Available online at www.jpsscientificpublications.com

Life Science Archives (LSA)

ISSN: 2454-1354

Volume – 7; Issue - 2; Year – 2021; Page: 2094 – 2098

DOI: 10.22192/lsa.2021.7.2.1

Research Article

EVALUATION OF α-AMYLASE INHIBITORY ACTIVITY OF *Putranjiva roxburghii* Wall., *Chrysophyllum roxburghii* G. Don AND *Tephrosia purpurea* (L.) Pers.

H. L. Raghavendra[1] and T. R. Prashith Kekuda[2*]

[1]*Faculty of Medicine (FMB), São Paulo State University (UNESP), Botucatu -18618687, São Paulo State, Brazil*

[2]*Department of Microbiology, S.R.N.M.N College of Applied Sciences, Balraj Urs Road, Shivamogga, Karnataka, India*

Abstract

Diabetes mellitus is one of the metabolic disorders that affect the well-being of people all over the world. Inhibition of α-amylase activity seems to be an attractive strategy for managing type II diabetes mellitus. Interest in botanicals with α-amylase inhibitory activity is triggered due to some drawbacks that are associated with the use of commercial drugs. In this study, we report the α-amylase inhibitory activity of *Putranjiva roxburghii* Wall., *Chrysophyllum roxburghii* G. Don and *Tephrosia purpurea* (L.) Pers. The shade dried and powdered plants materials were subjected for Soxhlet extraction using methanol. Inhibitory activity of different concentrations of extracts was assessed against porcine pancreatic α-amylase by DNS method. IC_{50} values were recorded. Acarbose was used as reference standard. All the three plants displayed marked dose dependent inhibition of α-amylase activity. Among the selected plants, *C. roxburghii* was effective in showing inhibitory activity to highest extent while the extract of *T. purpurea* revealed least inhibitory activity as revealed by IC_{50} values. Inhibitory activity against α-amylase activity was in the order of *C. roxburghii* >*P. roxburghii* >*T. purpurea*. These plants can be used in suitable form to manage type II diabetes mellitus through inhibition of α-amylase activity.

Article History

Received : 05.02.2021

Revised : 22.02.2021

Accepted: 03.03.2021

Key words: Diabetes mellitus, α-amylase, Botanicals and DNS

1. Introduction

Diabetes mellitus (DM) is one of the metabolic disorders characterized by hyperglycemia that results from deficiency of in insulin secretion. Besides, the change in the food habit and genetic factors are also responsible for the onset of DM. The global prevalence of diabetes is increasing these years and is high among urban population.

Management of *type 2 diabetes mellitus (T2DM)* is accomplished with exercise, medication and changes in diet. Treatment of *T2DM* is carried out by decreasing postprandial hyperglycemia. The inhibition of two key enzymes of carbohydrate metabolism viz. α-glucosidase and α-amylase significantly decrease the post-prandial increase of blood glucose and its absorption. Hence, inhibition of these enzymes seems to be an attractive strategy for the management of blood glucose level in *T2DM* and borderline patients.

***Corresponding author*:** Dr. T. R. Prashith Kekuda

E.mail: p.kekuda@gmail.com

LSA ISSN: 2454-1354

Drugs such as acarbose, voglibose and miglitol are used to inhibit the activity these enzymes. However, these are known to cause some side effects such as weight gain, diarrhea and abdominal discomfort. As an alternative, botanicals are proven beneficial as they possess antidiabetic properties. Plants are reported to be exploited ethnomedicinally for managing diabetes in several parts of the world. Herbal drugs are effective and are considered generally safer, when compared to synthetic drugs. It has been shown that extracts of higher plants possess inhibitory activity against α-amylase and α-glucosidase enzymes (Tamil *et al*., 2010; Tundis *et al*., 2010; Karthik *et al*., 2011; Adisakwattana *et al*., 2012; Kajaria *et al*., 2013; Goyal, 2015; Wickramaratne *et al*., 2016; Nanok and Sansenya, 2020). The present study was conducted to evaluate α-amylase inhibitory activity of three plants viz. *Putranjiva roxburghii* Wall., *Chrysophyllum roxburghii* G. Don and *Tephrosia purpurea* (L.) Pers.

2. Materials and Methods

Collection and extraction of plant materials

The plant materials (Table - 1) were cleaned under running water to eliminate any adhering matter and dried under shade. The powdered plant materials were extracted using methanol by Soxhlet extraction. The solvent was filtered and evaporated. The crude extracts of selected plants were used to assess their inhibitory potential against α-amylase.

Table - 1: Plants used in this study

Name	Family	Habitat	Common name	Part used
P. roxburghii	Putranjivaceae	Tree	Indian amulet tree	Seeds
T. purpurea	Leguminosae	Herb or under shrub	Wild indigo	Leaves
C. roxburghii	Sapotaceae	Tree	Wild star apple	Leaves

Inhibitory activity extracts against α-amylase

The concentrated extracts were dissolved in dimethyl sulfoxide (DMSO) to obtain different concentrations of extracts (0 – 50 mg/ml). The 3, 5-dinitrosalicylic acid (DNS) method employed by Karthik *et al*. (2011) was used to assess porcine pancreatic α-amylase inhibitory activity of plant extracts. Acarbose was used as reference standard.

Statistical analysis

The experiment was conducted in triplicates. The IC_{50} values were calculated by the regression equation (Y= a + bX; where, X=concentrations; Y=% Inhibition) using Microsoft Office Excel 2010.

3. Results

In our study, the extract of all three plants exhibited a dose dependent inhibitory activity against α-amylase (Figure - 1). Among extracts, marked activity was demonstrated by extract of *C. roxburghii* (IC_{50} value 6.06 mg/ml) while least activity was shown by extract of *T. purpurea* (IC_{50} value 10.05 mg/ml). An inhibitory activity of 50 % and higher was observed at extract concentration of 5 mg/ml in case of *C. roxburghii* while *P. roxburghii* and *T. purpurea* extracts produced an inhibition of 50 % at a concentration of 10mg/ml and higher. Acarbose displayed stronger inhibitory (IC_{50} value 0.40 µg/ml) activity than that of extracts tested.

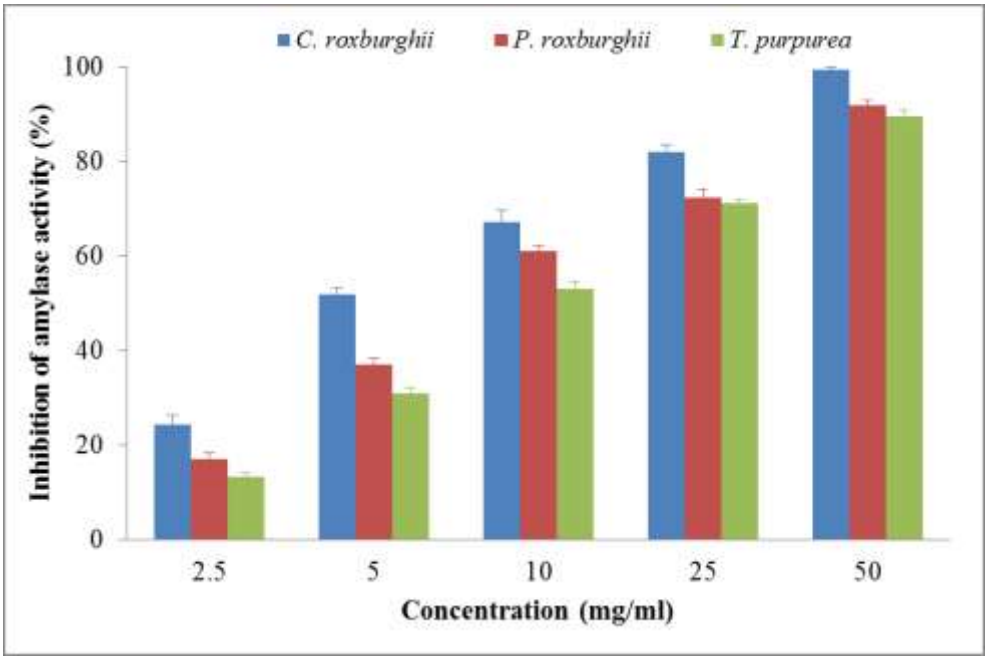

Figure - 1: Inhibition of α-amylase activity by extract of selected plants

4. Discussion

Pancreatic α-amylase is one of the key enzymes involved in the digestion of carbohydrates. This enzyme catalyzes the first step in starch hydrolysis to a mixture of smaller oligosaccharides consisting of maltose, maltotriose, and a number of α-(1→6) and α-(1→4) oligoglucans that are further acted upon by α-glucosidase to glucose units. Hence, cessation of starch degradation by these two enzymes can be crucial for the control of *T2DM*. Studies have shown that potential of crude extracts and purified compounds of plants to exhibit inhibitory activity against α-amylase (Ponnusamy *et al*., 2011; Sudha *et al*., 2011; Etxeberria *et al*., 2012; Bhagath *et al*., 2013; Nanok and Sansenya, 2020). In this study, the seed extract of *P. roxburghii* was effective in inhibiting amylase activity with an IC_{50} value of 7.88 mg/ml. In an earlier study, El-Manawaty and Gohar (2018) revealed the potential of extract of aerial parts of *P. roxburghii* to inhibit the activity of α-glucosidase. In an *in vivo* study, Varma *et al*. (2011) showed antidiabetic activity of ethanolic extract of *P. roxburghii* leaves in Alloxan induced diabetes in rats. In our study, marked enzyme inhibitory potential was observed in case of *C. roxburghii* extract. In a recent study, stem bark extract of *Chrysophyllum cainito* exhibited stronger inhibitory activity against α-glucosidase (Doan *et al*., 2018). Stem bark extract of *Chrysophyllum albidum* was also effective against α-glucosidase and α-glucosidase (Harley *et al*., 2020). In this study, among three extracts, least inhibitory activity was exhibited by extract of *T. purpurea*. Recently, Egharevba *et al*. (2019) showed inhibitory activity of *Tephrosia bracteolata* leaf extracts against α-glucosidase activity.

4. Conclusion

Marked dose dependent inhibition of α-amylase activity by extracts of selected plants was observed in this study. Among plants, *C. roxburghii* displayed stronger inhibitory activity as indicated by lower IC_{50} value. All the extracts have exhibited promising enzyme inhibitory activity which highlights the possible utilization of plants in the management of T2DM. Studies concerning isolation and characterization of active principles from crude extracts and their bio-efficacy demonstrations are to be carried out in future.

5. References

1) Adisakwattana S, Ruengsamran T, Kampa P, Sompong W. (2012). *In vitro* inhibitory effects of plant - based foods and their combinations on intestinal α-glucosidase and pancreatic α-amylase. *BMC Complement Altern Med*., 12: 110.
2) Bhagath K, Kekuda PTR, Mallikarjun N and Raghavendra HL. (2013). Anticaries and α-amylase inhibitory activity of *Jasminum arborescens* Roxb. (Oleaceae) leaves extract. *Int J Res Ayurveda Pharm.*, 4(6): 885 - 888.
3) Doan HV, Riyajan S, Iyara R and Chudapongse N. (2018). Antidiabetic activity, glucose uptake stimulation and α-glucosidase inhibitory effect of *Chrysophyllum cainito* L. stem bark extract. *BMC Complement Altern Med.*, 18(1): 267.
4) El-Manawaty MA and Gohar L. (2018). *In vitro* alpha-glucosidase inhibitory activity of Egyptian plant extracts as an indication for their antidiabetic activity. *Asian J Pharm Clin Res*., 11(7): 360 - 367.
5) Egharevba GO, Dosumu OO, Oguntoye SO, Njinga NS, Dahunsi SO, Hamid AA, Anand A, Amtul Z and Ujjukuri P. (2019). Antidiabetic, antioxidant and antimicrobial activities of extracts of *Tephrosia bracteolata* leaves. *Heliyon*, 5(8): e02275.
6) Etxeberria U, de la Garza AL, Campión J, Martínez JA and Milagro FI. (2012). Antidiabetic effects of natural plant extracts *via* inhibition of carbohydrate hydrolysis enzymes with emphasis on pancreatic alpha amylase. *Expert Opin. Ther. Targets*, 16(3): 269 - 297.
7) Goyal M. (2015). Traditional plants used for the treatment of diabetes mellitus in Sursagar constituency, Jodhpur, Rajasthan - An ethnomedicinal survey. *J Ethnopharmacol.*, 174: 364 - 368.
8) Harley BK, Dickson RA, Amponsah IK, Ngala RA, Berkoh D and Fleischer TC. (2020). Antidiabetic effect of *Chrysophyllum albidum* is mediated by enzyme inhibition and enhancement of glucose uptake *via* 3T3-L1 adipocytes and C2C12 myotubes. *Asian Pac J Trop Biomed.*, 10: 387 - 396.
9) Kajaria D, Ranjana, Tripathi J, Tripathi YB and Tiwari S. (2013). *In vitro* α amylase and glycosidase inhibitory effect of ethanolic extract of antiasthmatic drug - Shirishadi. *J. Adv. Pharm. Technol. Res.*, 4(4): 206 - 209.
10) Karthik S, Nandini KC, Kekuda PTR, Vinayaka KS and Mukunda S. (2011). Total phenol content, insecticidal and amylase inhibitory efficacy of *Heterodermia leucomela* (L). *Annals of Biological Research*, 2(4): 38 - 43.
11) Nanok K and Sansenya S. (2020). α-Glucosidase, α-amylase, and tyrosinase inhibitory potential of capsaicin and dihydrocapsaicin. *J Food Biochem.*, 44(1): e13099.
12) Ponnusamy S, Ravindran R, Zinjarde S, Bhargava S and Ravi Kumar A. (2011). Evaluation of traditional Indian antidiabetic medicinal plants for human pancreatic amylase inhibitory effect *in vitro*. *Evid Based Complement Altern Med*., 2011: 515647.
13) Sudha P, Zinjarde SS, Bhargava SY and Kumar AR. (2011). Potent alpha-amylase inhibitory activity of Indian ayurvedic medicinal plants. *BMC Complement Altern Med*., 11: 5.
14) Tamil IG, Dineshkumar B, Nandhakumar M, Senthilkumar M and Mitra A. (2010). *In vitro* study on α-amylase inhibitory activity of an Indian medicinal plant, *Phyllanthus amarus*. *Indian J Pharmacol.*, 42(5): 280 - 282.
15) Tundis R, Loizzo MR and Menichini F. (2010). Natural products as alpha-amylase and alpha-glucosidase inhibitors and their hypoglycaemic potential in the treatment of diabetes: an update. *Mini Rev Med Chem.*, 10(4): 315 - 331.

16) Varma A, Jain SK and Alok S. (2011). Hypoglycemic activity of *Putranjiva roxburghii* Wall. in alloxan induced diabetic rats. *Int. J. Pharm. Sci. Res.*, 2(1): 160 - 164.

17) Wickramaratne MN, Punchihewa JC and Wickramaratne DB. (2016). *In vitro* alpha amylase inhibitory activity of the leaf extracts of *Adenanthera pavonina*. *BMC Complement Altern Med.*,16(1): 466.

Access this Article in Online

Quick Response Code	
Website	**www.jpsscientificpublications.com**
DOI Number	**DOI: 10.22192/lsa.2021.7.2.1**
Thomson Reuters Researcher ID	**L – 5547 – 2016**
ISI Impact Factor	**4.206**

How to Cite this Article:

H. L. Raghavendra and T. R. Prashith Kekuda. 2021. Evaluation of α-Amylase Inhibitory Activity of *Putranjiva roxburghii* Wall., *Chrysophyllum roxburghii* G. Don and *Tephrosia purpurea* (L.) Pers. *Life Science Archives*, 7(2): 2094 – 2098.

DOI: 10.22192/lsa.2021.7.2.1