



Intact pulse cotyledon cell diet improves systemic growth via the somatotropic axis in malnourished mice

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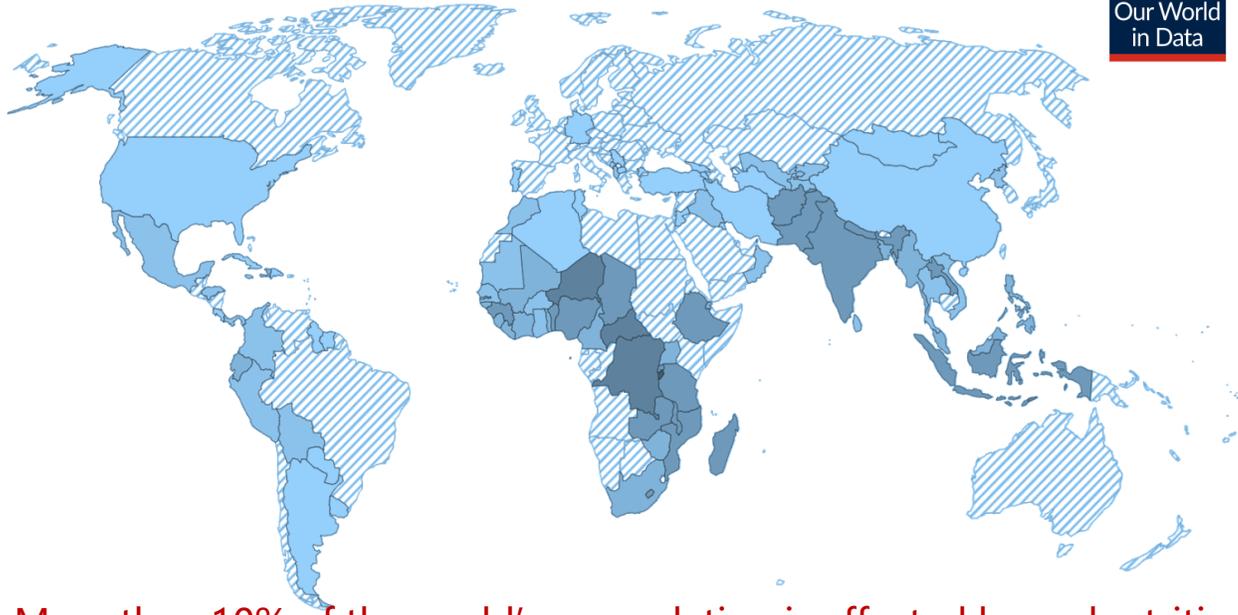


Yumeng Yan, Zhuqing Xie, Zhipeng Gu, Zhongxin Li, Qiang Huang, Bin Zhang. 2026.
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iMetaOmics 3: e70085. <https://doi.org/10.1002/imo2.70085>



Introduction

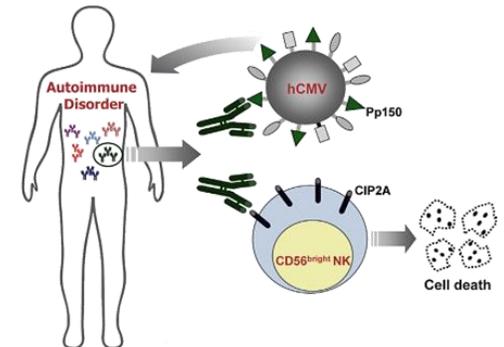
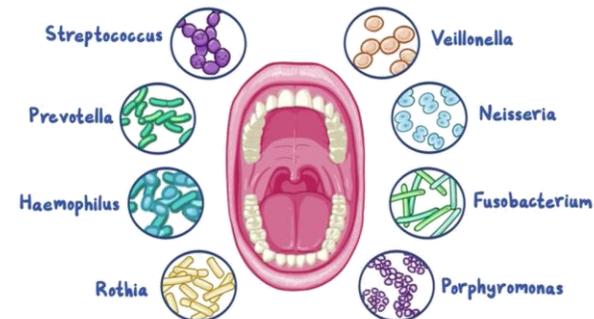
Our World in Data



More than 10% of the world's population is affected by malnutrition, which accounts for nearly half of all deaths among children under five.

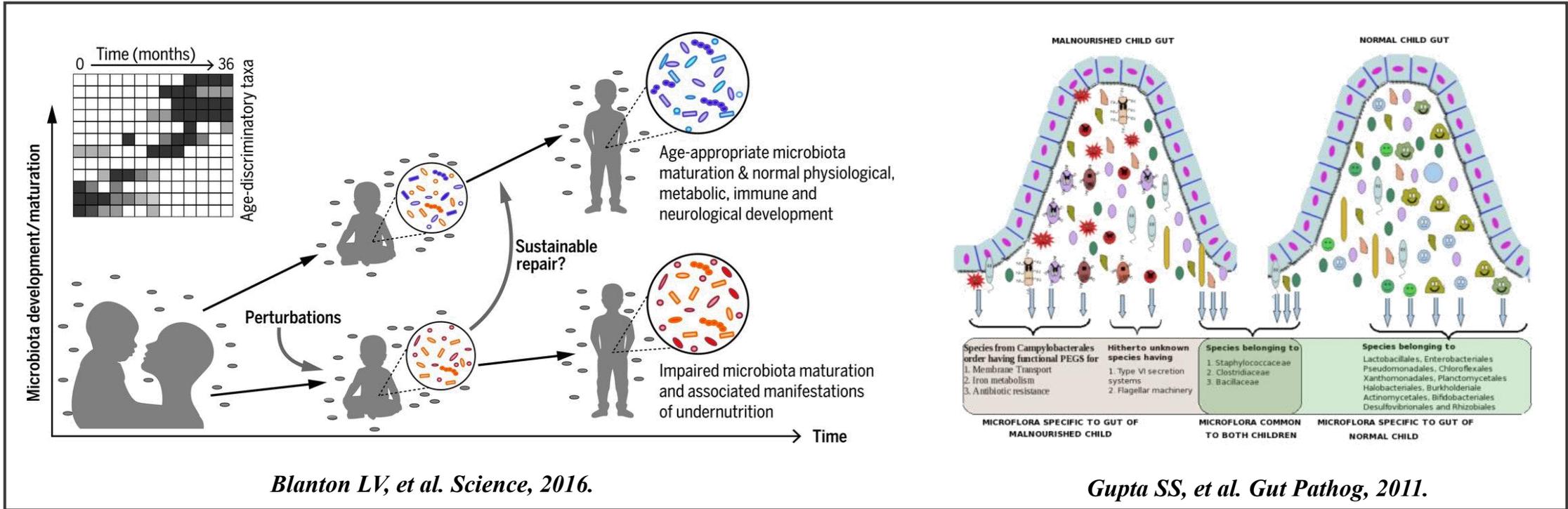
- Malnutrition in one or more forms affects countries worldwide, with the greatest burden occurring in low-income regions such as East Africa and South and Central Asia.
- In 2022, an estimated 149 million children under five were stunted, and about 45 million were affected by wasting.
- The global burden of malnutrition can have severe and long-lasting impacts on individuals, families, communities, and nations across developmental, economic, social, and healthcare dimensions.

Malnutrition is typically the result of insufficient food intake.

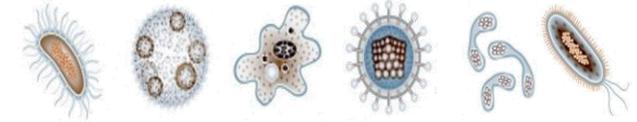
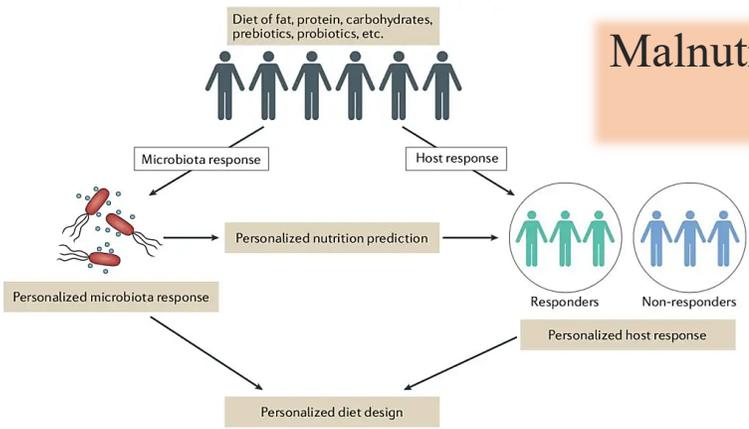




Introduction



Malnutrition is associated with an underdeveloped gut microbiota.



The gut microbiota may represent a primary target for the prevention and treatment of malnutrition.

Introduction

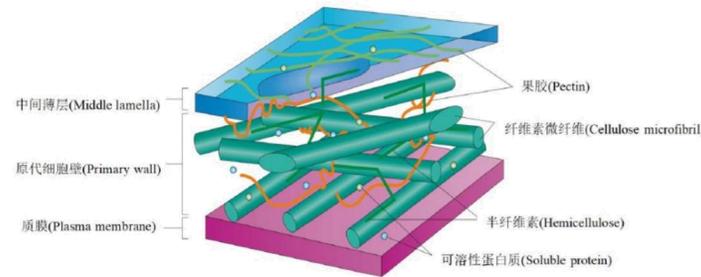


- Rapidly digestible starch (1.6%–19.2%) triggers a high metabolic response after ingestion.
- Slowly digestible starch (32.2%–76.3%) remains in the small intestine for a much longer time and undergoes gradual and complete digestion.
- Resistant starch (24.1%–45%) escapes digestion and functions as dietary fiber, being fermented by specific resident bacteria in the colon.

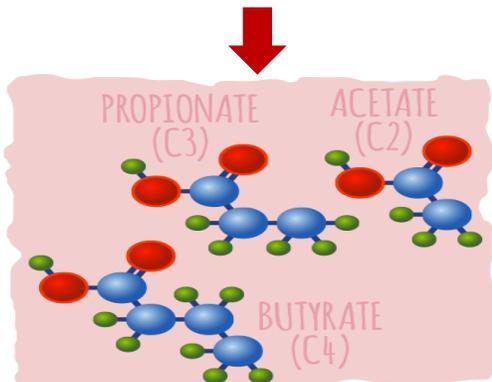
Rich in dietary fiber, resistant starch, vitamins, and minerals, pulses represent a healthy whole-food source that is high in carbohydrates and protein, yet low in fat.



A large body of research indicates that pulses have substantial potential for preventing or managing health conditions such as diabetes, cardiovascular disease, and malnutrition.



Plant cell wall & RS1 resistant starch: starch granules are tightly encapsulated, resisting enzymatic digestion, reducing starch bioaccessibility, and regulating postprandial glycemia.

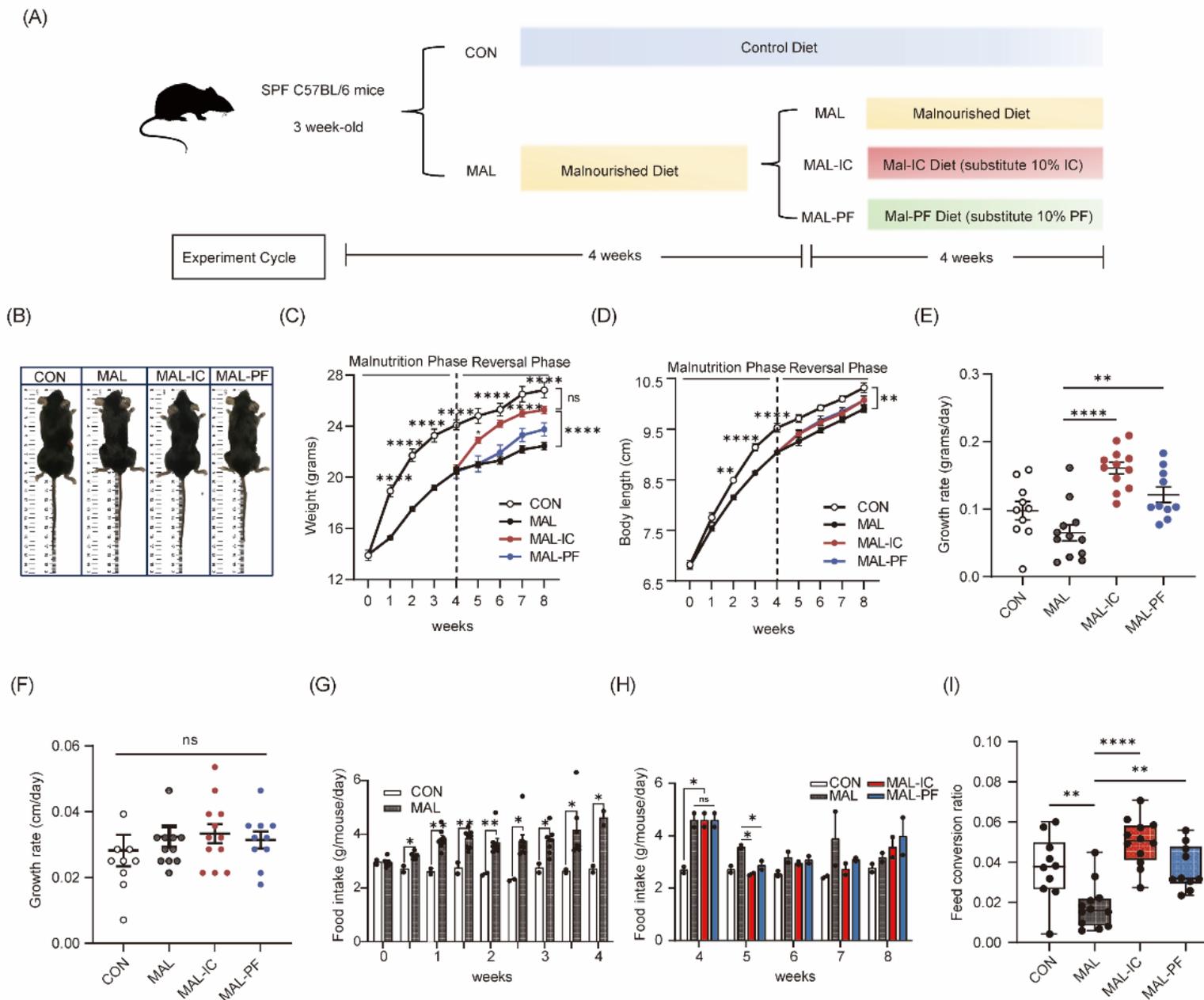


The low gastrointestinal digestibility of pulses enables their various nutrients to be delivered to the distal colon.

- ❑ Diverse dietary fiber fermentation in the distal colon can suppress protein fermentation—modulating the abundance and composition of the gut microbiota to promote the production of metabolites beneficial to the host.

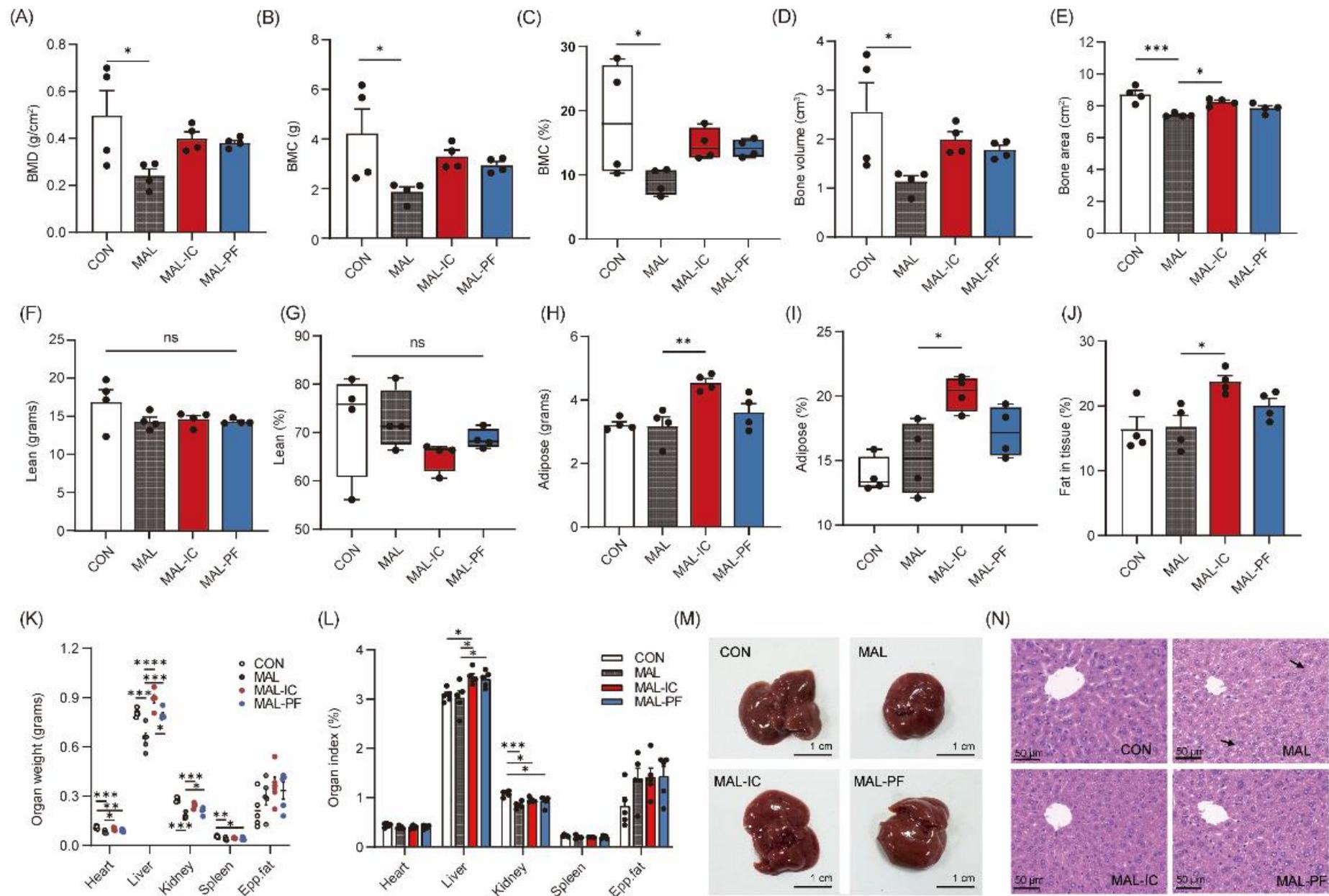


MAL-IC diet improves systemic growth in malnourished mice



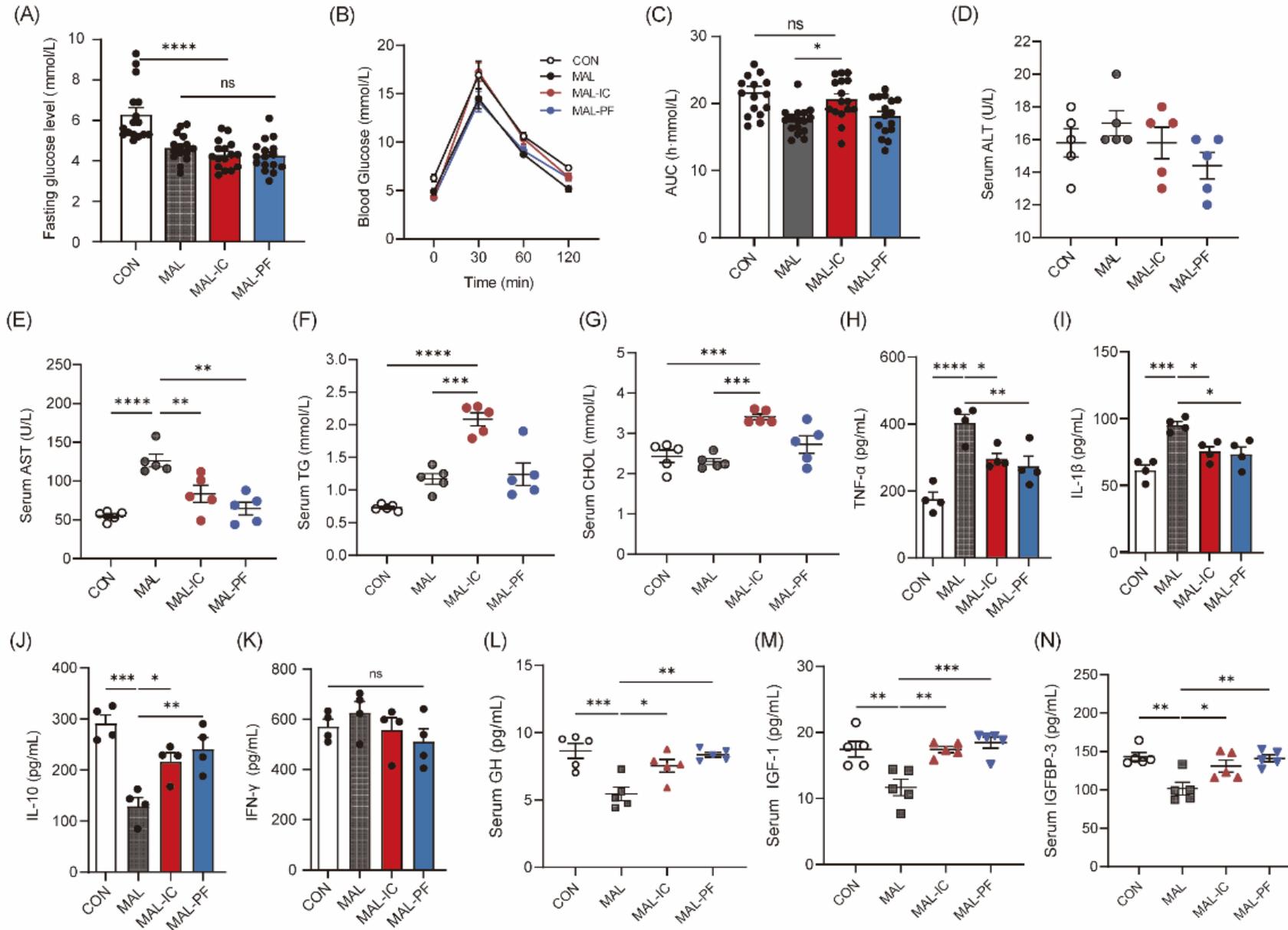


MAL-IC diet enhances bone area, promotes adipose weight gain, and alleviates liver inflammation in malnourished mice



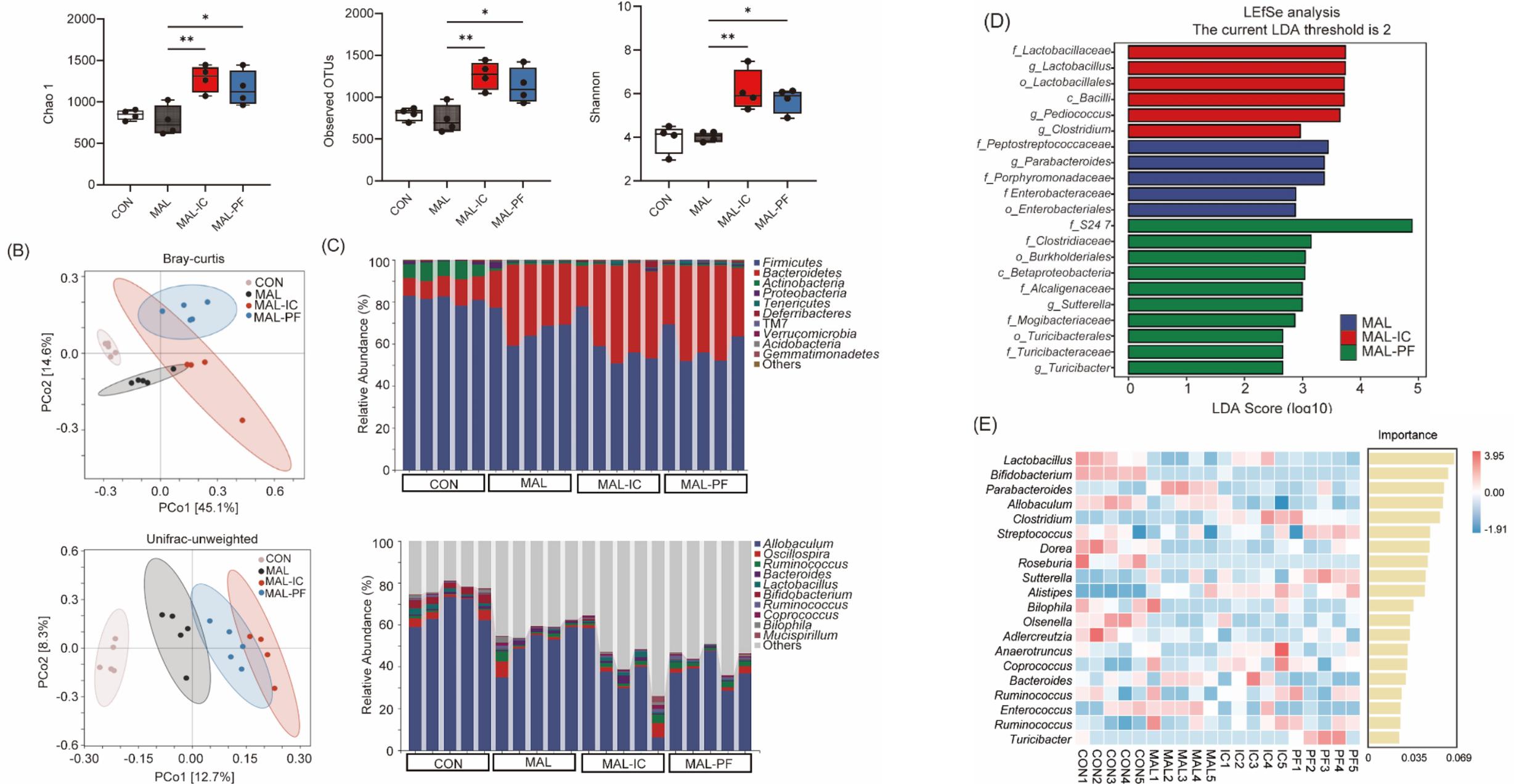


MAL-IC diet restores glucose levels and lipid metabolism, alleviates chronic inflammation, and enhances growth-related hormone secretion in malnourished mice





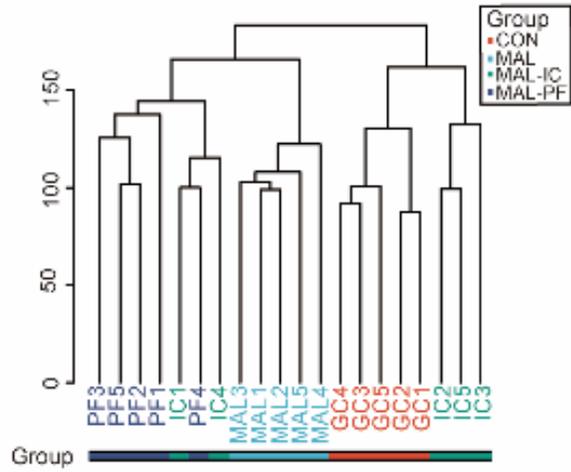
MAL-IC diet alters gut microbiota composition



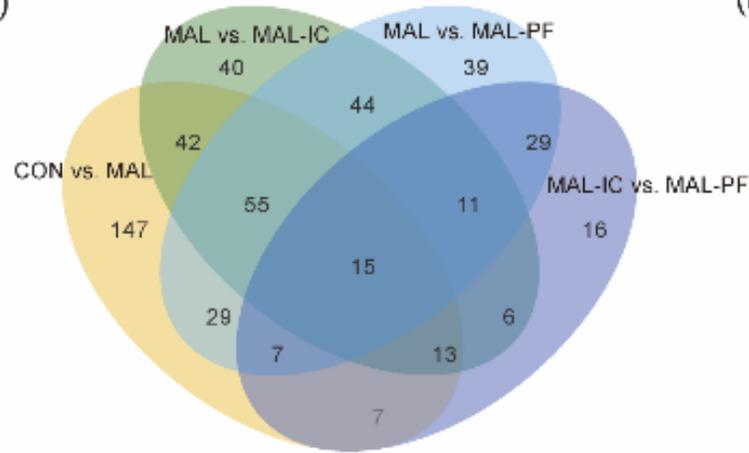


MAL-IC diet modulates the gut metabolome

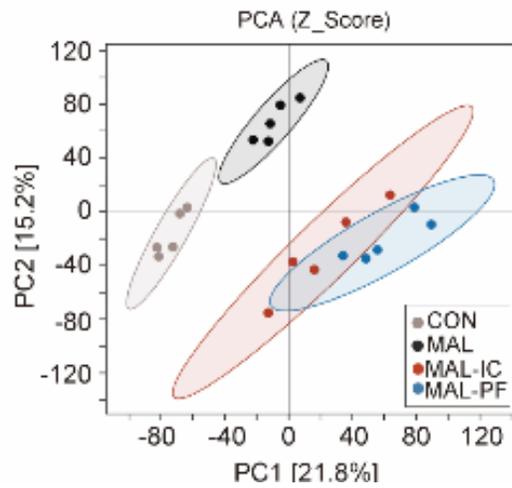
(A)



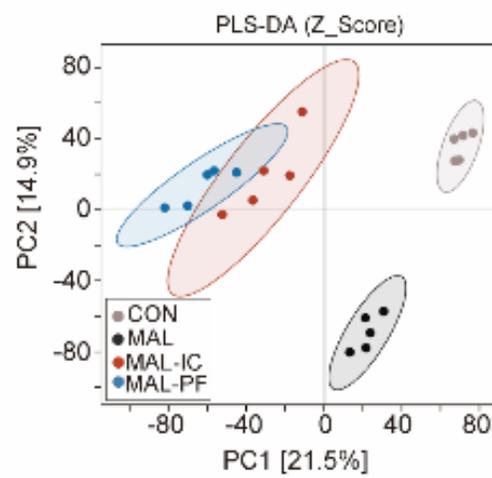
(B)



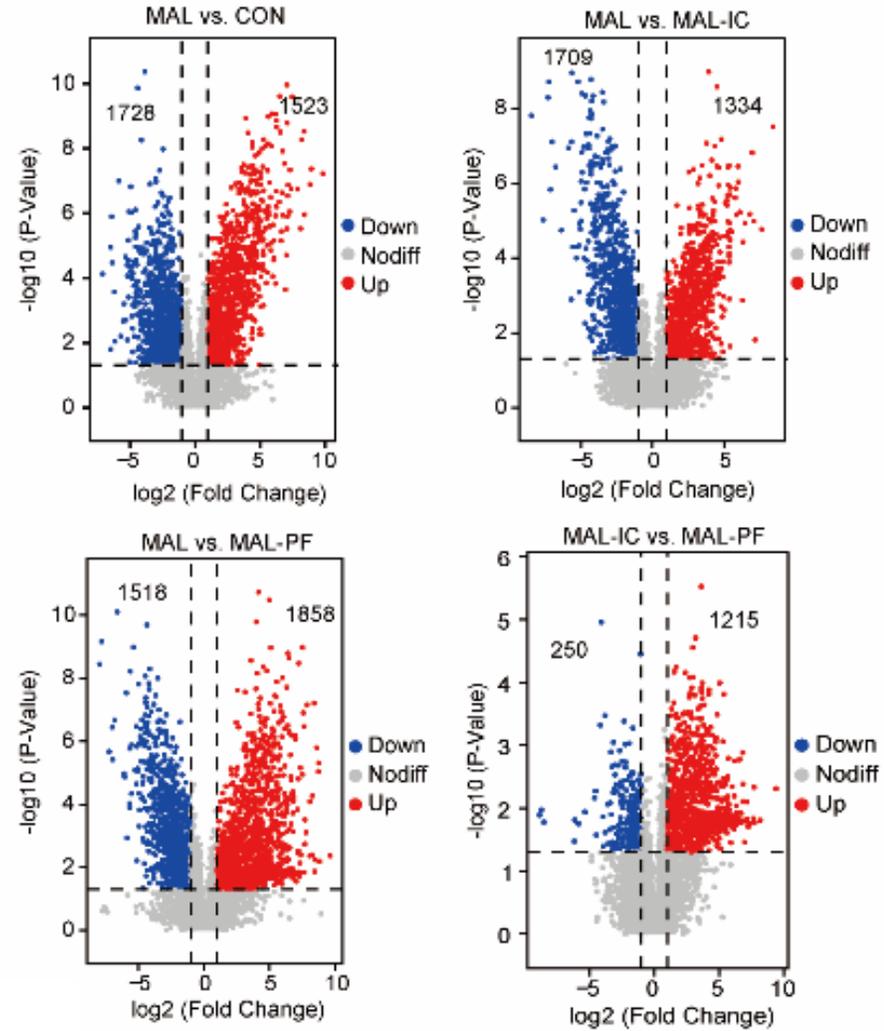
(C)



(D)



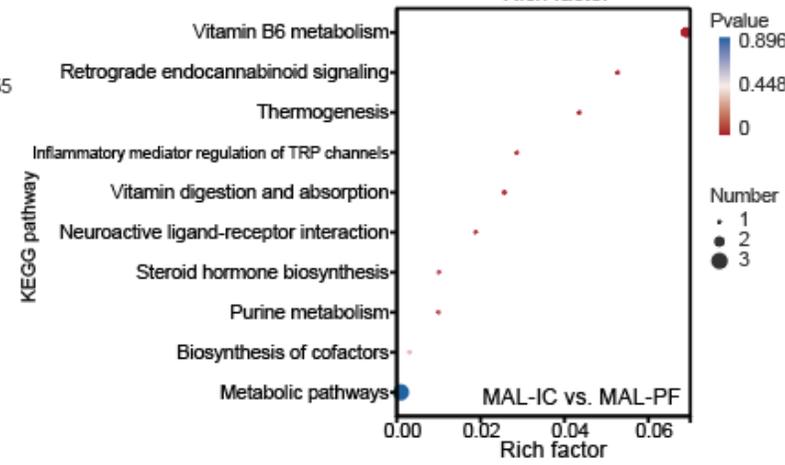
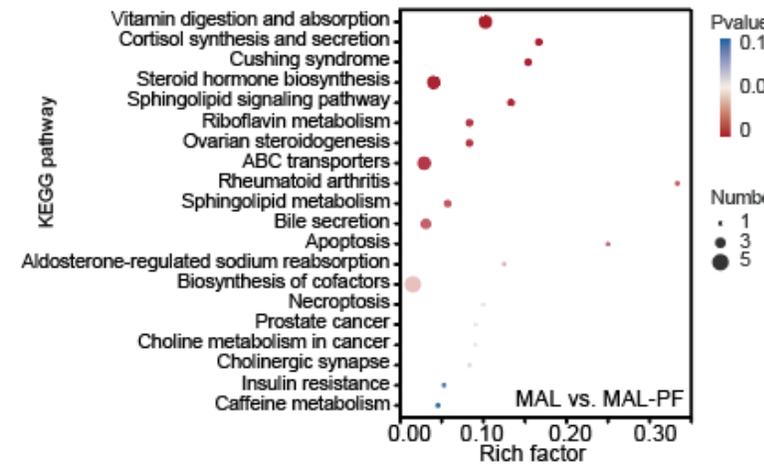
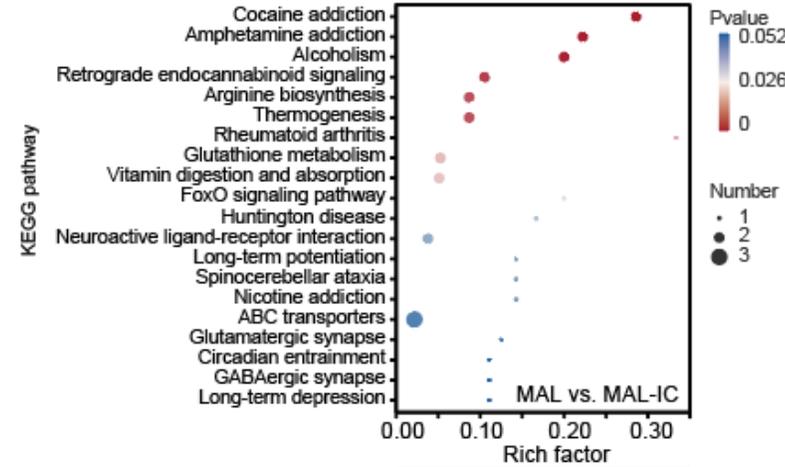
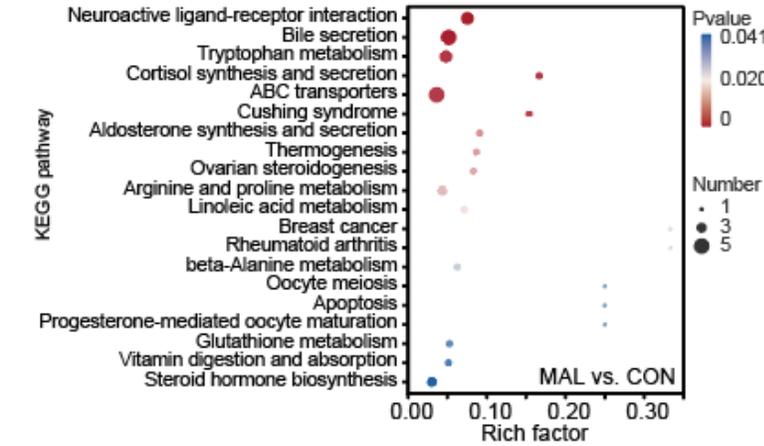
(E)



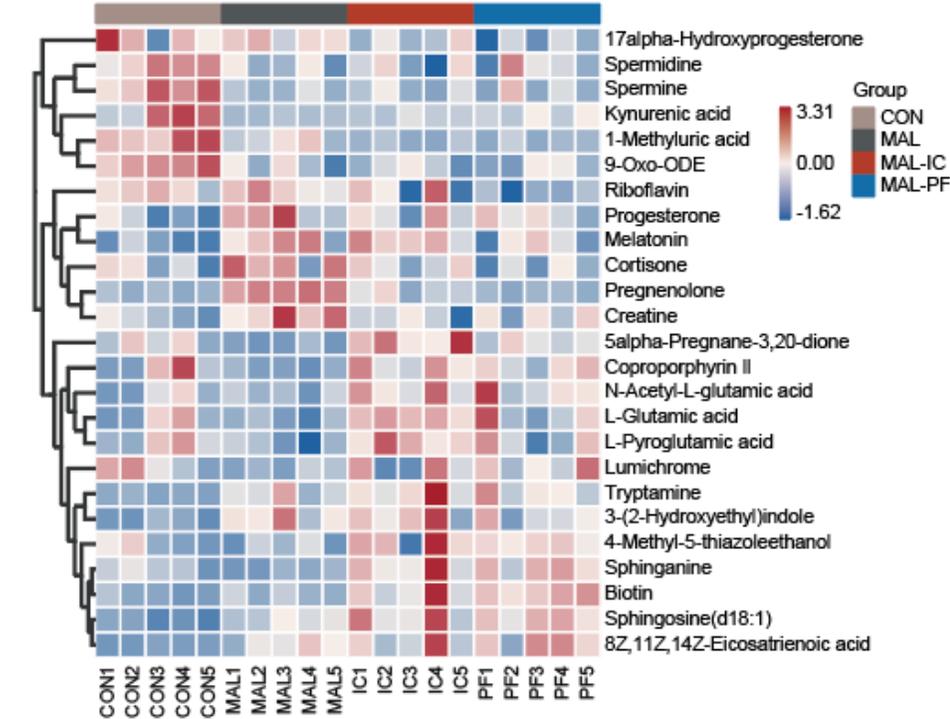


MAL-IC diet modulates the gut metabolome

(F)

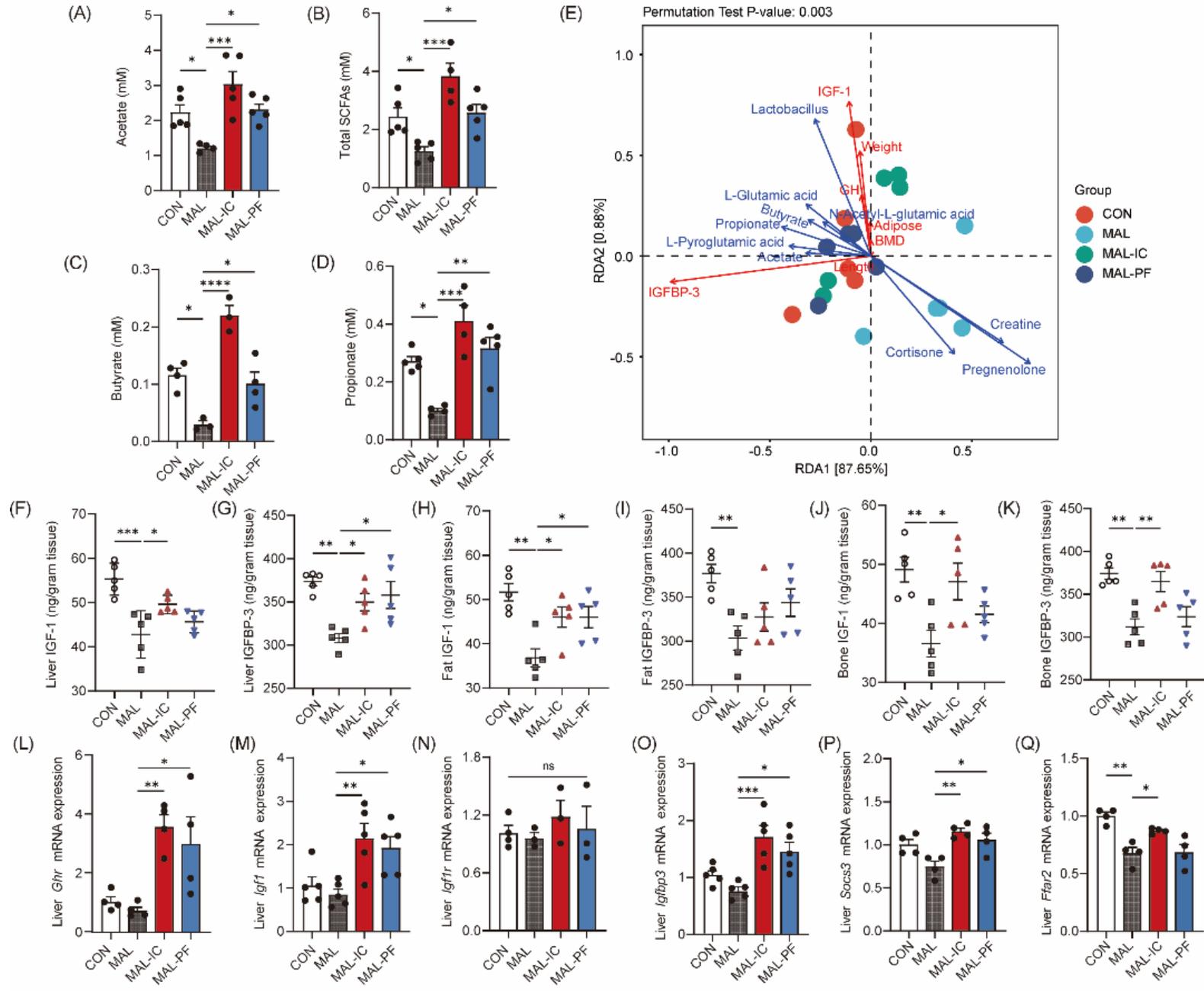


(G)



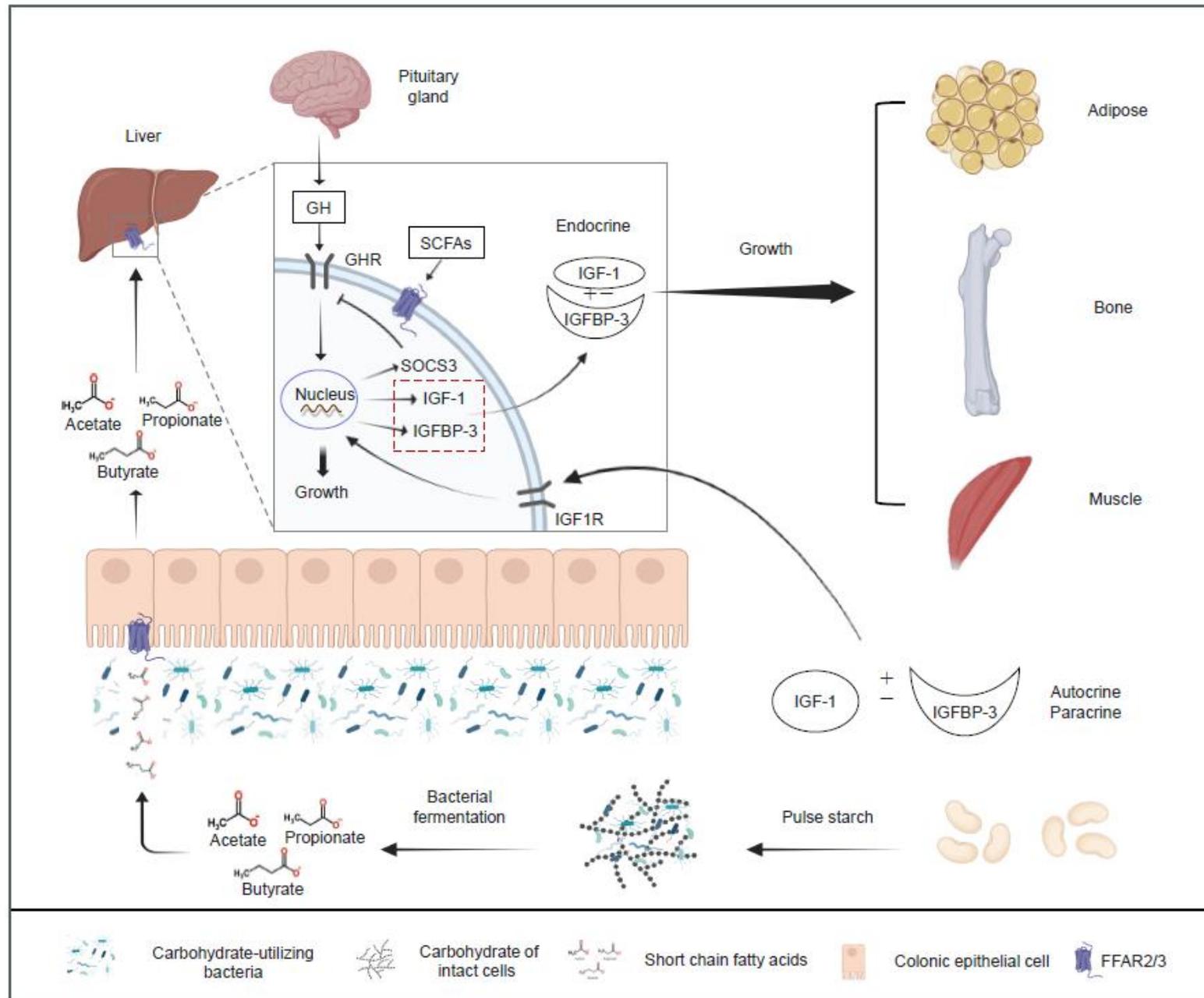


MAL-IC diet promotes SCFA production, supporting systemic growth





MAL-IC diet enhances somatotrophic axis activity





Summary

- ❑ This study demonstrates that intact pulse cotyledon cells are more effective than conventional pulse flour in mitigating malnutrition in mice.
- ❑ Mechanistically, the MAL-IC diet enriches beneficial carbohydrate-utilizing bacteria, such as *Lactobacillus* spp. and enhances the production of SCFAs, particularly acetate. These SCFAs circulate via the gut–liver axis, activating hepatic FFAR2 and subsequently stimulating the somatotrophic axis.
- ❑ This process facilitates systemic growth by augmenting GHR-mediated signaling and increasing IGF-1 and IGFBP-3 expression levels.
- ❑ Cumulatively, these results underscore the importance of maintaining cellular integrity in pulses to efficiently deliver nutrients to the colon and modulate gut microbiota composition, supporting an effective whole-food approach for combating malnutrition.

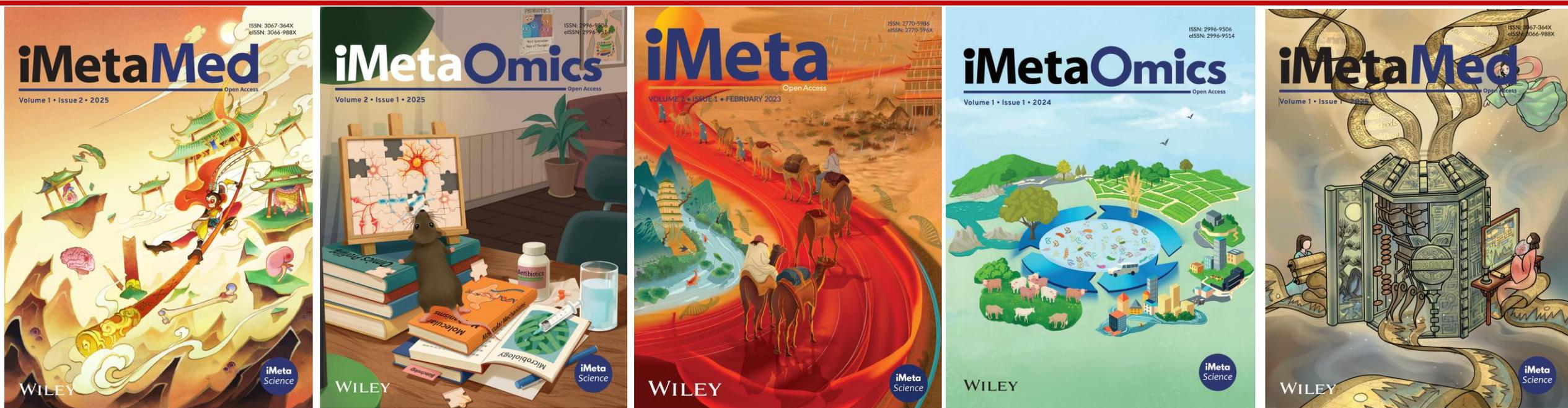
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