



A STUDY ON CONSUMER PREFERENCE AND NUTRIENT EVALUATION OF ONION SKIN POWDER (*Allium cepa L*) IN DEVELOPED FOOD PRODUCTS

Ms. R.VIJAYALAKSHMI

Department of Nutrition and Dietetics, Sengamala Thayaar Educational Trust Women's College
(Autonomous), Sundarakkottai, Mannargudi-614 016, Tamil Nadu, India (Affiliated to
Bharathidasan University, Tiruchirappalli-620 024).

ABSTRACT

The unwanted byproduct of the processing of onion bulbs is onion skin. It may be utilized to build unique food items since it includes a lot of bioaccessible and bioavailable chemicals, according to recent studies. Our bodies can benefit greatly from onions. The advantages of onions are widely known to a lot of individuals. Everybody enjoys it. Onion peels, meanwhile, are typically thrown aside. Many individuals are unaware of the numerous health advantages of onion peel. Antioxidants, fiber, vitamins A, C, and E, as well as heart-healthy flavonoids, are abundant in onion peels. The immune system, heart health, and blood sugar levels are all thought to be benefited by eating onion peels. B5). Three standardized recipes—soup, salad, and tea—were chosen for the current study, and customer approval was measured. The generated recipe was assessed using a four-point hedonic scale rating in a sample of individuals to determine the standard and onion skin powder-incorporated recipes, color, flavor, and taste. When compared to salad and tea, which also included onion skin powder, the soup was the recipe that the consumers preferred. Even though included soup had a greater total nutritional value than salad or tea, the majority of consumers liked the taste and flavor of the blended soup.

Key words: Onion skin powder, standardization, Incorporation, consumer acceptability, Nutrient analysis.

INTRODUCTION

The onion (*Allium cepa*. L.), a significant vegetable historically utilized as a dietary component in the Mediterranean diet, is produced in large quantities and is traded internationally and domestically. It is included in everyday diets either raw, cooked or processed into various onion products. When onions are added to various dishes, a high concentration of bioactive chemicals with potential health benefits results. (1987; Ursula Gawlik et al.)

These two items were the sole ones in our ancestors' diets, and they were exclusively used for flavor and health reasons. We do know a little bit about their health, but many of us are unaware of the various health advantages their skin offers. Onion skin has a lot of nutrients in it. Its skin has more nutrients than onions. Sprinkle it over soup, curry, etc. when preparing them, then boil them. After cooking, these can be thrown away. We are all aware of the importance of onions in cooking. Onions are full of nutrients and have a variety of medical uses. In a similar vein, even the onion peels that we toss in the trash might be of great use to us. Stop discarding the onion peel first, then. Our bodies can benefit greatly from onions. The advantages of onions are widely known to a lot of individuals. Everybody enjoys it. Onion peels, meanwhile, are typically thrown aside. Every natural product is nutrient- and energy-rich. Nature has created a surface structure, such as a shell or skin, to protect an object. It has a lot of safeguards in place for both flora and animals. Snails, turtles, and other creatures shelter within the top shell to fend off predators. Similar to this, fruits and vegetables that are grown organically have more nutrients in their outer shells. Many individuals are unaware of the numerous health advantages of onion peel. These nutrients contribute to improving both our skin's appearance and physical wellness. By employing onion skin, we may accomplish a variety of fantastic benefits. Onion skin contains many nutrients. Onion skin is used as a seasoning. Many nutrients are found in onion skin. Seasoning is made from onion peel. You may improve the flavor of your cuisine by adding dried or roasted onion skin powder to dishes (such as soups, steaming veggies and meats, and handmade slices of bread). According to several studies, onion skins are a good source of fiber, vitamins A, C, and E as well as heart-healthy flavonoids and antioxidants. The immune system, heart health, and blood sugar levels are all thought to be benefited by eating onion peels. However, be sure that the onion peels are free of pesticides and are obtained organically. To increase immunity, use onion peels. Onion skins contain a lot of antioxidants. They support the body's immune system in growing.

MATERIALS AND METHODS

Selection, Collection and Preparation of Standardized Recipes

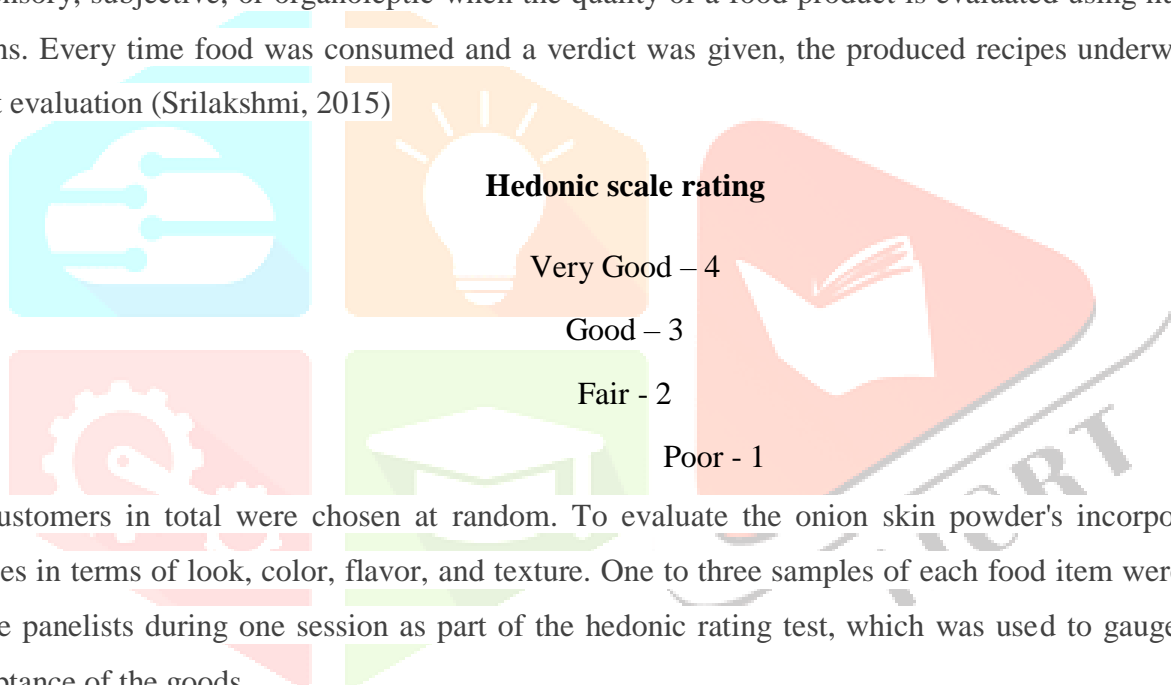
A variety of ingredients were purchased at the Mannargudi local market. The 5 kg of onions used in the preparation of the onion skin powder (OSP) were bought from a nearby market. The onion skin that was on top of it was gathered, the dirt, dust, and other impurities were taken out, and it was washed twice in deionized salt water before being dried (Gawlik-Dziki et al., 2013). The substance was sieved and pulverized after drying. Samples were gathered using a purposeful sampling technique.

Development and Standardization of Recipes through Incorporation

A total of three recipes (Recipe I soup, Recipe II salad and Recipe III Tea) were selected and the onion skin powder was incorporated at 2 to 8 percent level of incorporation of onion skin powder in standardized recipes.

Three dishes in all (Recipe I soup, Recipe II salad, and Recipe III tea) were chosen, and onion skin powder was added at levels ranging from 2 to 8 percent in the standardized recipes. High-quality food preparation is ensured by the use of standardized recipes. Additionally, it gets rid of supposition and avoids changes in quality. Utilizing precise proportions of the different ingredients results in accurate yields reduces leftovers, and supports cost-conscious eating. The bulk issue is requisitioned for the food products required for the day's meal. (2008) Maya Badri.

evaluating the customer acceptability of recipes that utilize both regular and fresh milk. It is considered to be sensory, subjective, or organoleptic when the quality of a food product is evaluated using human sense organs. Every time food was consumed and a verdict was given, the produced recipes underwent a four-point evaluation (Srilakshmi, 2015)



50 customers in total were chosen at random. To evaluate the onion skin powder's incorporation into recipes in terms of look, color, flavor, and texture. One to three samples of each food item were delivered to the panelists during one session as part of the hedonic rating test, which was used to gauge consumer acceptance of the goods.

Estimation of Nutrients Content of Standard and Most Acceptable Onion Skin Powder

The normal recipe and the most appropriate onion skin powder's nutritional content were examined using established methods. The nutritional analyses are included in appendix m, which also contains the process.

Using this method, vitamin A may be measured and vitamin C can be computed (Bayfield Cole, 1980). (Roe and Kuether, 1943). , This method was used to estimate vitamin E-alpha tocopherol (Baker et al., 1980), determine quercetin using the method (Patil et al.), and measure calcium using the method (Ferdinand Munz, 1935) and the fiber-iodine method. Sandell and Kolthoff from 1937.

Determination of vitamin A by the methods (Bayfield and Cole,1980)**Reagents**

90% alcohol, 2N, petroleum ether, sodium sulfate, and trichloroacetic acid with potassium hydroxide: 15g of trichloroacetic acid crystals should be dissolved in 25 ml of chloroform before being kept in the dark. Standard vitamin A: 10 ml of chloroform and 1.5 milligrams of vitamin palmitate.

Procedure

Make a fine paste out of 1 to 5 g of the sample material and stir in 1 ml of the saponification solution. Gently reflux the tubes for 20 minutes at 60 C, then let them cool to room temperature with 20 ccs of water and well mix. In two separate extractions, use 10 ml of petroleum ether to extract the vitamin. To remove the moisture, combine the extract with the sodium sulfate and let it sit for 30 to 60 minutes. Then, evaporate 5 ml of the ether extract to dryness at 60 C, and then dissolve the dried residue in 1 ml of chloroform. Chloroform should be used to bring the volume in each test tube to 1.0 ml. Using a fast delivery pipette, I quickly mixed the contents of the tube before adding 2.0ml of the TCA solution. Read at 620nm immediately in a spectrophotometer.

Determination of Vitamin C estimated by the method (Roe and Kuether, 1943)**Reagents**

9N H₂SO₄, 2% 2, 4-Dinitrophenyl hydrazine, 4% TCA, 10% Thiourea, 80% Sulphuric acid, and 2 g of DNPH were dissolved in 100 ml of this solution. Standard stock answer: 100mg of ascorbic acid were dissolved in 100ml of 4%TCA. Working criterion: 10ml of the stock solution was diluted with 100ml of 4% TCA.

Procedure

The plant material, 1g, was homogenized in 10ml of 4% TCA. 2000 rpm centrifuged for 10 minutes. A little amount of activated charcoal was added to the resulting supernatants, agitated thoroughly, and then allowed to sit for 10 minutes. The charcoal residue was removed after another centrifugation. The clear supernatants' volume was measured. This supernatant was divided into 1.0 ml aliquots for the test. The assay quantities were prepared with 4% TCA in 2 ml. 2 drops of 10% thiourea solution were added to the test tube after adding 0.5 ml of DNPH reagent. 3 hours at 37o C incubation. Drop by drop, in cool, 85% sulphuric acid, the generated ozone was dissolved, with no discernible temperature increase. After adding H₂SO₄, the DNPH reagent and thiourea were applied to the blank alone. After 30 minutes of room temperature incubation, the tubes were read spectrophotometrically at 540 nm to determine the absorbance.

Determination of Vitamin E - Alpha tocopherol was estimated by the method (Baker, et.al,1980)**Reagents**

Ethanol, double-distilled water, a 0.2% solution of 2,2'-dipyridyl in ethanol, and a 0.5% solution of ferric chloride in ethanol.

Procedure

1.5 ml of ethanol was added to 500 mg of material, which was then centrifuged after 15 minutes of mixing. The supernatant was dried at 80°C before being combined with 4.0 ml of butanol, 0.2 ml of 2, 2'-dipyridyl, and 0.2 ml of ferric chloride solution. At 520 nm, the developing red color was detected.

Determination of Quercetin by the method (Patil *et al*).

For subsequent processing, the dried hydro-alcoholic extracts were individually weighed in a prescribed dosage and dissolved in a known volume of distilled water. By precisely dissolving approximately 10 mg of each medication in an adequate amount of ethanol, the stock solution (100 g/ml) of quercetin was created. The volume was then adjusted to 100 ml using ethanol. With ethanol, another series of dilutions were created.

Quercetin calibration curve

As needed, aliquots of the working standard solution of quercetin were taken out of volumetric flasks and diluted with ethanol to a final concentration of 10 ml. The absorbance was measured at 256 nm, where it reaches its maximum, and compared to a reagent blank made similarly but without quercetin.

Procedure

The relevant sample aliquots were taken out and placed in separate 100 ml volumetric flasks. Quercetin's absorbance for each aliquot was measured at 256 nm. The Quercetin calibration was used to match the matching Quercetin concentration to the appropriate absorbance value.

Determination of Calcium – Ethylene diamine tetra acetate. (Ferdinand Munz, 1935)

Reagents

Disodium salt of ethylene diamine tetra acetic acid (EDTA): (0.1N) 1 liter of distilled water should be used to dissolve 27.224g of EDTD (disodium salt) before being stored in a polythene bottle. Ammonium buffer: Make a solution of 570g of ammonia and 70g of ammonium chloride. Making a sodium hydroxide solution by mixing 80 g of sodium hydroxide with 1 liter of distilled water. Erichrome black T indicator: In the ratio of 1: 200 (W/W), prepare a fine mixture of erichrome black T (solochrom black) using sodium chloride in a pestle and mortar. Ammonium purpurate indicator: In a pestle and mortar, mix a fine solution of ammonium purpurate (murexide) with 1.100 parts sodium chloride (W.W).

Procedure

To a conical funnel, pipette 5 ml of the sample. Add 5ml of ammonium buffer to this, then dilute with 100ml of distilled water. Erichrome black T should be added, and the solution should be warmed to 60°C. Tip the scale in favor of EDTA until the red color changes to blue. 'A' is noted as the endpoint. Add 5ml of the water sample, 5ml of the NaOH solution, and 100ml of dishwater to another fleck pipette. EDTS should be diluted until the pink color becomes blue. Note the letter "B" at the end.

Determination of Fibre by Iodine method. (Sandell and Kolthoff.,1937)**Reagents**

Sulfuric acid solution (0.2550.005N): 100ml of 1.25 g of concentrated sulfuric acid (conc must be checked by titration). 1.25 g of sodium hydroxide in 100 ml of distilled water (0.313-0.05N) (conc must be checked by titration with standard acid).

Procedure

To remove fat from 2g of pulverized material, extract it using ether or petroleum ether (final boiling temperature: 52oC; beginning boiling temperature: 35-38oC). If the fat level is less than 1%, the extraction could be skipped. 2 g of dried material are boiled in 200 ml of sulfuric acid for 30 minutes with bumping chips after being extracted with ether. Wash with hot water until the washings are no longer acidic after filtering through muslin, 30 minutes of boiling with 200 cc of sodium hydroxide solution Re-filter using muslin cloth, then wash with 25ml of boiling 1.25 percent H₂SO₄. 25ml of alcohol and three pieces of 50ml each of water, Transfer the residue to an ash dish after removing it (preweighed dish W1), Dry the residue for two hours at 130 degrees Celsius, chill the dish in desiccators, and weigh it again (W2). Then, ignite for thirty minutes at 600 degrees Celsius (W3).

TABLE.1. Ingredients and Procedure for the Preparation of Standard Vegetable Soup

S.No	INGREDIENTS	QUANTITY (GRAMS)
1	Carrot	15
2	Beans	15
3	Onion	15
4	Peas	15
5	Garlic	5
6	Ginger	5
7	Corn flour	2tsp
8	Pepper	1tsp
9	Oil	1 tsp

Procedure

The carrot, beans, peas, onion, garlic, and ginger were all chopped into small bits. 3 tablespoons of water and 2 tablespoons of cornflour were put into a small bowl and thoroughly mixed. Large, heavy-bottomed stockpot with 1/2 tbsp oil heated over medium heat. Add chopped ginger, onion, and garlic. Cook for 3–4 minutes after 1–2 minutes of sautéing. 2 12 cups of water or vegetable stock was added. Stir well before bringing the mixture to a boil. When it begins to boil, add salt (add as required as we already added salt for veggies). The pepper powder, cornflour, and water combination was added, and it was continually stirred for a minute to avoid lumps. Stirred and cooked mixture until thick and corn starch no longer had a raw

scent. It should take 7-8 minutes. Mix thoroughly after adding vinegar. At this point, taste the soup to check the seasoning and add more if necessary. Extinguish the flame. Place the heated vegetable soup into individual bowls before serving. (Thangam and others, 1988).

TABLE –2 Ingredients and Procedure for the Preparation for the Preparation of Onionskin Powder Incorporated Vegetables Soups (2 – 8 PERCENT)

S.NO	INGREDIENTS	QUANTITY (GRAMS)			
		2%	4%	6%	8%
1.	Carrot	15gm	15gm	15gm	15gm
2	Beans	15gm	15gm	15gm	15gm
3	Peas	15gm	15gm	15gm	15gm
4	Ginger	5gm	5gm	5gm	5gm
5	Garlic	5gm	5gm	5gm	5gm
6	Onion skin powder	2gm	4gm	6gm	8gm
7	Corn flour	2tsp	2tsp	2tsop	2tsp
8	Pepper	1tsp	1tsp	1tsp	1tsp
9	Oil	1tsp	1tsp	1tsp	1tsp

Procedure

Onion skin powder was added to the sample of vegetable soup at percentages of 2, 4, 6, and 8. The preparation steps were also followed.



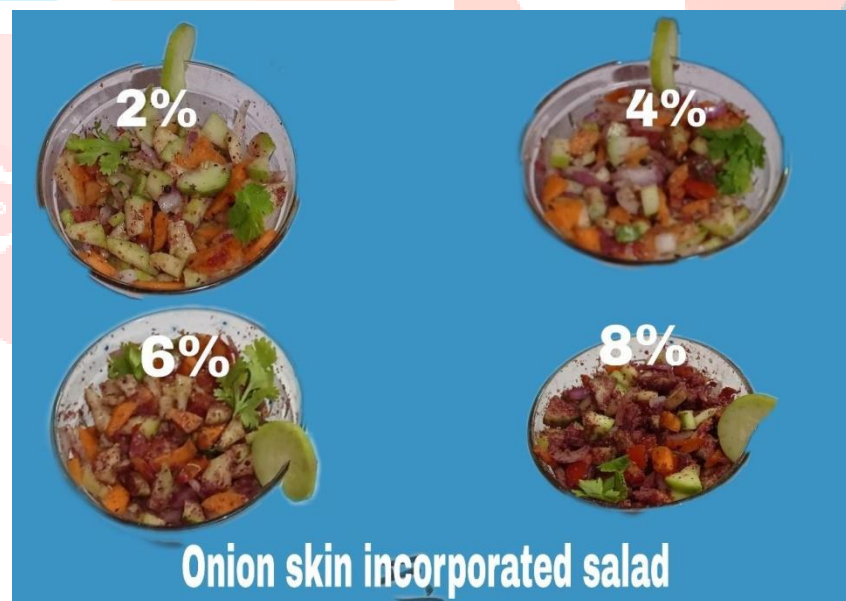
PLATE –II
Onion Skin Powder Incorporated Soup at (2 to 8) Percent Level

TABLE -III Ingredients and Procedure for the Preparation of Onionskin Powder Incorporated Salad (2 – 8 PERCENT)

S.NO	INGREDIENTS	QUANTITY (GRAMS)			
		2%	4%	6%	8%
1.	Carrot	15gm	15gm	15gm	15gm
2	Tomato	15gm	15gm	15 gm	15 gm
3	Cucumber	15gm	15 gm	15 gm	15 gm
4	Onion	10gm	10 gm	10 gm	10 gm
5	Onion skin powder	2gm	4gm	6gm	8gm
6	Pepper	1tsp	1tsp	1tsp	1tsp
7	Lemon juice	1tsp	1tsp	1tsp	1tsp

Procedure

Onion skin powder was added to the salad sample at percentages of 2, 4, 6, and 8 along with the standard salad-making techniques.

**PLATE -III**

Onion Skin Powder Incorporated Salad 2 TO 8 Percent Level

TABLE –IV Ingredients and procedure for the preparation of onion skin powder incorporated tea (2 – 8 PERCENT)

S.NO	INGREDIENTS	QUANTITY			
		2gm	4gm	6gm	8gm
	Onion skin powder	2gm	4gm	6gm	8gm
	Milk	100ml	100ml	100ml	100ml
	Water	25ml	25ml	25ml	25ml
	Jaggery	25gm	25gm	25gm	25gm
	Ginger (chopped)	1small pieces	1small pieces	1small pieces	1small pieces
	Tea powder	1 tsp	1 tsp	1tsp	1tsp

Procedure

Onion skin powder was added to the tea sample in ratios of 2, 4, 6, and 8. The usual methods of preparing tea were used.

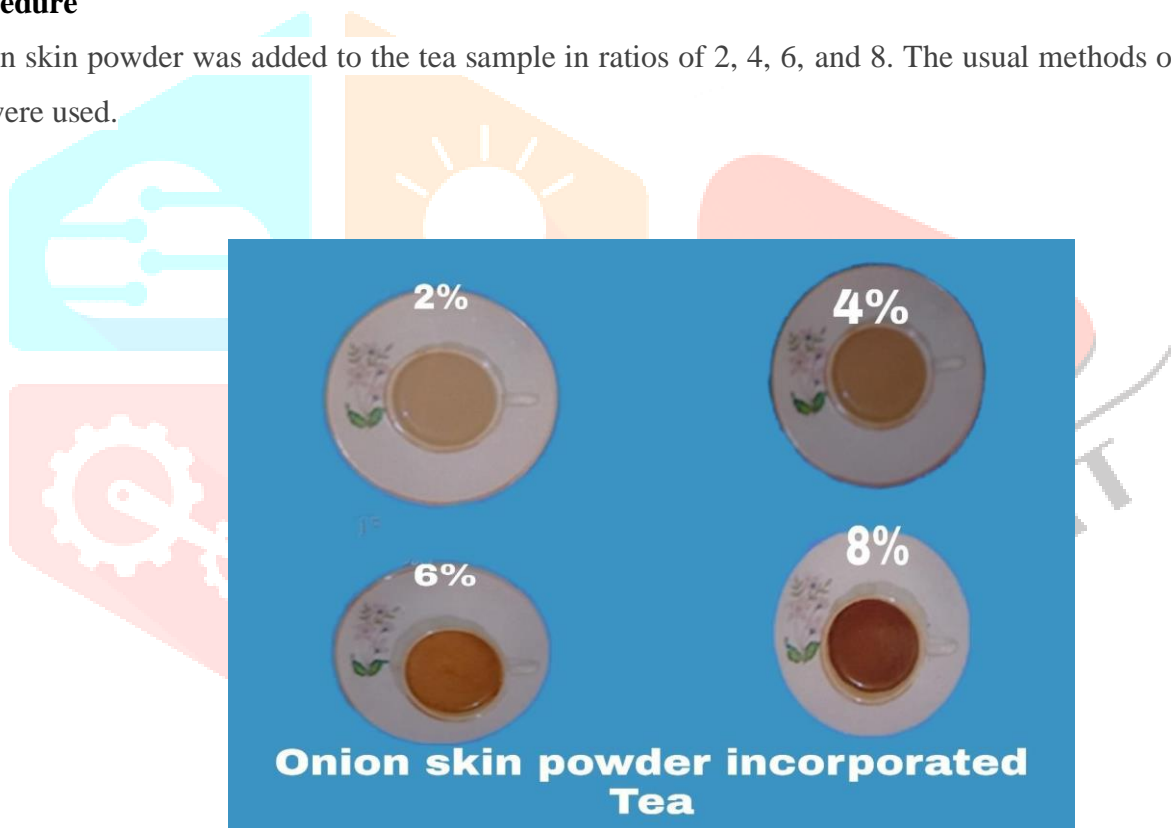


PLATE – IV

Onion Skin Powder Incorporated Tea at 2 to 8 Percentages



PLATE – IV

Onion Skin Powder Incorporated Soup, Salad and Tea at 2 to 8 Percentage

RESULT AND DISCUSSION

Standardization of recipes through incorporation

The recipes like soup, salad, and tea were selected for standardization. These are used to ensure that the same ingredients by weight or volume are used every time a dish is cooked, the methods of preparation should also be standardized so that the portions obtained each time are consistent in size, shape, volume, and color (Mohiniseti., 2001).

Consumer Acceptability of the Standard and Most Acceptable Onion Skin Powder Incorporated Recipes

TABLE – V Mean and Standard Deviation Score of Standard Soup, Salad and Tea

S.NO	OF THERECIPES	OVER ALL ACCEPTABILITY	
		Mean	Standard Deviation
1	Soup	16.74	± 8.95
2	Salad	16.25	± 6.63
3	Tea	15.99	± 3.19

The data in table (VII) show that the average and standard deviation of the customer acceptance score for typical soup, salad, and tea is 16.74 ± 8.95 , 16.23 ± 6.36 and 15.99 ± 3.11 respectively

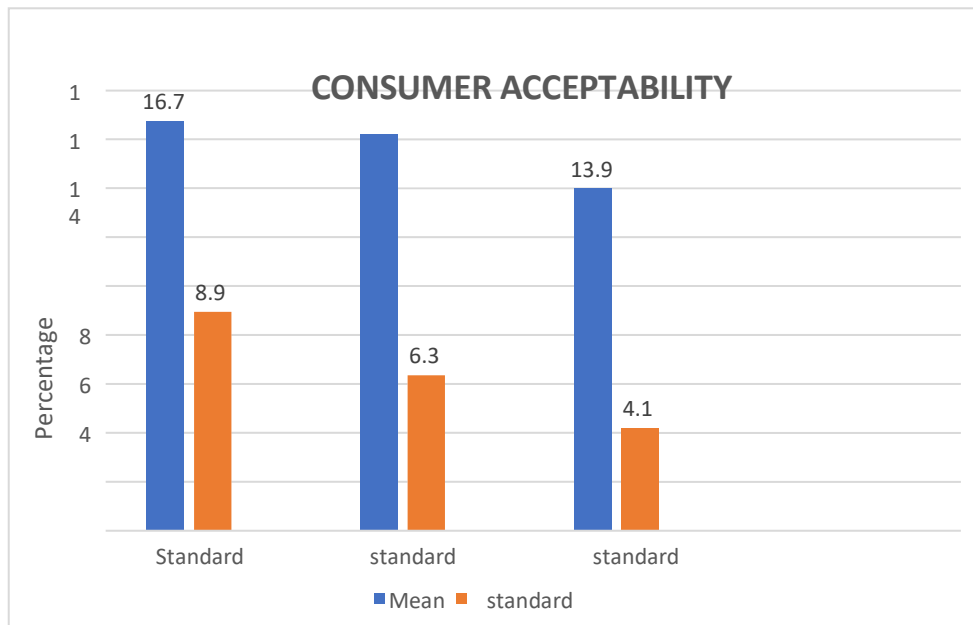


FIGURE –I

Consumer acceptability of standard soup, salad and tea

Nutrient Content of the Standard and Most Acceptable Onion Skin Powder Incorporated Recipes

TABLE – VI Overall view on nutrient content of 2 to 8 percent level of onion skin powder incorporated soup

S.NO	CRETERIA	Vitamin A (mg)	VitaminC (mg)	VitaminE (mg)	calcium (mg)	quercetin(mg)	dietary fiber (gm)
1	2 %	86.85	33.56	5.55	49.82	48.22	11.54
2	4 %	111.69	52.73	10.91	59.63	91.06	23.38
3	6%	135.43	72.32	16.32	79.26	133.95	27.1
4	8%	161.37	91.85	21.61	98.97	176.38	34.88

The nutritional value of soups with 2 to 8 percent of onion skin powder is shown in Table (XVII). The increased vitamin content includes vitamin A, vitamin C, vitamin E, calcium, quercetin, and dietary fiber. For a 2 to 8 percent level of onion skin powder integration, vitamin A varies from 86.85 to 161.37 mg per 100 ml, while vitamin C ranges from 33.56 to 91.85 mg per 100 ml. Per 100 cc, the amount of vitamin E varies from 5.55 to 21.61 mg. Between 49.82 and 98.97 mg of calcium are found in every 100 ml. Between 48.22 and 176.38 mg of quercetin are present in every 100 ml. Per 100 ml, the fiber content ranges from 11.54 to 34.88 mg. Soups with onion skin powder added have higher levels of vitamin A, vitamin C, vitamin e, calcium, quercetin, and dietary fiber than soups without it.

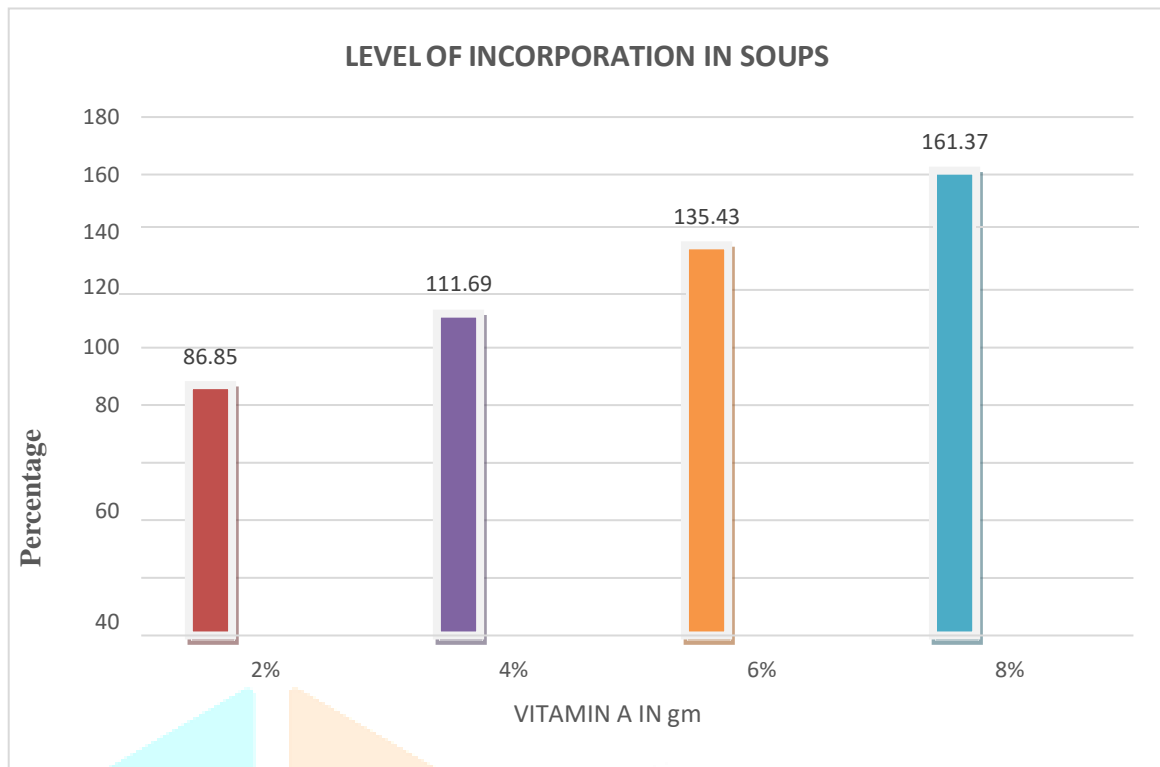


FIGURE -II
Vitamin a content of 2 to 8 percent level of onion skin powder incorporated soups

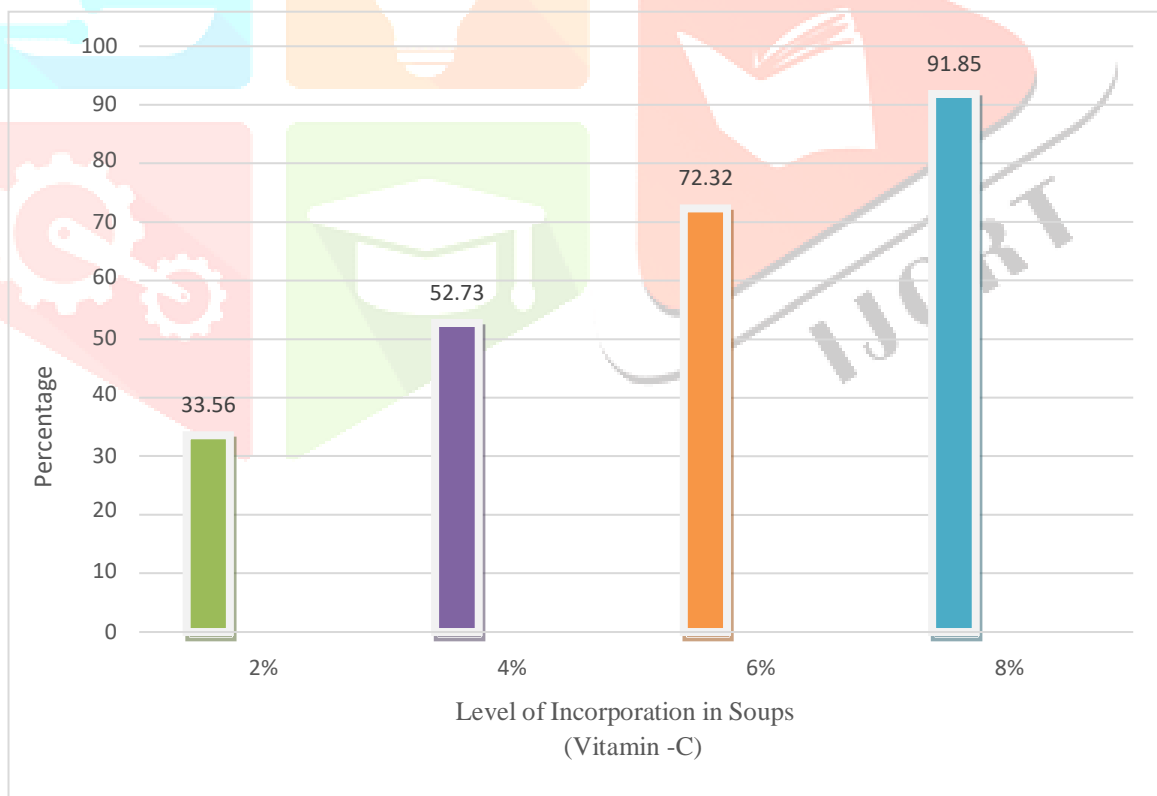


FIGURE -III
Vitamin c content of 2 to 8 percent of onion skin powder incorporated soups

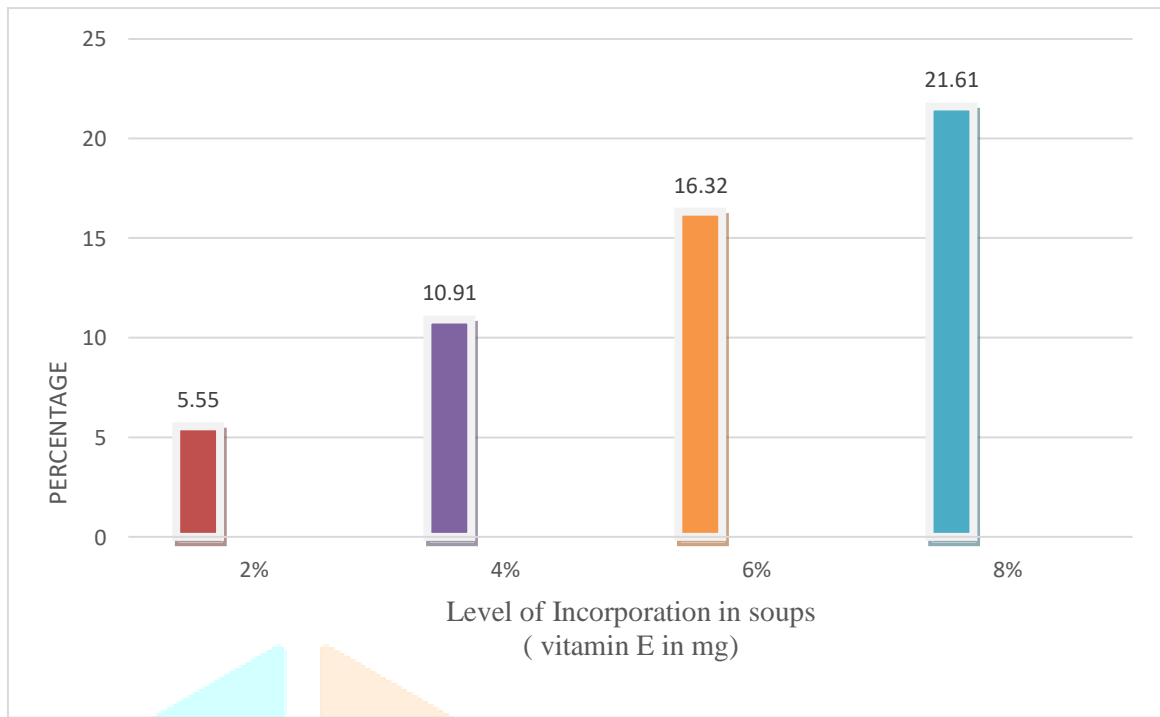


FIGURE – IV
Vitamin e content of 2 to 8 percent level of onion skin powder incorporated soups

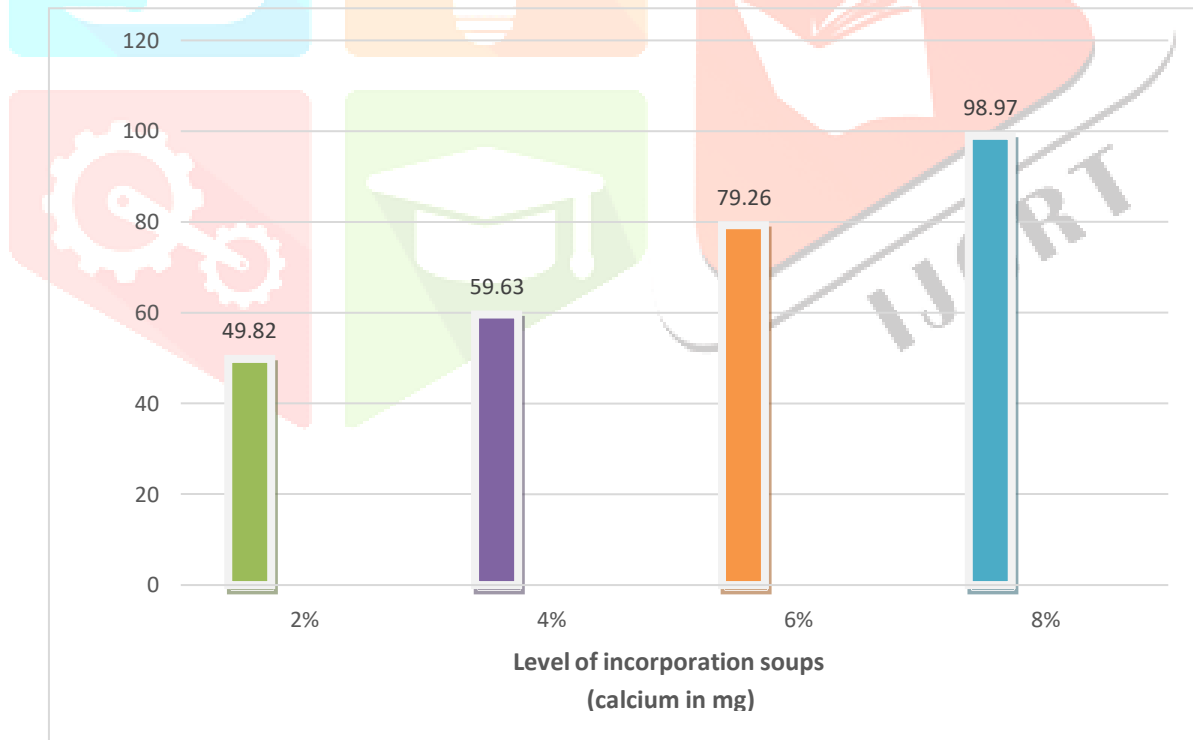


Figure – V
Calcium Content of 2 to 8 Percent of Onion Skin powder Incorporated Soup

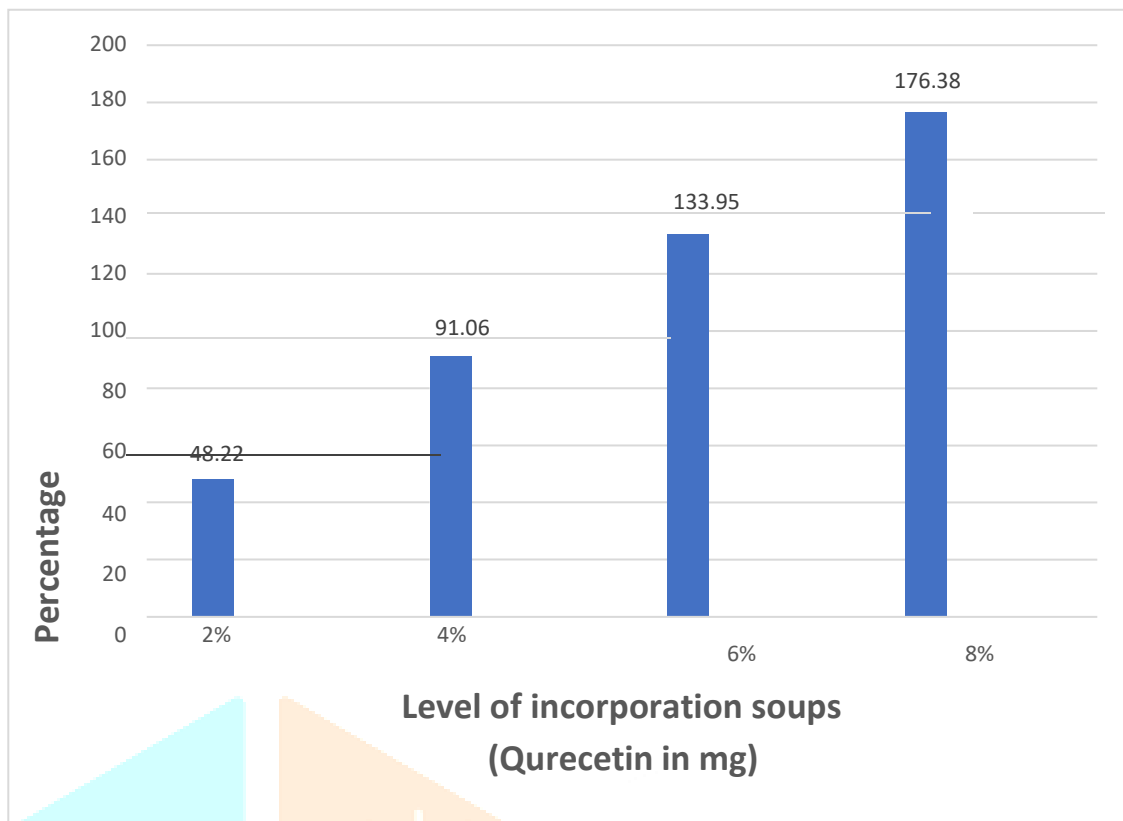


Figure – VI
Qurecetin Content of 2 to 8 Percent Onion Skin Powder Incorporated Soups

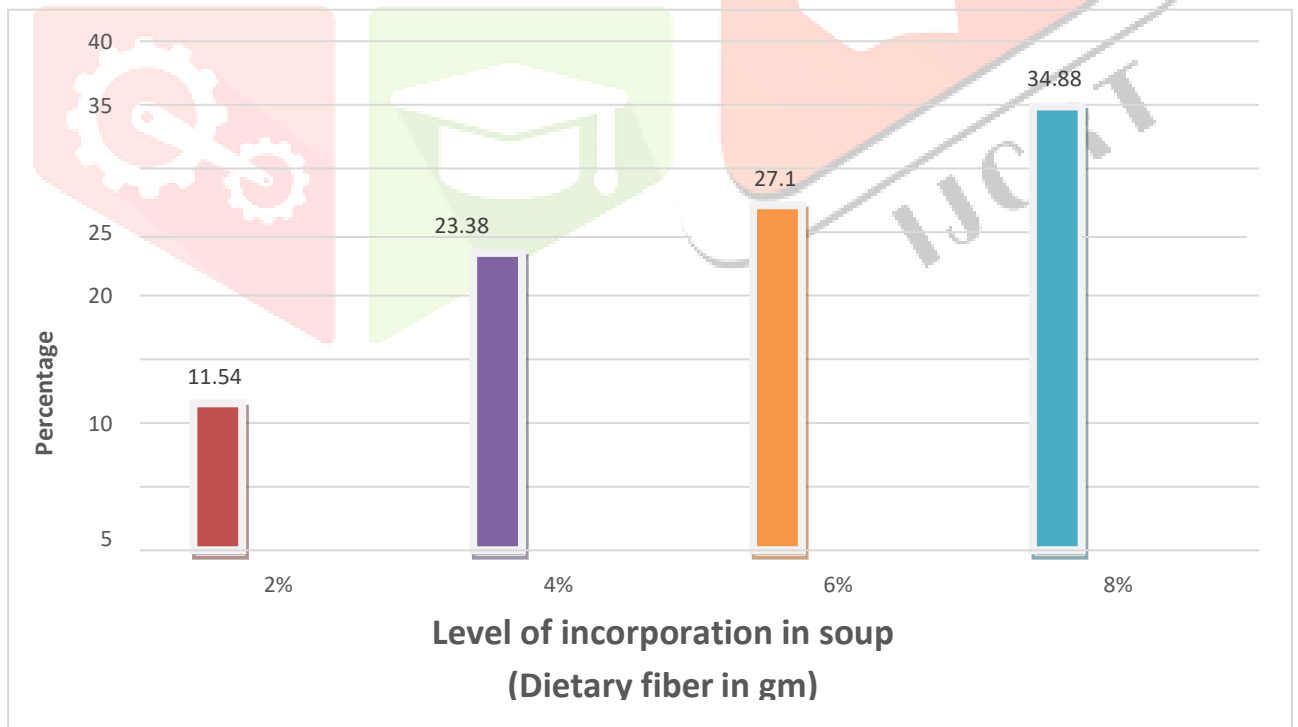


FIGURE VII
Dietary Fiber Contents in 2 to 8 Percent Level of Onion Skin Powder Incorporated

SUMMARY AND CONCLUSION

The incorporated in typical recipes at a proportion of 2, 4, 6, and 8%. The developed recipes were evaluated for organoleptic assessment using a four-point hedonic scale. The nutrition for the most well-liked onion skin powder incorporated recipes standard was examined following consumer acceptability testing of the recipes.

The onion is a widely utilized vegetable in cuisine all around the world. It is well known that this onion not only tastes distinct. Even though onion skin shouldn't be eaten, it has several health advantages. Typically, we use the interior of the onion and discard the peel. The onion's outer brown layer contains a rich source of antioxidants, fiber, and flavonoids, all of which are essential for healthy skin. The energetic pigment quercetin, which may be found in onions' skin, has potent anesthetic characteristics that can treat sleeplessness and prevent artery blockages as well as lower blood pressure and high blood pressure. Strong antibacterial, antioxidant, anticancer, and antifungal activities are abundant in onion peel. Quercetin, which is mostly found in the skin of onions and has potent flavonoid and antioxidant characteristics, kills cancer-causing cells and lowers the chance of developing cancer. Additionally, the insoluble fiber in onion skin helps to maintain a steady pH level and drain out toxins that have built up in the colon.

According to the findings of the current study, onion skin powder is also regarded as a consumable good. Various goods including soup, salad, and tea are made by adding onion skin powder at a rate of 2 to 8%. Most customers in this research liked the soup over the other two options. There were only minor differences in color and flavor and no alterations to the quality of the onion skin powder. Thus, it was approved by the general public. Vitamin A, C, E, calcium, fiber, Quercetin, and antioxidants were discovered to be abundant in the onion skin powder-incorporated soup's nutritional content, which was determined to be 6 percent higher than that of the regular soup. Most of the consumers liked the 6 percent level of onion skin powder incorporated soup.

BIBLIOGRAPHY

- **Amanda.**, 2010, The essential oils, Robert E. Krieger publishing company New York.
- **Ansari NA.,2007**, "Onion cultivation and production in Iran".
- **Daniel Zohary and Maria Hopf**; Domestication of plants in the world.2000
- **Deshraj Choudhary,2015**, Varieties of onions
- **Devi P.B., Rajendran, Vijaya Bharathi**, Health benefits of proso onion ;2002
- **Dr. Mehmet., 2002**, Onion varieties, Australia.
- **Elsevier Ltd 2015.**, Food science and technology, New Deli.
- **Flyman MV Afolayan J.** The suitability of wild vegetables for alleviating human dietary deficiencies. South African Journal of Botany. 2006;4: 492-497.
- **Fresco Louise O, Baudoin Wilfried O.** Food and Nutrition Security towards Human Security, Food Security and Vegetables–A Global Perspective, P.N. Agricultural Science Foundation, Bangalore, India.

2004:7-42.

- **Gamit.,**2003, Effect of fast food and instant food among peoples.
- **Gawlik-Dziki U.,** 2013, Food chemistry
- **Gomez M.I., S.C.Gupta;** 2003, Food Science and Nutrition.
- **Grubben, G.J.H.,**2003, A text book of Types of onion in India, first edition.
- **Gupta, A., Gupta, R., Lal, B.** Effect of *T.foenum-graecum* (fenugreek) seeds on glycaemic control and insulin resistance in type 2 diabetes mellitus: a double blind placebo controlled study. J. Assoc. Phys. Ind. 2001;49:1057-1061.
- **HamedFaridi.,**1997,Modern cookery,Fourth Edition, New Age International (p)Ltd, New Deli.
- **Harborne.J.B.,**2003, Phytochemistry, join willey&son Inc, New York.
- **Jacobsen, T.D,** 2002, The trentist of Indian medicinal plants, volume four,National institute of science communication, New Delhi.
- **Jiménez Aguilar DM, Grusak MA.** Minerals, vitamin C, phenolics, flavonoids and antioxidant activity of Amaranthus leafy vegetables. Journal of Food Composition and Analysis. 2017; 58:33-39.
- **Jimoh FO, Oladiji AT (2005).** Preliminary Studies on *Piliostigmathonningi*seeds:Proximate analysis, mineral composition andphytochemical screening. Afr. J. Biotech. 4(12): 1439-1442.
- **Kafie, et, al** 2002, Onion production and processing, frowsy university press,Iran.
- **Kumar.,** 1989, Plant nutritional challenges; Agriculture and food security.2018
- **Kumari M, Gupta S, Lakshmi AJ et al.,** Iron bioavailability in green leafy vegetables cooked in different utensils. Food Chemistry. 2004;86(2):217-222.
- **Liu RH.** Health benefits of fruits and vegetables are from additive and synergistic combination of phytochemicals. Am J Clin Nutr. 2003;78:517S-20S,
- **Margaret bogles.,** “Effect of essential oil of onion” Ravindra North TagoreMedical college, India 1976 July.
- **Marta corzo et al.,**1968, A nutrition Encyclopaedia, pegus pores, California.
- **Mensah JK, Okoli RI, Ohaju-Obodo JO, Eifediyi K** (2008) Phytochemical, nutritional and medical properties of some leafy vegetables consumed by Edo people of Nigeria. African Journal of Biotechnology 7: 2304-2309.
- **Mohammed, MI.** and Sharif, N. Mineral Composition of Some Leafy Vegetables consumed in Kano, Nigeria. Nigerian Journal of Basic and Applied Science. 2011; 19(2): 208-212.
- **Nadernejad.N.,** 2001, Agric marketing Indian, marketing ser.
- **Natalie loupe.,** 2020, “Diagnosis and control of onion disease” University Department of Plant Pathology.
- **Nwanekezie, E.C.** and Obiakor-Okeke, P.N. Mineral Content of Five Tropical Leafy Vegetables and

Effect of Holding Methods and Time. American Journal of Experimental Agriculture. 2014; 4(12):1708-1717

- **Otles S, Ozgoz S.** Health effects of dietary fiber. Acta Scientiarum Polonorum Technologia Alimentaria. 2014;13(2):191-202.
- **Pandey. B.P 1982.,** A text book of botany angiosperms, edition firsts, Chandand company.
- **Pawan kumar.,**1987, onion and garlic cultivation with processing.
- **Raju M, Varakumar S, Lakshminarayana R et al.,** Carotenoid composition and vitamin A activity of medicinally important green leafy vegetables. Food Chemistry. 2007;101(4):1598-1605. Roberfroid M. Dietary fiber, inulin, and oligofructose: A review comparing their physiological effects. Crit Rev Food Sci. Nutr. 1993; 33(2):103-148
- **Sanjeev Agarwale.,** 2001, Best -ever cook's collection Indian, Annesspublishing limited.
- **Sharmila Bharath.,** 2000, Medicinal plants, First Edition, oxford and IBHPublication.
- **Shibata A, Paganini-Hill A, Ross RK, Henderson BE.** Intake of vegetables, fruits, beta-carotene, vitamin C and vitamin supplements and cancer incidence among the elderly: a prospective study. Br J Cancer 2010;66:673-79
- **Solayman, M. Islam A. Paul S. Ali Y. Khalil I. Alam N. Gan SH.** Physicochemical properties, minerals, trace elements, and heavy metals in honey of different origins: A comprehensive review. Compr. Rev. Food Sci. Food Saf. 2016;15:219-233.
- **Spiller G.** Dietary fiber in prevention and treatment of disease. CRC Handbook of Dietary Fiber in Human Nutrition. USA: CRC Press LLC, 2001;363-431.
- **Suojala, T.,**2001, "Effect of harvest time on storage loss and sprouting in onion", Agricultural and Food Science, volume 10.
- **Tassan .C.G., 1975,**Indian folk medicine, pointer publishers.
- **Thomas T.,** 1972, "Hormone physiology of onion bulbs during dormancy", Experimental Horticulture, volume 23.