REPORT

Anti-glycation and Anti-oxidation properties of Capsicum frutescens and Curcuma longa fruits: Possible role in prevention of diabetic complication

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Abstract: The accumulation of advanced glycation end products (AGE’s) in the body, due to the non-enzymatic glycation of proteins is associated with several pathological conditions like aging and diabetes mellitus. Hence a plant having anti-glycation and anti-oxidation potentials may serve as therapeutic agent for diabetic complications and aging. In this study the anti-glycation and anti-oxidation properties of crude methanolic extracts of fruits of Capsicum frutescens and Curcuma longa were investigated. Among the two C. frutescens had more anti-glycation ability with a minimum inhibitory concentration (MIC50) of 90µg/ml as compared to 324µg/ml MIC50 of C. longa. Curcuma longa had the more anti-oxidation potential i.e. 35.01, 30.83 and 28.08% at 0.5mg, 0.25mg and 0.125mg respectively.

Keywords: AGE’s, Anti-glycation, Anti-oxidation, Capsicum frutescens, Curcuma longa.

INTRODUCTION

Diabetes mellitus a condition characterized by hyperglycemia. Diabetes affects around a 100 million people worldwide and such individuals are susceptible to long term complications of cataract, neuropathy, atherosclerosis, embopathy, retinopathy and slow wound healing abilities (Nathan, 1993 and Muhammed and Nessar, 2006). Hyperglycemia accelerates the process of glycation of proteins, which is supported by various studies over the past few decades that had generated an overwhelming body of evidence. These studies suggest that glycation is involved in several biochemical abnormalities in diabetes mellitus (Baynes et al., 1989). Glycation of proteins is a non-enzymatic reaction (Maillard reaction) that occurs between the carbonyl group of sugar and amino group of proteins forming Amadori products which on further oxidation, rearrangement and reduction reactions result in the production of AGE’s such as pentosidine, pyralline and carboxymethyllysine (Baynes et al., 1989; Bry et al., 2001; Sing et al., 2001; Ulrich and Cerami, 2001).

Recently scientists have given considerations to agents that possess the ability to inhibit the AGE’s formation because glycation is responsible for most of diabetic complications. Amino-guanidine particularly, has been studied extensively and its clinical trials managed to enter phase three (Sing et al., 2001; Edelstein and Brownlee, 1992; Freedman et al., 1999). However these trials were terminated due to safety concerns associated with it (Sing et al., 2001; Freedman et al., 1999). Other agents like pyridoxamin, carnosine, phenyl thiazoliumhave also been reported for their anti-glycation abilities however none of these agents shows significant level of anti-glycation (Sing et al., 2001; Stitt et al., 2002; Vasan et al., 1996).

Oxidation reaction is one of the reactions that is involved to covert glycated proteins into AGE’s. It is reported in several studies that the formation of AGE’s from Amadori products occurs partly because of oxidation (Rashbar and Figarolia, 2003). Therefore agents with anti-oxidation properties that can prevent further oxidation of Amadori products may halt the accumulation of AGE’s (Bonnefont, 2002).

C. frutescens (chilies) has been used as food additive and as an anti-microbial agent for years (Siehta et al., 1984). Furthermore some studies have also indicated the anti-oxidation potential of C. frutescens (Pellegrini et al., 2003). Curcuma longa (turmeric) has also been an important part of traditional medicines in the subcontinent region. They are used in conditions like nausea, indigestion, inflammation, improving skin complexion, liver diseases and wound healing (Charak, 2002; Jain, 1991; Chemexcil, 1992). Some studies have indicated that C. longa can be used as antibacterial, anti-fungal and anti-mutagenic agent (Guddadaranga, 2002). In this study we investigated the anti-glycation and anti-oxidation properties of the crude methanolic extract of the fruits from C. frutescens and C. longa.

MATERIALS AND METHODS

Plant material
Fruits of C. frutescens and C. longa were collected from Mardan which were kindly identified by Prof. Dr. Abdur
Extracted Text:

Rasheed, Plant taxonomist, Department of Botany, University of Peshawar, Khyber Pukhtunkhwa, Pakistan.

Extraction

The fruits of C. frutescens and C. longa were kept in shade for drying. After drying they were chopped and ground to powder. The powdered fruits were soaked in methanol for 15 days (twice) at room temperature. Each time the mixture was filtered and the filtrates were combined and concentrated to crude methanolic extracts using rotatory evaporator at 40°C.

Materials

The materials used for in vitro anti-glycation assay were: Bovine Serum Albumin (BSA), D-glucose, Sodium dihydrogen phosphate (NaH2PO4), Sodium Chloride (NaCl), Potassium Chloride (KCl), Amino guanidine (Merck), Retinoid (Merck) and Tri-Chloro Acetic Acid (TCA) (Sigma). While alkaline PBS (137nM NaCl, 8.1nM Na₂HPO₄, 2.68mM KCl, 1.47mM KH₂PO₄) was prepared and its pH adjusted to 7.4 with 0.25N NaOH.

Nitric Oxide (NO) free radical scavenging assay

To perform NO free radical scavenging assay the method of Ebrahimzadeh et al., 2009 was followed.

RESULTS

Anti-glycation assay

The UV double beam spectrophotometric analyses of both the reaction and test mixtures for C. frutescens and C. longa are shown in the fig 1. It can be seen that as the concentration of the C. longa extract increases the absorbance decrease and reaches minimum of 0.024 at 130µL. Same trend is observed for C. frutescens too with the exception that on the unexpected rise in absorbance from 90µL to 130µL. Minimum absorbance (0.027nm) for C. frutescens occurs at 90µL.

Fig. 1: Anti-glycation properties of amino guanidine, Curcuma longa and Capsicum frutescens

It can be inferred from fig 1 that the minimum inhibitory concentration (MIC₅₀) of amino guanidine and C. longa are 70.14µg/ml and 324µg/ml respectively, while for C. frutescens it is 90µg/ml. fig 2 shows the percent inhibition of Millard reaction or glycation by amino guanidine and...
the two plants extract verses the amount of test sample used i.e. sample concentration.

**Fig. 2**: Percent inhibition of Maillard reaction at different concentration of amino guanidine, *Curcuma longa* and *Capsicum frutescens*

**NO free radical scavenging Assay**

The anti-oxidation potential of both *C. longa* and *C. frutescens* was compared with ascorbic acid (Vitamin-C) as standard. Results obtained from NO scavenging assay are shown in table 1 and fig. 3.

**Fig. 3**: Anti-oxidation potential of both *Curcuma longa* and *Capsicum frutescens* in comparison with the standard ascorbic acid.

It can be seen from both the fig that *C. longa* has anti-oxidation potential exceeding the anti-oxidation potential of the standard at all the concentration. While *C. frutescens* showed anti-oxidation potential at all the test concentrations but its percent anti-oxidation effect is less than the standard and *Curcuma longa*.

**DISCUSSION**

As far as we had investigated there has been no anti-glycation study on *C. frutescens* and this study is the first one showing that they do have anti-glycation potentials. Our findings for the anti-glycation in-vitro assay showed that among the two, *C. frutescens* is more effective as an anti-glycation agent. We also found that the percent inhibition of glycationis concentration dependent.

The consistency of our anti-oxidation findings with the findings from other studies on the same plants show that our findings are reliable and applicable for further research (Wiwat and Wallaya, 2009). Like the other studies we also found that both *C. longa* and *C. frutescens* have anti-oxidation potential. However unlike the previous studies we compared the results and found that *C. longa* had more anti-oxidation potential than Ascorbic Acid (standard) and *C. frutescens*. Previously we investigated the anti-glycation and anti-oxidation potential of different fractions of *Fumaria indica* whole plant. Our results indicated that the chloroform fraction of the plant had more anti-glycation ability with a Minimum inhibitory concentration (MIC) of 148.96µg/mL as compared to the MIC of 221.96, 270.00, 294.01 and 322.49µg/ml of aqueous, ethyl acetate, *n*-hexane and crude methanolic fractions, respectively, while the results of anti-oxidation assay for Chloroform, ethyl acetate, aqueous, *n*-hexane and crude methanolic fractions were 29.39, 21.41, 15.25, 13.01 and 11.33% at 0.5mg/ml respectively (Haroon and Ibrar, 2012).

Keeping in view the involvement of glycation and oxidation reactions in complication of diabetes and aging, we suggest that both of these plants can be useful therapeutically. However our finding also suggest that a combination therapy of *Curcuma longa* and *Capsicum frutescens* extracts would be more suitable.

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**REFERENCES**


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