Dietary Rice Bran Alleviates Carbon Tetrachloride-Induced Liver Fibrosis in Mice

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Background and aims

The liver is the main organ involved in dietary nutrient catabolism, detoxification, bile production, and lipid metabolism. Various endogenous and exogenous stimulations may result in an inflammatory response and the formation of collagen deposits, which is a risk to develop liver cancer. Rice bran is the main by-product derived from rice milling, which contains various nutrients like phenolic compounds, and has been shown to alleviate alcoholic liver injury and hypolipidemic activity. In this study, we investigate the effects of rice bran on carbon tetrachloride (CCl_4)-induced liver fibrosis in mice.

Methods

Mice were fed a rice bran-containing diet or a normal diet with or without the injection of 20% CCl_4 twice a week for 7 weeks to induce a liver fibrosis model.

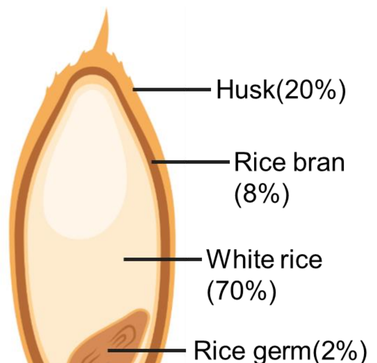
Results

Administration of a rice-bran-containing diet did not affect the body weight, liver weight ratio, or serum ALT levels in hepatotoxic CCl_4-treated mice. The histopathological H&E staining images showed that CCl_4 induced significantly irregular infiltration of borders, perinuclear vacuoles, and regional inflammation in the liver, whereas mice administered a rice-bran-containing diet expressed less abnormal hepatic morphology. To further clarify whether rice bran feeding alleviates CCl_4-induced liver fibrosis, we detected the expression of fibrosis-related genes, including α-SMA, COL1A2, and TGF-β, and used Sirius red staining to detect collagen deposition in liver tissues. In the control diet-fed group, CCl_4 injection resulted in higher gene expression of α-SMA, COL1A2, and TGF-β and collagen deposition in liver tissues, whereas this expression and deposition events were attenuated in rice bran-fed mice. Moreover, the consumption of rice bran enhanced the antioxidant genes expression, including catalase, sod1, sod2, and sod3.

Conclusion

In conclusion, the administration of a rice-bran-containing diet may have beneficial effects on liver fibrogenesis via antioxidants.

Table 1. Composition of normal diet and rice bran containing diet.



Ingredient	Normal diet	10% Rice bran
	g/kg	g/kg
Cornstarch	465	365
Maltodextrin	155	155
Sucrose	100	100
Casein	140	140
L-Cystine	2	2
Fresh soybean oil	40	40
Cellulose	50	50
Mineral Mix (AIN-93M-MIX)	35	35
Vitamin Mix (AIN-93M-MIX)	10	10
Choline Bitartrate	3	3
Rice bran	0	100
Total	1000	1000

Figure 1. Study design and the effect of rice bran on body weight.

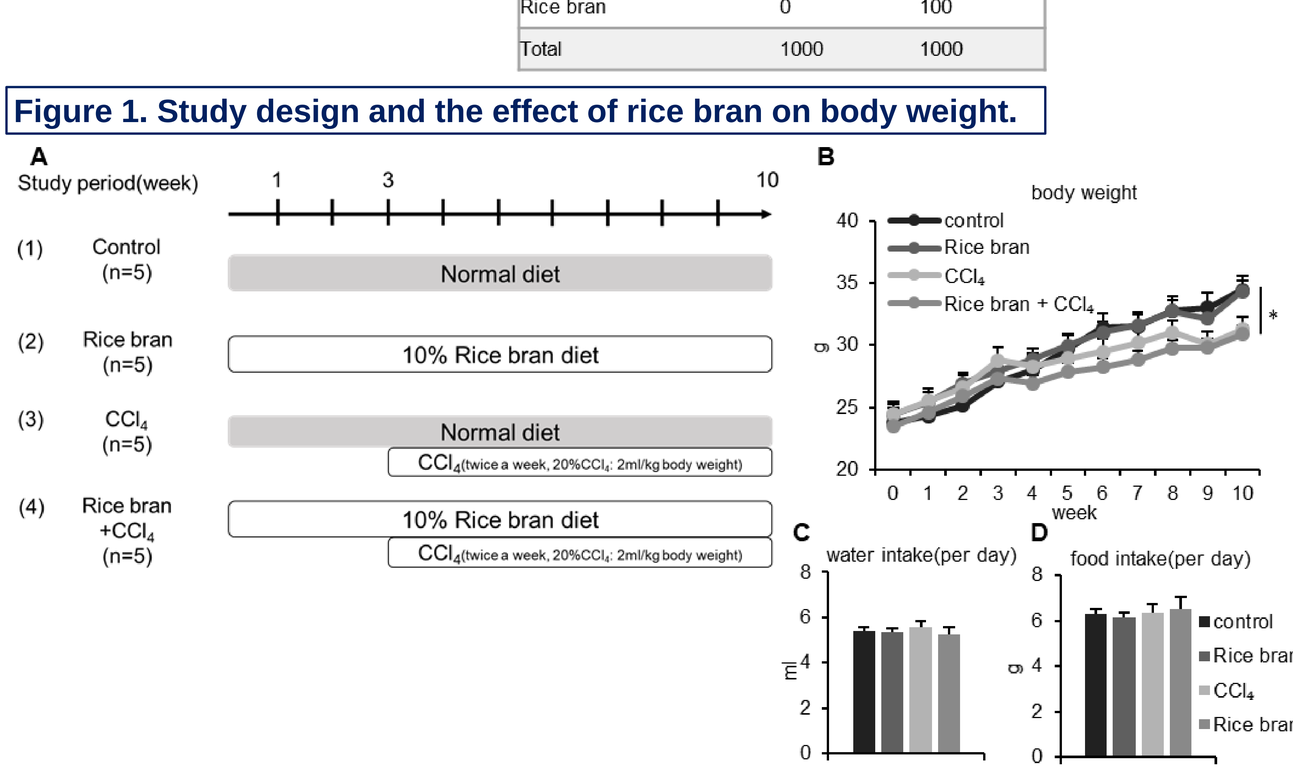


Figure 2. Rice bran feeding can alleviate abnormal hepatic morphology.

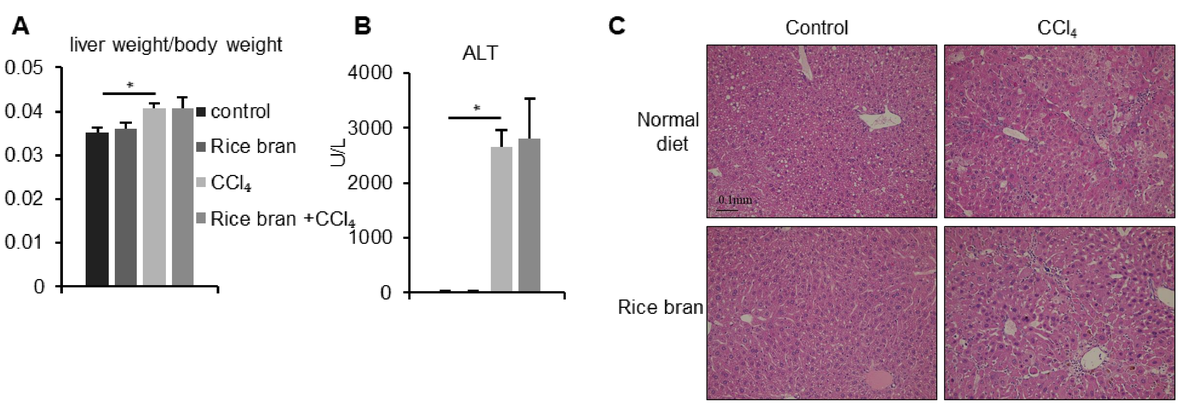


Figure 3. Rice bran feeding can alleviate CCl_4 –induced liver fibrosis.

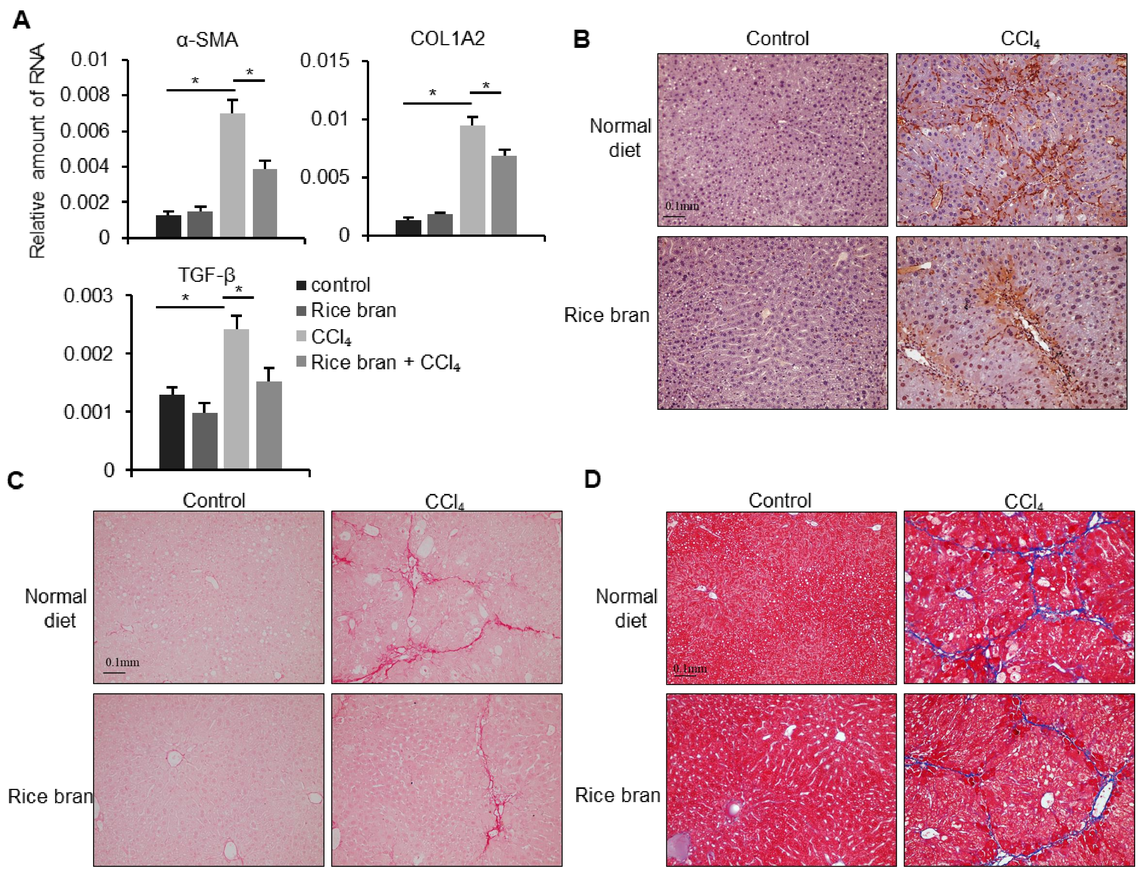


Figure 4. Rice bran feeding can promote detoxification and antioxidant genes.

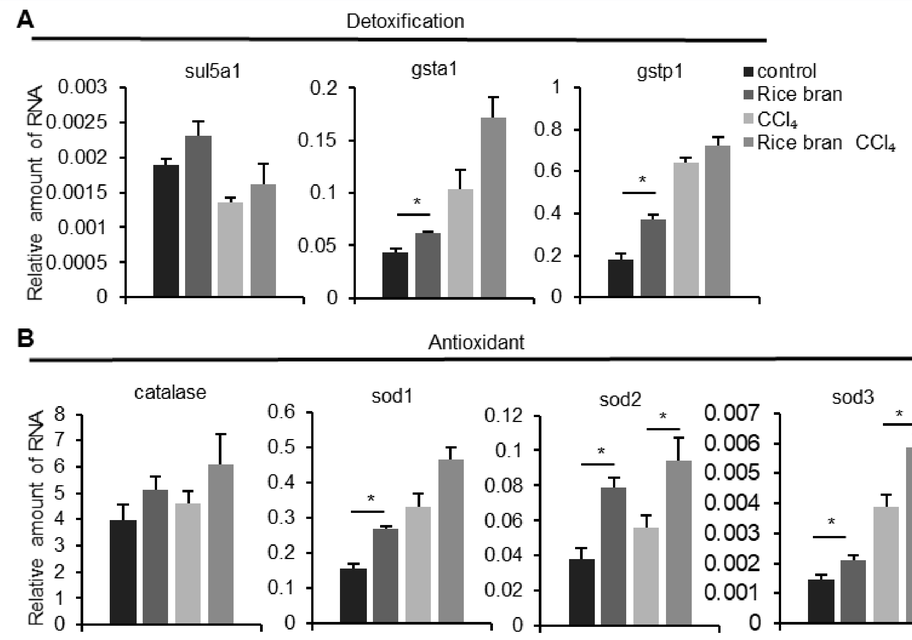


Figure 5. γ-oryzanol decreases TGF-β induced activation in LX2 cells.

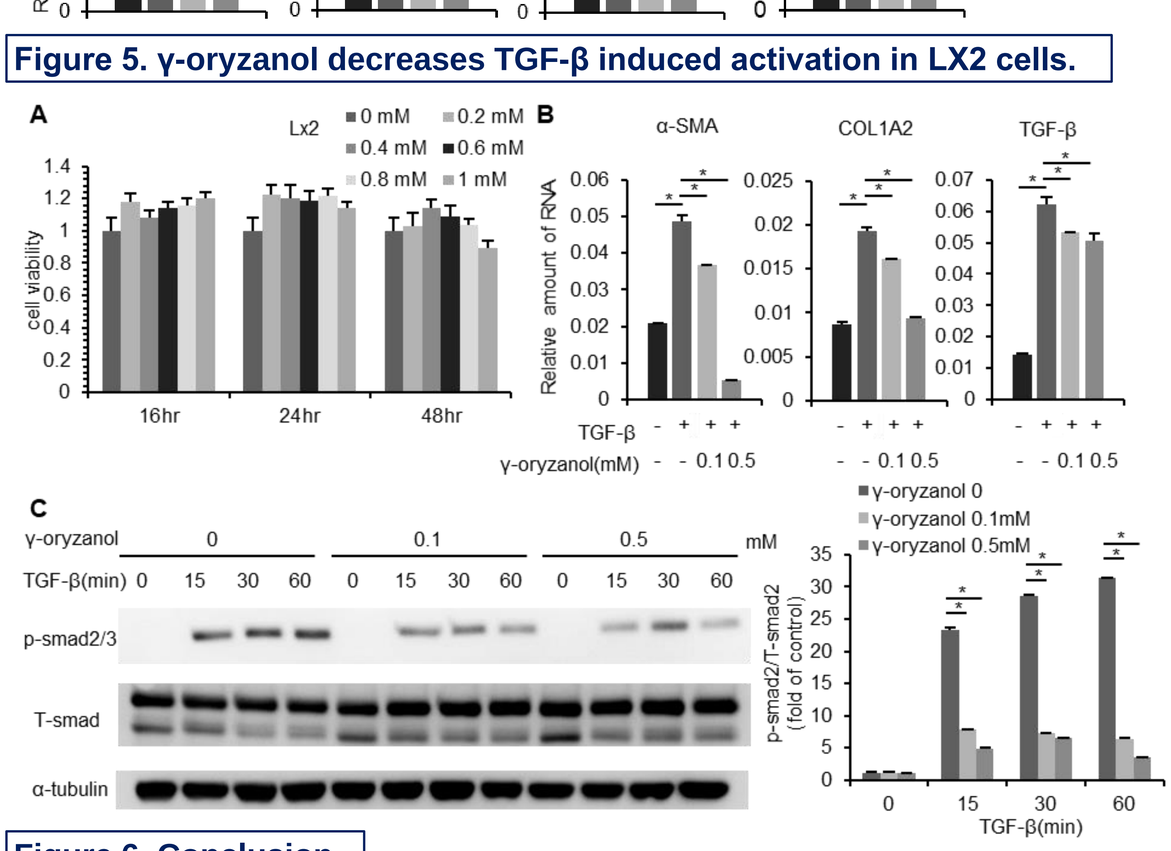


Figure 6. Conclusion.