ANTIOXIDANT POTENTIAL OF GUNDRUK - AN ETHNIC FOOD OF SIKKIM

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ABSTRACT

Aim: Gundruk is one of the ethnic foods of Sikkim. Ethnic group in Sikkim believe that gundruk is a good appetizer and keeps their body fit and promotes health. In view of this belief it was thought worthwhile to evaluate antioxidant potential of gundruk.

Material & Methods: In vitro antioxidant activity of gundruk was measured by superoxide anion generation with the help of xanthine-xanthine oxidase assay, linoleic acid peroxidation assay and by DPPH photometric assay as well as by ABTS radical scavenging assay, hydroxy radical scavenging assay and nitric oxide radical scavenging assay. At the same time total antioxidant capacity of gundruk was determined by phosphomolybdenum method and by ferric reducing power (FRP) method. Antioxidant compounds like polyphenol, ascorbic acid, flavonoids and carotenoid were also estimated in gundruk.

Results: Results showed that gundruk has strong antioxidant activity which was due to its high content of polyphenol.

Conclusion: The belief that gundruk keeps body fit and promotes health may have relation with antioxidant activity of gundruk.

Keywords: Gundruk, Anti-oxidant activity; Polyphenol; Flavonoid; Ascorbic acid; Carotenoids.

INTRODUCTION

Ethnic food is defined by the Swedish Chamber as food stemming from customs and traditions [1]. Verbeke et.al define ethnic food as the expression of food in terms of attitude, values, behavior and beliefs of a culture [2] while Church et.al define ethnic food as foods that originate from other countries with a different food culture [3]. As per description of Paula Arvela, Ethnic food is a site of struggle where the national is contested and destabilised as well as re-invented, re-made and re-mixed [4]. In fact, ethnic foods are originated from the heritage and culture of an ethnic group of a country and are prepared by applying knowledge of local ingredients of plants and/or animal sources. It is claimed that ethnic foods possess some important health-benefits compounds like antioxidant, bio-nutrients, antimicrobial, probiotics etc [5]. Ethnic foods are available in almost all countries of the world. Few examples are, Hindu food from India, Maori food from New Zealand, Masai food from Kenya, Pizza from Italy etc. [6,7]

Sikkim is a state in northeast India and a home to glaciers, alpine meadows and thousands of varieties of wildflowers. Several ethnic foods are available in Sikkim. Few of them are punguzom, kasalok, bauwa, bhatmas ko achar, chura, chambray, dheroh, falki, suzom, thuka, phaparko roli, kodoko roli, kwanti, koirala, gharutarul, gyuma, khajay, nakima, nya cham, piranlu, phashyagyari, phando, phulaaruwah, chatamari, chhwelaa, wachipa, kachla, chakho, dheroh, gyathuk, gharo, khouren, kegu, kentsong, kakhamari, lauwa, lapsi, moongarubuk, sitlimbur, rigchoboo, simattaru, shimrayo, saуneyingno, philuks, philingo, ponguzom etc [8].

Gundruk is one of the ethnic foods of Sikkim. The food is a fermented product of leafy vegetable such as rayo sag (Brassicca rapa ssp.), leaves of mustard, radish and cauliflower. The quality attributes to gundruk basically depends upon the typical flavour and sour-acidic taste which is developed during natural fermentation by lactic acid bacteria, mainly spp. of Lactobacillus. Gundruk is usually prepared in the form of soup and for its preparation gundruk, onion, tomato, chili, turmeric powder and salt are used as ingredients. In fact, gundruk is soaked in water for 10 minutes. In a frying pan oil is heated where chopped onions, salt are used as ingredients. In fact, gundruk is soaked in water for 10 minutes at 37°C. 100 µg / ml was chosen as test dose [9].

Studies of Antioxidant potential of gundruk

Antioxidant potential of gundruk was checked by doing antioxidant assays and estimation of antioxidant compounds.

Antioxidant assays

Antioxidant assays were done by noting superoxide anion generation through the followings. Xanthine-/xanthine oxidase assay – by the method of Chang et al [10]. Linoleic acid peroxidation assay- by the method of Chang et al [11].

Fig. 1 Gundruk.

Test sample

Using lyophilizer samples of gundruk were freeze dried and then made powder. The powder was extracted with water for 10 minutes at 37 °C. 100 µg / ml was chosen as test dose [9].

Studies of Antioxidant potential of gundruk

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DPPH photometric assay – by the method of Mensor et al [12]. 
Antioxidant potential of gundruk was also checked by, 
ABTS radical scavenging assay – by the method of Shirwaikar et al. [13] 
Hydroxy radical scavenging assay – by the method of Halliwell et al. [14] 
Nitric Oxide radical scavenging assay – by the method of Panda et al. [15] 
Total antioxidant activity of gundruk was checked by, 
Phospho molybdenum method as developed by Frii et al. [16] 
Ferric reducing power (FRP) method as suggested by Oyaizu [17] 

**Estimation of Antioxidant compounds**

Antioxidant compounds present in gundruk were estimated for,

**Flavonoids content**
Flavonoids content of gundruk was determined using Aluminum chloride colorimetric method [18].

**Polyphenol content**
Polyphenol content of gundruk was measured by Folin Ciocalteu reagent [19].

**Ascorbic acid content**
Ascorbic acid content of gundruk was determined by the method of Cakmak and Marschner [20].

**Carotenoids content**
Carotenoids content of gundruk was measured by the method of Jensen [21].

**Chemicals and reagents**
Chemicals and reagents required for the study were of analytical grade and of highest purity.

They were purchased from Merck, Germany, Sigma-Aldrich, St. Louis, MO, USA and from Loba Chem., Himedia Lab, India.

**RESULTS**

In vitro antioxidant activity of gundruk through superoxide anion generation by linoleic acid peroxidation assay, xanthine-/xanthine oxidase assay and by DPPH photometric assay is presented in Figure-2.

Percent inhibitions of xanthine oxidase, linolenic acid peroxidation and DPPH by gundruk were found 90, 76 and 88 respectively. In case of standard antioxidant quercetin the same values came as 100, 92 and 95 respectively.

Results of in vitro antioxidant activity of gundruk through ABTS scavenging assay, hydroxy radical scavenging assay and nitric oxide radical scavenging assay are shown in Figure-3. IC50 values for ABTS, hydroxyl radical and nitric oxide radical by gundruk were 25 μg / ml, 2.8 μg / ml and 49 μg / ml respectively. 
When ascorbic acid was used as standard antioxidant, the said values came 30 μg / ml, 3.9 μg / ml and 60 μg / ml respectively.

![Fig. 2: Showing in vitro antioxidant activity of gundruk through superoxide anion generation by linoleic acid peroxidation assay, xanthine-/xanthine oxidase assay and by DPPH photometric assay.](image)

![Fig. 3: Showing in vitro antioxidant activity of gundruk through ABTS scavenging assay, hydroxy radical scavenging assay and nitric oxide radical scavenging assay.](image)

Total antioxidant activity of gundruk checked by phospho molybdenum method and by ferric reducing power (FRP) method are shown in Figure - 4. By phospho molybdenum method and ferric reducing power method total antioxidant activity of gundruk came as 5.9 and 3.8 respectively. When butylated hydroxyanisole (BHA) was used as standard antioxidant, the same values were 6.5 and 4.7 respectively. Results were expressed in terms of M AAE/ g.

Amount of antioxidant compounds such as flavonoids, polyphenol, ascorbic acid and carotenoids present in gundruk are shown in Figure – 5. In terms of mg/g of dry weight, gundruk contained polyphenol, flavonoids, ascorbic acid and carotenoids as 72.9, 38.5, 27.3 and 20.5 respectively.

![Fig. 4: Showing result of total antioxidant activity of gundruk checked by phospho molybdenum method and ferric reducing power (FRP) method.](image)
potential of gundruk may be explained through its high content of phenolic compounds. Antioxidant potential of gundruk may therefore be explained through its high content of polyphenols.

CONCLUSION
From this study it is clear that gundruk, one of the ethnic foods of Sikkim, has in vitro antioxidant activity. This antioxidant activity of gundruk helps ethnic group of Sikkim to remain fit and active by inhibiting oxidation reactions in their body. The present study will encourage the in vivo studies to throw more light in this direction.

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Conflict of interest: The authors declare that they have no conflict of interest

REFERENCES

Results (mg/g of dry weight) were the mean of triplicate experiments.

DISCUSSION
Free radicals contain an unpaired electron in the atomic orbital. They have independent existence. They are very reactive, can donate or accept an electron from other molecules. Hydrogen peroxide, hydroxyl radical, superoxide anion radical, nitric oxide radical, and peroxy nitrite radical, oxygen anion, hypochlorite, etc. are examples of free radical. Free radicals and other reactive oxygen species (ROS) are generated in human body through aerobic respiration or from exogenous sources [22]. Free radicals also cause oxidative stress and adversely react with biological molecules like proteins, lipid and deoxy ribonucleic acid to produce molecular alterations. This leads to various degenerative diseases such as, diabetes, cancer, Alzheimer’s disease, Parkinson’s disease, arteriosclerosis, aging, arthritis, mongolism, immune deficiency diseases, asthma etc. [23] Antioxidative defense mechanisms are the effective paths to eliminate and diminish the action of free radicals. Human body has antioxidative defense mechanism through several enzymes and chemical compounds. Still more antioxidants are needed. To cope up the situation anti-oxidants were synthesized chemically. Butylated hydroxyanisole, propyl gallate, TBHQ (tert-butylhydroxyquinone) and butylated hydroxytoluene are examples of synthetic antioxidants. They are commercially available but their toxicity is a matter of concern. It is reported that these synthetic antioxidants may develop several diseases including cancer [24]. Therefore there was continuous search for natural anti-oxidants in different sources like plants, food products etc.

Gundruk is one of the ethnic foods of Sikkim. In the present study antioxidant potential of Gundruk was evaluated as ethnic group of Sikkim believes that gundruk keeps their body well. Since different antioxidant compounds have different mechanisms of action, several methods were used to assess the antioxidant efficacy of gundruk.

It was found out that gundruk has good antioxidant activity as revealed by superoxide anion generation with the help of linoleic acid peroxidation assay, xanthine-xanthine oxidase assay and by DPPH photometric assay. Range of inhibition was 76.90% which was very close to that of standard antioxidant quercetin. 92 – 100% (Figure – 2). Antioxidant activity of gundruk was also checked by hydroxy radical scavenging assay, ABTS radical scavenging assay and xanthine oxidase scavenging assay. In all cases gundruk showed high antioxidant activity and results were comparable to the effect of ascorbic acid (Figure-3). Total antioxidant capacity of gundruk was further checked by phospho molybdenum method and by ferric reducing power method. Results were expressed in terms of M AAE/ g. In both the two cases gundruk showed antioxidant activity which was comparable to that of the standard antioxidant butylated hydroxyanisole (Figure-4).

Polyphenols are secondary metabolites of plants. Studies strongly suggest that long term consumption of diets rich in plant polyphenols give protection against development of diabetes, osteoporosis, cancers, cardiovascular diseases, and neurodegenerative diseases [25]. As gundruk is a diet rich in leafy plants, antioxidant activity of gundruk may be related with the presence of antioxidant compounds specially polyphenols in leafy plants. Therefore amounts of polyphenol, flavonoids, ascorbic acid and carotenoids in gundruk were estimated. Gundruk contained high amount of polyphenol [72.9 mg/gm] and flavonoids [38.5 mg/gm] (Figure – 5). Mohdaly et al.[28] investigated antioxidant properties of various solvent extracts of potato peel, sugar beet pulp and sesame cake and showed that high antioxidant activity of the materials was due to its high content of phenolic compounds. Antioxidant potential of gundruk may therefore be explained through its high content of polyphenols.

Fig. 5: Showing amount of antioxidant compounds like polyphenol, flavonoids, ascorbic acid and carotenoids present in gundruk.


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