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Evaluation of Physicochemical and Antioxidant properties of Cauliflower waste (*Brassica oleracea,var. Botrytis.*)

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ABSTRACT

The present work was conducted to study the proximate composition of cauliflower waste with regard to its moisture content, crude protein, crude fat, crude fiber, dietary fibre ash content, minerals, and its antioxidant activity using different methods like 2,2-diphenyl-1-picrylhydrazyl) (DPPH), Ferric reducing antioxidant potential (FRAP) & total phenols were also determined. The cauliflower waste was made into flour before being used for the analysis. Moisture, crude protein, crude fat , crude fibre, Ash content, dietary fibre ,available carbohydrates were 10%, 21.01%, fat 3%, 2.6% , 13%, 5.39 & 45% respectively. Minerals (mg/100g) like Calcium, magnesium, iron, Sodium Potassium & zinc were 500,100, 65, 400, 3560, & 23. Results for antioxidant activity were as DPPH(70%), Total phenolic content(3.6 mM GAE/g) & FRAP values for 100, 200 & 300µL of sample extract were as: 4.4,4.9 & 5.01 respectively. From our study it was found that cauliflower waste has a good nutritional status and thus may be used in many food formulations providing a better alternative for utilisation of nutrient- rich waste which otherwise is being disposed off as such leading to environmental issues.

Keywords: FRAP, DPPH, Antioxidant.

I. INTRODUCTION

Cauliflower (*Brassica oleracea*) is an important vegetable grown all over the world and has a wide variety of uses directly as a vegetable or as an ingredient in salads, soups etc. Cauliflower occupies an area of 8.88 million ha, with an annual production of 16.40 million tonnes in the world (FAOSTAT, Database, 2004). In India area under cauliflower cultivation is 402.00 thousand hectares with production of 7887.00 thousand million tonnes. (National Horticulture Production Database-2012-13, MoA, GoI). In Jammu and Kashmir state area under cauliflower cultivation is 3.25 thousand hectares with annual production of 85.26 thousand million tonnes. (National Horticulture Production Database-2012-13, MoA, GoI). Cauliflower has the highest waste index i.e. ratio of edible portion to non edible portion and thus enormous amount of organic solid waste is generated. They are the rich natural sources of fibre, vitamins and minerals & thus the vegetable wastes are being focussed nowadays in food sector. In fact, cauliflower by-product has been reported as cheap source of enriched polyphenol extract (Llorach *et al*., 2005). These are found to be composed of both caffeic acid derivatives and flavonols (kaempferol acylglucoside derivatives). The main flavonoids which has been identified are kaempferol-3-o-sophoroside-7-o-glucoside and its sinapoyl derivative (kaempferol-3-o- (sinapoylsophoroside)-

7-o-glucoside). The consumption of polyphenol-rich foods seems to be associated with the prevention of some types of diseases aswell. The disposal of cauliflower waste in municipal bins results in rotting which creates foul smell thereby adding to the environmental problems and jeopardizes public health. The cauliflower waste being nutritionally rich and having bioactive & antioxidant properties can be explored as food additives for the formulation of new food products. The aim of the present work was to study the nutritional and antioxidant properties of cauliflower waste.

II. MATERIAL & METHODS

Procurement and Processing of raw material:

The raw material i.e Cauliflower waste was collected from Food Processing and Training centre (FPTC) SKUAST- K Shalimar where it is an main byproduct produced during vegetable pickle making. Upper stem, stalk and leaves were thoroughly washed to remove unwanted material and dirt, cut in small sizes, blanched in boiling water for 10-15 sec. and dried at room temperature for 1-2 h by spreading on filter paper followed by drying in hot oven at 40±5˚ C for 4-6 hours. Dried material was made into powder by grinding and was stored in polythene bags until further use.

III. PROXIMATE COMPOSITION OF CAULIFLOWER WASTE

3.1. Moisture (%)

Moisture content was determined by AOAC method (AOAC,2000). 5 g of sample was weighed and dried at 60-70^{o}C for 6-8 hours, to constant weight. The loss in weight was determined to calculate the percent moisture content.

3.2. Crude protein (%)

Crude nitrogen was determined by Kjeldahl method (Elinge *et al*., 2012) and crude protein was then determined by AOAC, 1990; Alfawaz, 2004).

Crude protein = Crude nitrogen × 6.25

3.3. Crude fiber (%)

Crude fiber was determined by following a gravimetric procedure of AOAC (AOAC, 2000).

3.4. Ash (%)

Ash content was determined by incineration at 550^{o}C in a muffle furnace for 6 hours (AOAC 2000).

3.5. Crude fat (%)

Crude fat was determined using BIOSOX using petroleum ether as a solvent (AOAC, 2000).

3.6. Carbohydrate (%)

Carbohydrate (CHO) content was determined by using an equation as given below;

CHO (%) = 100 – (%ash + %crude protein + %crude lipid + %fiber)

3.7. Dietary fiber (%)

Dietary fiber was estimated by dietary fibre analyzer (FIBRAPLUS DF) using the method as given by AOAC (2000).

3.8 Minerals:

Mineral analysis of the sample was done by using Atomic Absorption Spectroscopy method by AOAC (2000).

IV. ANTIOXIDANT ACTIVITY

4.1 Sample preparation

The dried samples was ground in a laboratory blender (Rumboa et al. 2009). The sample was extracted with methanol at 80 % concentration through refluxing at 60 °C. The solvent used in the present study have been extensively tried by many researchers for efficient extraction of phenolic compounds (Ignat et al. 2011). The extract was filtered using Buchner funnel lined with Whatman no.1 filter paper. The process was repeated twice and the final volume was made to 100 ml with deionized water. Sample was concentrated using rotary evaporator at 40 °C for removal of the solvent (Babbar et al. 2011). The extract was stored in a refrigerator and analyzed for antioxidant activity using DPPH, Total phenolic content (TPC) & Ferric reducing antioxidant potential (FRAP).

4.2 Total phenolic content (TPC)

Total phenolic content of the methanolic extracts was determined with Folin-Ciocalteu colorimetric method (Velioglu et al. 1998). Briefly, 0.5 ml extract was mixed with 0.5 ml Folin-Ciocalteu reagent. The contents were mixed by manual shaking for 15–20 s. After 3 min, 0.50 ml of saturated sodium carbonate solution was added and the solution diluted to 5 ml with deionized water. The reaction mixture was incubated in dark at room temperature for 2 h and its absorbance was measured at 765 nm against deionized water using a dual beam UV–vis spectrophotometer (T-60, PG Instruments, UK). The total phenolic content was determined using a calibration curve prepared with gallic acid standard (0.01–0.1 %) as a reference. The values were reported as mg of gallic acid equivalent (GAE) by reference to gallic acid standard curve and the results were expressed as milligrams of GAE per gram dry weight of sample.

4.3 DPPH(2,2-diphenyl-1-picrylhydrazyl)

The DPPH assay of extract and standard (BHT) was performed according to the method of Yamaguchi et al. (1998). 1 ml of 0.1 mM DPPH prepared in methanol was added to the reaction mixture containing 200µ L of extract. The tubes containing reaction mixture were incubated at ambient temperature for 20 min in dark. The DPPH absorption values at 517 nm were recorded after 30 minutes. Different concentrations of BHT in 80 %

methanol were used as standard. Antioxidant activity as scavenging activity (SA) was calculated as percent inhibition relative to control using following equation and expressed as:

% inhibition = Absorbance of control (517) − Absorbance of sample (517) /Absorbance of control (517) × 100

4.4 FRAP (ferric reducing antioxidant potential)

The FRAP of extract was measured according to the modified protocol developed by Benzie & Strain (1996) with minor modifications. Ferric-reducing/antioxidant power (FRAP) assay measures the ability of the antioxidants contained in the samples to reduce ferric-tripyridyltriazine (Fe^{3+}-TPTZ) to a ferrous form (Fe^{2+}), which absorbs light at 593 nm . The assay was carried out with 100µL, 200µL, 300µL of extracts respectively. To prepare FRAP solution a mixture of 0.1M acetate buffer (3.6), 10mM TPTZ (2,4,6-tripyridyl-s-triazinesolution in 40 mM HCl) & 20 Mm ferric chloride (10:1:1,V/V/V) was made. To 1.9 ml of reagent 0.1 ml of extract was added. The absorption maximum was taken using a UV visible spectrophotometer. The absorbance of reaction mixture was measured after 4 minutes against reagent blank. Value was expressed in µM FRAP/g of material.

FRAP value of Sample (µM) = (Change in absorbance of sample from 0 to 4 minute / Change in absorbance of standard from 0 to 4 minute) X FRAP value of standard.

V. RESULTS & DISCUSSION

5.1 Proximate composition

The chemical composition of cauliflower waste is presented in table 1. Moisture, crude protein, crude fat , crude fibre, Ash content, dietary fibre ,available carbohydrates were 10%, 21.01%, fat 3%, 2.6% , 13%, 5.39 & 45% respectively. Minerals like Calcium, magnesium, iron, Sodium Potassium & zinc are presented in table 1.

Table1.Proximate composition

Parameter	Cauliflower waste
Moisture (%)	10%
Crude protein (%)	21.01%
Ash content (%)	13%
Crude fat (%)	3%
Crude fibre (%)	2.6%
Dietary fibre (%)	5.39%

Total carbohydrates (%)	45%
Minerals tested (mg/100g)	
Ca	500
Mg	100
Fe	65
Na	400
K	3560
Zn	23

5.2 Antioxidant activity

5.2.1 Total phenolic content

Phenolic compounds are the major antioxidants present in brassica vegetables due to their high content and high antioxidant activity (Podsedek 2007). The TPC in CW was found to be 3.6 mM galllic acid/g ,our results are in line with Valentina et al. 2008,who reported that TPC of Cauliflower waste ranges from 3.4 to 3.8 mM gallic acid equivalent/g. The dominating phenolic acids in Brassica vegetables are sinapic acid derivatives (Winter and Herrmann 1986). However, more studies are needed to characterize the specific phenolic compounds present in the methanolic extracts of CW and identify the role of those compounds in imparting the antioxidant ability.

5.2.2 DPPH

This assay allows comparison of the reactivities of powerful antioxidants such as, BHT with those present in the vegetable extracts. DPPH possesses a proton free radical with a characteristic absorption which decreases significantly on exposure to proton radical scavengers (Yamaguchi et al. 1998). Further it is well accepted that the DPPH free-radical scavenging by antioxidants is due to their hydrogen donating ability. Additionally, DPPH has the advantage of being unaffected by certain side reactions of polyphenols, such as metal ion chelation and enzyme inhibition. The %inhibition by cauliflower waste was found as 70% while that of standard (BHT) was 83%.

5.2.3 FRAP

The principle underlying the assay is that at low pH, reduction of ferric tripyridyl triazine (Fe^{3+} TPTZ) complex to ferrous form Fe^{2+} (which has an intense blue colour) can be monitored by measuring the change in absorption at 593nm. For different concentrations of 100 µL, 200 µL & 300 µL the values obtained were as 4.4%, 4.9% & 5.01% respectively.

The assay measures the reducing capability by increased sample absorbance based on the formed ferrous ions. The change in absorbance is therefore, directly related to the combined or "total" reducing power of the electron donating antioxidants present in the reaction mixture.

VI. CONCLUSION

From our study it was found that Cauliflower waste powder is a good source of protein and thus can be used in food fortification. Our results showed that cauliflower waste exhibited significant antioxidant activity as assessed by different methods and thus may be used in many food applications which otherwise would be discharged as waste in the environment. Being rich in dietary fibre it can also be used as a source of dietary fibre in foods which are low in fibre, thus providing a better alternative for waste utilisation.

REFERENCES

[1.] AOAC. 1990. Official Methods of Analysis, 15th Ed., Association of Official
[2.] Analytical Chemists, Washington, DC.
[3.] AOAC, 2000. American Society of Analytical Chemistry and Preperation Method. 999:10.
[4.] Anonymous, 2012. Food Processing Sector Report. Ministry of Food Processing Industries, Government of India.
[5.] Anonymous, 2013. Physical progress report. Department of horticulture Kashmir, Government of Jammu and Kashmir.
[6.] Babbar N, Oberoi HS, Uppal DS, Patil RT. Total phenolic content and antioxidant capacity of extracts obtained from six important fruit residues. Food Res Int. 2011;44:391–396.
[7.] Benzie, I.F.F., Strain, J.J., 1996. The Ferric Reducing Ability of Plasma (FRAP) as a
[8.] measure of Antioxidant Power: The FRAP Assay. Anal. Biochem. 239, 70–76.
[9.] National Horticulture Production Database- 2012-13, Ministry of Agriculture, Government of India.
[10.] Elinge C. M., Muhammad A., Atiku F. A. , Itodo A. U. , PeniI. J. , Sanni O. M. ,Mbongo A. N. Proximate, Mineral and Anti-nutrient Composition of Pumpkin (Cucurbitapepo L) Seeds Extract. International Journal of Plant Research 2012, 2(5): 146-150
[11.] FAOSTAT, Database. 2004. Agricultural Data. http://www.fao.org.
[12.] Ignat I, Volf I, Popa VI. A critical review of methods for characterization of polyphenolic compounds in fruits and vegetables. Food Chem. 2011;126:1821–1835.
[13.] Llorach, R., F.A. Tomás-Barberán and F. Ferreres, 2005. Functionalisation of commercial chicken soup with enriched polyphenol extract from vegetable by-products. *Eur. Food Res. Technol*., **220**: 31-36.
[14.] Podsedek A. Natural antioxidant capacity of brassica vegetables: a review. LWT- Food Sci Technol. 2007;40:1–11.

[15.] Rumboa RGO, Cornago DF, Geronimo IM. Phenolic content and antioxidant capacity of Philippine potato tubers. J Food Compos Anal. 2009; 22:546–550.

[16.] Velioglu YS, Mazza G, Gho L, Onmah BD. Antioxidant activity and total phenolics in selected fruits and vegetables and grain products. J Agric Food Chem. 1998; 46:4113–4117.

[17.] Stojceska, V., P. Ainsworth, A. Plunkett, E. İbanoğlu and Ş. İbanoğlu, 2008. Cauliflower by-products as a new source of dietary fibre, antioxidants and proteins in cereal based ready-to-eat expanded snacks. J.Food Engineering, 87: 554-563.

[18.] Mohammed A. Alfawaz Chemical Composition and Oil Characteristics of Pumpkin (Cucurbita maxima) Seed Kernels. Food Sci. & Agric Res. Center, King Saud Univ. 2004 pp. (518

[19.] M. Winter and K. Herrmann, J. Chromatogr. 315, 243 (1984)

[20.] Yamaguchi, T., Takamura, H., Matoba, T., Terao, J., 1998. HPLC method for evaluation of the free radical-scavenging activity of foods by using 1,1,-diphenyl-2-picrylhydrazyl. Biosci. Biotechnol. Biochem. 62, 1201–1204