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

SARAH FIRDAUSA¹, MAUNG MAUNG CHO², KHIN MAUNG MAUNG², NILAR AUNG², NORSIDAH KUZAIFAH², SURYAWATI SURYAWATI¹

¹Faculty of Medicine, Universitas Syiah Kuala, Darussalam, Banda Aceh Indonesia
²Kulliyyah of Medicine, International Islamic University Malaysia

**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 peroxyl 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 (1.58µg/µl), luteolin (0.85µg/µl), morin (1.44µg/µl), and rutin (1.38µg/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
pellet. Diabetes was induced by a single injection intraperitonially 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).

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.

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.
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].

There were some studies described how TC extract might decrease the fasting blood glucose in diabetic rats significantly. This study also showed that the consumption of TC were able to maintain the body weight.

ACKNOWLEDGMENT

The author was thankful to colleagues who had supported this work.

REFERENCE

[1] Halliwell B, Gutteridge J 1999 Free radicals in medicine and biology 3rd ed (New York: Oxford University Press)
[2] Bisset NG, Nwaiwu J.1983. Quaternary alkaloids of tinospora species. Planta Med 48 275-9.
[3] Praman, S., Mulvany, M. J., Allenbach, Y., Marston, A., Hostettmann, K., Sirirugsa, P., and Jansakul, C. 2011. Effects of an n-butanol extract from the stem of Tinospora crispa on blood pressure and heart rate in anesthetized rats. J. Ethnopharmacol. 133(2) 675-86.
[4] Amom, Bahari H, Isemaal S, Ismail NA, Md Shah Z, Shah MSA. 2009. Nutritional Composition, Antioxidant Ability and Flavanoid Content of Tinospora crispa stem. Adv in Nat Appl Sci 3(1) 88-94.
[5] Akbarzaadeh A, Norouzian D, Mehrabi MR, Jamshidi S, Farhangi A, Verdi AA, Moffin SMA, Rad B.L. 2007. Induction of diabetes by Streptozotocin in rats. Indian J Clin Biochem 22(2) 60-4.
[6] Chen V, Ianuzzo CD. 1982. Dosage effect of streptozotocin on rat tissue enzyme activities and glycogen concentration. Can. J. Physiol. Pharm. 60(10) 1251-6.
[7] Sathishsekar D., Subramanian S. 2005. Antioxidant properties of Momordica
The blood glucose lowering effect of Malaysian tinospora crispa in rats
(Sarah firdausa, Maung Maung Cho, Khin Maung Maung, Nilar Aung, Norsidah Kuzaijah, Suryawati Suryawati)

Charantia (bitter gourd) seeds on Streptozotocin induced diabetic rats. *Asia Pac. J. Clin. Nutr.* **14**(2) 153-8.

Poonsawat T, Baydoun A, Chomko S, Talubmook C 2011 *Cytotoxicity and Bioactivities of Extract from Tinospora Crispa Stems*. The 12th Graduate Research Conference; Thailand: Khon Koen University; p. 694-701.

Noor H, Ashcroft SJH. 1989. Antidiabetic effects of Tinospora crispa in rats. *J. Ethnopharmacol.* **27**(1-2) 149-161.