Biokemistri
Vol. 32, No. 1, March 31, 2020, pages 69 - 76
Printed in Nigeria

0795-8080/2020 $10.00 + 0.00

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Also available online at http://www.bioline.org.br/bk

BKR 20200013/32107

Inhibition of some enzymes implicated in diabetes mellitus by raw and blanched extracts of African lettuce (*Launaea taraxacifolia*)

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(Received January 18, 2020; Accepted March 9, 2020)

ABSTRACT: This study evaluates the impacts of blanching on α-amylase, α-glucosidase and lipase activities, and Fe^{2+}-induced lipid peroxidation (LPO) inhibitory potentials as well as phenolic constituents of African lettuce (AL) leaves. The results revealed that both raw and blanched of AL extracts inhibited all the enzymes dose-dependently, but extract from raw AL had the highest α-amylase (IC_{50} = 0.20 mg/mL), α-glucosidase (IC_{50} = 0.27 mg/mL) and lipase (IC_{50} = 0.45 mg/mL) inhibitory potential compared to that of blanched AL (α-amylase, IC_{50} = 0.33 mg/mL; α-glucosidase IC_{50} = 0.52 mg/mL, lipase IC_{50} = 0.71 mg/mL). Raw AL extract exhibited highest lipid peroxidation (IC_{50} = 1.01 mg/mL) inhibitory effect, scavenged DPPH (0.62 mg/mL) and OH (0.40 mg/mL) radicals than the blanched (LPO, IC_{50} = 1.43 mg/mL; DPPH, 0.82 mg/mL; OH, 0.75 mg/mL). Furthermore, catechin, caffeic and ellagic acid, epigallocatechin, rutin, isoquercitrin and quercetin were identified in addition with gallic and chlorogenic acids and quercitrin in raw AL, while caffeic acid derivative (13.40 mg/g) was detected in blanched AL only. Conclusively, blanching reduced the antioxidant and antidiabetic potentials and phenolic contents of African lettuce leaves as evidence in the blanched AL.

Keywords: African lettuce, blanching, enzymes, antioxidant, polyphenols, diabetes mellitus.

Introduction

Diabetes mellitus is a known metabolic syndrome resulting from dysfunction of insulin production (Ryu *et al*., 2013; Saravanan and Parimelazhagan, 2014). Deactivation/reduction of α-amylase, α-glucosidase and lipase activities have been established as control points in the management of diabetes mellitus (Ademiluyi *et al*., 2015; Naik *et al*., 2016). Consumption of dietary food rich in phytochemicals, as alternative therapeutics is a reliable practice in managing the disease (Ademiluyi *et al*., 2015; Adefegha *et al*., 2015; Adedayo *et al*., 2015). In many homes today, consumption of vegetables is on the increase. The reason is because epidemiological studies have positively linked the intake of vegetables, known to be rich in bioactive compounds such as polyphenols, with effective management of diabetes mellitus.

According to Ryu *et al*. (2013) and Ademiluyi *et al*. (2015), polyphenols, a secondary metabolite phytochemicals, possessed insulin-like ability and could also prevent oxidation of biomolecules such as lipids, protein and genetic materials which, if left unchecked, can induce oxidative stress (Adedayo *et al*., 2015; Oboh *et al*., 2016). However, there are reports on the effects of processing, including blanching, on the biological effect of polyphenols.

African lettuce (*Launaea taraxacifolia*, Family: Asteraceae) is a tropical leafy vegetable, commonly consumed in Nigeria. The leaf is often used in folklore medicine as an alternative remedy in the treatment of several human ailments, including diabetes (Adebisi, 2004; Adinortey *et al*., 2012), but information on the mechanism of action is scarce. In Nigeria, African lettuce is blanched, before consumption, purposely to incr

Consumption of dietary phenolic-rich foods such as the studied sample could be of use to strengthen endogenous antioxidant (Adefegha *et al*., 2015; Oboh *et al*., 2018). The antiradicals and Fe^{2+} chelating abilities of the studied extracts could be among the possible mechanisms through which the studied samples prevent lipid peroxidation.

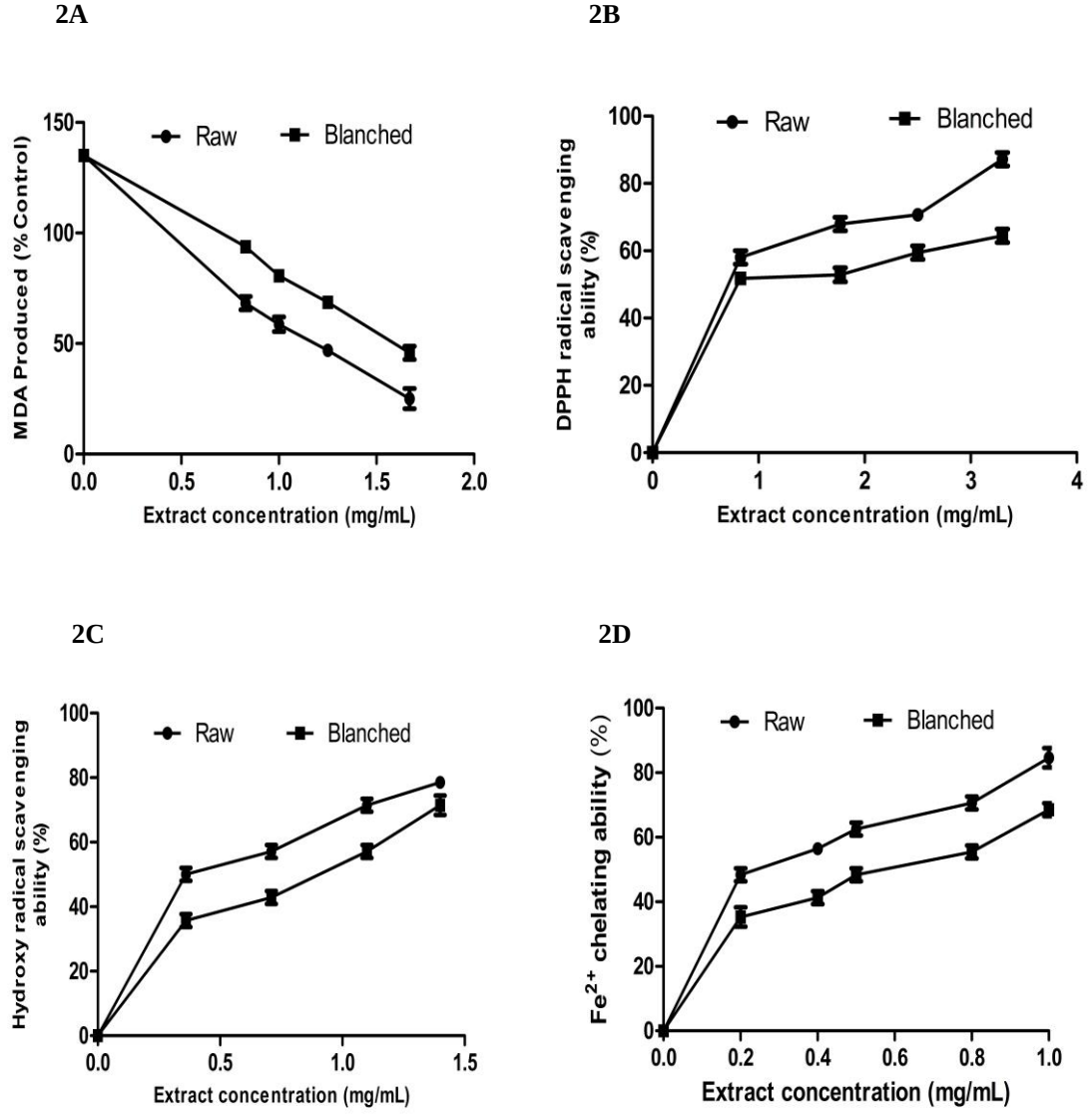

Figure 2A-Malonyladehyde content, (2B) DPPH radical and (2C) Hydroxyl (OH) radical scavenging abilities and, (2D) Fe^{2+} Chelating ability of raw AL (RAL) and blanched AL (BAL). Values represent means of triplicate.

HPLC-DAD analysis has advantage over colorimetric determination of phenolic compounds as it reveals accurate information of individual compounds. In this study, gallic acid, catechin, chlorogenic, caffeic and ellagic acid, epigallocatechin, rutin, isoquercitrin, quercitrin and quercetin were identified in the studied samples On the account of total phenol and flavonoid contents (Table 2), Raw leaf's extract contained higher total phenol than the extract from blanched. Likewise, the total flavonoid content was higher in the RAL compared to that of BAL. The HPLC-DAD phenolic profiles of African lettuce (raw and blanched) (Tables 3 and Figure 6a and b) revealed the presence of phenolic

acids and flavonoids. Gallic and chlorogenic acids and quercitrin were present only in the RAL while caffeic acid was revealed only in BAL. Furthermore, raw is richer in caffeic acid, epigallocatechin, quercetin while ellagic acid, rutin, and isoquercitrin were abundantly present in blanched extract when compared (Table 2).

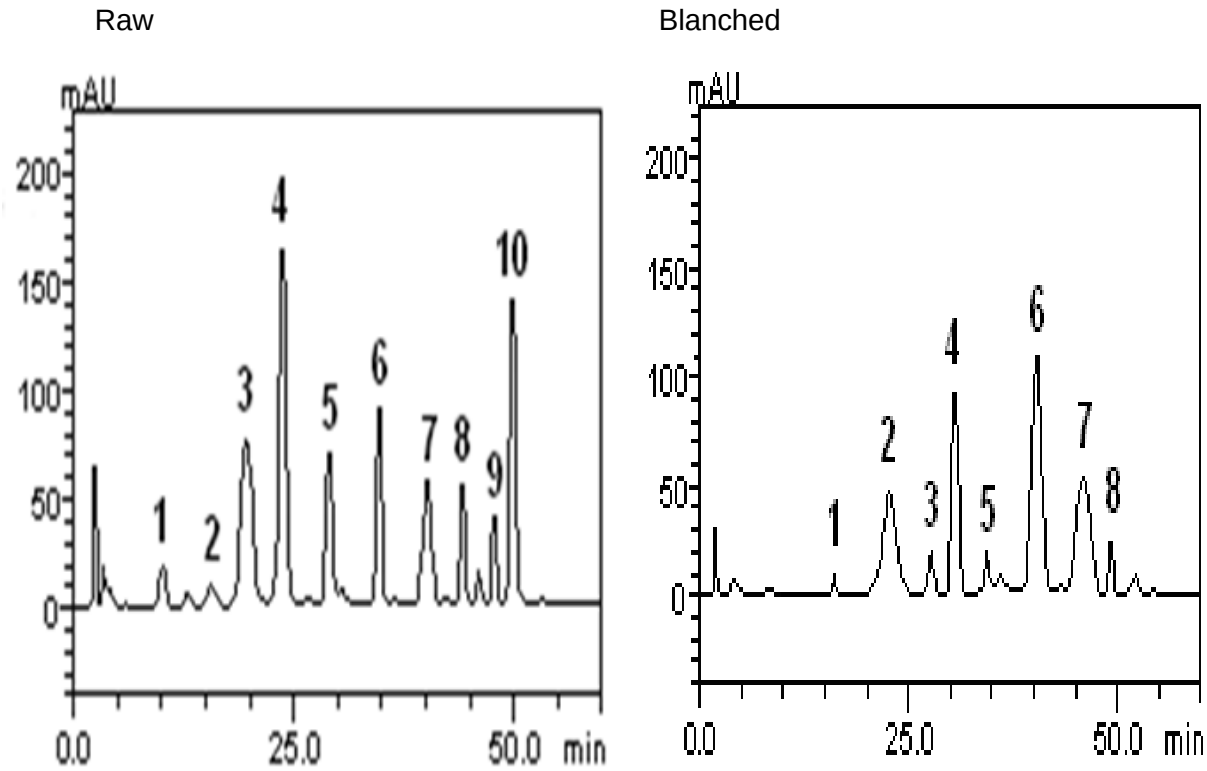

Figure 3. Representative high performance liquid chromatography profile of African lettuce leaves. (A) Raw leaves (RAW, peaks 1- 10 represents Gallic acid, catechin, chlorogenic acid, caffeic acid,, ellagic acid, epigallocatechin, rutin, isoquercitrin, quercitrin and quercetin respectively. (B) Blanched leaves (BAL, peaks 1-8 represents **c**atechin , caffeic acid , caffeic acid derivative , ellagic acid , epigallocatechin, rutin , isoquercitrin and quercetin respectively..

Several preclinical studies revealed that polyphenols offer protection against many human ailments most especially those triggered by oxidative stress such as diabetes and cardiovascular diseases (González-Castejón and Rodriguez-Casado, 2011) via chelation of metals and abstraction of free radicals whose formations have been linked to normal cellular metabolism (Amic *et al*., 2003). However, thermal processing including blanching have been reported to increase/decrease the phenolic content and antioxidative ability of vegetables (Valverdú-Queralt *et al*., 2011; Sharma and Gujral, 2011; Gerard and Roberts, 2014). The decrease/loss of some phenolic constituents (Table 2) and total phenolic contents (Table 3) in BAL extract could be accrued to the effect of the blanching process and consequently responsible for the decrease in the enzymes inhibition and antioxidant potentials. This loss of phenolics in the BAL extract is therefore in line with the report of (Ahmed and Ali, 2013), that blanching caused loss of phenolics in Cauliflower, and further stated that the loss could be as a result of covalent binding of amino acid with oxidized phenol and/or polymerization reaction. Phenolics in vegetables exist in two forms: free and those that form complexes with cell wall (bound phenolics). Hence, increased cooking temperatures and time causes cell walls disruption and breakdown of phenolic compounds (Miglio *et al*., 2007; Ferracane, *et al*., 2008; Bunea *et al*., 2008; Ahmed and Ali, 2013; Sharma and Gujral, 2011)

Conclusion

Inhibition of key enzymes linked to diabetes and oxidative stress by AL, could be one of the mechanisms behind its use in folkloric medicine. However, this study has shown that blanching causes a reduction of its potentials, in relation to loss of some phenolic constituents as indicated in the results with BAL. Therefore, blanching could reduce functional and nutraceutical values of AL.

Conflict of Interest

No Conflict of interest

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