

**Antioxidant and hypoglycemic effect of  
chromium enriched *Ganoderma lucidum*  
fermented rice products**

**富鉻靈芝米穀粉之抗氧化和降血糖研究**

**Speaker: Po-Syun Lin (林伯勳)**

**Advisor : Su-Der Chen (陳淑德) Ph.D**

**Hui-Huang Chen (陳輝煌) Ph.D.**

**Department of Food Science, National ILan University, Taiwan**

兩岸三地食品安全與人類健康企業高峰暨博士論壇 7/20/2013



# Outline

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## Introduction

- *Ganoderma lucidum* fermentation
- Diabetic mice

## Objectives

## Experimental design

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# *Ganoderma lucidum*

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**Kingdom: Fungi**

**Phylum: Basidiomycota**

**Class: Agaricomycetes**

**Order: Polyporales**

**Family: Ganodermataceae**

**Genus: *Ganoderma***

**Species: *G. lucidum***



[http://zh.wikipedia.org/wiki/File:Ganoderma\\_lucidum\\_01.jpg](http://zh.wikipedia.org/wiki/File:Ganoderma_lucidum_01.jpg)

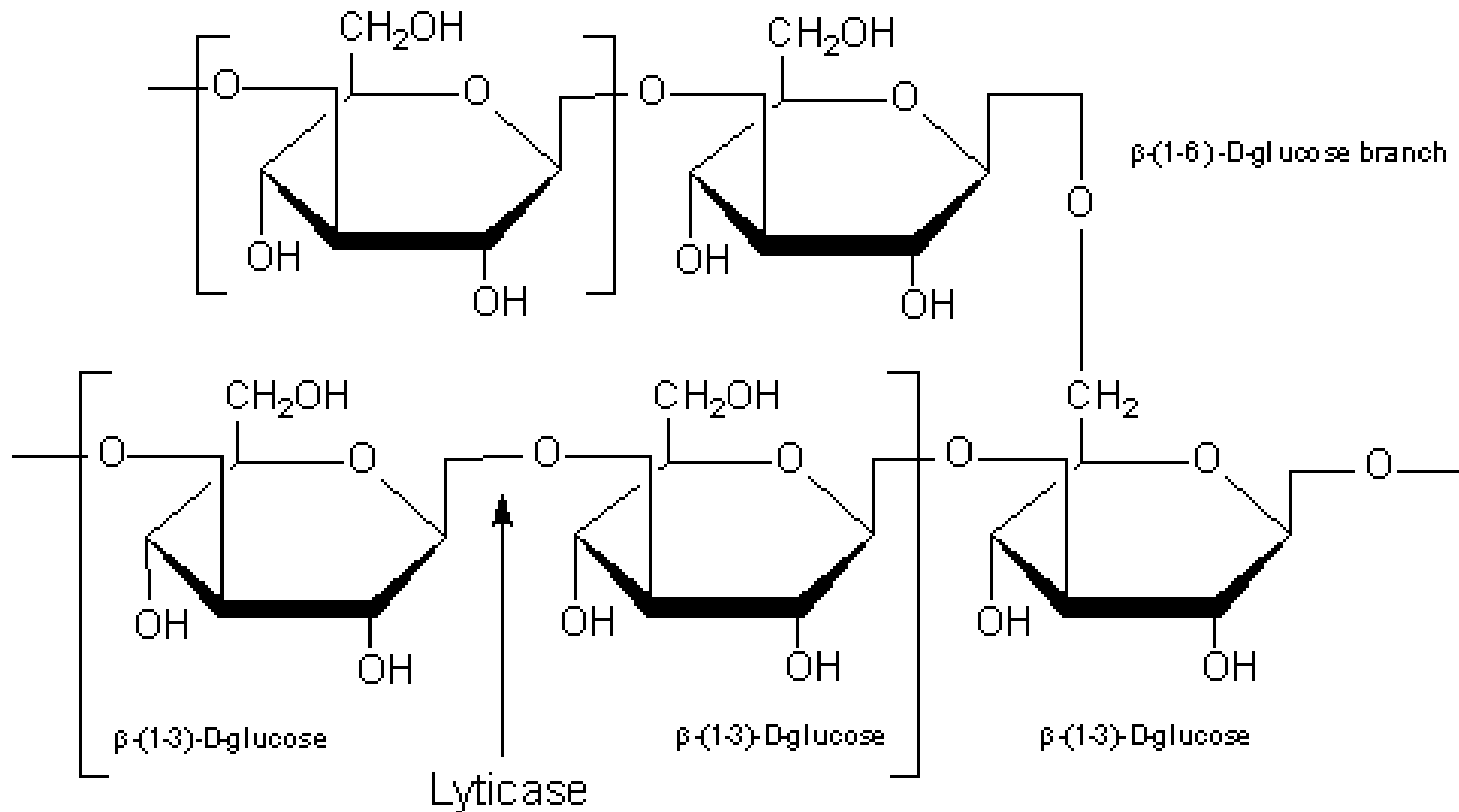
# ***Ganoderma lucidum* solid-state fermentation**

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- Low moisture content**
- Low device cost**
- Low process cost**
- High product value**
- Simple product isolation**

# Polysaccharides of *G. lucidum*

## $\beta$ -1,3-D glucan, $\beta$ -1,6-D glucan



# Bio-functions of *G. lucidum* polysaccharides

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- Immunomodulating
- Anti-inflammatory
- Hypoglycemic
- Hypocholesterolemic

(Lee *et al.*, 1999)

# Bio-functions of *G. lucidum* triterpenes

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- Anti-inflammation
- Hypoglycemic
- Anti-hypertensive
- Hepatoprotective

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(Tang and Zhong, 2004)



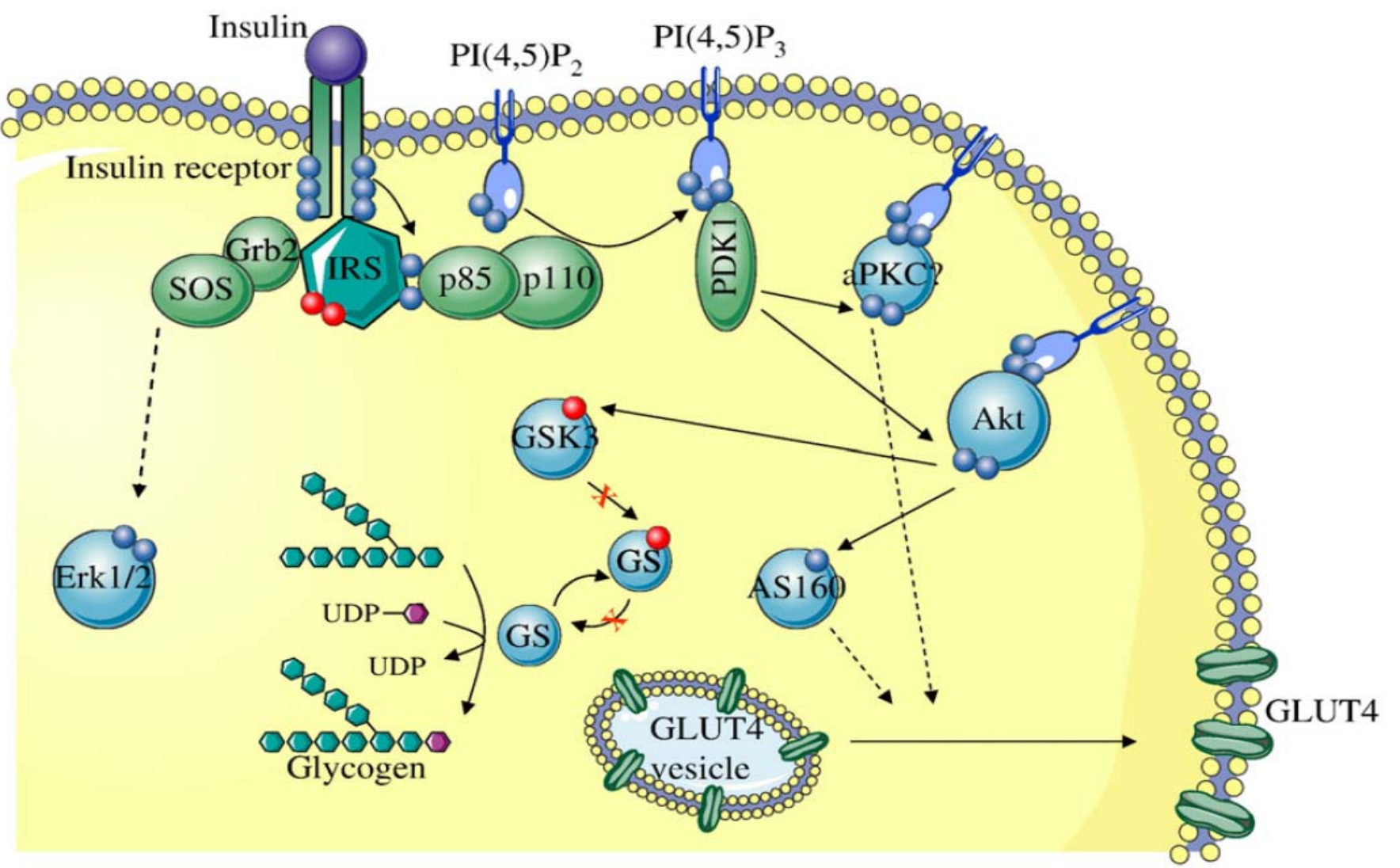
# Diabetes mellitus

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- Fasting blood glucose: 70~110 mg/dL**
- More drink, more eat, more urine**
- Type II diabetes is more than 90% of diabetes.**
- Manifestations of hyperglycemia and hyperinsulinemia**
- A risk factor is related to cardiovascular, hypertension and stroke.**



# Hypoglycaemic effects and insulin levels



# Objectives

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- ❑ **Antioxidant substance and ability of chromium enriched *G. lucidum* fermented brown rice product.**
- ❑ **Hypoglycemic activity of chromium enriched *G. lucidum* fermented brown rice product.**

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# Experimental Design

# Antioxidant of chromium enriched *G. lucidum* fermented rice products

1 kg Brown rice medium with 50% moisture and adding (0, 200 ppm)  $\text{CrCl}_3$ , sterilization

10 mL pre-activation of *G. lucidum*

14-days fermentation at 30°C

RF sterilization and hot air drying

antioxidant substance and ability

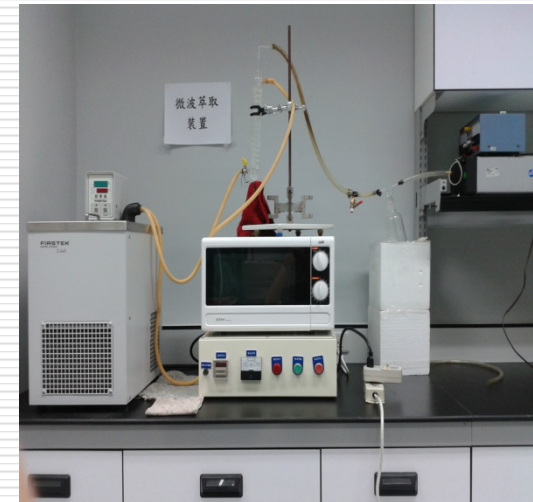


# Microwave extraction of chromium enriched *G. lucidum* fermented rice products

*Ganoderma lucidum* rice powder : ethanol (1:20)

25, 50, 75, 95 %  
ethanol

300 W Microwave extract 10 min



Polysaccharide, triterpences, glucan and total Cr<sup>3+</sup>

# Diabetic animal model

C57BL/6J mice

adapting one week

Normal (water)

i.p. injection STZ

STZ (water)

STZ (Chromium enriched  
*G. lucidum* rice extract)

Water intake, food intake and plasma glucose



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# Results and Discussion

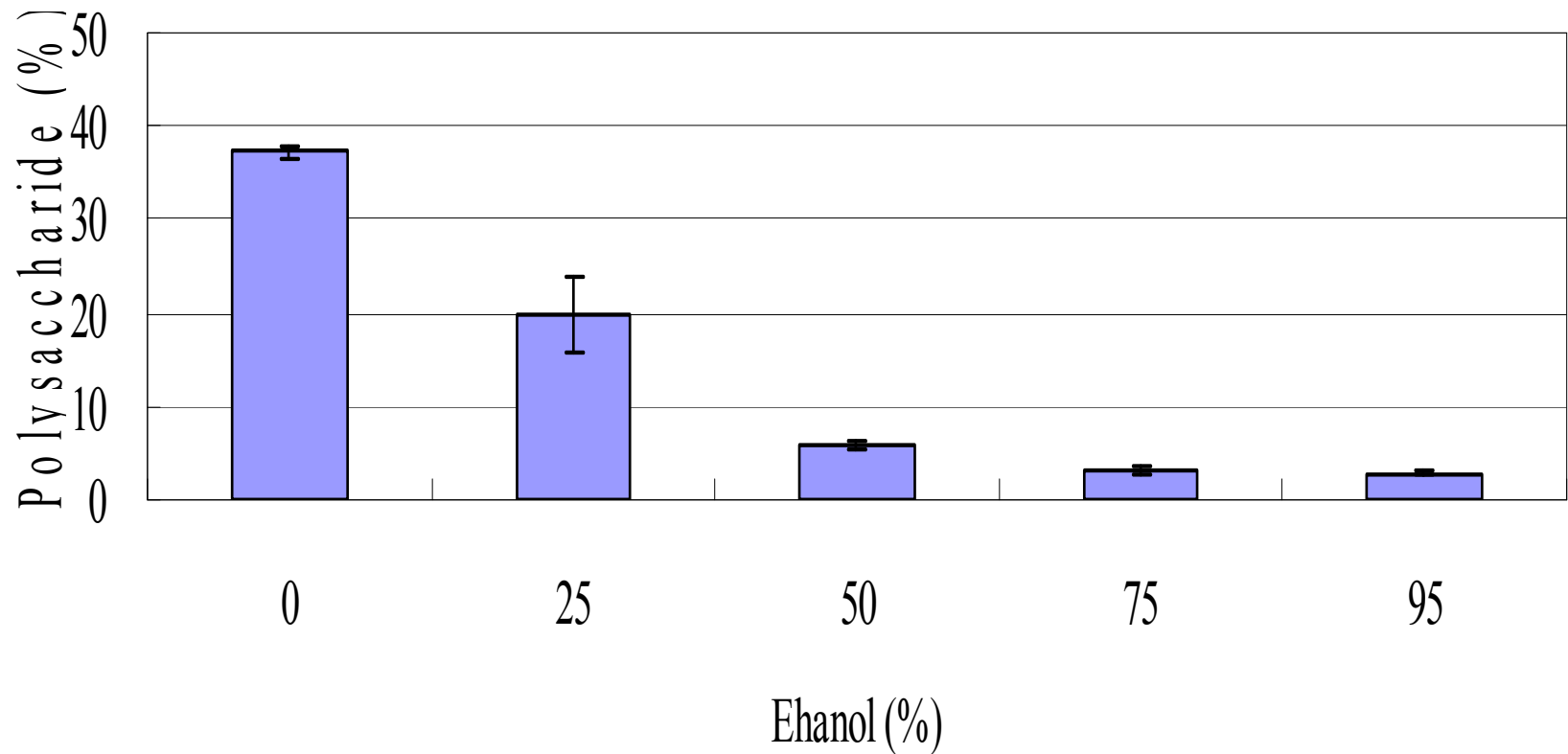
**Table 1. Effect of chromium adding on antioxidant in chromium enriched *Ganoderma lucidum* fermented brown rice**

<b>Biomass/ antioxidant</b>	<b>Brown rice substrate</b>	<b>Fermented rice</b>	<b>Fermented rice w/ 200 ppm Cr<sup>+3</sup></b>
<b>Biomass (%)</b>	<b>0</b>	<b>3.81±0.11<sup>a</sup></b>	<b>3.22±0<sup>b</sup></b>
<b>Flavonoid (<math>\mu</math>g/g)</b>	<b>198.97±4.13<sup>a</sup></b>	<b>234.97±0.76<sup>c</sup></b>	<b>220.53±3.16<sup>b</sup></b>
<b>Total phenol (mg/g)</b>	<b>1.30±0.05<sup>a</sup></b>	<b>1.96±0.05<sup>b</sup></b>	<b>2.93±0.05<sup>c</sup></b>
<b>Polysaccharide (%)</b>	<b>26.33±0.06<sup>a</sup></b>	<b>43.53±0.25<sup>b</sup></b>	<b>51.47±0.76<sup>c</sup></b>



**Table 2. Effect of chromium adding on antioxidant activities in chromium enriched Ganoderma lucidum fermented brown rice**

<b>Antioxidant activities</b>	<b>Brown rice substrate</b>	<b>Fermented rice</b>	<b>Fermented rice w/ 200 ppm Cr<sup>+3</sup></b>
<b>DPPH ability (%)</b>	<b>81.56±1.05<sup>a</sup></b>	<b>91.51±0.97<sup>c</sup></b>	<b>88.88±0.38<sup>b</sup></b>
<b>Ferrous ions (%)</b>	<b>54.26±2.95<sup>a</sup></b>	<b>56.12±1.78<sup>a</sup></b>	<b>68.05±1.31<sup>b</sup></b>
<b>Reducing power (ABS)</b>	<b>0.590±0.004<sup>a</sup></b>	<b>0.628±0.008<sup>b</sup></b>	<b>0.659±0.006<sup>c</sup></b>



**Fig. 1. Crude polysaccharide in chromium enriched *Ganoderma lucidum* rice by microwave extract with different ethanol concentration.**

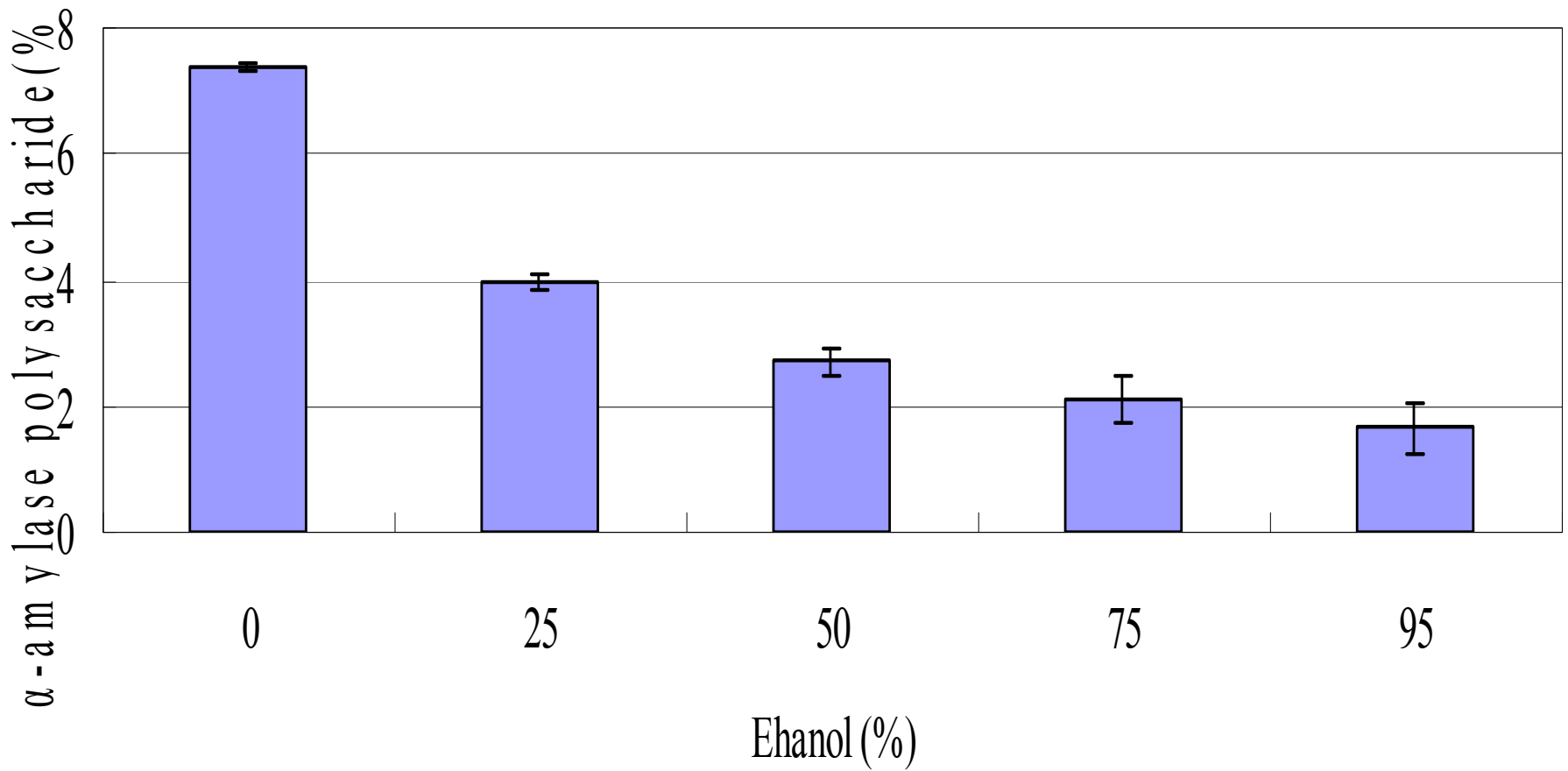


Fig. 2. Crude polysaccharide in chromium enriched *Ganoderma lucidum* rice by  $\alpha$ -amylase pretreatment and by microwave extraction with different ethanol concentration.

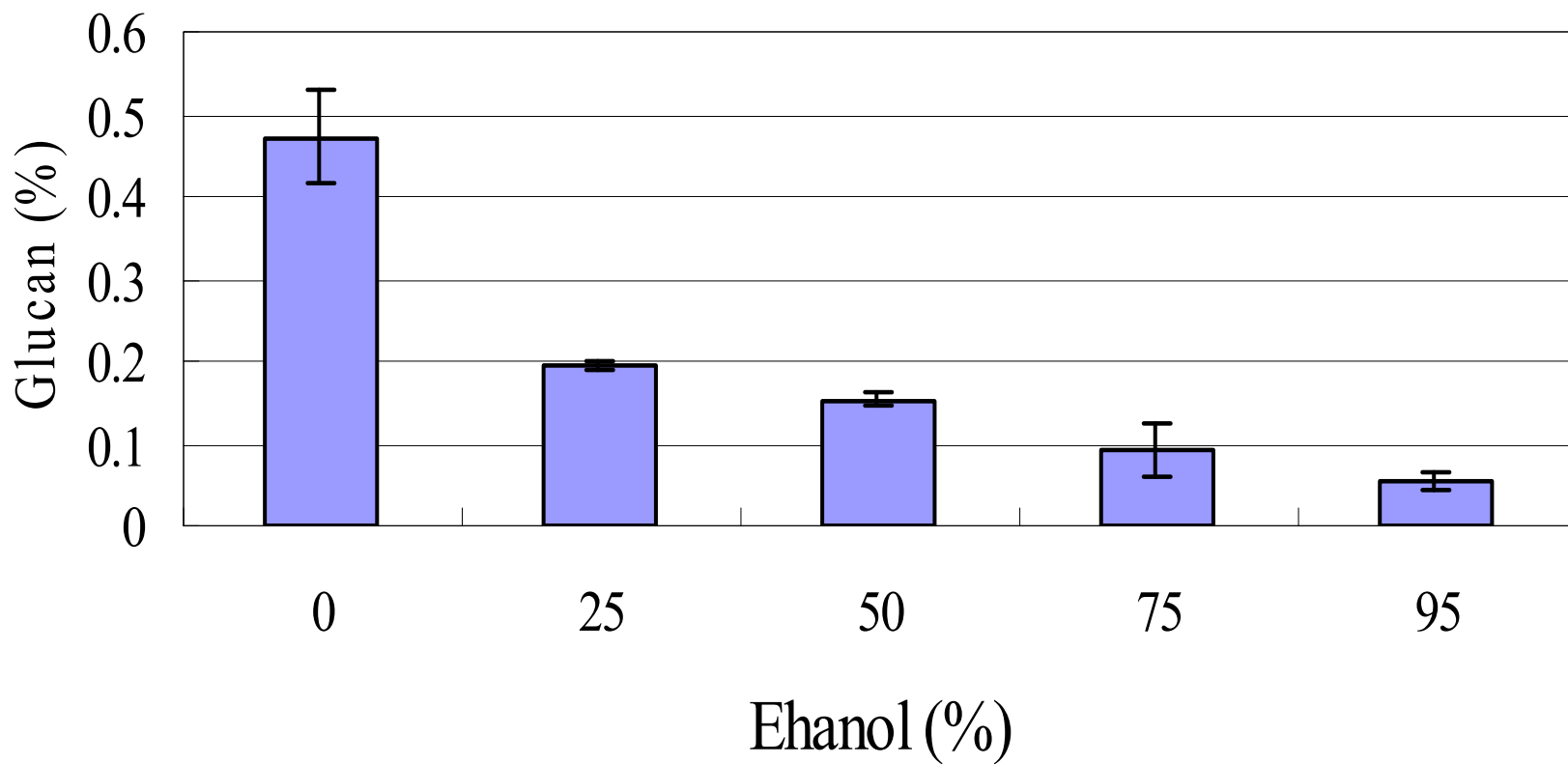


Fig. 3. Glucan in chromium enriched *Ganoderma lucidum* rice by microwave extract with different ethanol concentration.

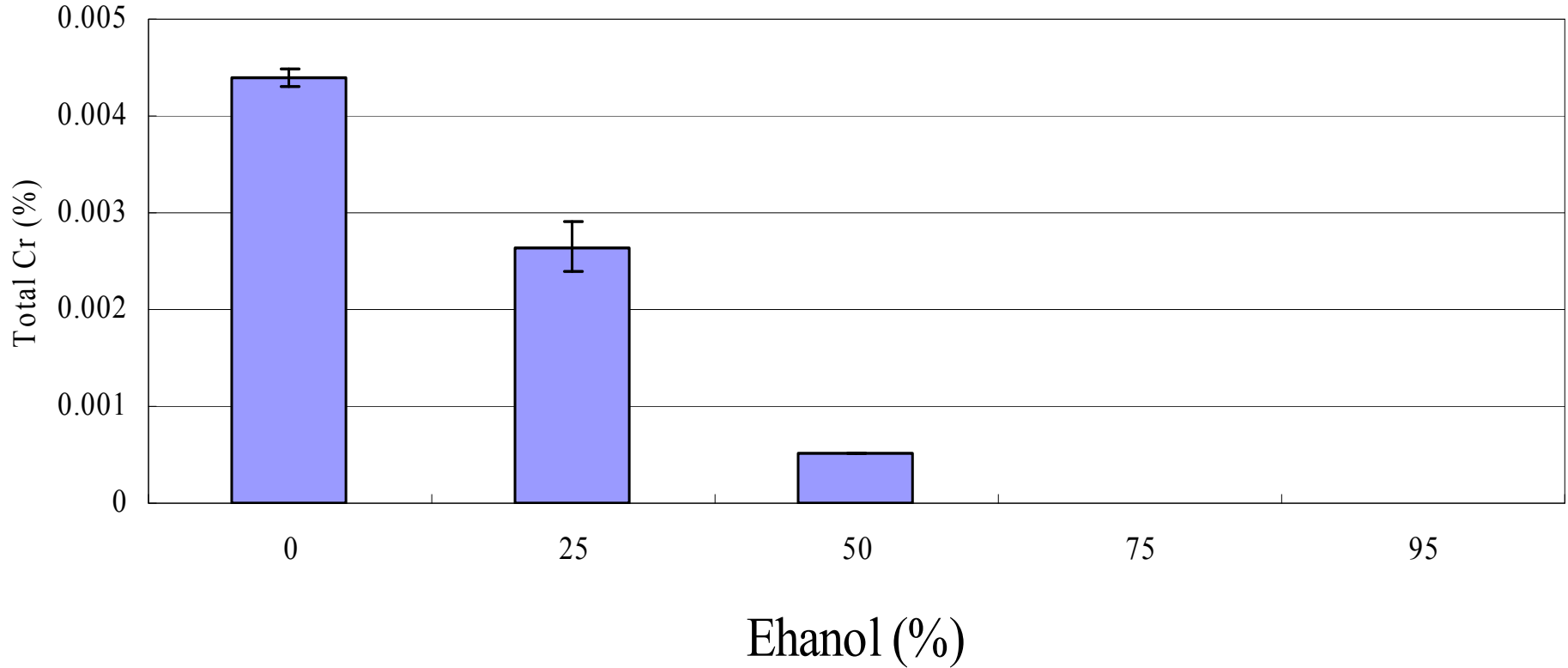


Fig. 4. Total Chromium in chromium enriched *Ganoderma lucidum* rice by microwave extract with different alcohol concentration .

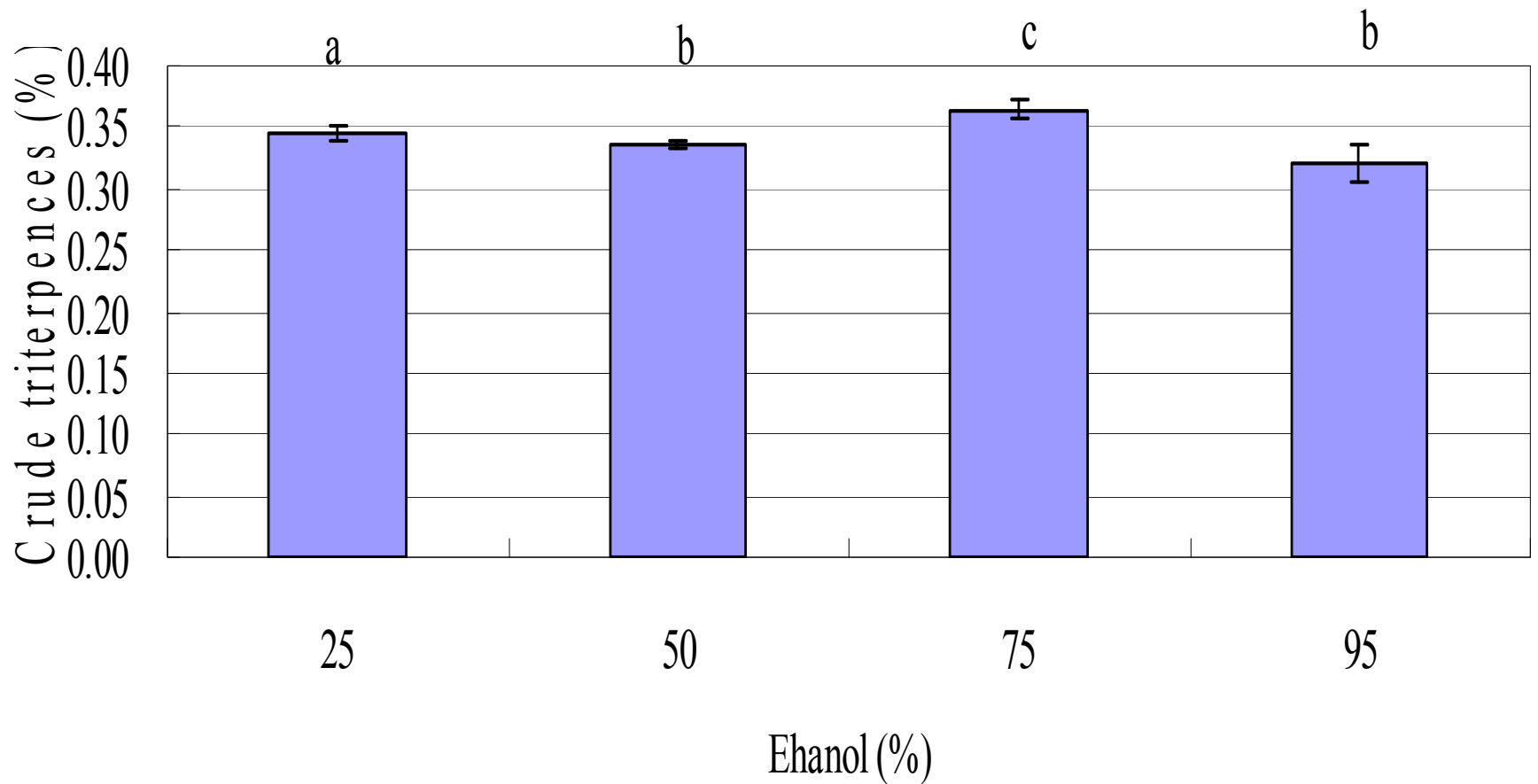


Fig. 5. Crude triterpenes in chromium enriched *Ganoderma lucidum* rice by microwave extract with different ethanol concentration.

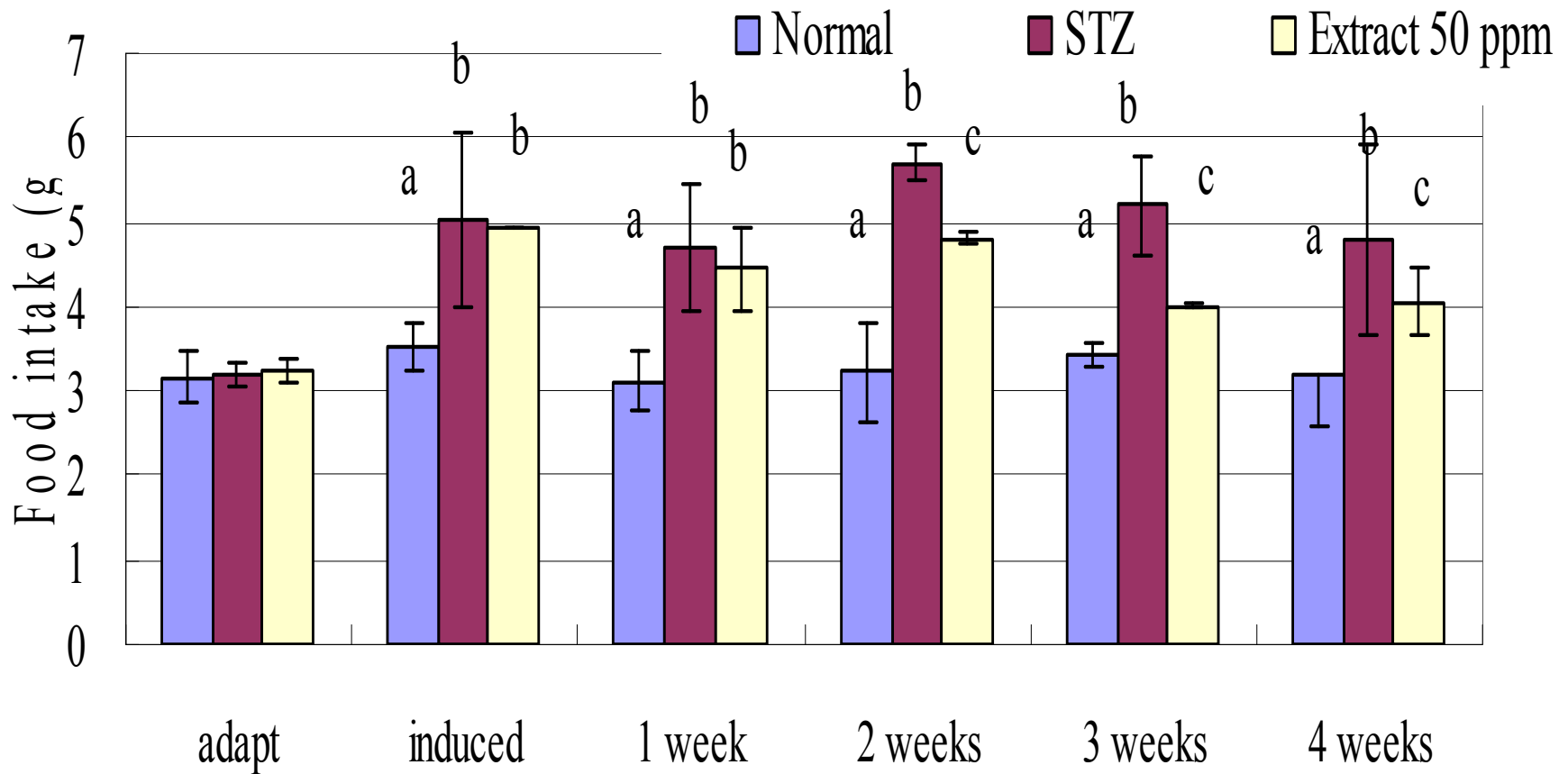


Fig. 6. Food intake changes of the STZ induced and treated 28-days mice (C57BL/6J).

Data represent means  $\pm$  SD. <sup>ab</sup> significant difference (P < 0.05). N=3.

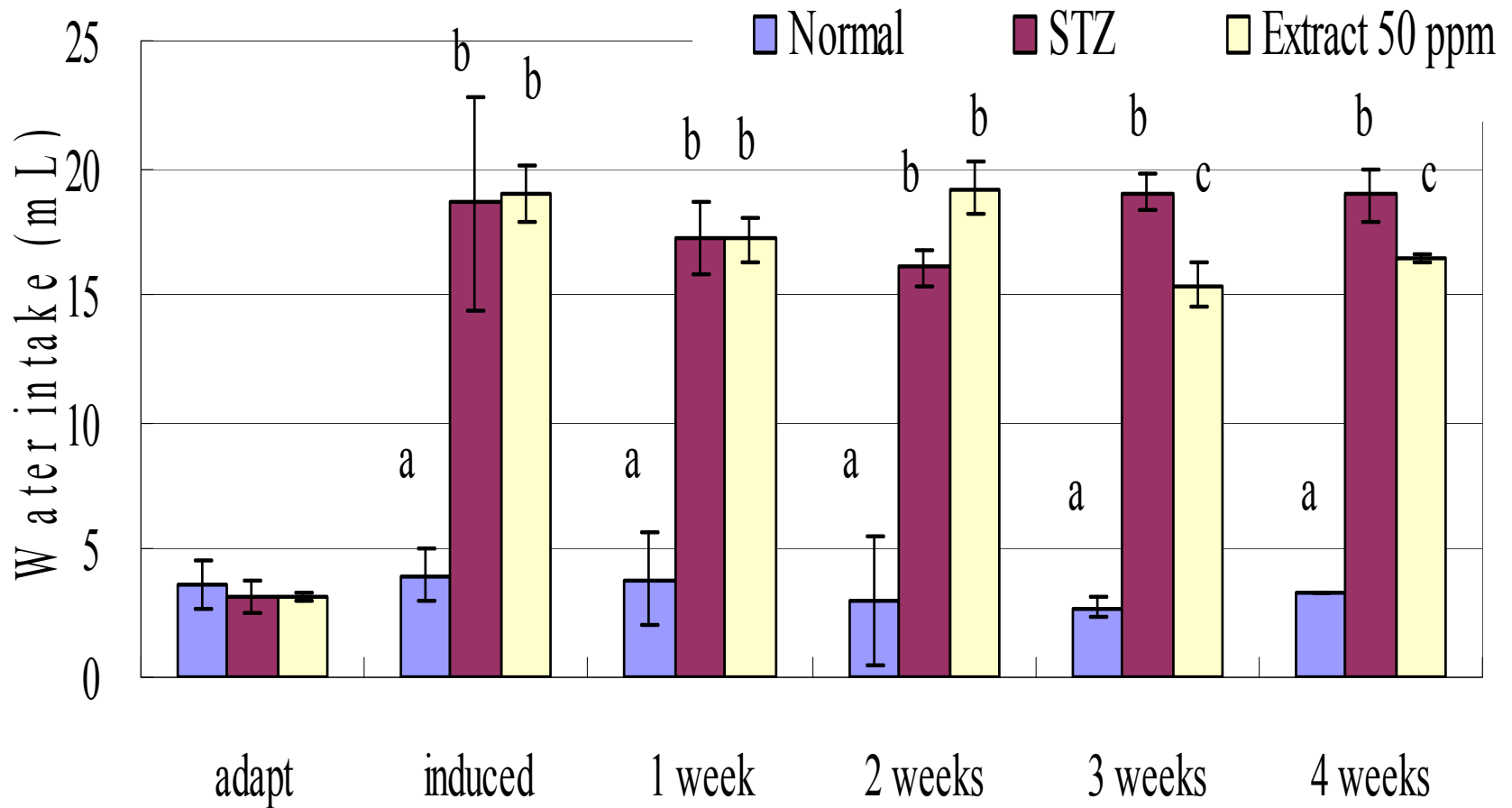


Fig. 7. Water intake change in the STZ induced and treated 28-days of the mice (C57BL/6J) treated .

Data represent means  $\pm$  SD. <sup>ab</sup> significant difference (P < 0.05). N=3.



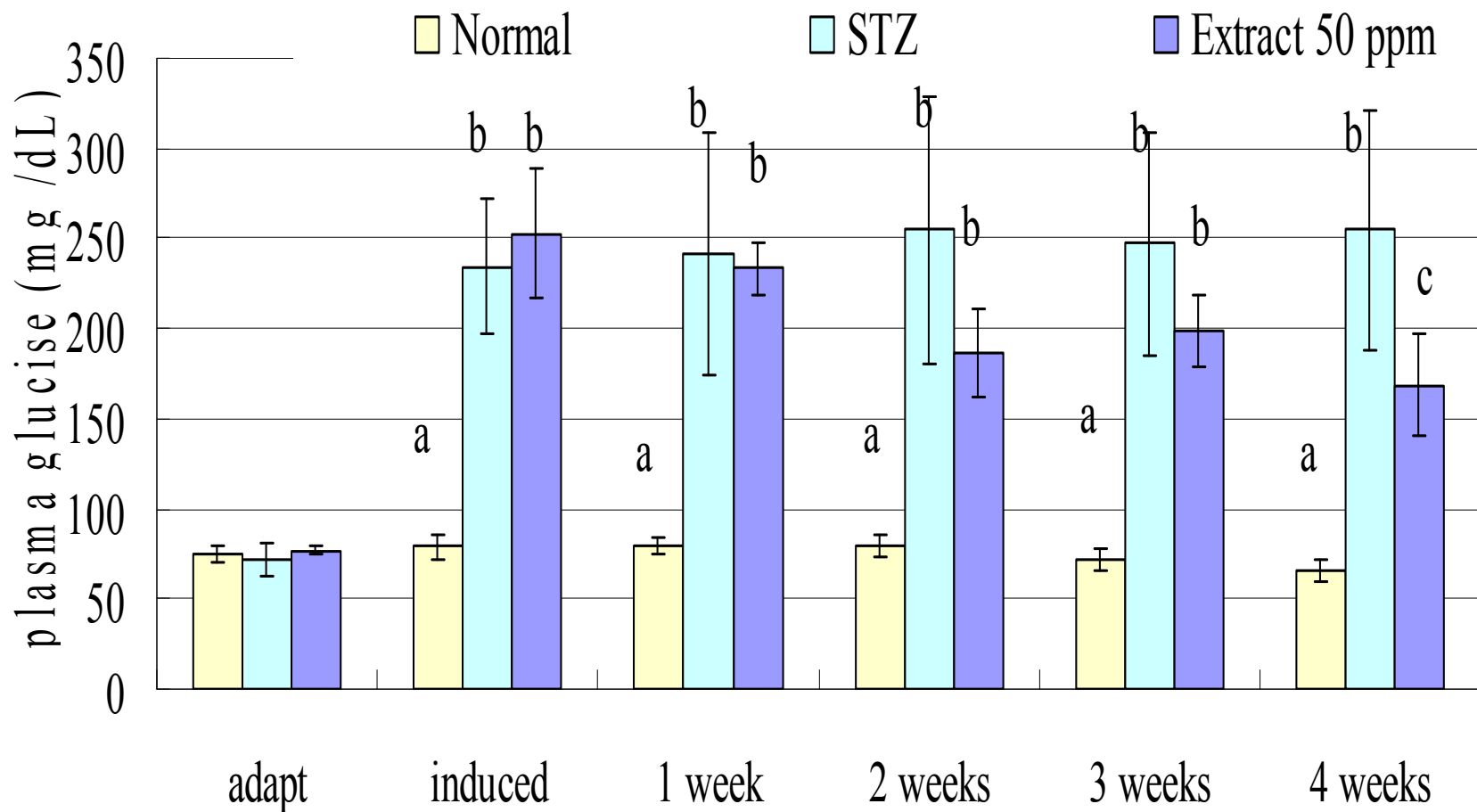


Fig. 8. Fasting plasma glucose in the STZ induced and treated 28-days mice (C57BL/6J) treated .

Data represent means  $\pm$  SD. ab significant difference ( $P < 0.05$ ). N=3.

# Conclusions

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- ❑ Chromium enriched *Ganoderma lucidum* fermented rice products has better polysaccharides, total phenol, ferrous ions and reducing power.
- ❑ Fermented rice products were extracted by 300W microwave 10 min with 25% alcohol to obtain higher crude triterpenes, polysaccharides and total chromium.
- ❑ Feeding 50 ppm extract in STZ mice had hypoglycemic effect.

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**Thanks for your attention.**