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COMPARATIVE STUDY OF SOLUBLE AND INSOLUBLE FIBRE CONTENT OF ONION (ALLUM CEPA) CONSUMED IN EASTERN NIGERIA

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Abstract

In this study, edible and outer parts of a common specie of onion consumed in Eastern Nigeria were analysed and compared for its soluble and insoluble fibre content by digesting the dry defatted onion sample with alpha amylase and protease to remove starch and proteins. Insoluble fibre was collected by filteration, soluble fibre was precipitated by addition of ethanol to a concentration of 78% and collected by filteration. Results revealed that soluble fibre content of edible part was 12.20 $\pm$0.15 > 9.09 $\pm$ 0.03% of that of the outer part while insoluble fibre content of edible part was 4.48 $\pm$ 0.03 > 1.19 $\pm$ 0.04% of the outer part. The difference in the soluble fibre content of edible parts and outer parts and insoluble fibre of edible parts and outer part was significant ($p<0.05$). Also there is significant difference ($p<0.05$) between soluble and insoluble fibre content of edible parts and soluble and insoluble fibre of the outer part or skin. Both parts contain reasonable quantities of both soluble and insoluble fibre though none individually met RDA as given by WHO. The results showed that combining the values of both soluble and insoluble fibre will amount to a quantity that moderately meet the lower range of RDA of fibres since both are valuable components of our diet, suggesting the incorporation of onion skin as part of our diet rather than a waste and also enabling the aggregation of these fibre, thereby providing optimum intake and synergy.

Keyword: Soluble and insoluble fibre, Health, onions.

Introduction

A visit to major markets and dumps for municipal wastes in eastern Nigeria showed that huge amount of onion skin is generated as waste. Onion skin is light in weight when dry and fly around the nearby areas constituting nuisance. The production of onion worldwide increased by a 25% over the past 10 years with a production of about 85 million tons nowadays (1) which makes onion as the second most important world horticultural crop after tomatoes. This high level of production gives as a result more than 500, 000 tonnes of onions skin waste (OSW) which are discarded within the European Union every year.

The first twelve principles of green chemistry is; preventing waste is better than treating or cleaning up waste after it is created (2).

In most eastern cities in Nigeria, there is still indiscriminate dumping of onion skin in drainages, road sides and nearby-water bodies by both seller and users who generate these waste in large quantities.

Onion belongs to the family Alliaceae. It is commonly found in temperate regions and the second most cultivated vegetable crop in the world. Onions are one of the most commonly used vegetables in all world cuisine which speaks a lot about their unique taste and numerous health benefits (3).

Multiple studies (4, 5, 6) have shown that antioxidants is high in onion skin even more than in edible part. Onion skin is found to be rich in both soluble and insoluble fibre yet it is being discarded due to human ingrained habits of peeling of the skin and cooking the edible parts (6).

Crude fibre of food has been defined as the washed, dried, organic residue that remains after boiling the defatted food materials (7). Dietary fibre on the other hand is a carbohydrate (polysaccharides) that is incompletely absorbed in humans and in some animals. Like all carbohydrates, when it is metabolised, it can produce four calories of energy or less than that because of its limited absorption and digestibility. There is much confusion about the difference between dietary fibre (soluble) and crude fibre (insoluble fibre). Most crude fibre contains one-seven to one-half dietary fibre. Crude fibre thus contains lignin which is found in the tissues of plants and cellulose basically a plant's skeleton. It is also needed in our food or diet because they aid in maintaining regular intestinal peristalsis (8).

Generally high fibre, both soluble and insoluble is desirable in our diet especially in an adult's diet because it promotes the wave-like contraction that moves food through the intestine, it expands the inside walls of the colon easing the passage of waste, making it an effective anti-constipation agent. It also lowers the risk of various cancers, bowel diseases and improves general health and wellbeing. Presence of high fibre improves glucose tolerance and is beneficial in treating maturity on-set diabetes (9) because they dissolve in water in the intestinal tract to produce a gel which slows the movement of food through the intestines and helps to lower blood glucose level since it slows the absorption of sugar (8).

According to World Health Organisation (WHO), Recommended Daily Intake (RDI) of fibre is between 19 – 38g which is defined for humans as an estimate of the amount of a chemical substance that can be ingested daily over lifetime without appreciable risk to health (10).

In this study, concentration of both soluble and insoluble fibre constituents of the common red onion species eaten in the eastern Nigeria were assayed. The results were discussed by comparing with previous studies reported in literature and as well compared with standard value (RDI) as given by WHO.

Materials and Method

Sample Collection and Preparation

The red onion species were bought in large quantity from Ose market Onitsha Anambra State Nigeria which is a major market in Eastern part of Nigeria. Onitsha is located 6^0 10 N 6^047^1E/6.167^{0}N6.783^{0}E. It was identified by experts in the Department of Biology, Federal College of Education (Tech.) Asaba, Delta State. Asaba is located 6^011^152-23^{11} N 6^0 $43^142.48$E. The onions

were unskinned to separate the waste from the edible parts. They were washed with water to remove dust, dirts etc. They were dried in open air as well as the diced inner onion part for a period of 1 – 2 months before it was taken to the laboratory for analysis.

Procedure

To 2g of both samples, 5ml of DMSO was added and heated at 100^0C. The solution was digested with 10ml of 5% alpha amylase and precipitation was induced by addition of ethanol. The solution was centrifuged to separate insoluble and soluble parts.

The insoluble part was washed with 85% ethanol, 100% ethanol and acetone. It was dried and 10ml of 12m H_2SO_4 added as well as water and heated to 100^0C. The solution after cooling was filtered and residue dried.

The dried residue was boiled under reflux for 30 minutes with 200ml of a solution containing 1.25g of carbonate free NaOH per 100ml. The final residue was filtered through a thin but close pad of washed and ignited asbestos in a Gooch Crucible.

Drying was done further in an electric oven, weighed and finally incinerated, cooled and weighed again. The loss in weight after incineration multiplied by 100 is the percentage crude fibre.

$$\% \text{ crude fibre} = \frac{Wt.of\ fibre \times 100}{Wt.\ of\ sample} \quad (11\text{- }12)$$

Statistical Analysis

The results were presented as mean $\pm$ standard deviation, n equal to 3, the number of replicate measurements. The two results, that is soluble and insoluble fibre content were compared for both inner and onion skin parts using T-test and were found to differ significantly ($p < 0.05$).

Results

Table I

	Soluble fibre	Insoluble fibre
Onion skin	09.4$\pm$ 0.03	1.19 $\pm$ 0.04
Onion inner	12.07 $\pm$ 0.15	4.48 $\pm$ 0.03

Results

Figure 1a

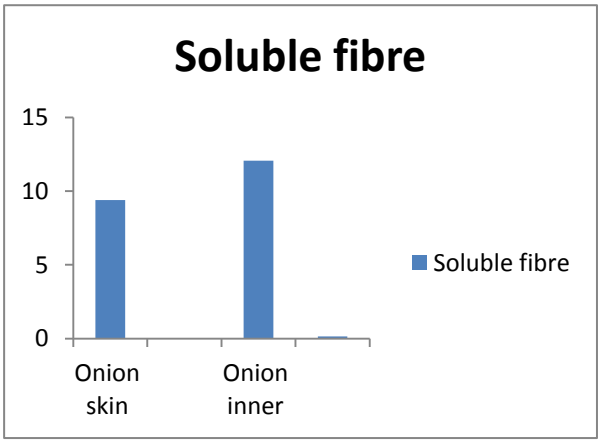
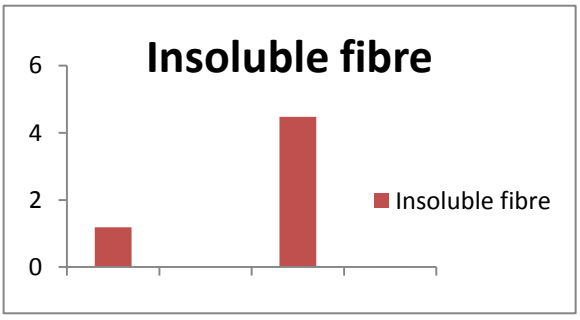


Figure 1b

Figures 1c



Discussion

According to CODEX Alimentarius Commission CAC (13), the intake of fibre is significantly below recommended levels throughout the world and that fibres are

analogous to vitamins in that they vary in structures, function and amount needed but each when present in the right amount contributes to optimal health.

The percentages of soluble and insoluble fibre of onion skin and edible parts were presented in Table 1 and figure I below, the results revealed greater percentages of soluble fibre (DF) in both onion skin and edible part with the edible part higher in soluble fibre than the skin and lower percentages of insoluble fibre in onion skin than in the edible part.

The results also showed that the soluble fibre content of both inner and onion skin analysed differ significantly from the insoluble fibre contents. The soluble and insoluble fibre contents of the edible part as well as the soluble and insoluble of the onion skin also showed significant difference ($p < 0.05$).

The order of this finding agrees moderately with findings of other researchers (14) (15) though nutritional composition of food may vary with other factors as climate, soil, agricultural practices and so on (16).

The levels of soluble and insoluble fibre were individually below RDA (19 – 38) varying for ages between 1 -> 70 years as given by WHO (10) but the combination of both fibres of the onion parts amounts to a value that is very close to the lower range value of RDA of fibres (19%). The edible part, though higher in both soluble and insoluble fibres had values far below RDA value for fibre. The good news is that soluble fibre (DF) was higher for both onion skin and edible part than the insoluble fibre thus even the waste (onion skin) is a rich source of dietary fibre.

Conclusion and Recommendation

The importance of fibre rich food cannot be over emphasized. Studies (4 – 6) have also shown that valuable phytochemical with high potentials for pharmaceutical, food and cosmetic industries can be recovered from onion skin. The results from this study therefore adopts the incorporation of onion skin with the edible part during blending or crushing of onion with other food ingredients in our homes and eateries. This will not only help in reducing the volume of onion skin generated as waste but also allowing aggregation of fibre, thereby providing optimum intake and synergy hence increasing the food value of our pots/plates.

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