



# Black rice diet alleviates colorectal cancer development through modulating tryptophan metabolism and activating AHR pathway

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# Introduction

Proximate composition (g.100 g<sup>-1</sup>) of white and black rice fractions.

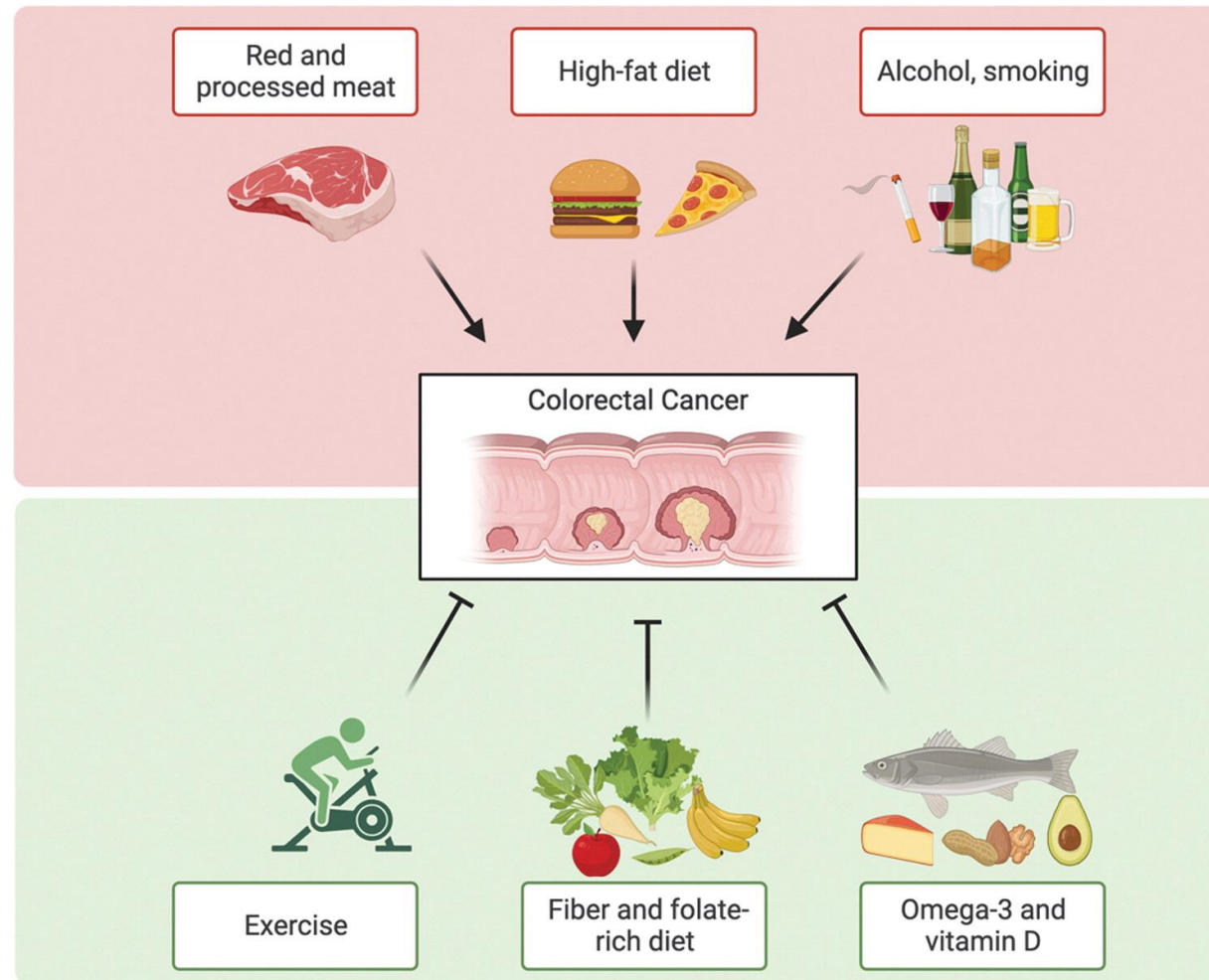
Rice	Fraction	Samples	Moisture	Carbohydrate	Protein	Lipid	Fibre	Ash
White	Brown	n = 40	Na	na	9.50	2.0.20	na	0.90
		n = 138	13.8	87.50	7.70	3.3	na	1.50
		*	11.37	86.55	8.71	3.16	3.90	1.58
	Milled	*	12.31	91.07	7.65	0.65	2.80	0.64
	bran	*	6.13	52.93	14.22	22.21	22.40	10.63
Black	Brown	n = 3	11.96	73.93	9.15	3.41	3.83	1.55
		n = 1	10.64	76.20	9.61	2.15	4.32	1.41
		n = 4	13.00	na	9.95	3.25	na	1.80
		n = 8	Na	na	10.20	2.70	na	1.00
Black glutinous	Bran	n = 1	10.35	39.12	11.12	18.56	9.25	10.45

*Note:* The data are expressed as mean; \*Average data of long and medium grains; na: not analysed.

Compared with white rice, black rice is rich in more nutrients such as anthocyanins, dietary fiber, minerals, vitamins and unsaturated fatty acids.



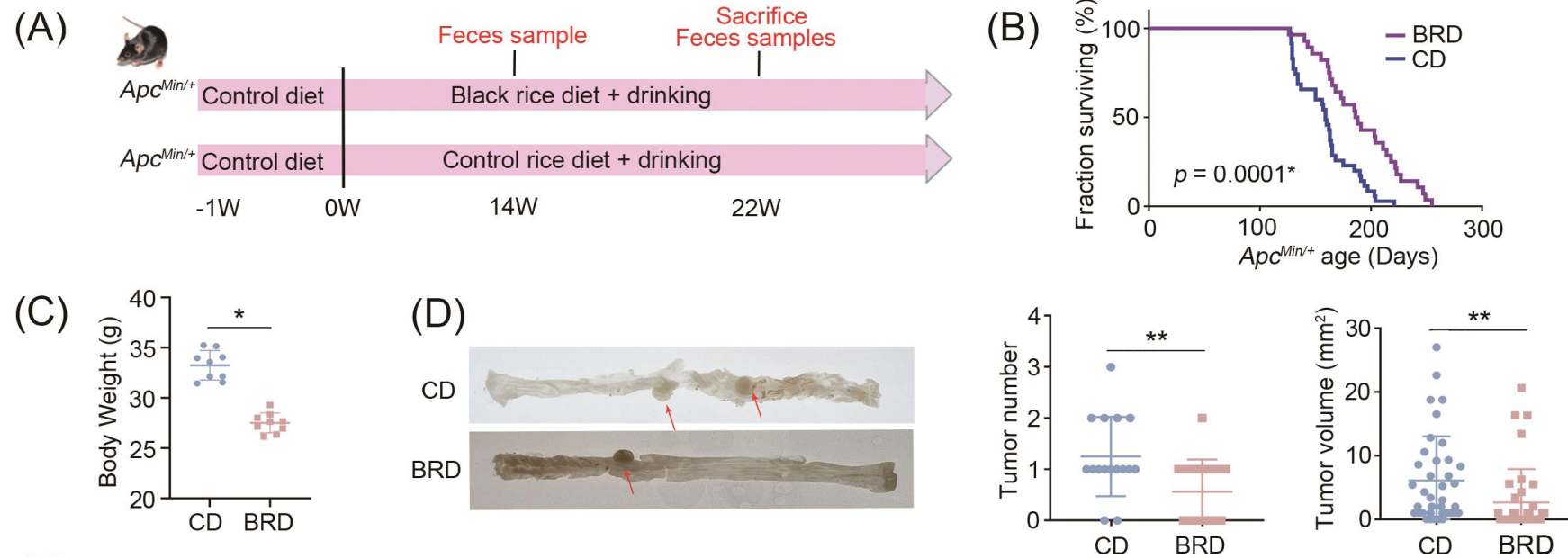
# Introduction



Different dietary patterns have different effects on the initiation and progression of colorectal cancer.

# Results

Figure 1

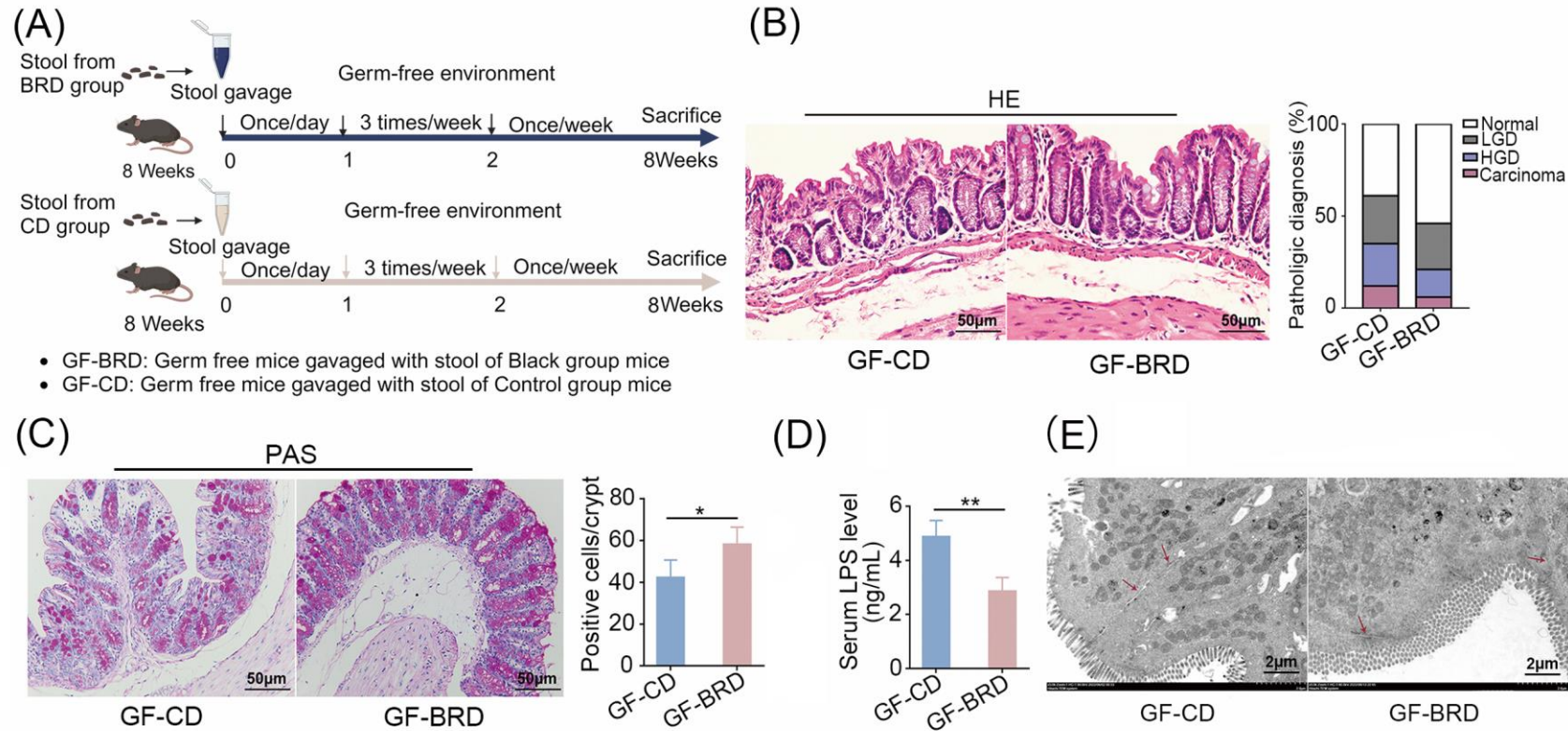


- Black rice diet (BRD) can prolong the life span of  $Apc^{Min/+}$  mice
- BRD can slow tumor progression in  $Apc^{Min/+}$  mice



# Results

Figure 2

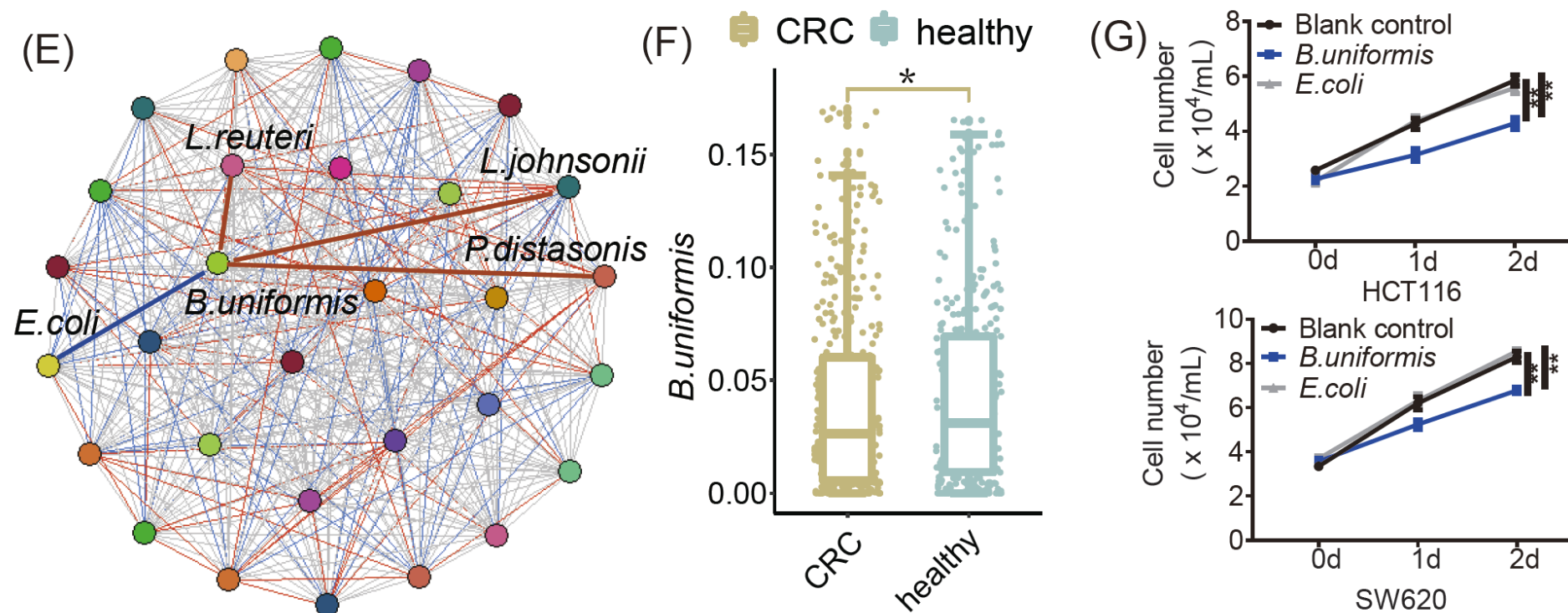


Germ-free mice with BRD fecal microbiota transplantation had enhanced gut barrier integrity compared with control diet (CD).



# Results

Figure 3

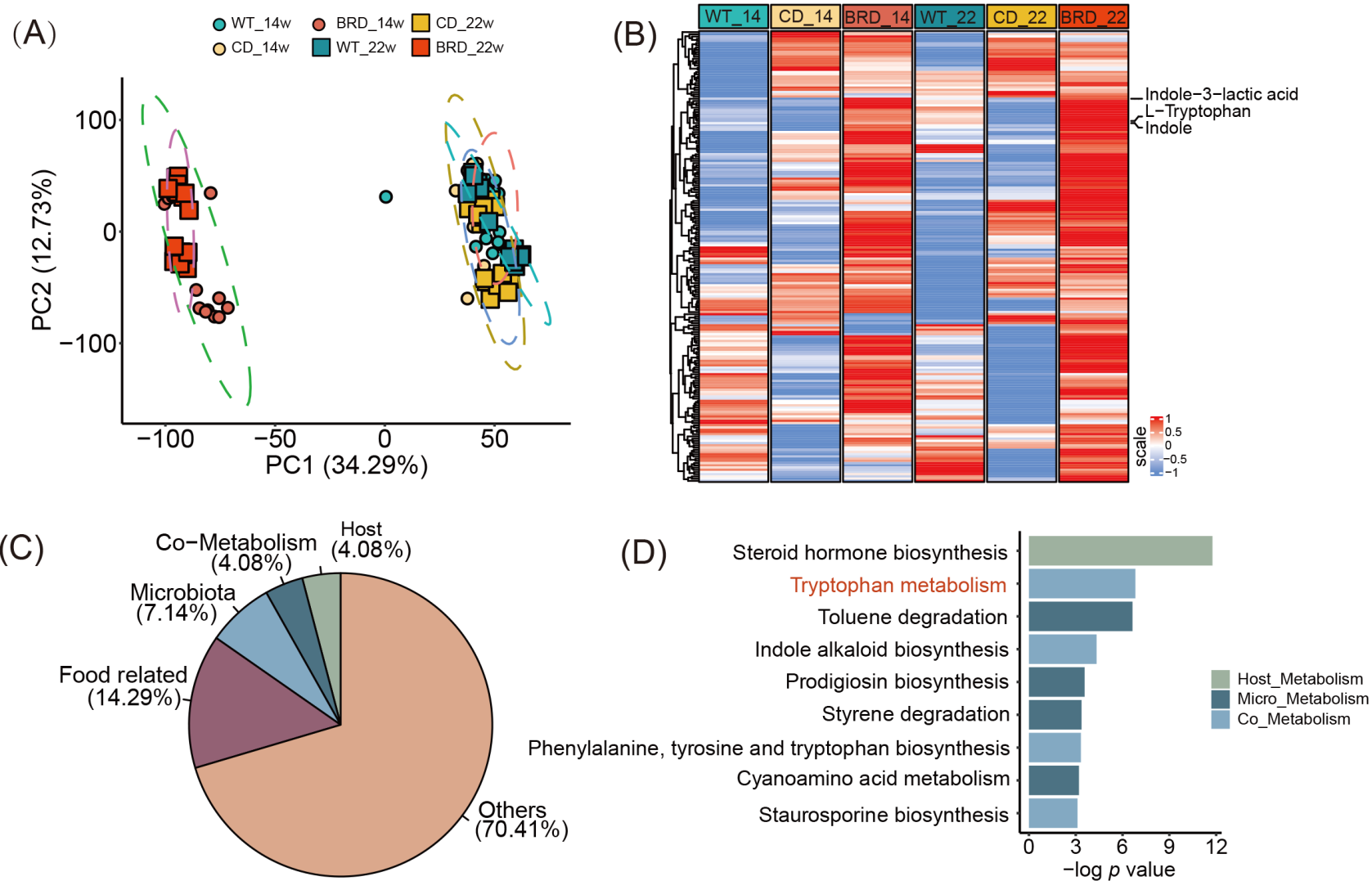


- The abundance of *B. uniformis* in feces of mice on the black rice diet was increased
- The abundance of *B. uniformis* was higher in healthy individuals compared to patients with CRC



# Results

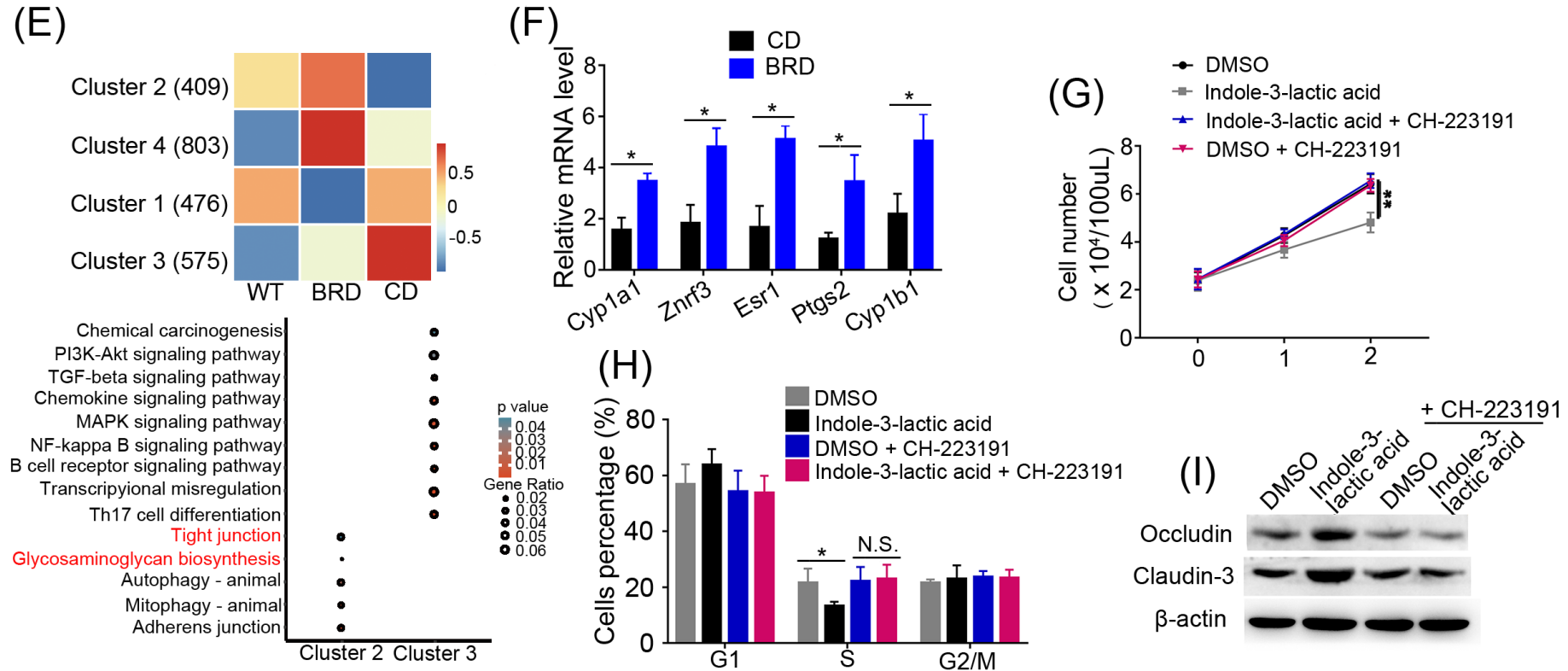
Figure 4



Indole, indole-3-lactate, and L-tryptophan, which are involved in the tryptophan metabolic pathway, were the major up-regulated metabolites in the black rice diet group.

# Results

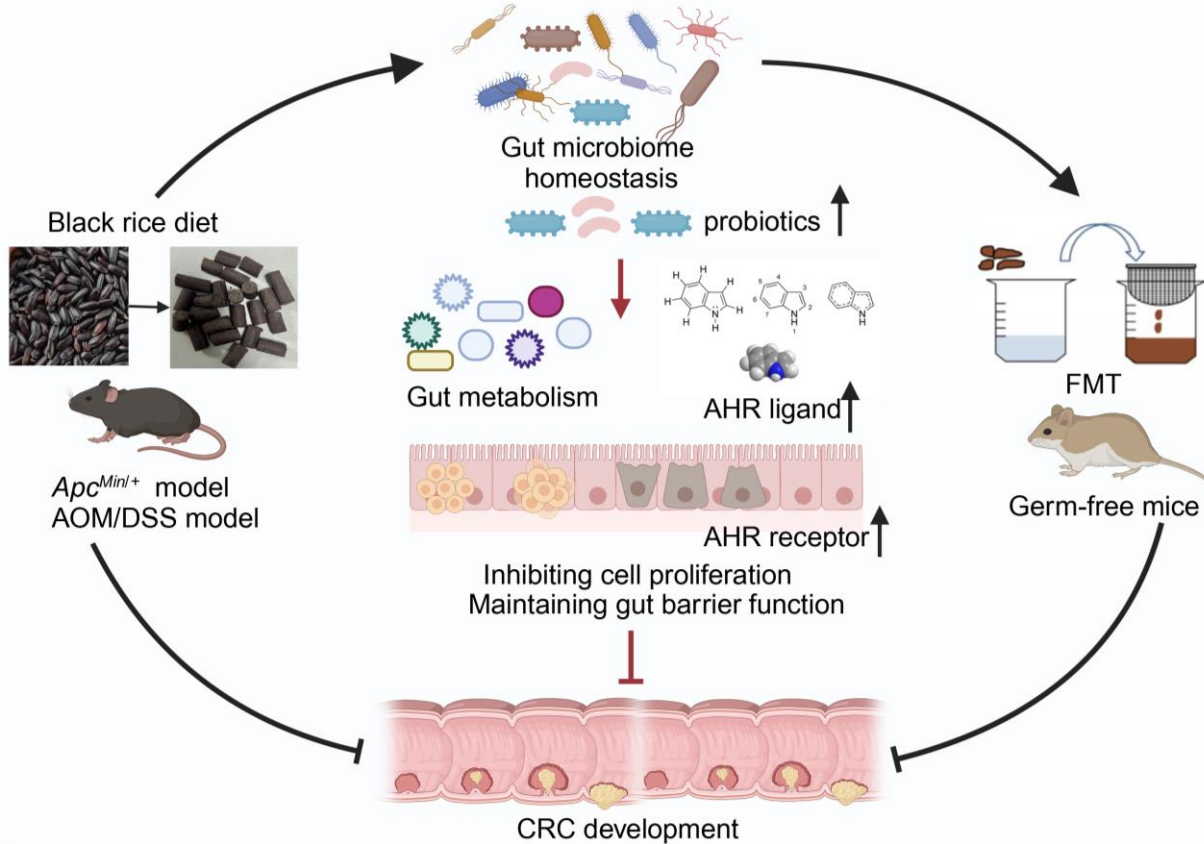
Figure 5



The upregulated metabolites in the BRD group demonstrate inhibitory effects on the proliferation and cell cycle of colorectal cancer cell lines. Furthermore, they function as ligands for aromatic hydrocarbon receptors (AHR), binding to these receptors in the intestine and activating downstream gene expression within the AHR pathway.

# Summary

Figure 6



- BRD exhibits a mitigating effect on the development of colon tumors in *Apc<sup>Min/+</sup>* and AOM/DSS colorectal cancer model mice.
- BRD promotes the proliferation of beneficial gut bacteria while simultaneously reducing potential intestinal pathogens.
- BRD induces an enhancement of the tryptophan metabolism pathway, in which indole and indole-3-lactate act as ligands for the AHR pathway. This activation of gene expression downstream of the intestinal AHR receptor contributes to slowing the progression of colorectal cancer.
- Moderate consumption of black rice is expected to have a positive impact on gut microbiota and metabolites, thereby presenting a potential strategy for the prevention of colorectal cancer.

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