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Nutritional Enrichment of Maize (*Zea mays* L.) Chips by addition of Shatavari (*Asparagus racemosus*) roots powder.

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Abstract

Roots of *Asparagus racemosus* (Shatavari roots) have high contents of calcium, iron, vitamin C and a variety medicinally beneficial compounds i.e. saponins, flavonoids and polyphenols. Taking this fact into consideration the crude powder of dried *A. racemosus* roots was added in varying amounts (10 to 50 %) as one of the ingredients of maize chips (nachos). Sensory evaluation revealed the best acceptability of chips having 20 % of crude powder of *A. racemosus* roots. Nutritional analysis revealed that the *Z. mays* chips containing 20 % of crude powder of *A. racemosus* roots have low glycemic index**,** low fat content but have high calcium, iron and vitamin C suitable for persons having calcium and iron deficiencies.

Keywords- *Asparagus racemosus* roots, Zea mays chips, Nachos, Organoleptic evaluation, Nutritional analysis. Vitamin C, Calcium, Iron, Carbohydrates, Protein, Fat.

Introduction

Asparagus racemosus belongs to family Asparagascae. The whole plant of ***Asparagus racemosus*** is regarded as "Rasayana" in Ayurvedic text. *A. racemosus* demonstrated their promising results in osteoporosis via targeting different pathways in bone metabolism, including balancing osteoblasts and osteoclasts, anti-inflammatory, immunomodulatory, antioxidant, and estrogen-like functions. (Karimi, et al., 2022) (Majumdar, et al., 2021). Its use in anxiety disorders, hypertension, dysmenorrhea, hyperlipidemia, hypertension and benign prostatic hyperplasia have earlier been well described (Singla & Jaitak, 2014). Studies also indicate that it has antidysentric (Visavadiya & Narasimhacharya, 2009) mucilaginous, galactogogue (Venkatesan et al, 2005), antispasmodic, diuretic, anti-diarrhetic (Singla, et al 2013), anticancer activities. The roots of *A. racemosus* comprises of a varied variety of therapeutically active compounds like saponins, alkaloids, flavonoids, dihydrophenanthrene and furan derivatives. *A. racemosus* is also known for boosting the immunological system and acting as guard shell for body organs like the vital ones like heart and brain (Kala, 2009). In a clinical trial it was observed that there was highly significant improvement in clinical manifestation of anaemia after therapy with both drugs (Shatavari and Iron folic acid tablets). But the percentage of relief was more in Shatavari than Iron folic acid tablets (Yang, 2023)

A comparison between the nutritional components of the fresh and dried *A.racemosus* roots revealed in terms of percentage moisture (88.3), protein (3.06), fat (0.2), carbohydrates (5.58), ash (0.46) and fibre (2.4) in fresh and moisture (6.60), protein (21.8),

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fat (3.76), carbohydrate (48.54), ash (4.5) and fibre (14.8) in dried respectively. (Karunarathne, et. Al., 2020) Similarly the content of minerals like copper, manganese, potassium, sodium, calcium, iron, cobalt, zinc and magnesium in fresh were recorded as 0.11±0.05, 1.0±0.08, 12.27±0.12, 4.82±0.11, 18.09±0.43, 10.17±0.32, 0.11±0.09, 0.17±0.04 and 113.10±0.54 mg/100g, respectively. The ascorbic acid, thiamine and riboflavin contents of fresh shatavari roots were calculated to be around 8.95±0.11, 0.20±0.08 and 0.71±0.03 µg/g, respectively. The analysis of these contents in dried shatavari roots were recorded as follows. The copper, manganese, potassium, sodium, calcium, iron, cobalt, zinc and magnesium contents were 0.51±0.06, 3.35±0.18, 14.91±0.33, 10.95±0.21, 80.93±0.37, 24.22±0.56, 0.39±0.05, 1.01±0.03 and 258.10±0.55 mg/100g, respectively. The ascorbic acid, thiamine and riboflavin content of shatavari root powder were calculated as 4.48±0.06, 0.16±0.06 and 0.34±0.43 µg/g, respectively. (Negi, et al., 2010)

Taking these facts into consideration **A. racemosus added Zea mays Chips** were prepared by standardizing the dried content of *A. racemosus* roots were prepared. The method of preparation, organoleptic evaluation and nutritional analysis of A. racemosus added Zea mays chips have been described in the present communication. .

Materials and Methods

A. Procurement of *A. racemosus* roots and preparation of fine powder.

Fresh roots of *A. racemosus* plants of were collected, washed thoroughly rinsed with tap water. These were cut into small pieces and kept under Sunlight till dried. The dried roots were finally powdered with the help of pestle and mortar. The course powder prepared in this was filtered through muslin cloth and finally the fine was stored in air tight screw capped glass bottle.

B. Preparation of Zea mays chips incorporated with *A. racemosus* roots

The dough for the preparation of triangular Zea mays chips consisted of varying amount of maize flour (50 to 90 g) and crude powder of *A. racemosus* roots (10 to 50 g) in a total of 100 g, 2.0 g of table salt, and 1.0 g carom seeds. Six dough samples prepared in this were (Sample 1: 0 g *A. racemosus* roots and 100 g of Zea mays fluor; Sample 2: 10 g *A. racemosus* roots and 90 g of Zea mays fluor: Sample 3: 20 g *A. racemosus* roots and 80 g of Zea mays fluor; Sample 4: 30 g *A. racemosus* roots and 70 g of Zea mays fluor; Sample 5: 40 g *A. racemosus* roots and 60 g of Zea mays fluor; Sample 6: 50 g *A. racemosus* roots and 50 g of Zea mays fluor. In each case tight dough was prepared using approximate 40 ml lukewarm water. The doughs were rolled out on wooden base as thin sheets, respectively. The triangular shape chips with each dough preparation were cut with cookie cutters. Chips prepared with each dough preparation were placed on baking trays and kept in preheated oven at 150°C for 10 min. Chips were later allowed to cool at room temperature.

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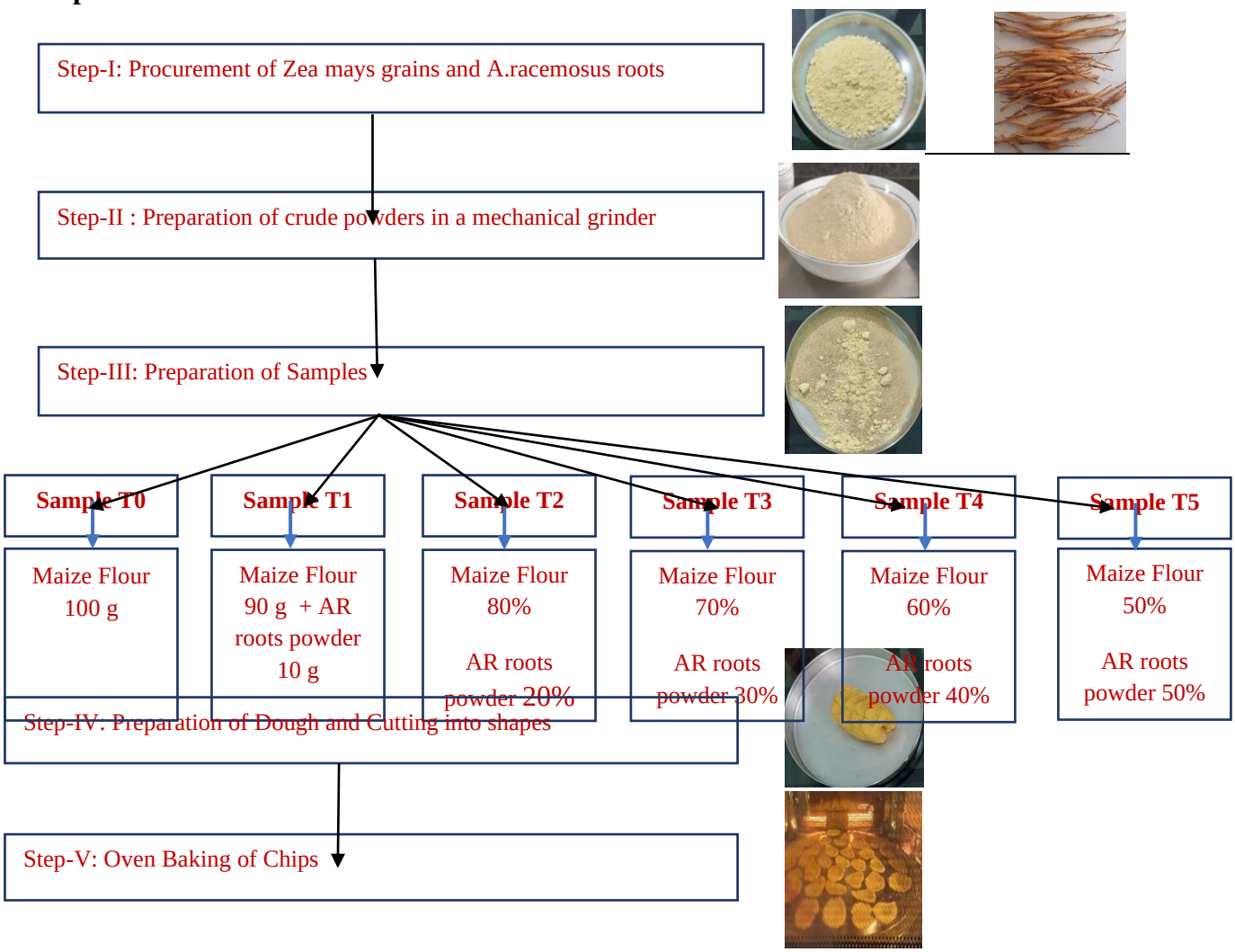
Fig 1: Steps in preparation of Zea mays chips incorporated with *A. racemosus* root powder



Developed food product with different percentage of test ingredient (*A. racemosus*)

C. Sensory evaluation of *A. racemosus* roots added in varying amounts in Zea mays chips.

The prepared chips were judged for Color, Texture, Taste and Overall acceptability with the help of 9 Point hedonic rating scale (0 to 9) by a panel of 15 experts. The points given on these parameters by experts were averaged and the total acceptability of the products was calculated.

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D. Proximate analysis of Zea Mays Chips.

a. Moisture content:

5.0 gm of fine powder of each sample (Zea mays chips) were taken separately in pre-weighed porcelain dishes (W). The dishes with sample were further weighed (W1), kept in 130^{o} C heated oven for 2 hours and after that removed from the oven and kept in desiccator at room temp. The dishes were further weighed againat every 30 min interval till a constant weight (W2). Finally the difference in the % moisture content of the sample was calculated by the formula % Moisture content = 100 x (W1-W2) / W1-W

Where

W1= Weight in grams of the dish with the material before drying

W2= Weight in grams of dish with the material after drying to constant weight

W= Weight in grams of the empty dish

b. Total Ash

The total ash content in chips samples was determined by the procedure (AOAC, 2000). 5.0 g of the crude powder of Zea mays chips was taken in a pre-weighed clean crucible. Crucible with half open lid was put over low Bunsen flame and heated till the fumes are not produced. The crucible with no lid was put in furnace and heated overnight at 550^{O} C. The lid was later placed after heating for preventing loss of fluffy ash. The crucible was cooled down in a dessicator and the cooled crucible was reweighed when the sample into it turns to gray. The % ash percent in the sample was calculated as follows:

Total Ash = W1-W2*100 / Ws

Where

W1 = Weight of the crucible with sample

W2 = Weight of the crucible with ash

Ws = Weight of the sample

c. Crude Fiber

2.0 g of the crude powder of Zea mays chips was taken in 500 ml round bottom flask. The measured volume (200 ml) of dilute sulfuric acid was poured into the flask. The flask was put on a hot plate to boil for 30 min. The sample was filtered with muslin cloth and the residue was washed several times with water.

200 ml of NaOH solution (0.313 N) was measured into a 500 ml round bottom flask to which acid digested sample was added. Mixture was boiled for 30 min, cooled and then filtered with muslin cloth. Residue was washed repeatedly with water. The residue was kept in an empty pre-weighed crucible (W_1) and kept in a hot air oven at 130^{0}C for 2 hours and then cooled in desiccator. The crucible was then placed in muffle furnace at 550^{0}C for 2 hours. The cooled crucible was again weighed (W_2). The total fiber content in the sample was calculated by taking difference i.e. W_2 and W_1. The % fiber content in the sample was calculated by the following formula

Crude Fiber = W1-W2 x 100 / Ws

Where

W1 = Weight of the crucible with sample

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W2 = Weight of the crucible with ash
Ws = Weight of the sample

d. Total Fat content;

A bottle and lid was in the incubator at 105^{o} C overnight and weighed till a constant weight is obtained. 3 to 5 g crude powder of Zea mays chips weighed on a filter paper was transferred to extraction thimble and put into Soxhlet. The bottle with 200 ml of petroleum ether on a heating mantle was connected to Soxhlet apparaturs and turned on the water to cool them and then the heating mantle was switched. Heating on the mantle was continued for 14 h (heat rate of 150 drop/min). The solvent was evaporated using vaccum condenser. The bottle was incubated at 80-90^{o} C until solvent is completely evaporated and the bottle is completely dry. After drying the bottle was transferred with partially covered lid to the dessicator and allowed to cool. The bottle was reweighed and its dried content. The % fat present in the sample was calculated as follows:

Formula:

Crude Fat % = W2 – W1* 100 / Ws

Where
W2 = Weight of the flask with fat
W1 = Weight of the flask
Ws = Weight of the sample

e. Protein:

The Protein content in Zea mays chips was calculated by obtaining nitrogen content by Kjeldahl Method and multiplying that with protein factor (6.25). 0.5 to 1.0 g of the crude powder of Zea mays chips was placed in digestion flask and to which 5 g of Kjeldahl catalyst (K_2SO_4 and $CuSO_4$) and 200 ml of concentrated sulfuric acid was added. In the similar way one control flask was taken which is devoid of sample. The flasks were placed in the inclined position and heat gently until frothing ceases until the solution is cleared. 60 ml of distilled water was added to it. The flasks were immediately connected to digestion bulb on condenser and with tip of condenser immersed in standard acid and 5 to 7 indicator in receiver. The flask was rotated to thoroughly mix the contents and heated until all ammonia is distilled. The receiver was removed, the tip of the condenser was washed and titrated excess standard acid distilled with standard alkali solution. The % protein content in the sample was calculated as follows:

Protein % = (A-B) x N x 14.007 x 6.25 / W

Where
A= Volume (ml) of 0.2 N HCl used sample titration
B= Volume (ml) of 0.2 N HCl used blank titration
N= Normality of HCl
W= Weight (g) of sample
14.007= Atomic weight of Nitrogen
6.25= the protein nitrogen conversion factor

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f. Carbohydrates:

The carbohydrate content in 100 g Zea mays chips was determined according to the nitrogen free method described by AOAC (2006) i.e. % carbohydrate (NFE) = 100 – (moisture + Protein + Fat + Ash + Crude fiber).

g. Calcium

5.0 g crude powder of Zea mays chips was taken in a 100 nl beaker where 8.0 ml of concentrated Sulfuric acid and 10 ml of concentrated nitric acid were added. The beaker was then placed on a hot plate and warmed cautiously until the reaction subsided. To avoid charring aliquots of concentrated nitric acid was constantly added. Then solution was allowed to cool and diluted with 10 ml of double-distilled water and boiled to fuming. The solution was heated to fuming state each time hydrogen peroxide was added until the residue became colorless or no further reduction of pale yellow color was obtained. Then the solution was made up to mark in 100 ml volumetric flask. 25.0 ml aliquot of digest was pipetted into a beaker and NaOH solution was added to adjust the pH to 12-13. Two drops of Solo-chrome dark blue dye was then added and immediately titrated against 0.01M EDTA solution to the blue end-point.

h. Iron

25 g sample was taken in a dish, 20% sulphuric acid was added into dish, mixed thoroughly to ensure proper wetting of the sample. Sample was then heated in an oven around 110^0C. After heating, content was again heated on soft flame for removal of all volatile and readily combustible matter. The dish was then transferred to furnace for ashing at 500^0C for 6 to 8 hours, later cooled. After obtaining carbon free ash, 1.0 ml HNO_3 and 10 ml of water was added to dissolve the sample ash. The content was transferred into 50 ml volumetric flask then 10 ml HCl was added to the dish and heated and the content was transferred to volumetric flask. Sample blank was prepared with same amount of reagents without sample. Absorbance of sample solution and blank wad determined using Atomic Absorption Spectrophotometer. The iron value is determined by comparing with standard graph.

i. Calorific Value

The calorific value (energy value) of 100 g Zea mays chips was calculated using the method described by Grah et al (2014) i.e. energy value = % protein x 4) + (% fat x 9) + (% carbohydrate x 4).

Statistical analysis

Values of samples with or without *A. racemosus* roots were compared statistically by employing Student's t test. Each value is the average value + S.E. the experiments were done in triplicate.

Results

Table 1 shows the percentage of Maize flour and crude powder of *A. racemosus* roots in Zea Mays Chips (T1 to T5). In each of the case the content of table salt and carom seeds was the same whereas the warm water content varies from 40 to 55 ml. After baking, the % yield of the chips were found as shown in Table 1.

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Sample	% Maize Flour (Base Ingredient)	% A. racemosus Roots (Test Ingredient)	% yield of the baked chips
T0	100	0	101
T1	90	10	110
T2	80	20	104
T3	70	30	103
T4	60	40	106
T5	50	50	107

Table 2 presents the results of sensory evaluation of samples T_0 to T_5 of Zea mays chips as average +S.E. of various samples of Zea mays chips. It is evident from the results that the sample T2 has scored the points 7.79 in color, 7.73 in texture, 8.52 in taste, and 7.83 in overall acceptability.

Sample	Color	Texture	Taste	Overall Acceptability
T0	7.00 (±0.43)	7.00 (±0.27)	7.00 (±0.38)	7.66 (±0.54)
T1	7.36 (±0.36)	7.00 (±0.99)	7.56 (±0.45)	7.48 (±0.45)
T2	7.79 (±0.27)	7.73 (±0.23)	8.52 (±0.21)	7.83 (±0.08)
T3	6.46 (±0.35)	6.21 (±0.00)	7.21 (±0.30)	6.46 (±0.19)
T4	5.33 (±0.29)	5.79 (±0.23)	6.33 (±0.67)	5.77 (±0.32)
T5	5.00 (±0.33)	5.33 (±0.27)	5.66 (±0.23)	5.33 (±0.32)

Sensory Attributes

Color

The average sensory ratings for the different sensory aspects such as color, texture, taste, and overall acceptability of Zea mays chips are shown in Table 2. Their diagrammatic representation in shown in Fig

Average sensory score of Color was highest in T2 (7.79 ±0.27) followed by T1, T0, T3, T4 and T5 having the scores of (7.36 ±0.36), (7.0 ±0.43), (6.46 ±0.35), (5.33 ±0.29) and (5 ±0.33) respectively. The calculated F value (18.73) was higher than the tabulated F value (4.75) at 5% level of significance. This shows there was significant difference in colour of control and treatment variations which indicates the different proportion of Asparagus racemosus added as the test ingredients affect the colour of the developed product. The colour of the developed product becomes lighter whereas the acceptability first increases and the decreases with the increase in amount of test ingredient. Treatment had significant influence and CD value was 0.35.

Texture

The mean score for Texture was highest in T2 (7.73 ±0.23), followed by T0 (7.0±0.27) , T1 (7.0±0.99), T3 (6.21±0.00) , T4 (5.79±0.23) and T5 (5.33 ±0.27). The calculated value of F (10.63) was higher than the tabulated vale of F (4.75) at 5% level of significance, which shows the significant difference in texture of control and treated food

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product. The addition of variable amount of Asparagus racemosus affect the texture of the developed chips increasing the crispiness thereby initially increasing and later decreasing the acceptability of the developed products. The treatment had the significant influence and CD value was 0.36

Taste

The average sensory score for the attribute of Taste was highest in T2 (8.52 ±0.21) followed by T1, T3, T0, T4 and T5 having the scores of (7.56 ±0.45), (7.21 ±0.30), (7.0 ±0.38), (6.33 ±0.67) and (5.66 ±0.23) respectively. The calculated F score (11.73) was higher than the tabulated F value (4.75) at 5% level of significance. Value addition of Asparagus racemosus roots powder to the base ingredients gradually increases the taste to certain concentration which later decreased with increasing concentration of test ingredient and hence the significant influence was seen in this treatment and CD value was 0.38.

Overall acceptability

The overall acceptability mean score was highest in T2 (7.83 ±0.08) followed by T1 (7.48±0.45) , T0 (7.66±0.54), T3 (6.46±0.19) , T4 (5.77±0.32) and T5 (5.33 ±0.23). The calculated value of F (15.42) was higher than the tabulated vale of F (4.75) at 5% level of significance, which shows the significant difference in overall acceptability of control and developed food product. The different percentage addition of Asparagus racemosus affect the overall acceptability of the developed nachos initially increasing and later decreasing the acceptability of the developed products. The treatment had the significant influence and the CD value was 0.41.

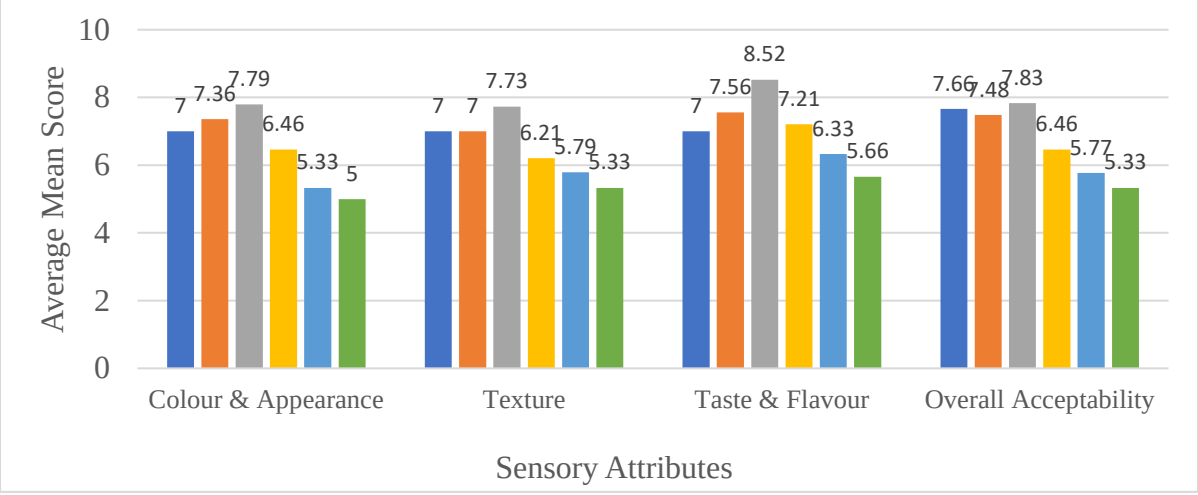

Figure 2. presents the results of sensory evaluation of samples T_0 to T_5 of Zea mays

Table 3 presents the proximate analysis of Zea mays chips (T_0 to T_5). The % moisture was more in T0 (6.52±0.22) followed by T1 (6.37±0.31), T2 (5.10±0.02), T3 (5.02±0.07), T4 (5.00±0.02) and T5 (4.82±0.18), respectively "T" values calculated from the difference in moisture % of control T0 and widely acceptable product T2 was 11.13 which shows significant difference. Percentage increase in the addition of *A. racemosus* roots powder shows decrease in % moisture that could beneficial for longer shelf life of the product and also contributes to crispiness of the product. The % ash content was found to be highest in T5

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(5.69±0.32) followed by T4 (4.64±0.15), T3 (4.05±0.42), T2 (3.92 ±0.07), T1 (3.49±0.26) and T0 (3.34±0.65). "T" values calculated from the difference in % ash content of control T0 and widely acceptable product T2 was 1.53 which shows insignificant difference. Increase in the addition of *A. racemosus* roots powder though showed % percentage increase in ash content of the final products, but statistically insignificant. The fiber content was found to be highest in T5 followed by T4 (5.61±0.18), T3 (5.12±0.22), T2 (4.50±0.04), T1 (3.84 ±0.02) and T0 (2.70±0.14) "T" values calculated from the difference in fiber content of control T0 and widely acceptable product T2 was 21.41 which shows significant difference. Increase in the addition of *A. racemosus* roots powder percentage shows increase in fiber content of the final products. The % fat content was highest in T0 (0.25±0.05) followed by T1 (0.24±0.02), T2 (0.21 ±0.02), T3 (0.19±0.03) T4 (0.16±0.02) and T5 (0.15±0.04). "T' values calculated from the difference in fat content of control product T0 and best acceptable product T2 was 1.28 which shows insignificant difference. Increase in the addition of *A. racemosus* roots powder percentage shows decrease in fat content of the final products.

The % protein content Zea mays chips enriched with root powder of A. racemosus revealed, significant increase in the protein content of the chips. T5 (6.86±0.03) had highest amount of protein, followed by T4 (6.74±0.33), T3 (6.38±0.05), T2 (5.78±0.04), and T1 (5.25±0.20). T0 (5.21±0.16) has the lowest amount of protein. "T" values calculated from the difference in protein content of control product T0 and best acceptable product T2 was 5.98 which shows significant difference. Calculation of carbohydrate content in Zea mays chips revealed that T5 (90.76±0.34) has highest carbohydrates content followed by T4 (89.03±0.05), T3 (84.42±0.14), T2 (80.49±0.18), T1 (69.45±0.35) and T0 (64.20±0.27). "T" values calculated from the difference in carbohydrate content of control product T0 and widely acceptable product T2 was 86.94 which shows significant difference. Addition of *A. racemosus* roots powder increase carbohydrate content in the final products.

Energy content was found to be highest in T5 (391.83±0.08) followed by T4 (384.52±0.02), T3 (364.91±0.07), T2 (346.97±0.26), T1 (300.96±0.05) and T0 (279.89 ±0.17). "T" values calculated from the difference in energy content of control product T0 and best acceptable product T2 was 369.61 which shows high significant difference.

Calcium content was found to be highest in T5 (211.26±0.23) followed by T4 (207.84±0.12), T3 (202.05±0.12), T2 (199.57±0.32), T1 (178.59±0.38) and T0 (12.62 (±0.41). "T" values calculated from the difference in calcium content of control product T0 and best acceptable product T2 was 622.59 which shows high significant difference. Increase in the addition of *A. racemosus* roots powder percentage shows increase in calcium content of the final products.

Iron content of different variations of *A. racemosus* added Zea mays chips revealed that with the increase in the percentage of A. racemosus roots powder, there was also significant increase in the iron content of the chips. T5 (7.37±0.36) had highest amount of iron, followed by T4 (7.14±0.44), T3 (6.62±0.18), T2 (6.00±0.11), and T1 (3.41±0.23). T0 (2.30±0.13) has the lowest amount of iron content. "T" values calculated from the difference in iron content of control product T0 and best acceptable product T2 was 18.55 which shows significant difference.

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Table 3. Proximate analysis of Zea mays chips

Sample	% Moisture (g)	% Ash (g)	% Fiber (g)	% Fat (g)	% Protein (g)	% Carb (g)	Energy (kcal/100g)	% Iron (mg)	% Calcium (mg)
T0	6.52 (±0.22)	3.34 (±0.65)	2.70 (±0.14)	0.25 (±0.05)	5.21 (±0.16)	64.20 (±0.27)	279.8 (±0.17)	2.30 (±0.13)	12.62 (±0.41)
T1	6.37 (±0.31)	3.49 (±0.26)	3.84 (±0.02)	0.24 (±0.02)	5.25 (±0.20)	69.45 (±0.35)	300.9 (±0.05)	3.41 (±0.23)	178.59 (±0.38)
T2	5.10 (±0.02)	3.92 (±0.07)	4.50 (±0.04)	0.21 (±0.02)	5.78 (±0.04)	80.49 (±0.18)	346.9 (±0.26)	6.00 (±0.11)	199.57 (±0.32)
T3	5.02 (±0.07)	4.05 (±0.42)	5.12 (±0.22)	0.19 (±0.03)	6.38 (±0.05)	84.42 (±0.14)	364.9 (±0.07)	6.62 (±0.18)	202.05 (±0.12)
T4	5.00 (± 0.02)	4.64 (±0.15)	5.61 (±0.18)	0.16 (±0.02)	6.74 (±0.33)	89.03 (±0.05	384.5 (±0.02)	7.14 (±0.44)	207.84 (±0.12)
T5	4.82 (±0.18)	5.69 (±0.32)	5.84 (±0.24)	0.15 (±0.04)	6.86 (±0.03)	90.76 (±0.34)	391.8 (±0.08)	7.37 (±0.36)	211.26 (±0.23)

Table 4. compares the statistical analysis of widely acceptable Zea may chips with root powder of A.racemosus (T2) with Zea mays chips without A, racemosus root powder. It is evident from the results that the T2 are rich in protein, carbohydrate, fiber, calcium and iron contents. However, there was no significant difference found in ash and fat between the two i.e. T2 and T0. T2 are also rich in calories.

S. No.		Sample		Difference (t0 -t1=D)	T (Calculated)	Standard Error of difference	Result
		T_0	T_2				
1.	Moisture (g/100g)	6.52 (±0.22)	5.10 (±0.02)	-1.42	11.13	0.12	S
2.	Ash (g/100g)	3.34 (±0.65)	3.92 (±0.07)	-0.58	1.53	0.37	NS
3.	Fiber (g/100g)	2.70 (±0.14)	4.50 (±0.04)	-1.80	21.41	0.08	S
4.	Fat (g/100g)	0.25 (±0.05)	0.21 (±0.02)	0.04	1.28	0.03	NS
5.	Protein (g/100g)	5.21 (±0.16)	5.78 (±0.04)	- 0.57	5.98	0.09	S
6.	Carbohydrates (g/100g)	64.20 (±0.27)	80.49 (±0.18)	-16.29	86.94	0.18	S
7.	Energy (Kcal/100g)	279.89 (±0.17)	346.97 (±0.26)	-66.29	369.61	0.17	S
8.	Calcium (mg/100g)	12.62	199.57	-186.95	622.59	0.30	S

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		(±0.41)	(±0.32)				
9.	Iron (mg/100g)	2.30 (±0.13)	6.00 (±0.11)	-3.70	18.55	0.19	S

Discussion

Results of the present study indicate that Zea mays chips incorporated with A, racemosus roots have more protein, carbohydrate, fiber, calcium and iron contents and therefore have more energy value. Though a non-significant difference was observed in moisture content of chips fortified with A, racemosus roots compared to control preparations indicating extended shelf life of A. racemosus fortified chips. It is not surprising to consider the chips not only as nutritive but also the medicinal ones for various ailments. The roots of A.racemosus have lot of bioactive constituents like alkaloids, steroid, terpenoids, and saponins, antioxidant flavonoids, Vitamin C, thiamine and riboflavin and many of the essential trace elements like copper, manganese, potassium, sodium, calcium, iron, cobalt, zinc and magnesium originally present in A.racemosus roots will be present in Zea mays chips..

Plant of *A.racemosus* is referred as 'rasayanam' means drugs from ayurvedic plants to lengthening the lifespans and enhancing their well- being by improving cellular vitality and resistance. (Goyal & Singh, 2003). It's use as plant based drugs is described in the Charaka samhita, the ancient literature of Ayurveda (Chawla. et al., 2011) . Various latter studies and researches have mentioned the properties of A.racemosus as it is antidysentric (Visavadiya & Narasimhacharya, 2009), nutritive, mucilaginous, galactogogue (Venkatesan N et al, 2005) , antispasmodic, diuretic, and antidiarrhetic (Singla et al., 2013) and has great impact on female reproductive health and suggested by gynaecologists in weakening of uterus and its endometrial wall, recurrent abortions and sudden termination of pregnancies, excessive menstrual bleeding. (Goel & Sairam, 2002)

Being highly qualitative and nutritive A. racemosus is also known for its essential property to boost the immunological system and acting as guard shell for major body organs like heart, brain (Kala, 2009) and other organ systems. Roots of A.racemosus is traditionally used in India for internal discomfort, cysts and tumor, febrile conditions (Gomase & Sherkhane, 2010). It will not be surprising for the use of these fortified chips in these conditions.

Conclusion: It can be concluded from the present study that Zea mays chips (nachos) fortified with 20 % concentration of *Asparagus racemosus* roots powder had wider acceptance and showed significant higher levels of nutrient content/100 g as compared to control. These fortified chips have more protein, carbohydrate, fiber contents and in addition have calcium and iron content best for use by calcium and iron deficient ones. . Elaborative comprehensive studies are needed for determining its therapeutic efficacy.

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