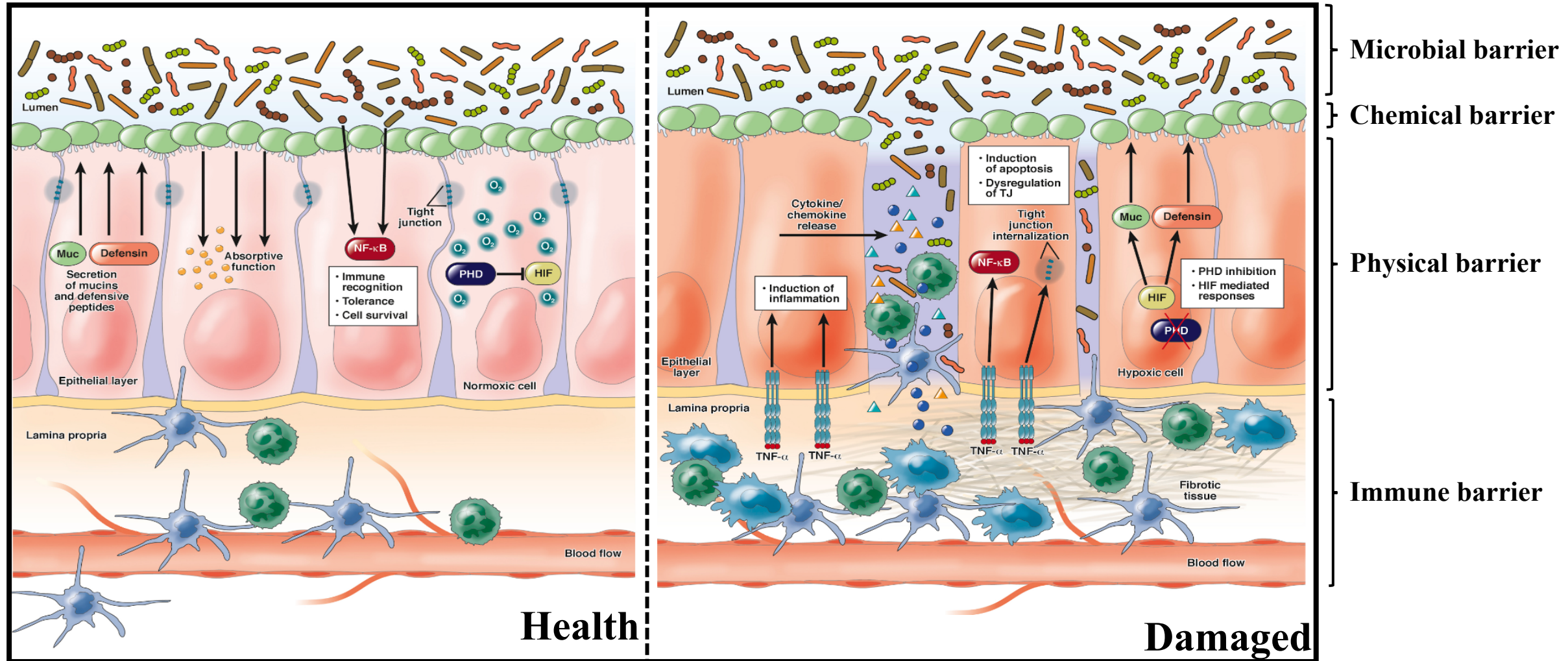
## ◆ The importance of intestinal health

- ✓ the main site for nutrient digestion and absorption ;
- ✓ the largest defense fortress for diseases, the largest immune organ, with 70% -80% of immunoglobulin synthesis cells in the gastrointestinal tract.
- ✓ The low growth performance and survival rate of pigs caused by intestinal health issues are key factors affecting pig production efficiency.



**Raising pigs = raising the intestines**

◆ An effective epithelial barrier is key to intestinal homeostasis and barrier dysfunction underpins inflammatory bowel disease.





◆ This study aimed to investigate the effects of milk powder supplemented with different kinds of fatty acids on the morphology and function of intestines of piglets.



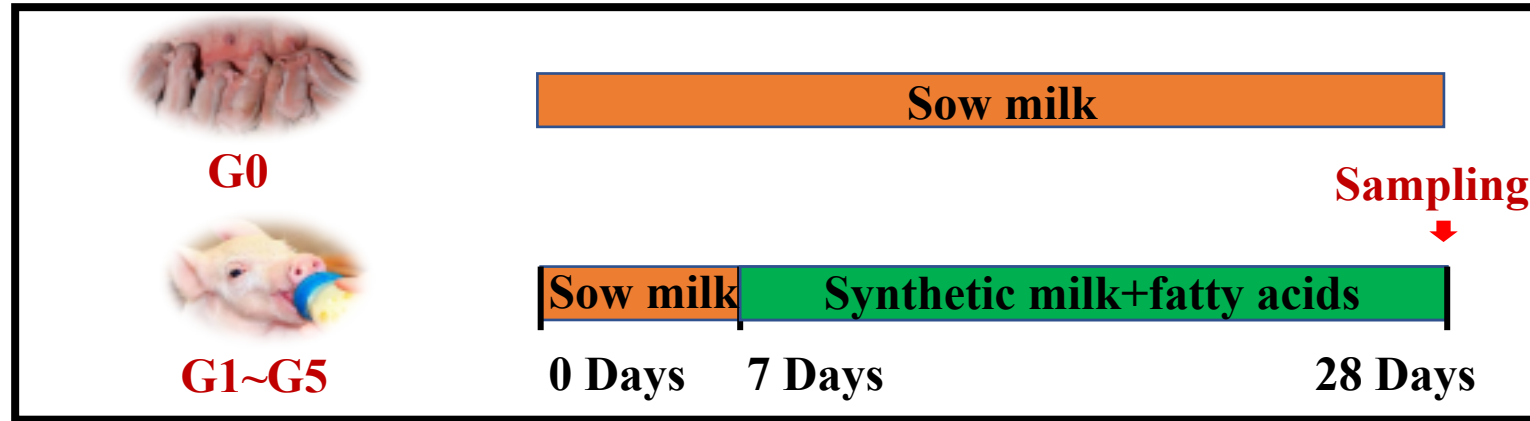
**Sow milk**

**or**



**Milk powder +  
fatty acids**

# Study design



Group 0: Breastfeeding

Rule for Group 1-5:  
Parallel ratio of SFA : UFA in bottle-fed groups

Group 1: Blending oil

(65% SECFA + 35% UFA)



Group 2: DHA algal oil

(65% SECFA + 20% DHA + 15% other UFA)

Group 3: OCFA algal oil

(5% SECFA + 60% SOCFA + 20% DHA + 15% other UFA)

Group 4: OCFA artificial

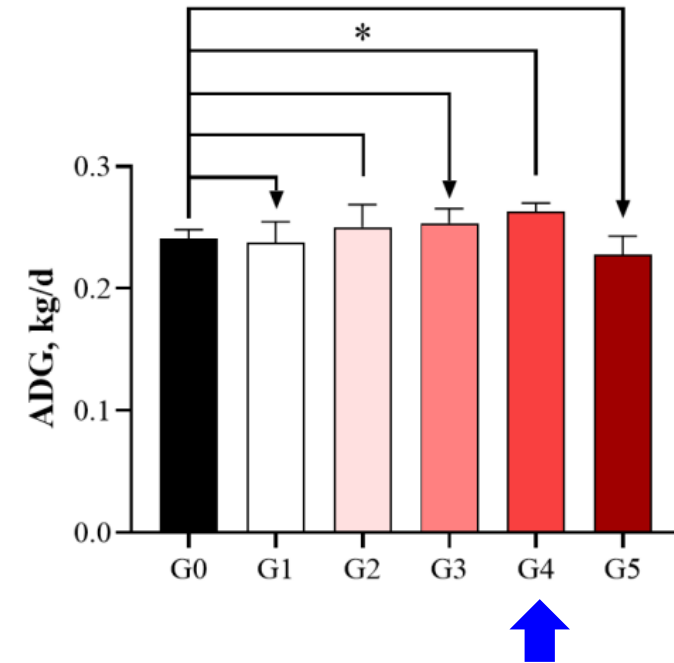
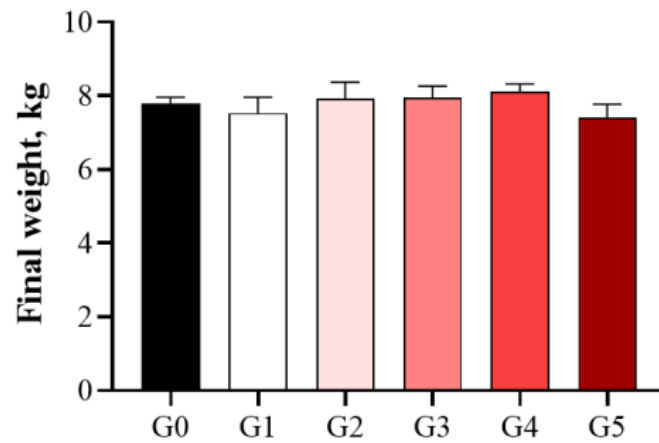
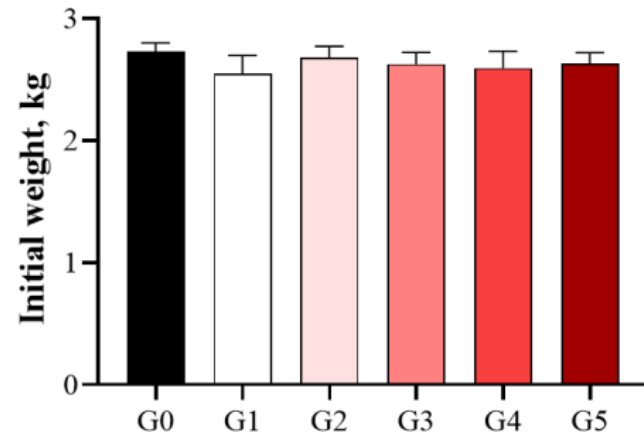
(5% SECFA + 60% SOCFA + 35% UFA)

Group 5: BCFA artificial

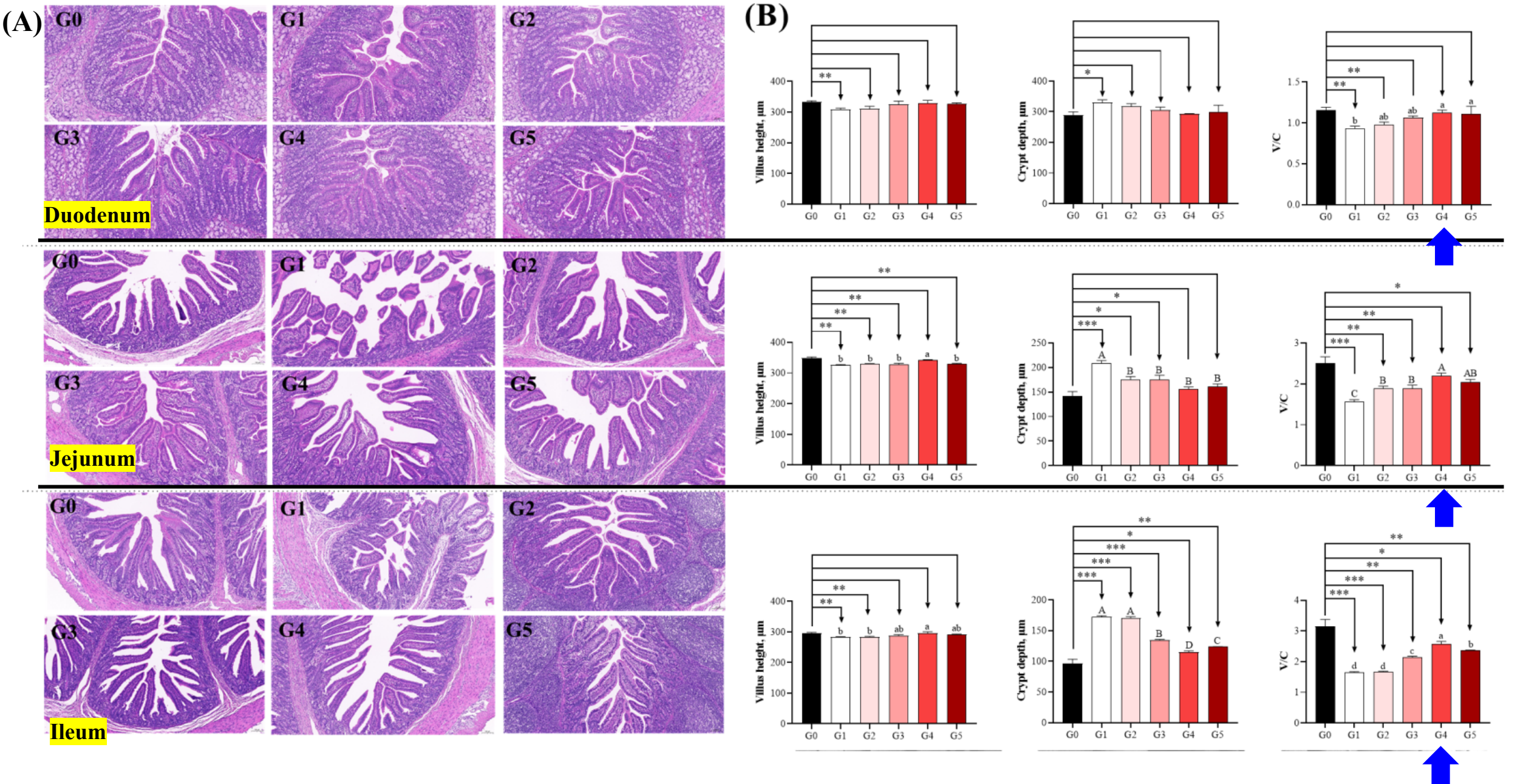
(5% SECFA + 60% SBCFA + 35% UFA)

◆ Milk powder + fatty acids did not decrease the body weight of piglets in comparison with the piglets fed with sow milk.

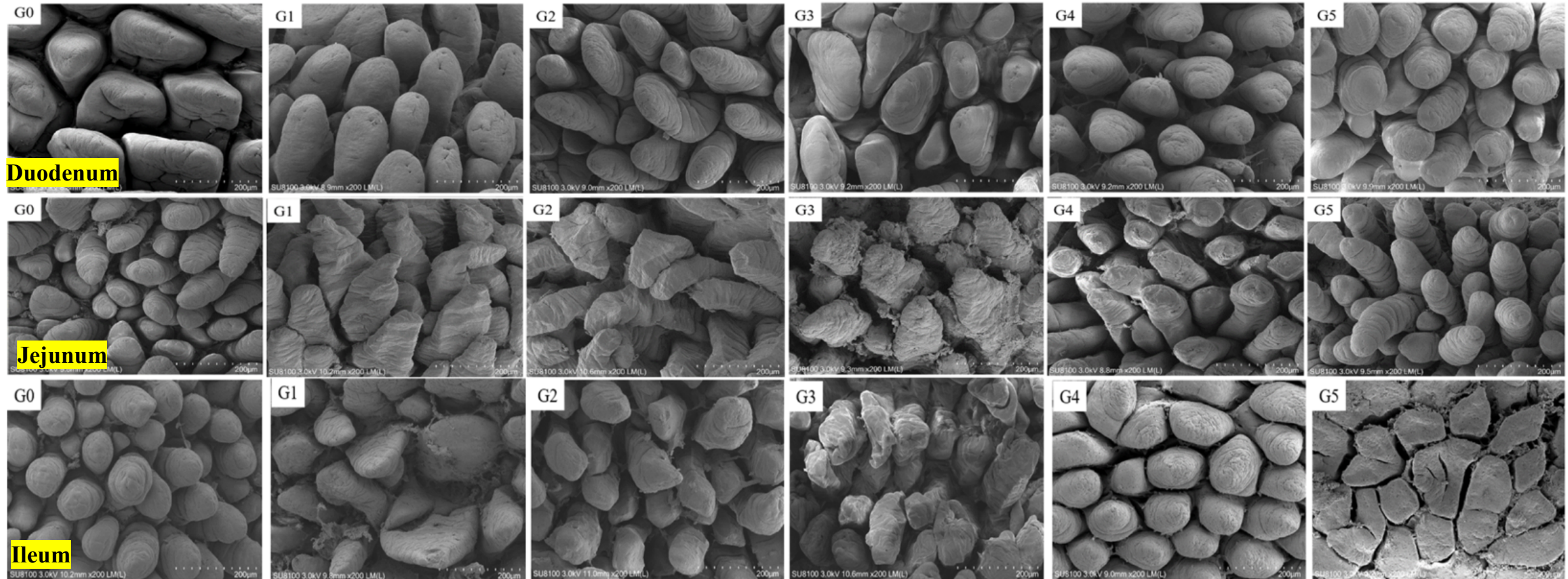
◆ Milk powder supplemented with OCFAs increased the average daily gain of piglets.



# ◆ OCFAs improved the intestinal morphology of piglets.

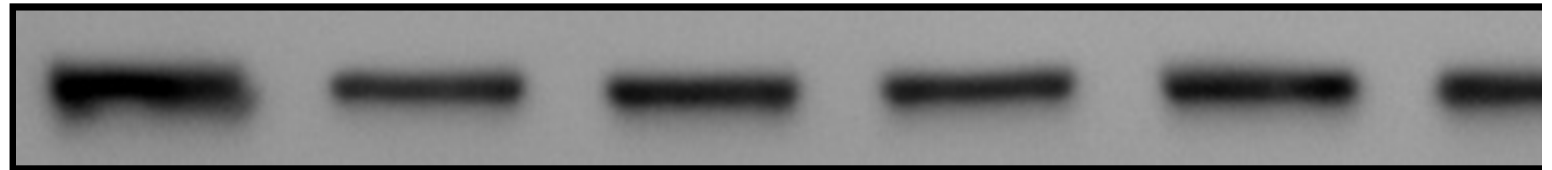


◆ The results of scanning electron microscopy further confirm that OCFA can improve the intestinal morphology and structure of piglets fed with milk powder

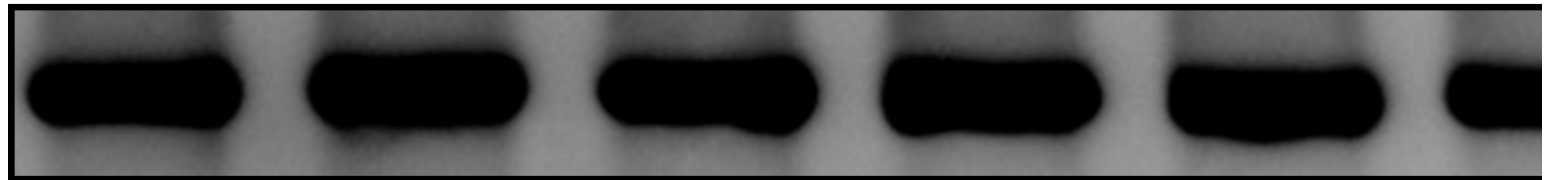


◆ The results of Ki67 protein expression showed that milk powder supplemented with DHA algal oil, OCFA, and BCFA could increase the proliferation of intestinal epithelial cells of piglets to the levels of sow milk-fed piglets, with the best effects observed in the OCFA group.

Ki67



$\beta$ -actin

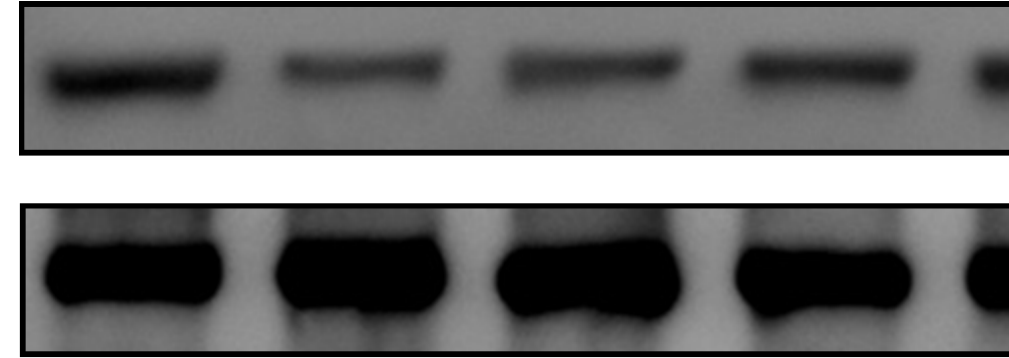


\*

◆ Similar to the Ki67 protein expression, p-mTOR and p-70S6K protein expression were also upregulated by OCFAs.

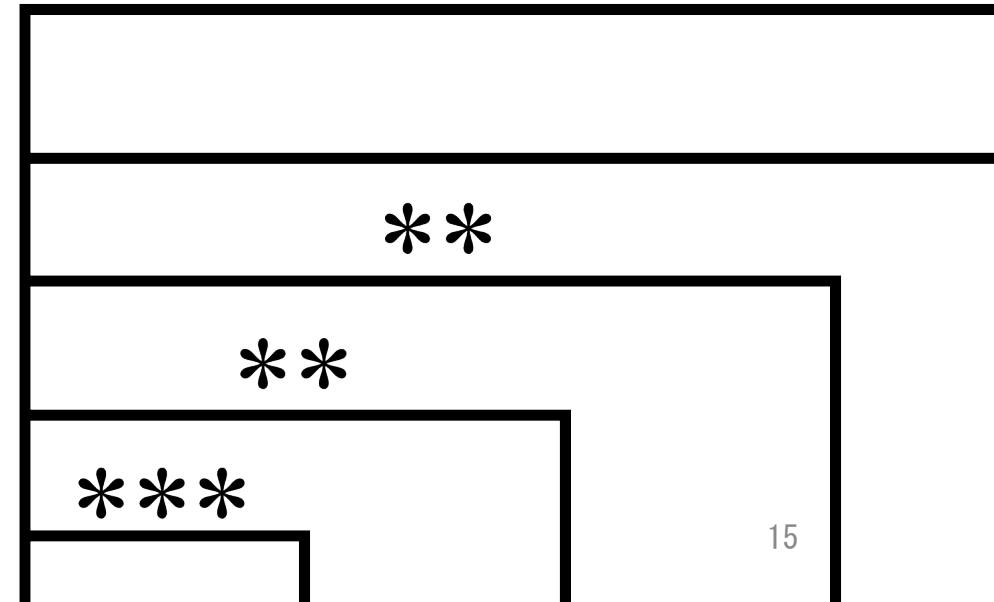
p-mTOR

$\beta$ -actin

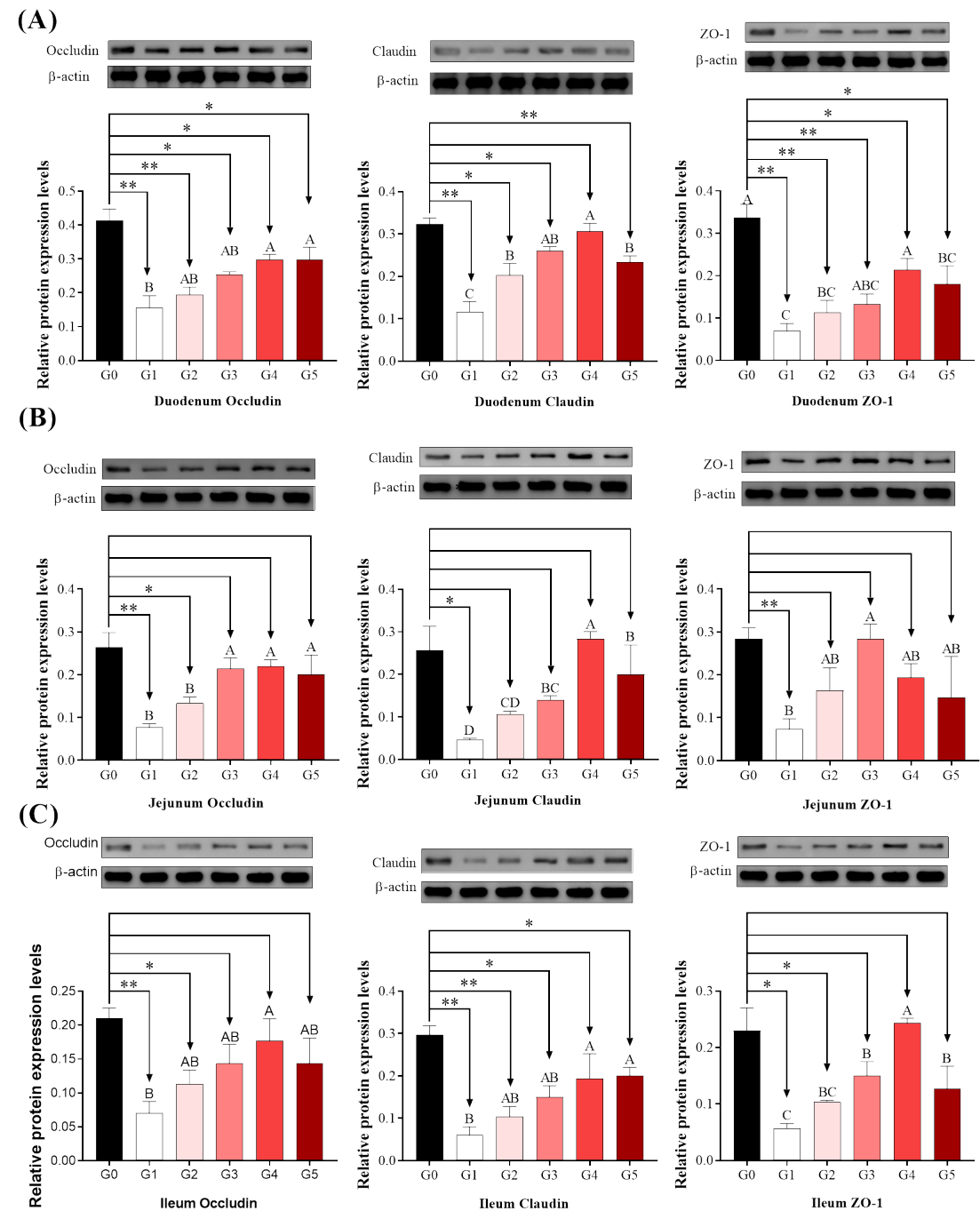


on levels

0.5



◆ The protein expression of intestinal tight junction proteins, including occludin, cludin, and ZO-1, were also upregulated by OCFAs to the levels of piglets fed sow milk.





RESEARCH

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# Gut microbiota-derived inosine from dietary barley leaf supplementation attenuates colitis through PPAR $\gamma$ signaling activation

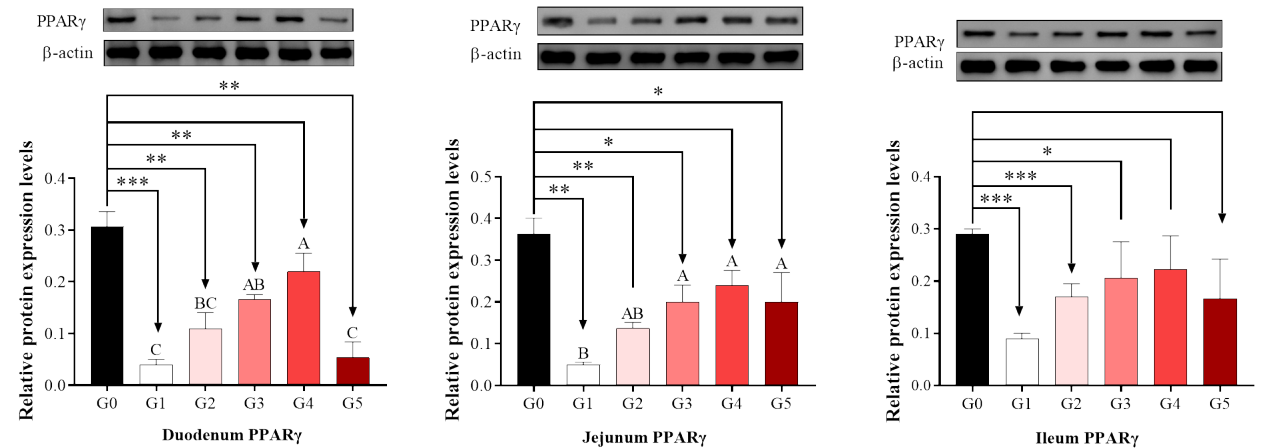
Daotong Li<sup>1,2</sup>, Yu Feng<sup>1</sup>, Meiling Tian<sup>1</sup>, Junfu Ji<sup>1</sup>, Xiaosong Hu<sup>1</sup> and Fang Chen<sup>1\*</sup>



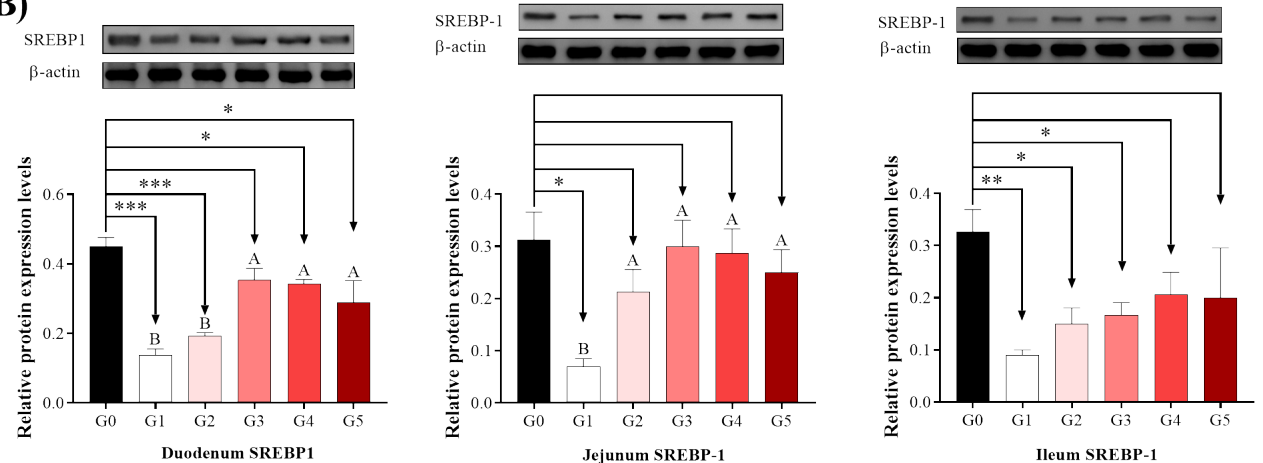
◆ Decreased expression of PPAR $\gamma$  in the colonic epithelium may be an important factor for the cause of intestinal dysfunction and chronic inflammation (Bouguen et al, 2015, Gut).

◆ Further evidence from PPAR $\gamma$  protein expression confirmed that OCFAs alleviated intestinal dysfunction of milk powder-fed piglets.

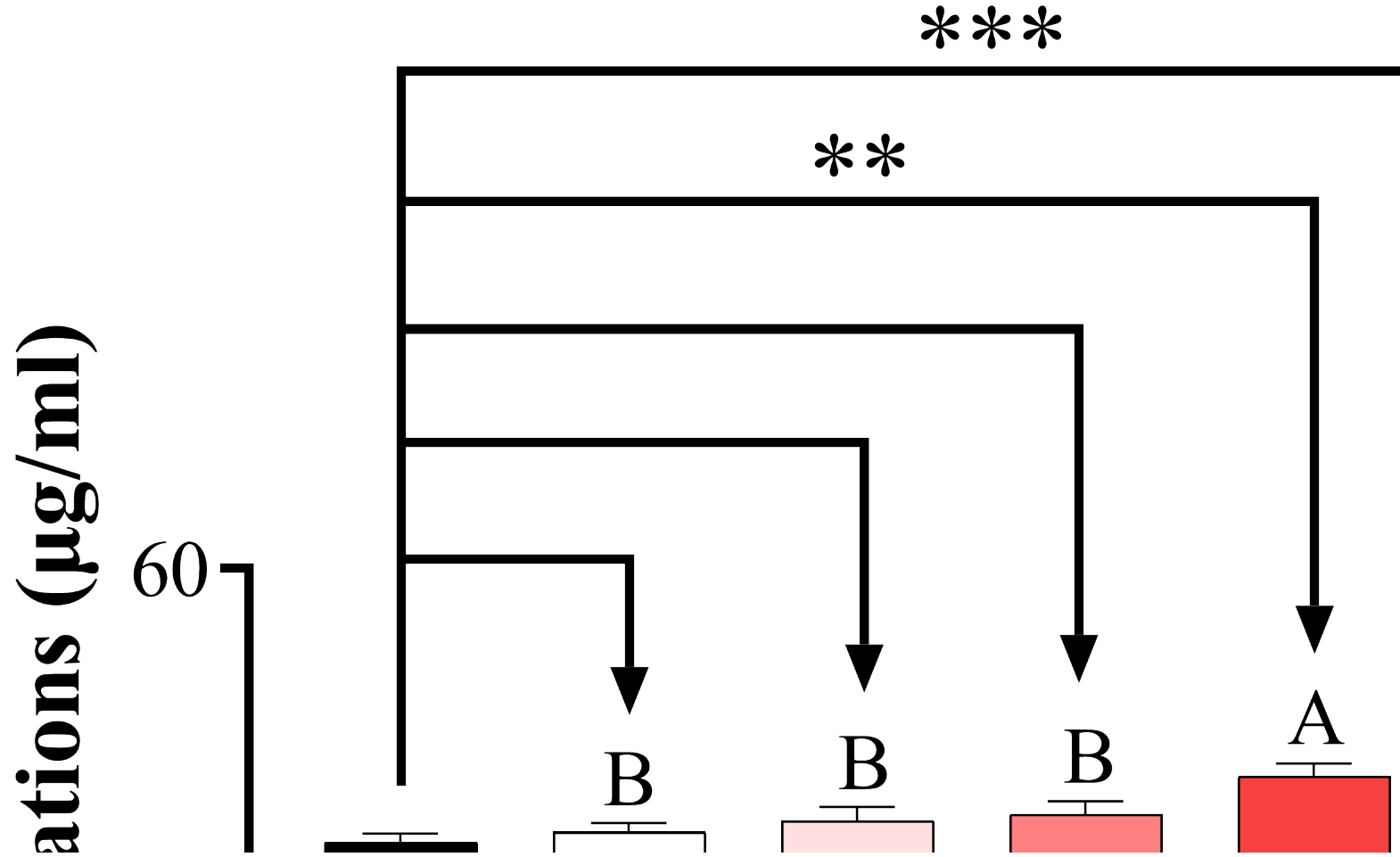
(A)

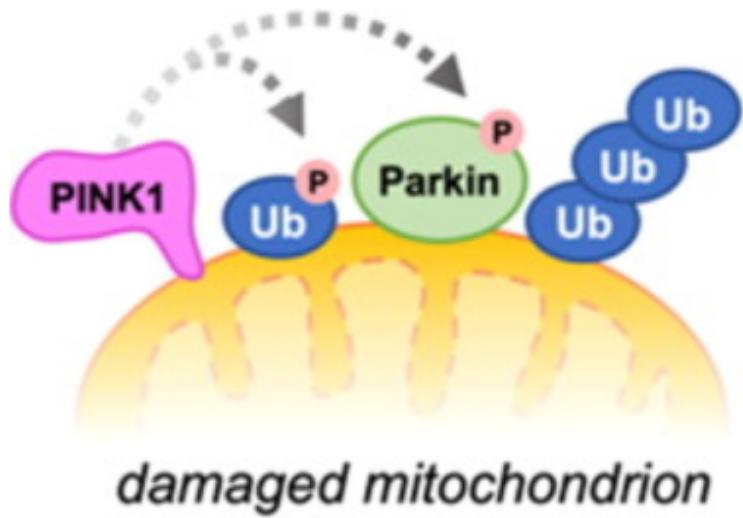


(B)

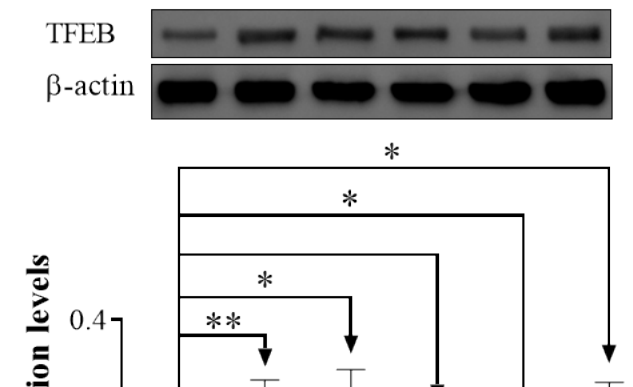
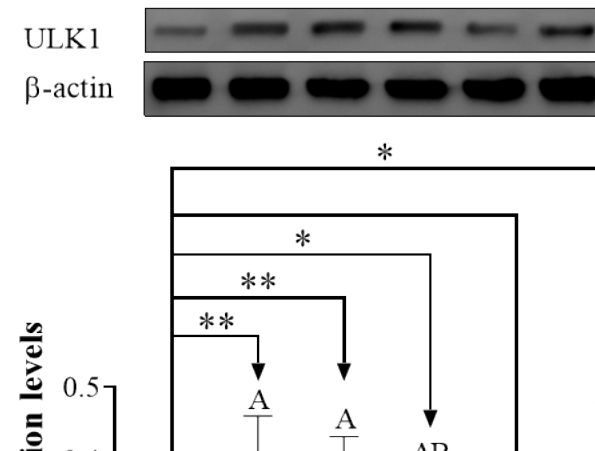
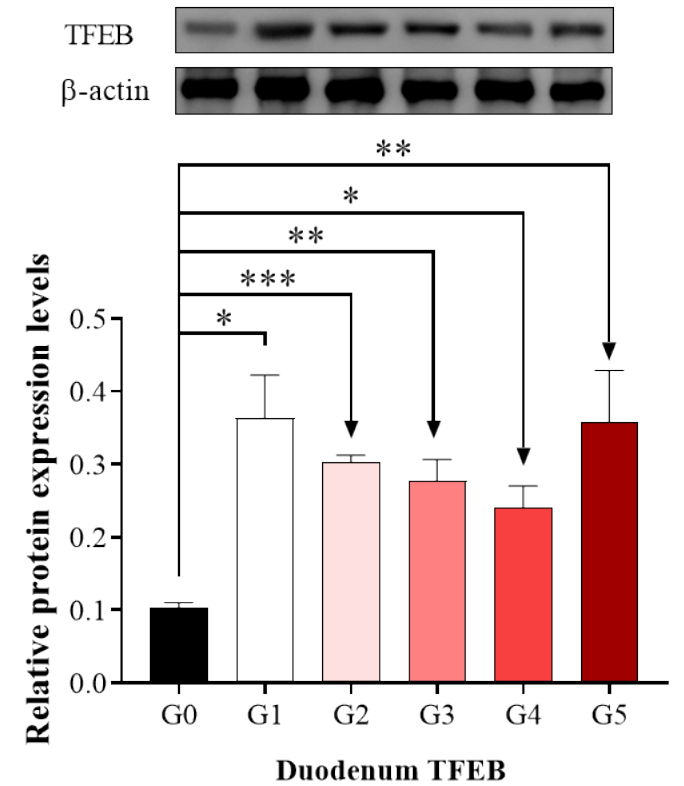
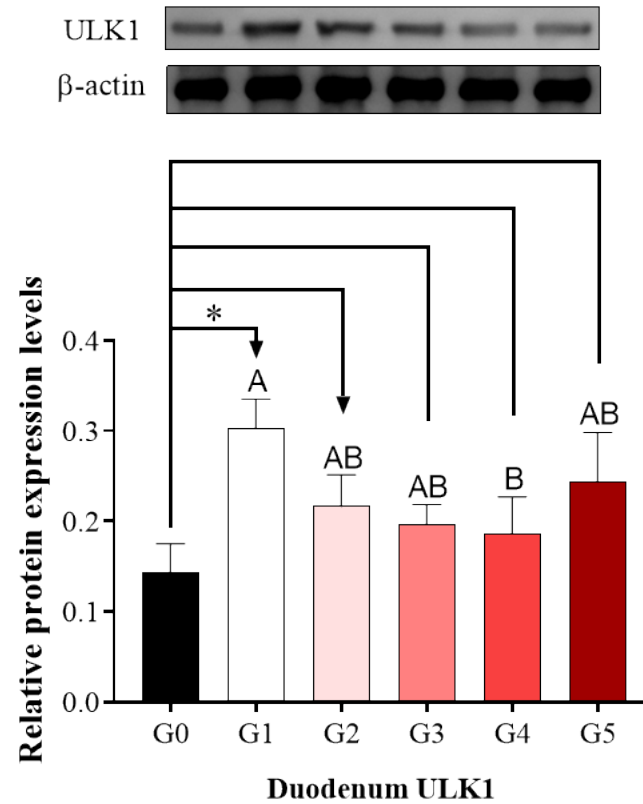


◆ Milk powder supplemented with OCFAs improved the immune barriers of the jejunum and ileum.





◆ In agreement with the alteration trend of p-mTOR, mitophagy was decreased in the OCFA group.



## ◆ **Summary and conclusion**

- ◆ **Milk powder supplemented with different kinds of oils did not decrease the body weight of piglets.**
- ◆ **Milk powder supplemented with OCFAs could improve the intestinal morphology and function, followed by the BCFAs. Moreover, their effects were comparable to those of the breastfeeding group.**

◆ In June 21-24, 2024, our institute will hold international academic conferences, and everyone is welcome to attend. If you want to come to China to participate, please contact me.

The 4<sup>th</sup> International Symposium on Sustainable Agriculture for  
Subtropical Regions (ISSASR-4)

(First Announcement)



ISSASR-4  
Changsha, China 2024

Website: <https://issasr-4.casconf.cn/>

Changsha, P. R. China

June 21-24, 2024

### Theme 3. Agropastoralism and Green Animal Husbandry

*Topics covered but not limited to:*

Session 1. Precision nutrition and intelligent husbandry

Session 2. Animal physiology metabolism regulation and body health

Session 3. Green and efficient husbandry and animal welfare

Session 4. Agropastoral models, plant breeding and sustainable development

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# ◆ Changsha



# Acknowledgements

## Prof. Yulong Yin Lab

Fengna Li, PhD  
Qiuping Guo, PhD  
Xichen Zhao, PhD  
Changbing Zheng, PhD  
Geyan Duan, PhD  
Jiayi, Yu, PhD  
Mengliao, Wan  
Jie Zheng  
Peiwen Zhang

## Fengyi (Shanghai) Biotechnology R&D Center Co., Ltd

Namhai Chua, PhD  
Xuebing Xu, PhD  
Fang Cong, PhD  
Mengmeng Li, PhD  
Bo Cao



**Funding:** the subjects of a cross-sectional study topic with an enterprise (202201037)