

STUDY OF CHROMIUM ENRICHED *GANODERMA LUCIDUM* FERMENTED WHEAT TO MODULATE STZ-INDUCED MICE BLOOD GLUCOSE

WEI-CHIH KUAN^a, SU-DER CHEN^{a*} AND YEONG-HSIANG CHENG^b

^a DEPARTMENT OF FOOD SCIENCE, ^b DEPARTMENT OF ANIMAL SCIENCE
ILAN UNIVERSITY, TAIWAN 26041, R.O.C.

*E-Mail : sdchen@niu.edu.tw
TEL: 0920518028

Abstract

The objectives of this study were to produce *Ganoderma lucidum* 14-days solid-state fermentation by adding different concentrations of trichloride chromium (Cr³⁺) in wheat medium, and to modulate blood glucose of streptozotocin (STZ) BALB/c mice after feeding with water extracts from the fermented wheat. The STZ-mice were administrated with 75 mg water extract / kg day (about 30 g Cr³⁺ / kg day) from enriched chromium *Ganoderma lucidum* fermented wheat (ECGLW), *Ganoderma lucidum* fermented wheat (GLW) or same inorganic Cr³⁺ from CrCl₃ for 14-days feeding. Results show the 200 ppm Cr³⁺ group had the highest organic Cr³⁺ conversion ratio than the others. The oral glucose tests of mice were decreased and the glucose tolerances of mice were improved after the ECGLW treatment. However, the GLW and CrCl₃ groups were not significant benefit on blood glucose.

Introduction

Trivalent chromium (Cr³⁺) has been applied in type II diabetes to control blood glucose level and improve glucose tolerance. Organic chromium were higher up-taking efficiency than inorganic chromium. *Ganoderma lucidum* were conversion chromium into organic form, and furthermore *Ganoderma lucidum* and the fermented product were modulated blood glucose in animals.

Materials & methods

1. Solid-state fermentation

Ganoderma lucidum (BCRC36123)

Seed cultivation for 7-days



Wheat (50% M.C.) for 14-days solid-state fermentation

With Cr³⁺ about 100, 200, 300 µg Cr³⁺/g

GLW

ECGLW

2. Animal examination

BALB/c Mice (6 weeks old)

Streptozotocin 65mg/kg BW and
Nicotinamide 230 mg/kg BW



DM Mice

Normal (n=3) Control (n=3) ECGLW (n=3)
75 mg/kg BW (30 µg Cr/kg BW) GLW (n=3)
75 mg/kg BW CrCl₃ (n=3)
(30 µg Cr/kg BW)

Fasting and meal plasma glucose level

* ECGLW=Enriched chromium *G. lucidum*

* The meal glucose level were determined after administered glucose solution 2 hours. Glucose dose were 2 g per kg body weight.

Results

Chromium (Cr³⁺) concentration were significant inhibit biomass growth at 300 ppm and decreasing crude polysaccharide produce while Cr³⁺ rise. Highest Cr³⁺ conversion were 54.7% at 200 ppm (Table 1). Moreover, the biomass growth and crude polysaccharides produce were better than about 300 ppm. The 200 ppm *G. lucidum* fermented product were sterilized, air dry and extract with 10-folds hot water about 100°C for 1 hr then administer to STZ-mice for 75 mg/kg body weight (about 30 µg/kg BW) daily. After 14-days treatment ECGLW were benefit glucose tolerance and control glucose rising after meal.

Table 1. Effect of chromium concentration in medium on biomass, crude polysaccharide and organic Cr³⁺ concentration after 14-days *Ganoderma lucidum* solid-state fermentation

Medium Cr ³⁺ (ppm)	Biomass (g/kg)	Crude Polysaccharide (g/kg)	Organic Cr ³⁺ (mg/kg)	Conversion rate (%)
0	18.3 ± 0.8 ^a	130.5 ± 1.0 ^a	0.0 ± 0.8	0.0 ± 0.0
50	18.7 ± 0.9 ^a	122.7 ± 6.0 ^b	17.3 ± 4.1 ^d	34.6 ± 8.1 ^c
100	17.2 ± 1.4 ^{ab}	115.5 ± 12.3 ^{bc}	43.6 ± 2.0 ^c	43.4 ± 2.3 ^b
200	18.2 ± 0.7 ^a	114.2 ± 6.4 ^b	109.4 ± 5.6 ^b	54.7 ± 2.8 ^a
300	16.3 ± 0.8 ^b	102.1 ± 3.6 ^c	129.5 ± 4.7 ^a	44.4 ± 6.6 ^b

Value means average ± Standard deviation (n=3).

^{abcd} Values followed by different letters in the same row are significantly different (*p* < 0.05).

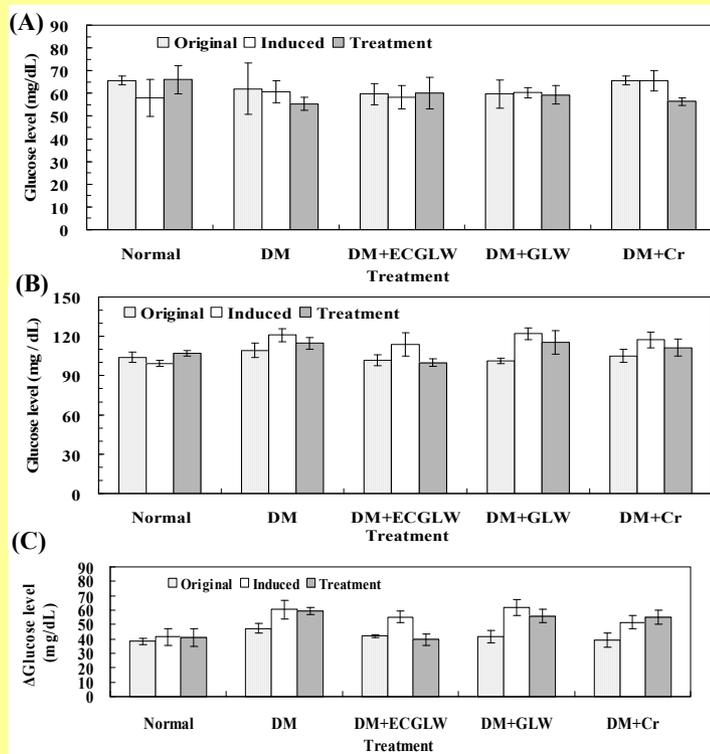


Fig. 2. The original and STZ induced and administrated 14-days fasting (A) meal (B) and (C) difference glucose level of the mice (BALB/c) treated 14-days with RO water or ECGLW or GLW or Cr. Error bar of the mean is standard deviation (n=3) for all treatments. *Letter are significantly different with original (*p* < 0.05). ^φLetter are significantly different with induced (*p* < 0.05).

Conclusion

Enriched chromium *Ganoderma lucidum* fermented wheat is a novel chromium supplement source and it has potential to modulate blood glucose.