

UTILIZATION OF ANIMAL BY-PRODUCTS FOR IMPROVEMENT OF ALCOHOLIC FATTY LIVER IN RATS

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Abstract – The purpose of this study was to assess the action of animal liver and bile extracts on ethanol-induced fatty liver in rats. Improvement would indicate the economic potential of animal liver and bile extracts as agents to alleviate the negative health effects of ethanol-induced fatty liver. Extracts from animal liver and bile, including pig bile powder, pig liver extract, a mixture of pig bile powder and pig liver extract, chicken bile powder, chicken liver extract, and a mixture of chicken bile powder and chicken liver extract were fed to Long-Evans rats. While rats fed ethanol over an extended period showed elevated values of aspartate transaminase, the results indicated that pig bile powder could decrease these values. The treatment with the pig liver extract has also decreased the aspartate transaminase levels. These results suggest pig bile and liver extracts have high potential to improve rats ethanol-induced fatty liver with serum biochemical parameters.

Key Words – aspartate transaminase, bile and liver extracts, ethanol-induced fatty liver.

I. INTRODUCTION

Drinking alcohol is a common cultural phenomenon that assists the formation of interpersonal relationships in human society. However, excessive alcohol consumption may induce liver damage, inflammation of liver, ethanol-induced fatty liver, and irreversible liver disease [1] and may also be an important risk factor for cancer, and cardiovascular disease; a reduction in liver damage among the elderly has great potential to reduce the disease burden [2].

Livers of poultry and other livestock are rich in protein, vitamins, and minerals. As an animal by-product, liver is an excellent source of nutrition. Nowadays in Taiwan and also in Japan, liver by-products are under-utilized for human consumption and used in the manufacture of animal feed or else discarded. The bile of poultry and livestock has had a small role in traditional Chinese medical science for several decades.

The results of the current study indicated that animal liver and bile extracts had a strong anti-oxidative capacity [3]. Thus, we also measured serum aspartate transaminase (AST) activities on rats. This study highlighted the effective use of by-products in the development of valuable healthful products. Such utilization also has the potential to reduce the cost of waste disposal management, and also brings benefits to pig and chicken farmers.

II. MATERIALS AND METHODS

According to the method employed in a previous study [3], bile was obtained from gallbladders of livestock by needle puncture and filtered through 2-layer swabs. This was followed by heat treatment at 100°C for 15 min. These samples were made into powder form by lyophilization (FD-5N, EYELA, Tokyo; Pump, G-100D, ULVAC, Kanagawa, Japan) and then stored at -20°C. The appearance of various liver and bile extracts is shown in Figure 1. The animal use protocol has been reviewed and approved by the Institutional Animal Care and Use Committee at National Chung Hsing University. During the experimental period, the daily water, food intake,

and body weight of experimental rats were recorded. Blood samples (1 mL) of each group were collected every four weeks by applying cardiac puncture after anesthesia with isoflurane (2~4%).

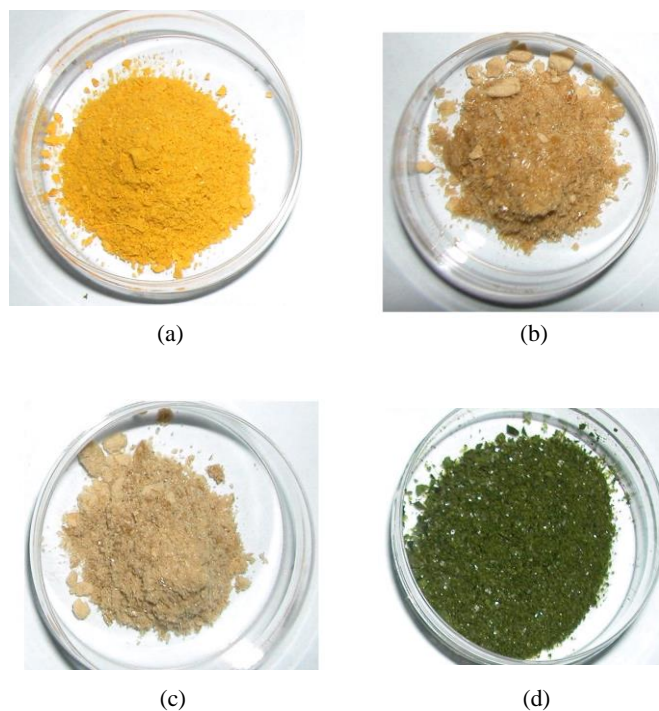


Figure 1 The appearance of various liver and bile extracts.
(a) pig bile powder, PBP (b) pig liver extract, PLE
(c) chicken bile powder, CBP (d) chicken liver extract, CLE

III. RESULTS AND DISCUSSION

The AST values of liver-damaged rats have been described by Balamurugan *et al.* [4]. The elevated levels of AST were known to indicate liver damage, and AST entered into the circulatory system because of the altered membrane permeability [5].

Table 1 shows the AST activity in each group of rats. There were no differences in the control group throughout the experiment (133.30-134.82 U/L), but an increase was observed in the ETH group. Among the extract groups, only the CBL group increased, while the other groups all recorded decreases in AST activity. The reason for increasing AST activity might be due to partial liver cell damage by the ethanol. The influence of different manipulations for serum compositions of rats was determined. In terms of percentage

change of AST activity between week zero and the 8th week, the ETH group was the highest (24.93%), with no significant differences found among other treatments. The activity of AST was observed to increase when the liver was damaged.

The observation correlated with the results of Marion & Krebs who indicated that AST activities were significantly increased in the study because of ethanol induced hepatotoxicity in rats [6]. Therefore, the activity of AST can be used as the diagnosis indicator for liver health status [7]. In general, the activity of serum AST of rats is higher than human, but it still increases when the liver is damaged.

Table 1 Effect of various treatments and experiment period on serum aspartate transaminase (AST) activities of rats

Treatment	Weeks					
	0		4		8	
CON	133.30±	4.59 ^{ax}	134.82±	14.16 ^{ax}	133.44±	5.59 ^{bx}
ETH	126.76±	4.06 ^{az}	141.58±	8.23 ^{ay}	158.36±	6.18 ^{ax}
PBP	135.72±	4.98 ^{ax}	139.85±	11.33 ^{ax}	130.07±	5.07 ^{ax}
PLE	136.13±	5.00 ^{ax}	136.38±	11.05 ^{ax}	134.43±	10.22 ^{ax}
PBL	134.15±	6.40 ^{ax}	136.90±	10.40 ^{ax}	141.73±	5.53 ^{ax}
CBP	132.87±	5.85 ^{ax}	131.22±	10.63 ^{ax}	133.20±	5.19 ^{ax}
CLE	135.82±	4.99 ^{ax}	137.25±	11.93 ^{ax}	130.57±	5.09 ^{ax}
CBL	130.77±	4.50 ^{ax}	132.50±	9.92 ^{ax}	153.72±	6.00 ^{bx}

1. Mean ± SD, unit : U/L, n=6.

2. Deionized water (CON), ethanol (ETH), pig bile powder (PBP), pig liver extract (PLE), pig bile and liver extract (PBL), chicken bile powder (CBP), chicken liver extract (CLE), chicken bile and liver extract (CBL).

^{a-b} Means with different superscript letters in the same column are different significantly (P < 0.05).

^{x-z} Means with different superscript letters in the same row are different significantly (P < 0.05).

IV. CONCLUSION

At the end of the experiment, the change of serum biochemical analysis showed that rats fed ethanol over an extended period can increase the values of AST. Comparing the various animal liver and bile extracts applied in the study, pig bile powder was observed to decrease the values of AST. In addition, the AST values were significantly decreased as a result of pig liver extract treatment. These results suggest that pig bile and liver extracts might improve rats ethanol-induced fatty liver in terms of serum biochemistry values. Further investigation is necessary for histological analysis of internal organs of the experimental rats.

ACKNOWLEDGEMENTS

This work was supported by the Council of Agricultural, Executive Yuan, R.O.C. Taiwan (Contribution No. 1848 from Livestock Research Institute, Council of Agriculture). The authors wish to thank Mr. Jonathan Lynch, Azabu University, Japan for his assistance in proof-reading this manuscript.

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