Journal of Pharmaceutical Research International

18(6): 1-6, 2017; Article no.JPRI.36067
ISSN: 2456-9119
(Past name: British Journal of Pharmaceutical Research, Past ISSN: 2231-2919, NLM ID: 101631759)

Phytochemical Screening Antioxidant and Alpha-glucosidase Inhibitory Activities of *Fagopyrum tataricum* L. Extract

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Authors' contributions

This work was carried out in collaboration between all authors. Author MW designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors MU and BAC supervised this research work. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/JPRI/2017/36067
Editor(s):
(1) Nawal Kishore Dubey, Centre for advanced studies in Botany, Banaras Hindu University, India.
Reviewers:
(1) Adalberto Di Benedetto, University of Buenos Aires, Argentina.
(2) Md. Abu Sayed, Hajee Mohammad Danesh Science and Technology University, Bangladesh.
Complete Peer review History: http://www.sciencedomain.org/review-history/21318

Original Research Article

Received 11th August 2017
Accepted 22nd September 2017
Published 10th October 2017

ABSTRACT

Objective: The objective of this work was the screening of different phytoconstituents and invitro antioxidant potential and α-glucosidase inhibitory activity of aerial parts of *Fagopyrum tataricum*.
Methods: Preliminary phytochemical screening was performed by using standard protocols. The antioxidant activity was determined by using spectroscopic method against 1, 1-diphenyl-2-picrylhydrazyl (DPPH) and α-glucosidase inhibition assay.
Results: The plant extract also shows potent antioxidant and α-glucosidase inhibitory potential against the tested methods.
Conclusion: From the results it seen that this plant exhibits significant antioxidant and α-glucosidase inhibitory potential.

Keywords: Fagopyrum tataricum L.; phytoconstituents; antioxidant; DPPH; α-glucosidase inhibition.

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1. INTRODUCTION

The over production of free radical in the human body for a long period of time may cause oxidative damage, eventually leading to chronic neurodegenerative disorders, diabetes mellitus [DM] and cancer [1]. Some biochemical and physiological reactions in the body and external environment is the cause of production of free radicals i.e. hydroxyl radicals, superoxide, peroxides, and singlet oxygen, as a byproduct [2]. The oxidative shielding acts as a defense mechanism by either decreasing chemicals in the body or the cellular uptake of toxic chemicals or to kill the cell by apoptosis and thus avoid the spreading to the neighboring cells [3]. Free radicals are major factor that are responsible for causing many chronic and neurodegenerative diseases like inflammation, coronary heart disease, stroke, cancer and DM [4]. Many synthetic antioxidants have shown toxic and/or mutagenic effects, which have shifted the attention towards the naturally occurring antioxidants [5]. Plants are the good source of biologically active compounds known as phytochemicals [6]. Because of their benefits on health, antioxidants are considered an important phytoconstituents. Vegetables, fruits, condiments and herbs contain a wide variety of free radical scavenging molecules such as phenolic compounds, nitrogen compounds, vitamins, and terpenoids, which have high antioxidant activities [7,8].

Formation of free radicals in the body are also the cause of diabetes mellitus (DM) [9]. DM is the most common endocrine disorder that affects 200 million people of whole world population [10]. The prevalence of DM will increase up to 366 million in 2030 [11]. The prevalence of DM has been increased under developed and middle-income countries due to different factors such as lack of physical activity and obesity due to dietary changes [12]. The indication of DM is hyperglycemia which is mainly due to lack of insulin action, insufficient insulin secretion or both [13]. The common mechanism for the treatment of DM is to retarding the conversion of polysaccharides to glucose by inhibiting *α*-glucosidase (carbohydrates-hydrolyzing enzyme) for absorption in the blood stream [14]. For the therapy of type II DM some synthetic *α*-glucosidase inhibitors, such as miglitol, voglibose and acarbose are clinically used now a day [15]. The efficacy of modern synthetic hypoglycemic drugs start to decline with long term use; because these synthetic agent causes gastro intestinal tract side effects and these drugs are very costly [16,17]. The major gastro intestinal side effects due to the use of these synthetic *α*-glucosidase inhibitors are diarrhea, abdominal discomfort, bloating and flatulence [18].

Free radicals play a significant role in development of DM. It is suggested that oxidative stress is the most common pathogenic cause to insulin resistance, β-cell dysfunction, impaired glucose tolerance and ultimately leading to type II DM [19]. Oxidative stress produces type II DM. In diabetic patients, the proposed mechanism that increases the oxidative stress consist of compromised antioxidant defenses, formation of advanced glycated end products, glucose autoxidation and a change in the glutathione redox status [20]. For relieving type II DM consumption of food which is rich in antioxidant is help full.

F. tataricum commonly known as a buckwheat is an herbaceous plant that belongs to the family polygonaceae [21]. The genus *Fagopyrum* consists of 16 species, a few of which have been newly discovered and only 4 species are found in Pakistan [22]. *F. tataricum* tea was shown to protect from leg oedema in patients with chronic venous insufficiency [23]. The use of *F. tataricum* herb is recommended for the prophylaxis and treatment of diabetic patients suffering from retinopathy [24]. *F. tataricum* flour is gluten free and is thus an important ingredient in diets or food products for people suffering from coeliac disease [25].

The evaluation of antioxidant and α-glucosidase inhibitory activities may be used for preliminary observations on pharmacological activities because natural compounds from plants that are considered to be safe have therapeutic effects and fewer health side effects than synthetic medicines [26]. The present study was designed to investigate the antioxidant and *α*-glucosidase inhibitory activities of aerial parts of *F. tataricum.*

2. MATERIALS AND METHODS

2.1 Collection and Identification of Plant Material

The plant was collected from the surrounding of Bahauddin Zakariya University, Multan in the month of August and was identified by Prof. Dr. Altaf Ahmad Dasti, Institute of Pure and Applied Biology, Bahauddin Zakariya University, Multan.

2.2 Antioxidant Activity: DPPH (1, 1, Diphenyl, 2-Picrylhydrazyl) Method

In 96-well plates 10 µl sample of *F. tataricum* was added after then 90 µl of 100 µM methanolic DPPH solution was added as well. The resultant 100 µL solution was mixed and incubated at 37°C for 30 min. Quercetin was used an standard antioxidant. The absorbance decrease was measured at 517 nm using a Synergy HT Bio Tek® USA micro plate reader. The DPPH inhibition (%) was calculated as following.

$$\text{DPPH scavenging activity (\%)} = \frac{A0-A1}{A0} X\ 100$$

Where A_0 and A_1 are control and sample absorbance respectively. IC_{50} shows the level at which 50% of the radicals were scavenged.

2.3 Alpha-glucosidase Inhibition Assay

Fagopyrum tataricum sample (10 µL) was dissolved in 70 µL of buffer phosphate (50 mM, pH 6.8) and 10 µL of enzyme solution. The sample was mixed and pre-incubated at 37°C for 10 minutes and pre-read at 400 nm. Reaction was started by the addition of 10 µL of substrate. Mixture were incubated at 37°C for 30 minutes. A control 0.5 _nM Acarbose were used after the incubation. Absorbance was measured at 400nm by using a 96 well plate reader.

$$\text{Inhibition (\%)} = \frac{(\text{A0} - \text{A1})}{(\text{A0})} X100$$

A_0 and A_1 are control and sample absorbance respectively.

2.4 Statically Analysis

Experiments were performed in triplicate. The results are expressed as mean ± SE. The concentration response curve was obtained by plotting inhibition percentages versus concentrations. IC_{50} value (half-maximal inhibitory concentration) of the sample was obtained graphically from an inhibition curve. Statistical calculations were carried out using IBM SPSS Statistics.

3. RESULTS

To evaluate this medicinal potential of *F. tataricum* extract was screened by using standards methods of in-vitro biological assays. These include, antioxidant and *α*-glucosidase inhibition assay. *F. tataricum* exhibited significant antioxidant activity. The % inhibition found to be 87.33±1.12 and its IC_{50} value was 159.51±1.29. Quercetin was used as a standard to check the antioxidant activity of *F. tataricum*. Methanol extract of *F. tataricum* also showed *α*-glucosidase inhibition activity. At concentration of 0.5 mg/mL % inhibition of *α*- glucosidase was 63.88±1.35 and its IC_{50} value was 391.55±1.44. Acarbose was used as a standard drug.

4. DISCUSSION

Free radicals are formed in our body due to different endogenous and exogenous factors which are responsible for different life threatening diseases like cardiovascular disease, cancer and DM. Antioxidants neutralize the free radicals that are responsible for cell damage. Natural antioxidants from plant sources are safer to health and have better potential than synthetic antioxidants [27]. Many plants have been reported to have free radical scavenging/ antioxidants potential. At concentration of 100 µg/mL methanol extract of *Ecbolium viride* (Forssk) have reducing power by DPPH 78.25±0.004 by using Quercetin as a standard [28].

Table 1. Antioxidant and alpha glucosidase inhibitory activities of methanol extract of aerial part of *F. tataricum*

Treatments	Antioxidants concentration (mg-mL^{-})	Inhibition at 0.5 mg-mL^{-} (%)	IC_{50} (µg-mL^{-})
F. tataricum	0.5	87.33±1.12	159.51±1.29*
Quercetin-control	0.5	91.50 ± 0.91	16.96 ± 0.14
F. tataricum	0.5	63.88 ±1.35	391.55±1.44*
Acarbose- control	0.5	92.23 ± 0.14	38.25 ± 0.12

*One way anova test was applied and value of p < 0.05 was considered as significant and shown by**

Diabetes is one of the world's greatest health problems, affecting about 171 million people and most of these will be dominated by those suffering from type II DM [29]. One of the strategies for the treatment of DM is the inhibition of carbohydrates digesting enzyme such as *α*-glucosidase in the gastrointestinal glucose absorption thereby lowering postprandial glucose level [30]. *α*-glucosidase inhibitors delay the breakdown of carbohydrate in the small intestine and diminish the post-prandial blood glucose excursion [31]. Plant phenolics are natural α-glucosidase inhibitors because they inhibit intestinal carbohydrate digesting enzymes owing to their protein-binding capability [32].

Many plants have been reported to have antidiabetic activity and being used in ayurveda for the treatment of DM [33]. *Phoenix dactylifera* and *Capparis spinosa* plants extracts have shown *α*-glucosidase inhibition of 55.02 (%) and 53.88 (%) respectively when they was given at 25 mg-mL^{-} concentration [34]. While the % inhibition of *F. tataricum* extract was 63.88±1.35 and its IC_{50} value 391.55±1.44. The results shows that *F. tataricum* extract is the one of most potent *α*-glucosidase inhibitor than the above mentioned plant extracts. So it causes delay in digestion, which would in turn decreases in the absorption of glucose, as a result the reduction of postprandial blood glucose level elevation.

Methanol extract of *F. tataricum* possess antioxidant and alpha glucosidase inhibitory activities. Plants which scavenge the free radicals and inhibit the *α*-glucosidase enzyme have antioxidant and anti-diabetic potential, which is directly related to the total amount of polyphenols and flavonols [35]. It is concluded that methanol extract of *F. tataricum* have scavenge the free radicals and inhibit the *α*-glucosidase enzyme, that might be due to polyphenols. Further studies on active constituents isolation along with in vivo animals study is needed to be investigated in detail to explore its pharmaceutical/neutraceutical use.

5. CONCLUSION

The results of this in-vitro study clearly indicated that methanolic extract of aerial part of *F. tataricum* have antioxidant and α-glucosidase inhibitory activity. These attributes when combined in one plant would be potentially useful to manage the DM and oxidative stress. The results suggested that phenolic compounds are the major contributor to the antioxidant and α-glucosidase inhibitory capabilities of this plant. Consequently, this plant could be suggested as a potential natural source of antioxidant and antidiabetic compounds for the prevention or the treatment of diabetes and its complications. Further studies on active constituents isolation along with in vivo animals study is needed to be investigated in detail to explore its pharmaceutical/neutraceutical use.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

ACKNOWLEDGEMENT

The author is grateful to Prof. Dr. Bashir Ahmad Chaudhary, Dean and chairman Department of Pharmacy, Bahauddin Zakariya University, Multan for providing facilities to carrying out research work on *F. tataricum.* Furthermore I am thankful to Muhammad Tahir Haseeb, Faculty of Pharmacy, University of Sargodha for providing me guidelines in writing this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Halliwell B. Free radicals and antioxidants: Updating a personal view. Nutr Rev. 2012; 70(5):257-265.
2. Durackova Z. Some current insights into oxidative stress. Physiol Res. 2010;59(4): 459-469.
3. Tiwari AK. Antioxidants, new-generation therapeutic base for treatment of polygenic disorders. Curr Sci. 2004;86(8):1092-1102.
4. Scalbert A, Manach C, Remesy C, Morand C. Dietary polyphenols and the prevention of diseases critical. Crit Rev Food Sci Nutr. 2005;45:287-306.
5. Dasgupta N, De B. Antioxidant Activity of *Piper Betle* L. Leaf extract *in vitro*. Food Chem. 2004;88:219–224.
6. Hausladen A, Stamer JS. Nirosative stress. Method in Enzymology. 1999;300: 389-395.
7. Tusevski O, Kostovska A, Iloska A, Trajkovska L, Simic SG. Phenolic

production and antioxidant properties of some Macedonian medicinal plants. Cent Eur J Biol. 2014;9(9):888-900.

8. Lara Q, Maysam S, Zaid A. Comparative study of natural anti-oxidant activity for ginger-oregano and Syrian thyme. Int J Pharm Sci Rev Res. 2013;22(1):56-58.
9. Tiwari BK, Pandey KB, Abidi AB, Rizvi SI. Markers of oxidative stress during diabetes mellitus. J Biomark. 2013;2013:1-8.
10. Wais M, Nazish I, Samad A, Beg S, Abusufyan S, Ajaj SA, Aqil M. Herbal drugs for diabetic treatment: An updated review of patents. Recent Pat Antiinfect Drug Discov. 2012;7(1):53-59.
11. Wild S, Roglic G, Green A, Scree R, King H. Global prevalence of diabetes. Estimates for the year 2000 and projections for 2030. Diabetes Care. 2004; 27(5):1047-1053.
12. Popkin BM, Adair LS, Ng SW. Global nutrition transition and the pandemic of obesity in developing countries. Nutr Rev. 2012;70(1):3-21.
13. American Diabetes Association. Diagnosis and classification of diabetes mellitus. Diabetes Care. 2012;35(1):S64–S71.
14. Kumar S, Narwal S, Prakash O. *α*-glucosidase inhibitor from plants: A natural approach to treat diabetes. Pharmacogn Rev. 2011;9:19-29.
15. Zhang H, Wang G, Beta T, Dong J. Inhibitory properties of aqueous ethanol extracts of propolis on alpha-glucosidase. Evid Based Complement Altern Med. 2015;2015: 1-7.
16. Satyanarayana T, Katyayani BM, Latha HE. Hypoglycemic and antihyperglycemic effect of alcoholic extract of *Euphorbia leucophylla*. Phcog Mag. 2006;2:244–253.
17. De Melo EJM, Raposo MJ, Lisboa Neto JA. Medicinal plants in the healing of dry socket in rats: Microbiological and microscopic analysis. Phytomedicine. 2002;9:109–116.
18. Cheng AYY, Fantus IG. Oral antihyperglycemic therapy for type II diabetes mellitus. Canadian Med Assoc J. 2005;172(2):213–226.
19. Ceriello A, Motz E. Is oxidative stress the pathogenic mechanism underlying insulin resistance, diabetes, and cardiovascular disease? The common soil hypothesis revisited. Arterioscler Thromb Vasc Biol. 2004;24:816-823.
20. Davison GW, George L, Jackson SK, Young IS, Davies B, Bailey DM, Peters JR, Ashton T. Exercise, free radicals, and lipid peroxidation in type I diabetes mellitus. Free Radic Biol Med. 2002;33(11):1543-1551.
21. Holasova M, Fiedlerova V, Smrcinova H, Orsak M, Lachman J, Vavreinova S. Buckwheat—the source of anti-oxidant activity in functional foods. Food Res Int. 2002;35(2):207–211.
22. Qaiser M. Polygonaceae. In: Flora of Pakistan. (Eds.): S.I. Ali and M. Qaisar. Department of Botany, Karachi University and Missouri Botanical Garden, St Louis, Missouri, U.S.A. 2001;205: 110-124.
23. Ihme N, Kiesewetter H, Jung F, Hoffmann KH, Birk A, Muller A, Grutzner KI. Leg oedema protection from a buckwheat herb tea in patients with chronic venous insufficiency: A single centre, randomised, double blind, placebo-controlled clinical trial. Eur J Clin Pharmacol. 1996;50(6): 443-447.
24. Archimowiz-Cyrylowska B, Adamek A, Drozdzik M, Samochowiec L, Wojcicki J. Clinical effect of buckwheat herb, *Ruscus* extract and *troxerutin* on retinopathy and lipids in diabetic patients. Phytother Res. 1996;10:659–662.
25. Alvarez-Jubete L, Arendt EK, Gallagher E. Nutritive value of Pseudocereals and their increasing use as functional gluten free ingredients. Trends Food Sci Tech. 2010; 21:106-113.
26. Deng J, Cheng W, Yang G. A novel antioxidant activity index (AAU) for natural products using the DPPH assay. Food Chem. 2011;125:1430-1435.
27. Ansari AQ, Ahmed SA, Waheed MA, Juned SA. Extraction and determination of antioxidant activity of *Withania somnifera* Dunal. Eur J Exp Biol. 2013;3(5):502-507.
28. Ashoka BVL, Arunachalam G, Jayaveera KN, Madhavan V, Banu S. Free radical scavenging activity of methanolic extract of *Ecbolium viride* (Forssk). Alston Roots. Pharm Lett. 2011;3(4):285-288.
29. Gershell L. Type 2 diabetes market. Nat Rev Drug Discov. 2005;4:367–368.
30. Mccue P, Kwon YI, Shetty K. Anti-amylase, anti-glucosidase and anti-angiotensin I-converting enzyme potential of selected foods. J Food Biochem. 2005;29(3):278–294.
31. Kwon YI, Apostolidis E, Shetty K. Evaluation of Pepper (*Capsicum annuum*) for management of diabetes and

hypertension. J Food Biochem. 2007; 31(3):370–385.
32. Fornari T, Vicente G, Vazquez E, Garcia-Risco MR, Reglero G. Isolation of essential oil from different plants and herbs by supercritical fluid extraction. J Chromatogr A. 2012;1250:34–48.
33. Sama K, Murugesan K, Sivaraj R. Invitro alpha amylase and alpha glucosidase inhibition activity of crude ethanol extract of *Cissus arnottiana*. Asian J Plant Sci. 2012;2(4):550-553.
34. Amiri A, Azemi ME, khodayar MJ, Namjoyan F. *In vitro α*- amylase and *α*-glucosidases inhibitory effects of some plant extracts. Int J Pharmacognosy and Phytochem Res. 2015;7(2):315-318.
35. Po-Chow H, Huang G, Ho Y, Lin Y, Huang S, Chiang Y, Tseng M, Chang Y. Activities of antioxidants, *α*-glucosidase inhibitors and aldose reductase inhibitors of the aqueous extracts of four *Flemingia* species in Taiwan. Bot Stud. 2010;51:293-302.

Peer-review history:
The peer review history for this paper can be accessed here:
http://sciencedomain.org/review-history/21318