

The blood glucose lowering effect of Malaysian *Tinospora crispa* in rats

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Abstract. Diabetes is defined as a chronic hyperglycemia which should be countered by the effective, safe and readily available hypoglycemic agents. Herbal is among alternatives that have been used by society for years but lacks of documented evidences. *Tinospora crispa* (TC) is enriched by phytochemicals which potentially reduce blood glucose thus is useful for diabetic patients. This study aimed to investigate the potency of TC in reducing blood sugar and body weight. It involved 30 healthy rats divided into 5 groups namely: normal control, normal fed with TC extract, diabetic, TC-treated diabetic (dose 500 mg/kg w/w), and vitamin E-treated diabetic rats (60 IU). The body weight and fasting blood glucose were measured each week for 1 month. The administration of TC extract 500 mg/kg (w/w) helps to maintain body weight in diabetic rats and reduce the fasting blood glucose. TC is highly potent as hypoglycemic agents therefore needed to be explored further.

Keywords: *Tinospora crispa* (TC), fasting blood glucose, body weight

INTRODUCTION

Diabetes is resulted from uncontrolled blood glucose (hyperglycemia) which potentially causes complications to many vital organs after drug therapy. Treatments should be implemented when lifestyle modification and exercise are failed. The selected therapy should targeted the main problem existed in the body. In hyperglycemia, cells are exposed to free radicals, the reactive species which are responsible for oxidative stress that leads to the organ damage. Endogenous antioxidants are able to counter the action of free radicals. However, when the amount of free radicals exceeds the antioxidants, oxidative stress will take place. In this situation the consumption of external antioxidants is necessary.

Plants are natural sources that provide a plenty of antioxidants, such as flavonoid, polyphenols etc. Those compounds scavenge free radicals such as peroxide, hydroperoxide or lipid peroxy and thus inhibit the oxidative mechanisms that lead to degenerative diseases,

such as diabetes [1]. *Tinospora crispa* is among the plants that attract researchers to observe its activity in reducing blood glucose due to its chemical compounds that act as natural antioxidants.

The chemical constituents of TC extracts have been widely investigated. The extracts of stem and root of the plant contain quaternary alkaloids [2]. It contains the terpenoids and terpenoid glycosides [3]. The antioxidant property, flavonoid and total phenolic content of the aqueous crude extract of the stem have been investigated too. The flavonoids detected in TC are catechin (1.58 µg/µl), luteolin (0.85 µg/µl), morin (1.44 µg/µl), and rutin (1.38 µg/µl), which may be collectively responsible for the high antioxidant activity. The total phenolic content is 0.29±0.01 mg (GAE)/100g of fresh sample [4]. Limited data were found to proof the activity of Malaysian-TC in reducing blood sugar and its effect to body weight thus this study is important to conduct.

METHODOLOGY

Animals

Thirty rats weighing 250-300 grams were acclimatized for 2 weeks in a clean cage with a cycle of 12 hours dark and 12 hours of light. Water is provided ad libitum with standard

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pellet. Diabetes was induced by a single injection intraperitoneally of streptozosin (50 mg/kg body weight). Experimental animals are divided into 5 groups, including: normal (N) which received no treatment; normally treated (NT) which received TC extract (500 mg/kg); diabetic rats (D) were the control animals with diabetes; diabetic treated (DT) were diabetic animals which received 500 mg/kg TC extract and diabetic treated with vitamin E (DE) were diabetic animals which received 60 IU of vitamin E.

Preparation of TC extract

TC barks were obtained and determined at Jubli Perak Farm Park, Malaysia. Samples are cut into 2-3 cm sizes and then dried at 40°C for 5 days. The dried samples were then mashed into powder. The powder was soaked in 1:10 water in a 60°C water bath for 6 hours. The mixture was then filtered and lyophilized for 5 days to produce 2.08% (w/w).



Figure 1. Died TC stem

The Evaluation of blood glucose lowering effect of TC and its effect on body weight

Blood collection is performed on the tail vein using a glucometer (Accu Check Advantage 2). Measurement of blood sugar levels and body weight were carried out at weeks 0, 1, 2, 3 and 4.

RESULTS AND DISCUSSION

The effect of TC on body weight

The body weight changes during the study period were illustrated in the line graph in Figure 2. In diabetic groups (D, DT and DE) the body weight slightly increased from 303 grams (week 0) to about 320 grams (week 2). The body weight of diabetic TC treated (TC) maintained this value steadily till reached 331 grams in week 4. Conversely, for diabetic control (D) and diabetic treated with vitamin E (DE), the body

weight ameliorated since week 2 and it dropped to 265 grams and 277 grams in week 4 for group D and DE respectively.

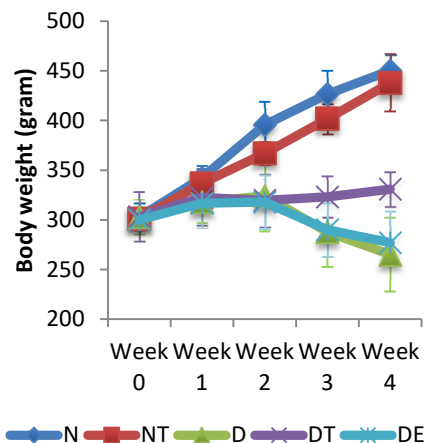


Figure 2. The mean of body weight of different groups during study period. Vertical lines represent SD.

The effect of TC on blood glucose

The effect of TC is shown in figure 3. Both diabetic groups, control and vitamin E treated rats, showed the slow decrease in blood glucose during the study. The value for diabetic control was 16.68 mmol/L in week 0 and dropped to 15.65±3.26 mmol/L in week 4. The mean fasting blood glucose of diabetic treated with vitamin E (DE) was close to diabetic control (D). In week 0, the value was 15.75±2.49 mmol/L and in week 4 it declined to 14.65±2.49 mmol/L.

The administration of TC aqueous extract in the diabetic treated rats (DT) reduced the elevated levels of fasting blood glucose throughout the treatment period considerably. The averages of fasting blood glucose in week 0 was 16.72±2.77 mmol/L, then it started to decline to 15.85±2.94 mmol/L at week 1 and continuously decreased till it dropped to 9.75±1.45 mmol/L at week 4.

The results of this study indicated that hyperglycemia deteriorated the body weight of diabetic animals. The administration of TC might prevent the loss of body weight to certain extent; however this reduced body weight effect could not be prevented by daily supplementation of vitamin E. In adult rats, diabetes might cause body weight loss and this was also seen in the present study. The consequences of diabetes such as hyperglycemia, hypoinsulinemia, polyphagia, polyuria and polydipsia may be accompanied by weight loss in adult diabetic rats within three

days after STZ induction. Then, within one week to ten days, the amount of those factors are almost stable, which indicates irreversible destruction of Langerhans islets [5].

The impairment of body weight observed in diabetic rats might be the result of increased protein break down due to unavailability to utilize carbohydrate for energy source [6]. In vivo study of diabetic experimental animals also showed a significant decrease of body weight in diabetic rats. The STZ was induced intraperitoneally at a dose of 55 kg/bw and resulted in fasting blood glucose of 275.18 ± 12.50 mg/dl and a noticeable reduced body weight [7].

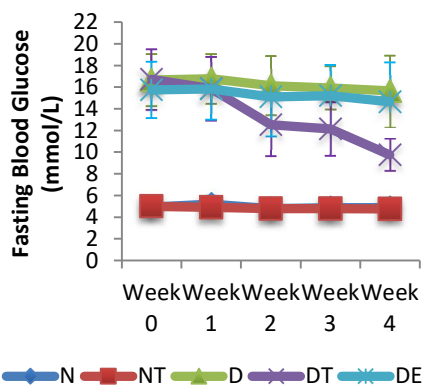


Figure 3. Mean fasting blood glucose level of different groups during study period. Vertical lines represent SD.

The TC administration led to the increase of glucose metabolism and thus enhanced body weight in this group to certain extent. The possible mechanism was caused by TC extract which slowly reduced the blood glucose level in blood there by potentiating the insulin effect (Sathishsekar & Subramanian, 2005) of the residual β -cells to be more potent and reducing the toxic effect of free radical generated from STZ induction.

There were some studies described how TC extract might decrease the fasting blood glucose. A previous in vitro study reported that TC ethanolic extract used at a dose of 250 mg/kg decreased the blood glucose level and increased the body weight of the diabetic rats. It increased serum insulin in diabetic rats received TC extract compared to the diabetic controls. This might be the reasons on how TC extract reduce the FBG [8].

Noor & Ashcroft [9] have elucidated the anti-hyperglycaemic activities of TC by studying its effect on intestinal glucose absorption and

glucose uptake into adipocytes. They found that the anti-hyperglycaemic effect was probably due to stimulation of insulin release via modulation of β -cell Ca^{2+} concentration and was not due to the involvement of intestinal glucose uptake or uptake of the glucose into the peripheral cells [9].

In this study, hypoglycemic action of TC extract might be due to stimulation of residual activity of β -cells. TC extract prevented the further damage of beta cell by decreasing free radical generation and it potentiated the work of residual β -cells by enhancing insulin release via modulation of β -cells Ca^{+} concentration.

CONCLUSION

We have demonstrated the effect of *Tinospora crispa* in decreasing fasting blood glucose in diabetic rats significantly. This study also showed that the consumption of TC were able to maintain the body weight.

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