NUTRIENT COMPOSITION AND VALUE ADDITION TO SWEET POTATO [*Ipomoea batatas* (L.) Lam] GENOTYPES

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CERTIFICATE

This is to certify that the thesis entitled **"NUTRIENT COMPOSITION AND VALUE ADDITION TO SWEET POTATO [*Ipomoea batatas* (L.) Lam] GENOTYPES"** submitted by **Miss SAMREEN K. KITTUR,** for the degree of **MASTER OF HOME SCIENCE** in **FOOD SCIENCE AND NUTRITION** to the University of Agricultural Sciences, Dharwad is a record of research work carried out by her during the period of her study in this University, under my guidance and supervision, and the thesis has not previously formed the basis of the award of any degree, diploma, associateship, fellowship or other similar titles.

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Introduction

1. INTRODUCTION

Sweet potato [*Ipomoea batatas* (L.) Lam], a perennial tuber crop, is a member of the Convolvuleacea family. Though, this family includes about 45 genera and 1,000 species only *Ipomoea batatas* is of economic importance as food. Tubers are main usable part of the plant, although leaves can also be used. Tubers are characterised by high unit mass (1-3 and even 5 kg) and diverse shapes – spherical, oval, spherical-oval and fusiform.

Sweet potato is an exceptionally essential crop in several parts of the world, being produced in more than 100 countries. Today, the main commercial producers of sweet potatoes are India, China, Indonesia, Vietnam, Japan and Uganda. It is also a main food crop of the tropical and sub-tropical areas and therefore, can provide a nutritional advantage to the people of rural and urban regions by enhancing their production and increasing consumption. Sweet potato is positioned as the seventh most major food crop in the world, fourth in tropical countries and fifth most essential food crop on a fresh weight basis in developing countries after rice, wheat, maize and cassava.

India has a long history of sweet potato cultivation. It is an important tuber crop grown in almost all parts of India. In 2014-15, sweet potato was cultivated in about 1.11 million hectares, the total production was 11.3 million tonnes and productivity was 10.1 tonnes/hectare. The major area under sweet potato in India is spread over: Karnataka, Orissa, Uttar Pradesh, West Bengal, Madhya Pradesh, Chhattisgarh, Assam, Nagaland, Meghalaya and Tamil Nadu. In 2014-15, the total production in Karnataka was 35.21 lakh tonnes. Sweet potato varieties exist in many colours of skin and flesh, ranging from white to deep purple, although white and yellow, orange flesh are the most common (Adam, 2005). The dominant sweet potato varieties grown by farmers in sub-Saharan Africa including Nigeria have white or cream flesh, which contain little or no beta-carotene (Stathers *et al*., 2005). However, improved varieties including orange-fleshed varieties, with varying genetic and agronomic characteristics are been developed in Nigerian research institutions and released to farmers (Afuape 2009; Egeonu and Akoroda, 2009; Afuape, 2013). There are about eighteen white fleshed and six orange fleshed sweet potato varieties released in Ethiopia (Tofu *et al*, 2007; Anon, 2015). However, most of these varieties are obsolete and are not under production. There are five varieties of sweet potato released by Central Tuber Crops Research Institute (CTCRI), Bhubaneswar, *viz*. ST-13 (Bhu Krishna), an anthocyanin rich variety, ST-10 (Bhu Swami) is a white fleshed variety, CIP-440127 (Bhu Kanti) and CIPSWA-2 (Bhu Ja) are

orange fleshed varieties, ST-14 (Bhu Sona) is a β-carotene rich variety (Anon, 2016). Sweet potato is used mostly as vegetable and snack food. Industrial utilization is very negligible causing negative growth in area and production.

The carbohydrate content of the sweet potato tubers varies from 25 % to 30 %, while the rest is composed of water (58 % to 72 %). Sweet potatoes are good sources of vitamin C, vitamin E, dietary fibre, calcium, potassium and iron, and are low in fat and cholesterol. However they also contain moderate quantities of thiamine (B_1), riboflavin (B_2), niacin, pantothenic acid (B_5), pyridoxine (B_6) and folic acid. Moderate quantities of sodium, magnesium, manganese and zinc are also present.

Sweet potatoes are usually consumed by baking, boiling, microwaving, steaming and frying. These cooking processes would certainly bring about a number of changes in the physical characteristics and chemical composition of sweet potatoes. A number of factors including maturity period, storage, amylase potential, curing and baking treatment significantly influence sweetness/sugar content of sweet potato tubers (Wang and Kays, 2001; Dziedoave *et al*, 2010; Adu-Kwarteng *et al*, 2014).

Sweet potato tubers have anti-diabetic, anti-oxidant and anti-proliferative properties due to the presence of valuable nutritional and mineral components (Jaarsveld *et al*, 2005; Abubakar *et al*, 2010). Furthermore, *Ipomoea batatas* tubers, which are steady item in the Americans' diet, appear to be very beneficial in the diet of diabetics and consumers with an insulin resistance, as they have a low glycemic index (Ludvik *et al*, 2004; Allen *et al*, 2012). Orange fleshed sweet potato is gaining importance as the least expensive source of antioxidants, providing essential health benefits. Consumption of orange fleshed sweet potato tubers can also provide sustainable vitamin A, which plays a major role in preventing and treating night blindness, thus enlisting the food based approach for managing the problem of modern chronic diseases together with vitamin A deficiency. Anthocyanins from purple fleshed sweet potato have been shown to exhibit strong radical scavenging and antimutagenic activity, significantly reduce high blood pressure and have anti-inflammatory, antimicrobial, hepatoprotective (Wang and Mazza, 2002; Pisha *et al*, 1994), anticancer (Hagiwara *et al*, 2002; Kurata *et al*, 2007), Chemo protective activities (Tsuda *et al*, 2003; Kamei *et al*, 1995) and ultraviolet protection effects (Oki *et al*, 2002; Suda *et al*, 2003; Teow *et al*, 2007).

The majority of subsistence farmers who eat sweet potato do not utilize a storage technique of any kind, instead using a method of continuous cultivation and leaving

the tubers in the ground until they are ready to be used (Onwueme, 1982; Smit, 1994). While less common, simple methods of storage do exist. The common ones include pit, clamp, and indoor storage and all extend the storage time of sweet potatoes by some degree (Devereau, 1994; Dandago and Gungula, 2011). Maintaining proper storage temperature is probably the most significant barrier to good storage in subsistence farmers. Pre-treatment of sweet potato can help to minimize risk of losses. Curing can toughen the skin and heal minor physical damages while drying can reduce spoilage and inactivate metabolic degradation. Optimum storage of sweet potatoes occurs at 12–16 °C (54–61 °F), 85–90 % relative humidity (RH) and requires proper ventilation to remove excess carbon dioxide (CO_2) and bring in oxygen (O_2) for respiration. At these conditions sweet potatoes have been shown to last 5 months to a maximum of a year compared to 2–3 months normally (Devereau, 1994).

Fresh sweet potato tubers are bulky and semi-perishable with shelf life of few weeks. This calls for suitable user friendly methods for processing the tubers for future use. The flour, if produced from sweet potato, has the potential for utilization in a variety of food products such as baked goods (bread, cakes, cookies, biscuits); doughnuts, breakfast foods (instant porridge, crisp, flake-type products); noodles or pasta-type products; sauces (soy sauce, ketchup); and brewing adjuncts (Van Hal, 2000; Mais and Brennan, 2008). Sweet potato flour can add natural sweetness, colour, and flavour to processed food products.

All India Co-ordinated Research Project on Tuber crops functioning at the Regional Horticultural Research and Extension Centre, Dharwad under University of Horticultural Sciences, Bagalkote has identified a large number of genotypes. It is essential to screen these for quality parameters so as to shortlist and choose the genotype with good quality attributes for cultivation and utilization of sweet potato tubers among populations. Hence, the present study was conducted with the following objectives:

- To record the colour and physico-chemical properties of sweet potato genotypes
- To estimate the nutrient composition of sweet potato genotypes
- To evaluate the cooking quality and acceptability of sweet potato genotypes
- To investigate the flour production potential and characterization of flour of sweet potato genotypes.

Review of Literature

2. REVIEW OF LITERATURE

The sweet potato [*Ipomoea batats* (L.) Lam] is a dicotyledonous plant which belongs to the family Convolulaceae. It is a tuberous root crop important for food security and cultivated in over 100 developing countries. Over 95 % of the global sweet potato production is in developing countries like India, Srilanka and Nigeria. Among other root and tuber crops, sweet potato contains higher amounts of carbohydrates, vitamins, minerals and protein. It also contains much higher levels of provitamin A, vitamin C and minerals than rice or wheat. In addition to the nutritional values, sweet potato has been rediscovered as functional food with high levels of various phytochemicals providing health benefits. The components in the flesh contribute to the colour. The literature pertaining to the study "Nutrient composition and value addition to sweet potato genotypes" has been reviewed under the following sub-headings:

2.1. Colour and physico-chemical properties of sweet potato genotypes

2.2. Nutrient composition of sweet potato genotypes

2.3. Cooking quality and acceptability of sweet potato genotypes

2.4. Flour production potential and characterization of flour of sweet potato genotypes

2.1. Colour and physico-chemical properties of sweet potato genotypes

Physical characteristics of agricultural products are the most important parameters in the design of grading, handling, processing and packaging systems. Physical characteristics like length, width, thickness, circumference, mass and volume are important.

A study was conducted by Mwanga *et al.* (2001) to record tuber shape, skin colour, flesh colour and dry matter content of five sweet potato cultivars in Uganda. The root shape varied from obovate, long – irregular and round. The skin colour varied from purple-red, red, brownish orange and yellow. The flesh colour varied from white, cream to pale yellow. The variety Slowola had higher dry matter content (34.00 g %) and the variety Bwanjule had lower dry matter content (30.00 g %).

An investigation to determine the skin colour and flesh colour of ten varieties of sweet potato by Laurie and Magoro (2008) indicated that the tubers were of various skin colour i.e. cream to pale brown (Amasi), pale cream (Letlhabula), copper (Mamphenyane), cream

(Mokone, Monate and Ndou), bright purple (Phala), pale orange (Serolane and Excel) and orange (W-119). The tubers were of various flesh colours i.e. cream with pale orange spots (Amasi), pale cream (Letlhabula), cream with slight pale orange (Mamphenyane), dark cream (Mokone), cream (Monote and Ndou), cream with slight pale orange (Phala), orange with yellow ring (Serolane), orange with yellow cortex (Excel) and orange (W-119).

Egbe *et al.* (2012) studied the diameter and length of eleven sweet potato varieties in Makurdi, Southern Guinea Savanna of Nigeria. The root diameter in the varieties ranged from 0.80 cm in NASPOT2 variety to 8.23 cm in NARSP/05/022 variety. The root length in the varieties ranged from 5.83 cm in NASPOT2 variety to 21.67 cm in NARSP/05/022 variety.

Nabubuya *et al.* (2012) determined physical properties of ten sweet potato varieties. The sweet potato varieties were of various skin and flesh colour i.e. pale yellow (NASPOT, Soroti, Esapat), pink-purple (Dimbuka, New kawogo, Kakamega, NASPOT 9, NASPOT 10), purple (NASPOT 2), yellowish brown (Ejumala) and cream (NASPOT 1), pale yellow (Dimbuka), yellow (Soroti and Esapat), white (NASPOT 2 and New kawoga), pale orange (Kakamega), orange (NASPOT 9 and NASPOT 10), deep orange (Ejumala). The dry matter content in the sweet potato varieties ranged from 30.20 g per cent in Dimbuka to 39.20 g per cent in Esapat. Higher pH was seen in Esapat (6.65) and lower was seen in NASPOT 10 (6.03).

A study was conducted by Teye and Abano (2012) to determine physical properties of two sweet potato varieties. The length and volume were higher in Ukerewe (12.30 ± 2.80 cm and 161.01 ± 74.70 $cm^{3,}$ respectively) compared to TIS 2 (11.60 ± 2.20 cm and 92.78 $cm^{3,}$ respectively). The variety TIS 2 was wider, thicker and heavier (5.71 ± 1.30 cm, 4.90 ± 1.10 cm and 111.00 ± 1.58 g, respectively) compared to Ukerewe (6.48 ± 1.12 cm, 3.90 ± 0.90 cm and 73.00 ± 3.90 g, respectively).

While evaluating thirteen orange fleshed sweet potato genotypes for dry matter and weevil incidence Desai *et al.* (2013) found that higher dry matter was found in the genotype ST-14 (34.70 g %) and lower was found in Gouri (22.50 g %). Higher weevil damage (10.02 %) was found in the genotype 440127 and lower (2.44 %) in the genotype S-61.

Mcharo and Ndolo (2013) determined skin colour, flesh colour and dry matter content of fourteen pre-release sweet potato genotypes in Kenya and Nairobi. The skin colour varied from cream-white, purple-red, brown, red and cream while the flesh colour varied from

orange, cream, white and light cream. In Nairobi, the dry matter content ranged from 21.01 g per cent in Zapallo to 32.75 g per cent in Marooko. In Western Kenya, the dry matter content ranged from 25.44 g per cent in Mugande to 28.33 g per cent in KEMB 10.

A study was conducted to evaluate high altitude orange fleshed sweet potato genotypes (eight) for dry matter content in lowland and rain forest ecology of Umudike Southern eastern Nigeria (Nwankwo and Afuape, 2013). The percentage dry matter content ranged from 13.30 g per cent (199044.2) to 31.19 g per cent (Shaba) with mean of 24.70 %. The check variety 87/0087 had dry matter of 30.47 g per cent.

Rahman *et al.* (2013) conducted a study on evaluation of orange fleshed sweet potato genotypes for yield and quality. Skin colour, flesh colour, length and diameter or circumference of ten sweet potato genotypes was determined. The skin colour varied from light red, red, light brown, brown, light red, light brown, cream to deep brown. The flesh colour varied from deep orange to intermediate orange, intermediate orange, intermediate orange to pale yellow orange, pale yellow orange to intermediate orange, orange to intermediate orange, cream to pale yellow, cream and intermediate orange. The variety BARI SP 3 was lengthier (14.97 cm) and the variety CIP 194515.15 was shorter (9.90 cm). The variety H_{19}/06 had higher diameter (6.92 cm) while CIP 194513.15 had lower diameter (4.48 cm).

While assessing the physicochemical properties of eight sweet potato varieties Ellong *et al.* (2014) reported that skin colour (red, pink, beige, purple and pale yellow) and flesh colour (light apricot yellow, yellowish, off white, pale yellow, white, white to beige and purple) varied. The length, diameter and weight of sweet potato varieties ranged from 15.35 to 21.21 cm, 5.65 to 9.55 cm and 300.00 to 647.00 g, respectively. The dry matter content ranged from 29.56 g per cent in CAM/09/005 to 39.32 g per cent in CAM/09/006.

A study was conducted to characterize, evaluate and document physico-chemical attributes of 114 sweet potato accessions and two check varieties in Ethiopia (Ali *et al.* 2015). Around 27 per cent of 114 sweet potato accessions were elliptic and 18 per cent of them were long and irregular with only 6 accessions having oblong shape. White skin colour was dominant which accounted for 22.80 per cent of entries and only few accessions (2.50 %) had red skin colour. Many accessions (37.79 %) had creamy flesh colour while only 1.75 per cent had pale yellow colour. The specific gravity ranged from 0.05 to 4.22. The mean of

accessions for pH and TSS was 6.20 and 12.14 ^{o}B respectively, while the mean of checks was 6.06 and 12.64 ^{o}B respectively.

Ji *et al.* (2015) studied dry matter content of four different coloured genotypes. The varieties were purple (Jizi 01), red (Xinong 431), yellow (Beijing 553) and white (Shangshu 19). Dry matter content of purple (Jizi 01) and red fleshed sweet potatoes (Xinong 431) was higher (31.80 g % and 32.60 g %, respectively) while that of yellow fleshed sweet potato Beijing 553 was lower (27.50 g %).

A study was conducted by Yahaya *et al.* (2015) to record colour and shape of sixteen improved sweet potato advanced lines in Kano, Sudan savannah of Nigeria. The skin colours of the varieties were orange, milky white and purple. The flesh colours of the varieties were orange, milky white, white and light orange. The root shape was elliptic, ovate, oblong, and irregular.

Kathabwalika *et al.* (2016) determined the skin colour, flesh colour and dry matter in eight orange fleshed sweet potato genotypes tested in three agro-ecological zones of Malawi *viz*. Bunda, Bembeke and Maseya site. The skin colour varied from cream, purple to orange and the flesh colour varied from deep orange, pale orange, yellow to orange. The dry matter content in the Bunda site ranged from 23.30 to 34.40 g per cent. The genotype LU06/0527 had higher dry matter (34.40 g %) and the genotype BV/009 had lower (23.30 g %). The dry matter content of varieties from Bembeke site ranged from 27.50 g per cent in the genotype Kenya to 34.10 g per cent in the genotype LU06/0428. The dry matter content in Maseya site ranged from 22.50 to 35.40 g per cent. The genotype Zondeni had higher dry matter (35.40 g %) and LU06/0299 had lower dry matter (22.50 g %).

A study was conducted on effect of season and tuber size on dry matter and specific gravity of ten clones of sweet potato in Jos-Plateau, North-Central Nigeria (Namo and Babalola*,* 2016). During wet season, the dry matter content ranged from 25.39 to 32.50 g per cent while during dry season the dry matter content ranged from 28.50 to 32.95 g per cent. The effect of clone and season and the effect of clone and tuber size on mean dry matter shows that the clone WADA BOLIGE had higher dry matter (32.73 g %) and the clone TIS 86/0356 had lower dry matter (25.71 g %).

Gurmu and Mekonen, (2017) conducted a study on the root shape, skin colour, flesh colour, length, diameter, individual root weight and registration of a newly released sweet

potato variety “Hawassa-09” for production in Ethiopia. The root shape was round elliptic. The skin colour was cream and flesh colour was white. The root length, diameter and individual root weight was 16-20 cm, 7-10 cm and 0.80-1.50 kg respectively.

The skin colour and flesh colour varied between the sweet potato cultivars. Other physical parameters like length, width, circumference, weight, volume and density also varied between the cultivars.

2.2. Nutrient composition of sweet potato genotypes

Among other root and tuber crops, sweet potato contains higher amounts of complex carbohydrates, dietary fibre and beta-carotene, while having moderate contents of other micronutrients including vitamin B_5, vitamin B_6, manganese and protein (Shih *et al.*, 2007). Processing of tubers leads to changes in the composition.

Lyimo *et al.* (2010) conducted a study on effect of processing methods on nutrient contents of six sweet potato varieties grown in Lake Zone of Tanzania. Proximate composition, reducing sugars, total carotenoids and minerals content were analysed. The protein and fat content ranged from 1.44 to 2.50 g/100 g and 0.03 to 0.95 g/100 g, respectively while ash content ranged from 0.87 to 0.98 g/100 g. The reducing sugar and carbohydrate content ranged from 102.04 to 145.60 mg/100 g and 23.91 to 33.45 g/100 g, respectively. The total carotenoid content ranged from 49.32 to 994.02 µg/100 g. The calcium, iron and magnesium content ranged from 23.55 to 29.20 g/100 g, 0.54 to 0.67 g/100 g and 12.39 to 14.09 g/100 g, respectively. Processing of sweet potato varieties by boiling, roasting and sun drying did not have any significant effect on the carbohydrate, protein, fat, ash, calcium, magnesium and iron contents. However, significant ($p \leq 0.05$) effect was observed on reducing sugars and total carotenoids, when processed by these methods.

Dincer *et al.* (2011) conducted a study on effects of baking and boiling on the nutritional and antioxidant properties of three sweet potato cultivars. Proximate composition and beta carotene content was analysed in fresh, boiled and baked samples. Higher protein content was seen in fresh sample of Beniazuma cultivar (5.08 g/100 g) and lower protein content was seen in baked sample of Koganesengan cultivar (3.54 g/100 g). Higher ash was seen in the baked sample of Kotobuki cultivar (2.62 g/100 g) and lower ash content was seen in fresh sample of Koganesengan cultivar (2.13 g/100 g). The Boiled sample of Koganesengan showed higher crude fibre content (2.70 g/100 g) and baked sample of

Beniazuma showed lower crude fibre content (2.11 g/100 g). The fresh sample of Koganesengan cultivar (64.89 g/100 g) showed higher starch content and boiled sample of Beniazuma showed lower starch content (49.22 g/100 g). In the fresh form, higher beta carotene was seen in Beniazuma cultivar (15.63 mg/100 g) and lower was seen in Koganesengan cultivar (5.63 mg/100 g). In the boiled form, higher beta carotene was seen in Beniazuma cultivar (12.64 mg/100 g) and lower was seen in Koganesengan cultivar (3.28 mg/100 g). In the baked form, higher beta carotene was seen in Beniazuma cultivar (10.07 mg/100 g) and lower was seen in Koganesengan cultivar (1.15 mg/100 g).

A study was conducted by Rose and Vasanthakaalam, (2011) to compare selected nutritional content of four varieties of sweet potato comprising of both yellow (two) and white (two) coloured flesh. Proximate composition and total sugar content were analysed. The moisture content in the yellow varieties ranged from 62.78 g per cent in (Kwizekumwe) to 64.03 g per cent in (440170) and in white varieties ranged from 62.58 g per cent in (Rutambira 4-160) to 64.34 g per cent in (Mugande). In yellow varieties, the crude protein and crude ash ranged from 0.71 and 0.43 g per cent in 440170 to 0.91 and 0.44 g per cent in Kwizekumwe variety, respectively and in white varieties it ranged from 0.80 and 0.42 g per cent in Rutambira 4-160 to 0.81 and 0.40 g per cent in Mugande, respectively. The crude fibre in yellow varieties ranged from 0.12 g per cent (Kwizekumwe) to 0.14 g per cent (440170 variety) and in white varieties it ranged from 0.11 g per cent (Rutambira 4-160) to 0.12 g per cent (Mugande). The total reducing sugars and beta-carotene content in yellow varieties ranged from 1.74 g per cent and 1.68 µg/100 g in 440170 to 2.50 g per cent and 1.85 µg/100 g in kwizekumwe, respectively and in white varieties the total reducing sugars ranged from 1.94 g per cent (Rutambira 4-160) to 2.04 g per cent (Mugande variety).

Effects of cooking and frying on antioxidants present in sweet potatoes were studied by Chukwu *et al.* (2012). Vitamin A, C and E content in sweet potatoes were analysed. In the fried form, higher vitamin A was found in sample fried for 10 min (6.52 mg/100 g) and lower was found in raw sweet potatoes (4.99 mg/100 g), higher vitamin C content was found in sample fried for 10 min (0.67 mg/100 g) and lower was seen in raw sample (0.50 mg/100 g), higher vitamin E content was found in raw sample (0.35 mg/100 g) and lower was seen in sample fried for 15 min (0.32 mg/100 g). In the cooked form, higher vitamin A content was found in the sample cooked for 10 min and 15 min (8.13 mg/100 g) and lower was seen in

sample cooked for 20 min (7.77 mg/100 g), higher vitamin C content was seen in sample cooked for 20 min (0.89 mg/100 g) and lower was seen in sample cooked for 10 and 15 min (0.80 mg/100 g), higher vitamin E content was seen in the sample cooked for 10 and 15 min (0.29 mg/100 g) and lower was seen in sample cooked for 20 min (0.26 mg/100 g).

A study was conducted by Eleazu and Ironua (2013) to analyse the proximate and antioxidant properties of a sweet potato variety commercially sold in South Eastern Nigeria. The moisture, protein, fat, ash, crude fibre and carbohydrate were 55.76, 2.67, 0.65, 1.15, 0.12 and 40.77 g per cent, respectively. The reducing sugar and starch content were 1.58 g/100 g and 20.78 g per cent, respectively. The energy value was 174 kcal. The phenols content was 0.945 g GAE/100 g, carotenoid content was 5.00 µg/100 g and flavonoids content was 50.77 mg QE/100 g with DPPH scavenging activity of 85.28 %.

Senanayake *et al.* (2013) analysed the nutrient composition of five different cultivars of sweet potato namely SWA (Wariyapola red), SWP3 (Wariyapola white), SWP4 (Pallepola variety), SWP5 (Malaysian variety) and SWP (CAR I 273) in Sri Lanka. The crude protein, total fat and crude fibre content ranged from 1.20 to 3.30, 1.10 to 1.70 and 6.50 to 13.60 g/100 g, respectively. The calcium, iron and zinc content ranged from 2.10 to 5.90, 4.20 to 6.30 and 1.60 to 2.60 mg/100 g, respectively.

The proximate composition of fifteen sweet potato genotypes was analysed by Omodamiro *et al.* (2013). Moisture content ranged from (59.10 g %) in NRSP/05/03 to (71.25 g %) in CIP440293. Protein content was found to be higher in Centennial genotype (6.94 g %) and lower in NRSP/05/03 (3.77 g %). Fat content was 1.02 g per cent in Ex-Igbarium and 1.72 g per cent in CIP440163. Higher amounts of ash, crude fibre and carbohydrate were reported in NRSP/05/5A (1.52, 2.00 and 33.32 g %, respectively). Lower amounts of ash and fibre (0.50 and 0.67 g %, respectively) were recorded in the genotype Centennial and lower amount of carbohydrate was reported in CIP440293 i.e. 20.28 g per cent.

Agbemafle *et al.* (2014) conducted a study to analyse the proximate composition of cream skinned sweet potato. Results showed 59 ± 0.69 g per cent moisture, 7.85 ± 0.08 g per cent protein, 0.95 ± 0.00 g per cent fat, 0.21 ± 0.00 g per cent fibre, 2.27 ± 0.17 g per cent ash, 62.68 ± 8.00 g percent carbohydrate and 2.41 ± 0.00 g percent reducing sugar.

Assessment of proximate characteristics of five organic sweet potato cultivars was conducted by Anthony *et al.* (2014). The results showed that the moisture, protein, fat, ash

and crude fibre content ranged from 2.59 to 5.40, 3.98 to 5.02, 1.41 to 2.92, 2.27 to 3.10 and 0.60 to 4.70 g per cent respectively.

Three cultivars of sweet potato namely Goldstar, Carmen Rubin and White Triumph, cultivated in south-western Poland were analysed for chemical composition and nutritional value (Krochmal-Marczak *et al.* 2014). Total protein, ash and crude fibre ranged from 1.50 to 1.63 g/100 g, 1.38 to 1.52 g/100 g and 0.86 to 0.97 g/100 g respectively. Starch, total and reducing sugars ranged from 14.90 to 14.91 g/100 g, 2.90 to 3.85 g/100 g and 1.09 to 1.60 g/100 g, respectively. Vitamin C content ranged from 20.26 to 24.20 mg/100 g. White triumph cultivar with white skin and flesh was characterized by significantly higher content of starch, sugars, protein and vitamin C, in comparison with cultivars having coloured skin and flesh (Gold star and Carmen Rubin).

The effect of cooking methods on some proximate properties of sweet potato was investigated by Adepoju and Adejumo (2015). In this study, orange flesh variety was boiled, boiled unpeeled, roasted unpeeled and untreated sample served as control. Higher moisture and lower protein was seen in untreated sample (69.80 and 0.46 g %) and lower moisture and high protein was seen in boiled and unpeeled sample (63.00 and 0.82 g %). The fat content ranged from 1.00 g per cent in sample boiled and unpeeled to 3.50 g per cent in roasted and unpeeled. The ash ranged from 0.81 g per cent in boiled and unpeeled sweet potato to 1.00 g per cent in other three samples. The fibre and carbohydrate ranged from 0.81 g per cent in boiled and peeled sweet potato to 1.00 g per cent in other three samples and 26.84 g per cent in untreated sweet potato sample to 33.37 g per cent in boiled and unpeeled, respectively. Higher beta-carotene and vitamin C content was seen in untreated sweet potato sample (7.68 mg/100 g and 0.46 mg/100 g). Lower beta-carotene was seen in boiled and peeled sample (0.48 mg/100 g) and lower vitamin C was seen in boiled and unpeeled sample (0.37 mg/100 g).

Ali *et al.* (2015) evaluated the reducing sugar, total sugar and total starch content of 114 sweet potato accessions in Ethiopia. The moisture content ranged from 1.003 per cent to 16.69 per cent with Tis-9468-7 and Tis-82/0602-6 recording higher value and Becale-B and Tis-8250-2 recorded lower value. Reducing sugar content ranged from 2.50 to 10.33 mg/100 g. CN-1752-14 and CN-1752-9 had the higher reducing sugar content and Neffsie and Korojo-1 had lower reducing sugar. The range for total sugar concentration was between 9.53 and 17.25 mg/100 g with CN-1752-15 and CN-2059-7 having higher value and Tis-80/063-3 and Tis-9465-2 having lower value. Total starch concentration was ranged from 1.17 to 16.40

mg/100 g. CN-1752-15 and CN-2059-7 had higher total starch among accessions and checks whereas Tis-7035-7 and Tis-80/043-3 had lower starch content.

Ji *et al.* (2015) conducted a study to analyse nutrient composition and dietary fibre content of four sweet potato cultivars with different flesh colours namely purple (Jizi 01), red (Xinong 431), yellow (Beijing 553) and white (Shangshu 19). The protein content ranged from 6.53 g per cent (Shangshu 19) to 4.86 g per cent (Beijing 553). Higher fat and ash content was found in the genotype Xinong 431 (0.76 and 3.21 g %, respectively) and lower in the genotype Shangshu 19 (0.56 and 1.68 g %, respectively). Higher starch and lower dietary fibre content was seen in the Shangshu 19 (71.4 and 1.85 g %, respectively). Lower starch content was found in the variety Xinong 431 (60.1 g %) and higher dietary fibre was found in Jizi 01 (2.35 g %).

Cooking treatment effects on sugar profile and sweetness of eleven-released sweet potato varieties was studied by Owusu-Mensah *et al.* (2016). Sugar content was analysed in raw, baked, micro waved and steamed samples. Higher sucrose was found in baked sample (11.01 %) while lower sucrose was found in steamed sample (4.30 %). The raw sample of sweet potato showed higher glucose and fructose content (2.69 and 1.58 %, respectively) and the baked sample showed lower values (1.10 and 0.84 %, respectively). The baked sample registered higher maltose content (20.13 %) and raw sample showed lower maltose content (0.63 %).

Effect of sun-drying on nutrient content of four orange fleshed sweet potato tubers namely Jewel, Karoti dar, Kabode and Ejumala in Tanzania was conducted by (Nicanuru *et al.* 2015). Proximate composition and beta carotene content were analysed. The composition range of fresh sweet potato tubers was moisture (65 to 70.40 g %), protein (1.90 to 2.70 g %), fat (1.10 to 1.67 g %), ash (2.70 to 4.20 g %), crude fibre (3.00 to 3.60 g %), carbohydrate content (18 to 26.80 g %) and beta carotene (24.20 to 73.90 mg/100 g). On drying, the nutrient composition was protein (4.89 to 9.29 g %), fat (0.56 to 1.93 g %), ash (1.95 to 3.54 g %), crude fibre (3.19 to 6.07 g %), carbohydrate content (72.36 to 80.33 g %) and beta carotene (8.2 to 59.8 mg/100 g).

A study was conducted by Shekhar *et al. (*2015) to investigate the genotypic variability in biochemical composition of two contrasting cultivars of sweet potato (white fleshed - WFSP and orange fleshed - OFSP). The study revealed that the moisture (71.41

g %), protein (4.85 g %), ash (4.70 g %) and fibre (2.35 g %) were higher in OFSP than WFSP (68.93, 2.93, 4.46 and 2.31 g %, respectively). However, starch content was higher in OFSP (55.83 g/100 g) compared to WFSP (43.25 g/100 g). The total carotenoid content of OFSP was 0.05 mg BCE/g, which was eightfold higher than that of WFSP (0.006 mg BCE/g). There was considerably higher carbohydrate and reducing sugar contents in WFSP (14.28 mg/g and 4.47 g % respectively) compared to OFSP (12.29 mg/g and 2.76 g %, respectively).

Sinha *et al.* (2015) conducted a study on effect of cooking methods on beta carotene, anthocyanin, vitamin C and antioxidant content of two cultivars of sweet potato (orange fleshed and purple fleshed). Sweet potatoes were subjected to steaming, frying and dehydration. In ST-13 (purple fleshed), higher anthocyanin was found in steamed sample (290.63 mg/100 g) and lower was seen in fried sweet potato (76.03 mg/100 g) while higher vitamin C content was found in fresh sample (21.13 mg/100 g) and lower in steamed sweet potato (15.85 mg/100 g), DPPH activity was higher in steamed sweet potato (82.56 %) and was lower in fried sample (52.11 %). In ST-14 (orange fleshed), higher beta carotene content was reported in fresh sample (10.38 mg/100 g) and lower was in fried sample (8.14 mg/100 g) while higher vitamin C content was seen in fresh sweet potato (19.00 mg/100 g) and lower in fried sample (15.13 mg/100 g), DPPH activity was higher in steamed sweet potato (69.28 %) and lower was found in dehydrated sample (43.93 %).

The proximate composition, total carotenoids and total polyphenol content of nine orange fleshed sweet potato varieties grown in Bangladesh were compared (Alam *et al.* 2016). The moisture content ranged from 70.95 to 72.96 g per cent, protein content ranged from 1.91 to 5.83 g per cent, fat from 0.17 to 0.30 g per cent, ash from 1.17 to 1.29 g per cent, crude fibre from 0.30 to 0.54 g per cent and carbohydrate ranged from 21.10 to 24.50 g per cent. Total polyphenol and total carotenoids content ranged from 94.63 to 133.92 mg GAE/100 g and 0.38 to 6.38 mg/100 g, respectively on fresh weight basis.

Kathabwalika *et al.* (2016) conducted a study on evaluation of starch and beta-carotene content of eight varieties of orange fleshed sweet potato genotypes grown in three agro-ecological zones of Malawi. The starch content in Bunda region ranged from 19.90 to 28.50 g per cent, in Bembeke region from 25.30 to 34.10 g per cent and in Maseya region, it ranged from 15.60-28.50 g per cent. The beta carotene content in Bunda region ranged from

467.00 to 7869.90 µg/100 g, in Bembeke region 649.40 to 5941.50 µg/100 g and in Maseya region, it ranged from 932.20 to 6793.20 µg/100 g.

Determination of nutritional facts of organic orange (OFSP) and purple sweet potatoes (PFSP) was conducted by Rodrigues *et al.* (2016). Proximate composition and starch content were analysed. The moisture, protein, fat, ash, crude fibre, total carbohydrate and starch content in orange fleshed sweet potato were (69.42, 3.69, 0.42, 2.04, 3.68, 65.41 and 90.17 g % respectively). While purple fleshed sweet potato contained moisture (73.00 g %), protein (5.70 g %), fat (0.42 g %), ash (3.80 g %), crude fibre (4.28 g %), total carbohydrate (85.8 g %) and starch (103.7 g %).

The mineral composition of ten cultivars of sweet potato having various flesh colours (cream, white, yellow and orange) in landraces of Benin was determined by Sanoussi *et al.* (2016). The calcium and phosphorus content ranged from 23.04 to 29.97 mg/100 g and 42 to 46.33 mg/100 g respectively. The zinc and iron content ranged from 0.23 to 0.27 mg/100 g and 0.53 to 0.73 mg/100 g respectively.

The sweet potato tubers were rich in protein, total sugars, reducing sugars, vitamin C and macro-elements. Genetic characteristics of researched cultivars significantly influenced the nutrient content in sweet potato tubers.

2.3. Cooking quality and acceptability of sweet potato genotypes

Sweet potato is usually cooked by baking, boiling, microwaving, steaming, or frying. These cooking processes would certainly bring about a number of changes in the physical characteristics, chemical composition and acceptability of sweet potatoes (Wang and Kays, 2001; Padda and Picha, 2008; Takenaka *et al.* 2006).

The acceptability of seven orange fleshed sweet potato varieties in the Lake zone of Tanzania was studied by Kulembeka *et al.* (2004). The parameters evaluated were appearance, taste, texture, fibrousness and acceptability. The assessment was done by farmers and children on 5 point hedonic scale. The mean scores provided by farmers for appearance, taste, texture, fibrousness and acceptability were 3.50, 3.51, 2.74, 3.20 and 3.64, respectively. The sweet potato varieties received scores of 3.29, 3.75 and 3.24, respectively by children for taste, colour and acceptability.

Omodamiro *et al.* (2013) studied the acceptability of 15 sweet potato genotypes. A panel of 20 semi trained members was used to evaluate attributes such as colour, aroma,

taste, mouth feel and general acceptability of boiled sweet potatoes on a 9-point hedonic scale. The results of the sensory evaluation showed that the most acceptable variety was NRSP/05/3D with a score of 6.07 and the scores for colour, taste and mouth feel were 5.06, 6.47 and 6.60, respectively. The least acceptable variety was CIP440293 with a score of 4.47 and the other scores for colour, taste and mouth feel were 6.73, 4.80 and 4.80, respectively.

The influence of sugar composition on the sensory attributes of seven baked sweet potatoes was evaluated by Chan *et al.* (2014). The samples were evaluated by 48 untrained panellists on a 7 - point hedonic scale. Overall acceptability results showed that the most acceptable variety was CYY95-26 (5.60) and the least acceptable variety was TARI97-01 (4.52). There was a high positive correlation between overall acceptability and sweetness ($r = 0.69$, $p < 0.01$), sweetness was determined as the most important factor determining the overall acceptability.

Evaluation of acceptability of sweet potato clones in selected agro-ecological zones of Uganda was conducted by Niringiye *et al.* (2014). Individual post harvest taste panellists assessed the palatability attributes namely, appearance, taste, flavour and general appreciation. The sensory evaluation was done on 5 - point hedonic scale. The mean scores for appearance, taste, flavour was 3.30, 3.30 and 3.20, respectively while that for general appreciation was 3.20.

Comparative evaluation of the quality parameters of yellow (YFSP) and orange (OFSP) fleshed sweet potato baked crisps was conducted by Oluwale *et al.* (2015). The organoleptic evaluation of the samples was done by 10 semi-trained panel using 9 - point hedonic scale and the attributes evaluated were colour, taste, crispiness, texture, flavour, mouth feel, and overall acceptability. Results revealed that YFSP had significantly higher ($p < 0.05$) sensory scores in all the rated attributes colour (7.90), taste (7.20), crispiness (8.00), texture (7.50), flavour (7.00), mouth feel (7.10) and overall acceptability (7.90) than OFSP (6.50, 6.30, 6.50, 6.40, 6.00, 6.50 and 6.40, respectively).

Johnson *et al.* (2016) conducted a study to determine the impact of baking time and temperature on sensory quality of sweet potatoes. The sweet potatoes were baked at 325 ^{o}F for 60 min, 375 ^{o}F for 45 min and 425 ^{o}F for 30 min. The samples were evaluated on a 9 - point hedonic scale by seventy eight untrained panellists. The mean scores for the samples baked at 325 ^{o}F, 375 ^{o}F and 425 ^{o}F were 6.49, 6.46 and 5.63, respectively. The consumer panellists preferred the sweet potatoes baked at a lower temperature for longer duration.

The sensory attributes of a sweet potato variety were determined by Gurmu and Mekonen (2017). The texture of the boiled tubers was moderate dry, colour was cream and taste was intermediate sweet. The tubers were accepted by most of the panellists farmers.

Sweet potatoes can be cooked by different methods like steaming, frying, pressure cooking, boiling and baking. The cooking time varied between the different sweet potato cultivars.

2.4. Flour production potential and characterization of flour of sweet potato genotypes

Sweet potatoes can be processed into flour, which is less bulky and more stable than the highly perishable fresh tuber. This flour can be used as a thickener in soup, gravy, fabricated snacks and bakery products.

While determining the swelling power of native, drum dried and hot air dried sweet potato flour Yadav *et al.* (2006) reported the values of 9, 14 and 18 per cent, respectively.

A study was conducted by Singh *et al.* (2008) to determine the colour of wheat and sweet potato flour blends. The sweet potato tubers were peeled, sliced manually, dried and milled to flour. The sweet potato and wheat flours were blended in different ratios (SPF:WF-00:100, 20:80, 40:60, 60:40, 80:20, 100:00). The L* values of the flour blends decreased significantly from 94.43 to 82.38 as the sweet potato flour increased from 0 to 100 per cent. Correspondingly, the a* and b* value increased from 2.73 to 8.52 and 9.23 to 21.59, respectively.

Ahmed *et al.* (2010) conducted a study to evaluate the effects of drying temperature and pre-treatment on the quality parameters such as functional properties and colour characteristics of sweet potato flour. Four types of sweet potato flour were used i.e. Flour from peeled or unpeeled sweet potatoes with or without sulphite treatment. At drying temperature of 55 ^{o}C, the Hunter colour parameters i.e. L*, a* and b* values were higher in flour from sulphite treated sweet potatoes i.e. 88.16, 3.18 and 26.72, respectively, L* and b* values were lower in flour from unpeeled sweet potatoes without sulphite treatment (82.58 and 23.23) and a* value was lower in flour from peeled sweet potatoes without sulphite treatment (2.42). At drying temperature of 60 ^{o}C, L* and b* values were higher in flour from peeled sulphite treated sweet potatoes i.e. 88.09 and 26.70, a* value was higher in flour from unpeeled sulphite treated sweet potatoes (2.91) and L*, a* and b* values were lower in flour

from unpeeled sweet potatoes without sulphite treatment (82.80, 2.26 and 22.12, respectively). At drying temperature of 65 °C, L* and b* values were higher in flour from peeled sulphite treated sweet potatoes i.e. 87.56 and 26.48, a* value was higher in 3.07, L* and b* values were lower in flour from unpeeled sweet potatoes without sulphite treatment (80.68 and 24.09) and a* value was lower in flour from peeled sweet potatoes without sulphite treatment i.e. 2.88. At drying temperature of 55 °C, water solubility index and swelling capacity were higher in flour from unpeeled sulphite treated sweet potatoes (22.40 % and 3.27, respectively) and water solubility index was lower in flour from peeled sulphite treated sweet potatoes (23.54 %) and swelling capacity was lower in flour from peeled sweet potatoes without sulphite treatment (2.85), water absorption index was higher in flour from peeled sulphite treated sweet potatoes (2.53) and lower in flour from peeled sweet potatoes without sulphite treatment (2.18). At drying temperature of 60 °C, water absorption index and swelling capacity were higher in flour from unpeeled sulphite treated sweet potatoes (2.44 and 3.24) and were lower in flour from peeled sweet potatoes without sulphite treatment (2.21 and 2.99), water solubility was higher in flour from peeled sweet potatoes without sulphite treatment (25.75 %) and lower in flour from peeled sulphite treated sweet potatoes (23.20 %). At drying temperature of 65 °C, water absorption index and swelling capacity were higher in flour from unpeeled sulphite treated sweet potatoes (2.61 and 3.49) and water absorption index was lower in flour from unpeeled sweet potatoes without sulphite treatment (2.28) and swelling capacity was lower in flour from peeled sweet potatoes without sulphite treatment (3.24), water solubility index was higher in flour from unpeeled sweet potatoes without sulphite treatment (27.17 %) and lower in flour from peeled sulphite treated sweet potatoes (25.87 %).

Adeleke and Odedeji (2010) investigated the functional properties of wheat and sweet potato flour blends. The sweet potato tubers were sorted, washed, peeled, sliced, blanched, drained, dried, milled to flour. The two flours were blended in different ratios (WF:SPF - 100:0, 90:10, 85:15, 80:20, 75:25, 0:100). Bulk density value of wheat flour (100 %) was 7.47 g/cm^3 while it was 6.83 g/cm^3 in sweet potato flour. pH of 100 per cent wheat and sweet potato flour was 6.01 and 5.50, respectively. The water and fat absorption capacity of 100 per cent wheat flour was 2.45 g s^{-1} and 2.15 g s^{-1} ,respectively and that of 100 per cent sweet potato flour was 1.27 g s^{-1} and 0.65 g s^{-1}, respectively. The swelling power and

viscosity for 100 per cent wheat flour was 12.75 per cent and 73 B.U, respectively and that for 100 per cent sweet potato flour was 5.73 per cent and 35 B.U, respectively.

A study was conducted by Eleazu and Ironua (2013) to know the functional properties of the flour of a sweet potato variety. The sweet potato tubers were washed, peeled, sliced, oven dried, milled to flour and used to estimate functional properties. The results showed that bulk density and pH were 0.92 g/ml and 5.32, respectively. The water absorption and oil absorption capacities were 125 and 175 g per cent, respectively.

Quality assessment of flours produced from three varieties of sweet potato was carried out by Idowu *et al. (*2013). The sweet potato tubers were washed, peeled and again washed, sliced, conditioned, fermented, washed, dried and milled to flour. The bulk density and pH ranged from 0.45 to 0.58 g/ml and 5.00 to 5.60, respectively. The water absorption capacity and swelling capacity ranged from 0.82 to 2.07 per cent and 16.0 to 28.05 g/g, respectively. The pasting clarity and pasting temperature were 57.00 to 66.50 per cent and 73.4 to 78.8 °C, respectively. The viscosity was 1.27 to 1.38 ml/s.

Agbemafle *et al.* (2014) conducted a study to analyse the functional properties of sweet potato flour. The sweet potato tuber/s were sorted and graded, washed, peeled, sliced, dried, milled to flour, sieved and packed. The results showed 0.95 ± 0.14 ml/g of water absorption capacity and 1.37 ± 0.26 ml/g oil absorption capacity. The swelling power was 8.88 ± 0.82 g/g.

A study was conducted by Anthony *et al.* (2014) to analyse the functional properties of five organic sweet potato varieties. The sweet potato samples were peeled, washed, chipped, sundried and milled. In the variety NGB/SP/034, the bulk density was higher (0.83 g/ml) and pH was lower (6.04). In the variety SLIPOT/003, the bulk density was lower (0.68 g/ml) and pH was higher (6.26). The swelling power was higher in the variety NGB/SP/109 i.e. 0.05 g/g and it was lower (0.03 g/g) in the variety NGB/SP/034. The water binding capacity in the varieties ranged from 5.77 g/g in NGB/SP/083 to 1.85 g/g in NGB/SP/109. The dispersibility ranged from 60.00 g/g in NGB/SP/034 to 42.00 g/g in SLIPOT/003.

Effect of variety and processing method on functional properties of traditional sweet potato flour of three varieties (two yellow fleshed and one orange fleshed) was assessed by Fetuga *et al.* (2014). The sweet potato tubers were washed, parboiled and soaked, sliced, followed by drying either in sun or in dehydrator and milling. Water absorption capacity,

water solubility and swelling power were analysed. Higher water absorption capacity was seen in American Orange Fleshed variety (702.50 %) which was processed by parboiling and lower was seen in Nigerian Yellow Fleshed variety (196.50 %) which was processed by both soaking in water and parboiling or vice versa. Higher water solubility was seen in the variety American Orange Fleshed variety (52.40 %) which was processed by soaking in water and lower was seen in Nigerian Yellow Fleshed variety (8.29 %) which was processed by parboiling. Higher swelling power was seen in the American Orange Fleshed variety (3.71 %) which was processed by parboiling method and lower was seen in the variety Ugandan Yellow Fleshed variety (0.52 %) which was processed by soaking in water.

Mohd. Hanim *et al.* (2014) conducted a study to compare the functional properties of flour VitAto with commercial sweet potatoes - Bukit Naga and Okinawan available in Malaysia. The sweet potato tubers were washed, soaked, dried, sliced, milled, sieved and packed. The colour of VitAto flour was orange with the reading of L, a, b, reading of 73.3 ± 0.06, 15.0 ± 0.15 and 29.9 ± 0.21, respectively. The Bukit Naga flour was orange with readings of 74.2 ± 0.20, 11.3 ± 0.06 and 29.3 ± 0.42, respectively and the Okinawan flour was dark purple with readings of 61.6 ± 0.46, 13.6 ± 0.21 and 12.6 ± 0.06, respectively. The percentage yield of flour obtained from tuber of VitAto was lower (19.74 %), than Okinawan flour (23.98 %) and Bukit Naga flour (20.15 %). The pH and bulk density of VitAto, Bukit Naga and Okinawan flour were 5.66, 5.93, 5.85 and 0.63, 0.66 and 0.72 g/cm^3, respectively. The water absorption index and water solubility index of VitAto, Bukit Naga and Okinawan flour were 2.69, 2.67, 2.59 per cent and 14.07, 13.97, 13.40 per cent, respectively. The swelling power of VitAto, Bukit Naga and Okinawan flour was 3.13, 3.11 and 2.99 g/g, respectively.

Otalunde *et al.* (2015) analysed the functional properties and colour characteristics of flour of 10 varieties of sweet potato. The sweet potato tubers were washed, air-dried, peeled, sliced, dried in oven and milled to flour. The L, a and b values were in the range of 79.90 to 101.48, -0.27 to 3.54 and 9.89 to 27.94, respectively. The water absorption capacity and water solubility were in the range of 140 to 280 per cent and 6.89 to 26.18 per cent, respectively. The swelling power was in the range of 1.66 to 5.00 g/g.

The functional properties of flour of two varieties of sweet potato (orange fleshed and purple fleshed) were evaluated by Rodrigues *et al.* (2016). The sweet potato tubers were

washed, sanitized, peeled and sliced manually, blanched, hot air dried and milled to flour. The yield in the orange fleshed sweet potato was 23.90 per cent and in purple fleshed sweet potato was 24.20 per cent. The water solubility index, water absorption index, fat absorption index and swelling power of orange fleshed sweet potato were 38.88, 5.65, 69.39 per cent and 16.62 g/ml, respectively while that in purple fleshed sweet potato were 21.87, 4.82, 49.55 per cent and 15.01 g/ml, respectively.

Colour properties of sweet potato and wheat flour blends was analysed by Saeed *et al.* (2012). The sweet potato tubers were washed, trimmed, peeled, sliced, dried, milled to flour and sieved. The wheat and sweet potato flours were blended in the different ratios (WF:SPF-100:0, 95:5, 90:10, 85:15, 80:20, 75:25). The L* values of the flour blends decreased significantly from 95.75 to 84.96 with increasing sweet potato flour. The value of a* and b* increased from 2.62 to 5.92 and 9.84 to 14.65, respectively with increasing the proportion of sweet potato flour in flour blends.

Ali *et al.* (2012) conducted a study to analyse the colour and functional properties of flour of three sweet potato cultivars. The sweet potato tubers were washed, manually peeled, sliced, air dried and milled to flour. The colour of the Black vine and Big red flour was yellow (L = 79.90 and 78.00, a = -1.80 and -1.80, b = 14.30 and 13.00, respectively). Deep orange colour was seen in the flour of cultivar Lovers name with values of L = 72.20, a = 13.00, b = 27.30. Higher swelling power was seen in the cultivar Big red (4.60 g/g) and lower was in the cultivar Black vine (2.42 g/g). Higher solubility was seen in the cultivar Lovers name (0.32 %) and lower in the cultivar Big red (0.11 %).

Kamble *et al.* (2017) conducted a study to determine the yield and colour of sweet potato flour processed by conventional method and potassium metabisulphite method. The yield of the flour processed by conventional method was 12.30 per cent and that processed by potassium metabisulphite method was 13.70 per cent. The colour of the flour processed by conventional method was dull white and the colour of the flour processed by potassium metabisulphite method was white.

The above studies indicated that the flours are viable for preparation of food products, mainly for baking. The organic flours showed interesting index of water and fat absorption and swelling power, which suggests a great technological quality and viability of their incorporation in several kinds of food products.

Material and Methods

3. MATERIAL AND METHODS

Sweet potato [*Ipomoea batatas* (L.) Lam] is a dicotyledonous plant, belongs to the family Convolvulacea. It is an important food security crop that feeds millions of people in the developing world. Sweet potato is mainly consumed by low income people since it is one of the cheap substitutes for starchy staples such as rice, wheat and potatoes and contains considerable level of starch, soluble sugars, vitamins, minerals and other nutrients.

The present study was conducted during 2016-17 in the Department of Food Science and Nutrition, College of Community Science, University of Agricultural Sciences, Dharwad, Karnataka, to evaluate the physico-chemical properties, nutrient composition, cooking quality, acceptability, flour production potential and characterization of flour of sweet potato genotypes.

The materials used and methodology employed in carrying out the research are depicted in Fig. 1 and details are presented in this chapter under the following sub-headings:

3.1. Procurement of sweet potato genotypes

3.2. Determination of colour and physico-chemical properties of sweet potato genotypes

3.3. Nutrient composition of sweet potato genotypes

3.4. Vitamin C

3.5. Cooking quality and acceptability of sweet potato genotypes

3.6. Flour production potential and characterization of flour of sweet potato genotypes

3.7. Statistical analysis.

3.1. Procurement of sweet potato genotypes

Fourteen sweet potato genotypes harvested in the month of January, 2017 were obtained from Regional Horticultural Research and Extension Centre (RHREC), Dharwad, of University of Horticultural Sciences, Bagalkote. The variety MLT-Vikram was used as check (Plate 1 and 2).

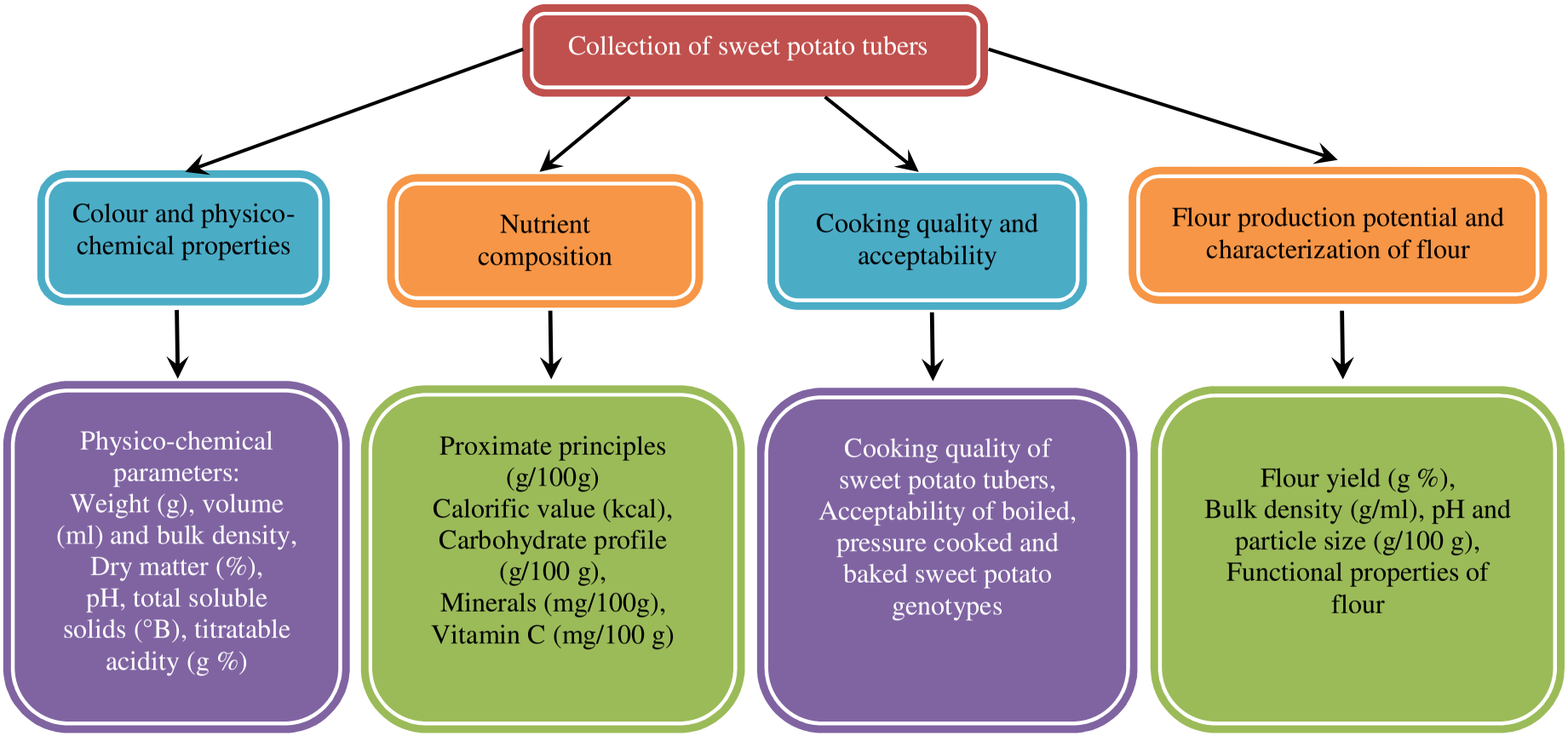


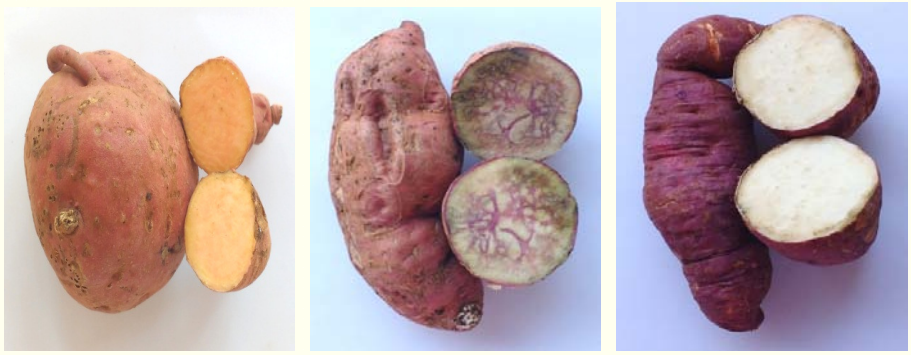
Fig. 1. Research design

Plate 1. Sweet potato crop

1. GP-HUB-14 2. MLT-CIP-SWA 3. URT-TSP-12-10 4. GP-HUB-25

5. GP-HUB-26 6. GP-HUB-35 7. GP-HUB-36 8. GP-HUB-44

9. GP-HUB-95 10. MLT-440127 11. MLT-Gouri 12. Sreebhadra



13. GP-HUB-66 14. URT-TSP-12-12 15. MLT-Vikram

Plate 2. Sweet potato genotypes selected for the study

3.2. Determination of colour and physico-chemical properties of sweet potato genotypes

The physical properties of sweet potato, like those of other agricultural materials are essential for the design of equipment for handling, harvesting and storing the tubers or determining the behaviour of the tubers for its handling besides marketability.

The physico-chemical properties like skin colour, flesh colour, length, width, circumference, weight, volume, bulk density, dry matter, pH, total soluble solids and titratable acidity were determined.

3.2.1. Skin colour

Randomly selected tubers were matched for colour with that of a paint shade card and it was recorded by visual observation.

3.2.2. Flesh colour

Randomly selected tuber was cut at the centre horizontally and colour was observed similar to the colour of skin. The tubers were classified as white fleshed, cream fleshed, orange fleshed and purple fleshed.

3.2.3. Length

Randomly ten tubers were selected and the length of each tuber was measured vertically from apex to base with the help of a scale in centimetres (cm).

3.2.4. Width

Randomly ten tubers were selected and the width at the broadest part of each tuber was measured horizontally with the help of scale in centimetres (cm).

3.2.5. Circumference

Randomly ten tubers were selected and the circumference at the broadest part was measured with the help of thread and scale in centimetres (cm).

3.2.6. Weight

Randomly ten tubers were selected and the weight of each tuber was noted with the help of electronic weighing balance in grams (g). The averages were calculated.

3.2.7. Volume

Randomly ten tubers were selected and the volume of each tuber was measured by water displacement method in millilitres (ml) and averages were calculated.

3.2.8. Bulk density

Using weight to volume the bulk density was calculated as:

$$\text{Bulk density (g/ml)} = \frac{\text{Weight (g)}}{\text{Volume (ml)}}$$

3.2.9. Dry matter

Cleaned sweet potato tubers were weighed and cut into slices (2 mm) manually with the help of chips maker. The chips were dried in hot air oven at 40 °C. Weight of the chips after drying was noted as dry matter and expressed in percentage (%).

$$\text{Dry matter (g/100 g)} = \frac{\text{Final weight (g)}}{\text{Initial weight (g)}} \times 100$$

3.2.10. pH

Sweet potato tuber (ten grams) was mascerated in a pestle and mortar and crushed into small pieces and the pH was measured with the help of hand pH meter (Hannah instruments pHcp).

3.2.11. Total Soluble Solids

Sweet potato tuber (ten grams) was mascerated in a pestle and mortar and squeezed through double layered cheese cloth. TSS was measured using Erma Hand Refractometer and expressed in °Brix.

3.2.12. Titratable acidity

Sweet potato (ten grams) was mascerated in a pestle and mortar, the sample was transferred to a 250 ml beaker, 100 ml distilled water was added and boiled for one hour and the water level was maintained. Volume was made upto 100 ml. Five ml aliquots were taken and titrated against 0.1N NaOH using phenolphthalein as indicator till pink colour persists for few seconds (Ranganna, 1986). Results were expressed in terms of per cent (%) citric acid.

3.3. Nutrient composition of sweet potato genotypes

All the genotypes were analysed for proximate principles, carbohydrate profile, minerals and vitamin C content.

3.3.1. Preparation of sample

The tubers were washed and sliced using chips maker. The slices (2 mm) were dried in hot air oven at 35 - 40 °C. The dried slices were ground to meal and the meal was used for further estimations.

3.3.2. Proximate composition

3.3.2.1. Moisture

Moisture content was analyzed by oven drying method. Sweet potato sample was oven dried at a temperature of 100 ± 1 °C until constant weight was obtained (Ranganna, 1986) and moisture was calculated using the formula

$$\text{Moisture (g/100 g)} = \frac{\text{Initial weight (g) - Final weight (g)}}{\text{Weight of the sample (g)}} \times 100$$

3.3.2.2. Fat

Fat was estimated as crude ether extract of the dry material. The moisture free sweet potato sample was weighed into a thimble, extracted with anhydrous ether for about 1½ hour in Socs plus (Pelican Equipment). The ether was then evaporated and the beaker with the residue dried in an oven at 40 - 60 °C, cooled in a dessicator and weighed. The fat content was calculated using the formula.

$$\text{Fat content (g/100 g)} = \frac{\text{Weight of ether extract}}{\text{Weight of the sample (g)}} \times 100$$

3.3.2.3. Protein

Organic nitrogen in the sweet potato sample was digested (Pelican Kelplus equipment) with sulphuric acid in the presence of catalyst. The ammonia liberated by making the solution alkaline was distilled (Pelican Kelplus equipment) in to a known volume of standard acid which was back titrated (Ranganna, 1986). Protein percent was calculated by multiplying the nitrogen present with the factor 6.25.

$$\text{Protein (g/100 g)} = \frac{14 \times \text{Normality of the acid} \times (\text{titrant value burette reading})}{\text{Sample weight (g)} \times 1000} \times 100$$

3.3.2.4. Ash

The ash content was determined from the loss in weight that occurs during incineration of the sweet potato sample at a high temperature enough to allow organic matter to be burnt off without allowing appreciable decomposition of ash constituents. The heating was continued until the resultant ash was uniform in colour (white or gray) and free from un burnt carbon and fused lumps (Ranganna, 1986). The ash was calculated using the formula

$$\text{Ash content (g/100 g)} = \frac{\text{Weight of ash (g)}}{\text{Weight of the sample (g)}} \times 100$$

3.3.2.5. Crude fibre

Extraction of dehydrated and defatted sample with 1.25% sulphuric acid and 1.25% sodium hydroxide. The insoluble residue was collected by filtration, dried, weighed and ashed for mineral contamination of fibre residue. Crude fibre measures cellulose and lignin in the sample. The crude fibre was calculated using the formula

$$\text{Crude fibre (g/100 g)} = \frac{\text{Weight after drying in oven (g)} - \text{weight after incineration (g)}}{\text{Weight of the sample (g)}} \times 100$$

3.3.2.6. Carbohydrate by difference method

Carbohydrate was computed by subtracting the sum of per cent values of moisture, protein, fat and ash from 100. Available carbohydrate content was calculated by deducting the sum of percent value of moisture, protein, fat, ash and crude fibre from 100.

3.3.2.7. Calorific value (kcal / 100 g)

The calorific value was calculated by summing up the values obtained by multiplying carbohydrate, protein and fat content with Atwater constants (4, 4 and 9) respectively and expressed as kcal / 100 g.

3.3.3. Carbohydrate profile

3.3.3.1. Sugars

The total and reducing sugars when heated with alkaline copper tartrate reduce the copper from the cupric to cuprous state and thus cuprous oxide was formed. When cuprous oxide was treated with arsenomolybdic acid, the reduction of molybdic acid to molybdenum blue takes place. The blue colour developed was compared with a set of standards in a colorimeter at 510 nm and detailed procedure is presented in Appendix I (Ranganna, 1986).

$$\text{Non reducing sugar} = \text{Total sugar} - \text{reducing sugar} \times 0.95$$

3.3.3.2. Starch

The sweet potato sample was treated with 80% alcohol to remove sugars and then starch was extracted with perchloric acid. In hot acidic medium, starch was hydrolysed to glucose and dehydrated to hydroxymethyl furfural. This compound forms a green coloured product with anthrone (Ranganna, 1986) which was measured at 630 nm using spectrophotometer (Systronics Spectrophotometer 104) and detailed procedure is given in appendix II.

3.3.3.3. Dietary fibre

The soluble, insoluble and total dietary fibre fractions were analyzed by gravimetric, enzymatic method. The sweet potato sample was gelatinized by boiling for 15 min in the presence of a heat stable alpha amylase. It was incubated with pepsin at acidic pH for one hour and with pancreatin at neutral pH for one hour. Insoluble dietary fibre was filtered off with celite as the filter aid. Soluble dietary fibre was precipitated from the filtrate with four volumes of ethanol and recovered by filtration in the same way as insoluble dietary fibre (Asp *et al*., 1983). Detailed procedure is presented in appendix III.

3.3.4. Minerals content

3.3.4.1. Calcium

Calcium in the sweet potato sample was estimated by titrimetric method. Calcium was precipitated as oxalate and it was dissolved in hot sulphuric acid and titrated against standard potassium permanganate (Ranganna, 1986).

3.3.4.2. Phosphorous

Phosphorous reacts with molybdic acid to form a phosphomolybdate complex. It was then reduced with aminonaphtholsulphonic acid to the complex molybdenum blue which was measured colorimetrically at 650 nm (Ranganna, 1986).

3.3.4.3. Magnesium

Magnesium was estimated by EDTA titrimetric method (Derderian, 1961). Sample was digested and zirconyl oxychloride was added to the solution to form insoluble salt with erthophosphates at the pH of 5.5 – 6.5. The solution was filtered and erichrome black T and murexide indicators were added to the solution for the estimation of calcium and calcium + magnesium. The solution was treated with EDTA (Appendix IV).

3.3.4.3. Micro minerals

The sweet potato sample was treated with a mixture of mineral acid (tri acids) and heated for more rapid decomposition. Heating was continued until the digest was reduced to a few ml of clear white residue. The residue was dissolved in 6 N hydrochloric acid, filtered and made to a known volume with distilled water for various elemental analyses, the micro minerals (copper, manganese, iron and zinc) content was estimated by and the solution was read in Atomic Absorption Spectrophotometer (model: AAS GBS Avanta). Detailed procedure is provided in Appendix V.

3.4 Vitamin C

Vitamin C reduces the 2, 6 - dichlorophenol indophenol dye to a colourless leuco-base. The ascorbic acid gets oxidised to dehydroascorbic acid. The dye is pink coloured in acid medium. Oxalic acid is used as the titrating medium.

3.5. Cooking quality and acceptability of sweet potato genotypes

Sweet potato tubers can be processed by different methods *viz.* steaming, roasting, boiling, baking and frying.

3.5.1. Methods of processing on acceptability of sweet potato

Three methods of cooking were employed to assess acceptability of sweet potato.

3.5.1.1. Boiling

About 50 g of tuber was washed and boiled at 105 °C in a vessel covered with a lid till soft and done. Cooking quality was studied in terms of colour, gain in weight and time taken for boiling. Boiled tubers were peeled, cut into cubes and subjected to sensory evaluation.

3.5.1.2. Pressure cooking

About 50 g of sweet potato tuber was washed, pressure cooked at 15 lbs pressure for 15 minutes, cooled, peeled, cut into cubes and subjected to sensory evaluation.

3.5.1.3. Baking

About 50 g of sweet potato tuber was washed, baked in a baking oven at 200 °C for 25 minutes, cooled, peeled, cut into cubes and subjected to sensory evaluation.

3.5.1.4. Sensory evaluation

The samples were evaluated for appearance, colour, flavour, taste, texture and overall acceptability. Ten staff and students of the Department of Food Science and Nutrition constituted the panel of judges to evaluate the genotypes on 9 - point hedonic scale (Appendix IV). Processed genotypes of sweet potato were coded and presented to the panel of judges for evaluation of sensory characteristics.

3.6. Flour production potential and characterization of flour of sweet potato genotypes

In order to explore the possibility of diverse use of sweet potato genotypes flour production potential was tested.

3.6.1. Preparation of flour

The tubers of all genotypes were washed, peeled and sliced (2 mm) using domestic chips maker. The slices were dried in a hot air oven at 40 °C and ground to flour.

3.6.2. Flour yield

Weight of the flour of all sweet potato genotypes was recorded and noted as yield of flour. Per cent yield was calculated with the help of the following formula

$$\text{Yield (g/100 g)} = \frac{\text{Final weight (g)}}{\text{Initial weight (g)}} \times 100$$

3.6.3. Bulk density

Ten grams of sweet potato flour was transferred to a 25 ml graduated measuring cylinder and tapped ten times from a height of 8 to 10 cm. The bulk density (g/ml) was calculated as the ratio of weight to volume by using following formula

$$\text{Bulk density (g/ml)} = \frac{10\ (g)}{\text{Volume of flour (ml)}}$$

3.6.4. pH

The pH of the sweet potato flour was determined according to the method of AOAC (2005). Ten grams of sample was mixed with 100 ml of distilled water. The mixture was allowed to stand for 15 min, shaken at 5 min interval and filtered with Whatman No 1 filter paper. The pH of the filtrate was measured using a hand pH meter (Hannah instruments pHcp)

3.6.5. Particle size

One hundred gram of sweet potato flour was passed through sieves of different meshes of BSS standards from 60, 85, 100, 150, 200, 240 and 300 with sieve opening of 0.250, 0.180, 0.150, 0.106, 0.075, 0.063 and 0.053 mm respectively. The sample was passed from bigger to smaller mesh size. The sample above the sieve was weighed and recorded. Percentages (g/100 g) calculated.

3.6.6. Water absorption capacity

Water absorption capacity was assessed by the method of Quin and Paton (1983) with few modifications. To estimate water absorption capacity, 5 g of sweet potato flour was weighed in a 50 ml centrifuge tube and 30 ml of water was added and stirred with a glass rod for 5 min. After allowing the contents to stand for 30 min, at ambient conditions, it was centrifuged at 11,000 rpm for 25 min. The weight of centrifuge tube before and after centrifugation was noted and expressed as per cent of water absorbed on a dry weight basis

$$\text{WAC (g/g)} = \frac{\text{Tube after centrifugation (g)} - \text{Tube with sample (g)}}{\text{Weight of sample (g)}} \times 100$$

3.6.7. Oil absorption capacity

A method given by Sosulki *et al.* (1976) was used to determine oil absorption capacity. Sweet potato sample (1 gram) was mixed with 10 ml of refined oil in pre-weighed centrifuge tubes. The tubes were stirred for 1 min for complete dispersion of sample in the oil. After 30 min of holding time at room temperature, the sample was centrifuged at 3,000 rpm for 25 min. The separated oil was removed and tubes were inverted on oil absorbent paper for 25 min to drain the oil prior to reweighing. The oil absorption capacity was expressed as grams of oil absorbed per gram of the sample.

$$\text{OAC (g/g)} = \frac{\text{Tube after centrifugation (g)} - \text{Tube with sample (g)}}{\text{Weight of sample (g)}} \times 100$$

3.6.8. Swelling power and solubility

The swelling power and per cent solubility was determined according to the method used by Schoch (1964). Five hundred mg (W_1) of sweet potato sample was added to a centrifuge tube, weight of centrifuge tube and test sample was noted (W_2). After addition of 20 ml (V_E) distilled water, the centrifuge tube was placed in water bath at 100 °C for 20 - 30 min till the contents were cooked. Then it was centrifuged at 5,000 rpm for 10 min. The supernatant was transferred to a test tube and the inner side of the centrifuge tube was dried well and weighed (W_3). The swelling power of flour was calculated as follows.

$$\text{Swelling power (g / g)} = \frac{W_3 - W_2}{W_1} \times 1$$

For per cent solubility, weight of dried petri plate was noted (W_4) and after pouring 10 ml aliquot (V_A) in the dish, it was dried at 110° C for 4 - 5 h. The petri plate was cooled in a dessicator and weighed (W_5).

$$\text{Solubility (\%)} = \frac{(W_5 - W_4)\, V_E}{V_A\ W_1} \times 100$$

3.7. Statistical analysis

The data collected in triplicates for physico-chemical properties, nutrient composition and flour production potential was tabulated and analysed using one-way analysis of variance and F-test. The results were presented as Mean ± SD. Critical difference was used to test the significance between the samples. The probability fixed for the test of significance was $p < 0.01$. All the statistical analysis was done using the SPSS software (version 16.0).

Experimental Results

4. EXPERIMENTAL RESULTS

Sweet potato [*Ipomoea batatas* (L.) Lam] a native of tropical America belongs to the family Convolvulaceae. It is valued for its short growing period of 90 to 120 days, thus becoming a very important crop in developing countries. It is currently seen as a future crop that is likely to increase its importance over the next 20 years. The crop is cultivated throughout tropical and subtropical regions and is ranked seventh among the most important food crops of the world. Number of genotypes have been developed which needs to be evaluated for quality. The study was under taken to evaluate the characteristics of fourteen genotypes of sweet potato and the research findings have been presented under the following headings after subjecting the data to appropriate statistical analysis.

4.1. Colour and physico-chemical properties of sweet potato genotypes
4.2. Nutrient composition of sweet potato genotypes
4.3. Cooking quality and acceptability of sweet potato genotypes
4.4. Flour production potential and characterization of flour of sweet potato genotypes
4.5 Correlations between nutrient composition and functional properties of sweet potato genotypes

4.1. Colour and physico-chemical properties of sweet potato genotypes

The physical properties of sweet potato, like those of other agricultural produce are essential for the design of equipment for handling, harvesting, and storing the tubers. Physical properties affect the converting characteristics of solid materials by air or water and cooling and heating load of food products.

4.1.1 Colour properties of sweet potato genotypes

Table 1 shows the colour of sweet potato genotypes. The skin colour and flesh colour varied between the genotypes. The skin colour varied from pale rose, pale cream to gulf red and the flesh colour varied from white, light cream, dark cream, orange to purple. The check variety MLT-Vikram was white fleshed.

4.1.2. Physical properties of sweet potato genotypes

The physical properties of sweet potato genotypes are presented in table 2. The mean length, width, circumference, weight, volume and bulk density of the genotypes was 14.56 cm, 6.96 cm, 19.81 cm, 264.79 g, 261.95 ml and 1.08 respectively. The genotype GP-HUB-36

Table 1. Colour properties of sweet potato genotypes

Sl. No	Genotypes	Skin colour	Flesh colour
1	GP-HUB-14	Pale rose	White
2	MLT-CIP-SWA	Gulf red	White
3	URT-TSP-12-10	Pale rose	Light cream
4	GP-HUB-25	Pale cream	Dark cream
5	GP-HUB-26	Pale cream	Dark cream
6	GP-HUB-35	Pale cream	Dark cream
7	GP-HUB-36	Pale rose	Light cream
8	GP-HUB-44	Pale rose	Light cream
9	GP-HUB-95	Pale rose	Dark cream
10	MLT- 440127	Pale cream	Dark cream
11	MLT-Gouri	Gulf red	Light cream
12	Sreebhadra	Pale rose	Dark cream
13	GP-HUB-66	Pale rose	Orange
14	URT-TSP-12-12	Pale rose	Purple
15	MLT-Vikram (check)	Gulf red	White

Note: For determining the skin colour, paint shade card (Shalimar paint shade card) was used.

Source: GP-HUB-14, GP-HUB-25, GP-HUB-26, GP-HUB-35, GP-HUB-36, GP-HUB-44, GP-HUB-66, GP-HUB-95 – All India Co-ordinated Research Project on tuber crops, Regional Horticultural Research and Extension Centre, Dharwad.

MLT-CIP-SWA, URT-TSP-12-10, URT-TSP-12-12, MLT-440127, MLT-Gouri – Central Tuber Crops Research Institute, Trivandrum.

Sreebhadra – University of Horticultural Sciences, Bagalkote.

MLT-Vikram – University of Agricultural Sciences, Dharwad.

Table 2. Physical properties of sweet potato genotypes

Sl. No	Genotypes	Length (cm)	Width (cm)	Circumference (cm)	Weight (g)	Volume (ml)	Bulk density
White flesh							
1	GP-HUB-14	16.57 ± 2.40^{cde}	8.29 ± 2.11^{e}	24.71 ± 6.47^{cd}	397.90 ± 176.25^{e}	477.00 ±147.96^{f}	0.80 ± 0.14^{a}
2	MLT-CIP-SWA	13.66 ± 2.47^{abcd}	6.71 ±1.36^{abcde}	18.88 ± 4.59^{ab}	254.80 ±132.06^{abcde}	248.40 ± 152.29^{bcde}	1.09 ± 0.15^{bcd}
Cream flesh							
3	URT-TSP-12-10	13.28 ± 1.58^{abcd}	5.88 ± 0.73^{ab}	16.80 ± 2.76^{ab}	179.40 ± 57.81^{abc}	162.40 ± 60.73^{abc}	1.13 ± 0.18^{cd}
4	GP-HUB-25	16.26 ± 3.47^{cde}	6.22 ± 0.74^{abc}	17.28 ± 2.50^{a}	233.6 ± 86.66^{abcd}	242.00 ± 92.68^{bcde}	0.98 ± 0.17^{abc}
5	GP-HUB-26	17.17 ± 3.25^{de}	5.41 ± 0.81^{a}	15.76 ± 3.16^{a}	206.20 ± 68.50^{abcd}	164.80 ± 53.18^{abc}	1.27 ± 0.24^{d}
6	GP-HUB-35	13.09 ± 2.97^{abcd}	6.42 ± 1.43^{abc}	17.97 ± 3.96^{a}	207.6 ± 114.22^{abcd}	212.70 ± 115.60^{abcd}	0.95 ± 0.09^{abc}
7	GP-HUB-36	19.58 ± 5.03^{e}	6.15 ± 0.92^{abc}	17.71 ± 2.34^{a}	296.90 ± 106.79^{bcde}	294.80 ± 87.10^{bcde}	0.99 ± 0.14^{abc}
8	GP-HUB-44	15.83 ± 2.92^{cde}	6.51 ± 0.80^{abcd}	18.59 ± 2.92^{ab}	286.70 ± 110.09^{bcde}	292.00 ± 112.68^{bcde}	0.98 ± 0.05^{abc}
9	GP-HUB-95	12.53 ± 2.24^{abc}	10.91 ± 2.45^{f}	28.98 ± 6.98^{d}	359.93 ± 125.70^{de}	321.20 ± 121.25^{cde}	1.13 ± 0.08^{cd}
10	MLT-440127	12.89 ± 2.90^{abc}	8.20 ± 1.30^{de}	24.09 ± 4.69^{bcd}	323.90 ± 138.08^{def}	328.70 ± 165.24^{de}	1.01 ± 0.13^{abc}
11	MLT-Gouri	11.22 ± 3.80^{ab}	5.88 ± 1.84^{ab}	16.29 ± 5.75^{a}	157.60 ± 134.58^{ab}	150.30 ± 117.08^{ab}	0.99 ± 0.08^{bc}
12	Sreebhadra	13.13 ± 4.19^{abcd}	7.61 ± 1.78^{bcde}	23.67 ± 7.02^{bcd}	359.20 ± 235.99^{de}	397.50 ± 248.45^{ef}	0.87 ± 0.11^{ab}
Orange flesh							
13	GP-HUB-66	10.07 ± 2.82^{a}	5.57 ± 1.00^{a}	16.98 ± 3.45^{a}	109.80 ± 46.54^{a}	59.30 ± 37.10^{a}	2.01 ± 0.48^{e}
Purple flesh							
14	URT-TSP-12-12	14.21 ± 2.86^{bcd}	7.77 ± 0.41^{cde}	20.82 ± 0.40^{abc}	310.90 ± 56.27^{bcde}	301.90 ± 61.98^{bcde}	1.03 ± 0.05^{abc}
Check (White flesh)							
15	MLT-Vikram	18.91 ± 0.40^{e}	6.98 ±0.52^{abcde}	18.66 ± 1.70^{ab}	287.47 ± 22.52^{bcde}	276.29 ± 13.80^{bcde}	1.03 ± 0.05^{abc}
	Mean	14.56 ± 2.88	6.96 ± 1.21	19.81 ± 3.91	264.79 ± 107.47	261.95 ± 105.80	1.08 ± 0.14
	F value	7.88	11.09	7.74	4.67	7.52	23.94
	S. Em. ±	0.97	0.42	1.37	37.87	38.00	0.05
	C. D. @ 1% level	3.59**	1.58**	5.09**	139.93**	140.44**	0.21**

Note: Means are average of ten tubers ± SD, ** - Significant at 0.01 level.

was lengthier (19.58 cm) and orange fleshed genotype GP-HUB-66 was shorter (10.07 cm). The length of the genotypes GP-HUB-36 (19.58 cm) and check variety MLT-Vikram (18.91 cm) was higher and on par with each other statistically. The width in the genotypes ranged from 5.41 to 10.91 cm. The width of the genotypes GP-HUB-95 (10.91 cm), GP-HUB-14 (8.29 cm) and MLT-440127 (8.20 cm) was higher. The genotype GP-HUB-95 had significantly higher circumference (28.98 cm) and GP-HUB-26 had significantly lower circumference (15.76 cm). The weight and volume in the genotypes ranged from 109.80 to 397.90 g and 59.30 to 477.00 ml respectively. The genotype GP-HUB-14 was heavier (397.90 g) and had higher volume (477.00 ml) and the genotype GP-HUB-66 was lighter (109.80 g) and had lower volume (59.30 ml). The weight of the genotypes URT-TSP-12-12, GP-HUB-36, check variety MLT-Vikram and GP-HUB-44 (310.90, 296.90, 286.70 and 287.47 g, respectively) was statistically on par with each other. The volume of the genotypes URT-TSP-12-12, GP-HUB-36, GP-HUB-44, check variety MLT-Vikram, MLT-CIP-SWA and GP-HUB-25 (301.90, 294.80, 292.80, 276.29, 248.40 and 242.00 ml, respectively) was statistically on par with each other. The bulk density ranged from 0.80 to 2.01. The bulk density of the genotypes URT-TSP-12-12 (1.03), check variety MLT-Vikram (1.03), MLT-440127 (1.01), GP-HUB-36 (0.99), GP-HUB-44 (0.98) and GP-HUB-35 (0.95) was on par with each other statistically.

4.1.3. Physico-chemical properties of sweet potato genotypes

Table 3 reveals the physicochemical properties of sweet potato genotypes. Significant differences existed between the genotypes with regard to pH, TSS, titratable acidity and dry matter. All the genotypes showed acidic pH (5.48 to 6.50) except GP-HUB-95 which showed neutral pH (7.00). The genotypes GP-HUB-44 and URT-TSP-12-12 showed equal pH (6.18). The genotypes GP-HUB-25 (5.58), GP-HUB-66 (5.58) and Sreebhadra (5.54) exhibited significantly lower pH and were on par with each other statistically. The TSS of fourteen sweet potato genotypes and check variety MLT-Vikram ranged from 5.50 (GP-HUB-35) to 11.83 (GP-HUB-44). Significant and higher TSS was seen in the genotypes GP-HUB-44 (11.83 °Brix), GP-HUB-95 (11.50 °Brix) and Sreebhadra (11.33°Brix) and also were on par with each other statistically. The genotypes GP-HUB-25, GP-HUB-26 and GP-HUB-36 contained equal amount of TSS (8.00 °Brix). The genotype GP-HUB-25 (0.16 g %) showed significantly higher titratable acidity and significantly lower titratable acidity was exhibited

Table 3. Physico-chemical properties of sweet potato genotypes

Sl. No	Genotypes	pH	Total soluble solids (°Brix)	Titratable acidity (g %)	Dry matter (g %)
White flesh					
1	GP-HUB-14	5.70 ±0.02^{bcd}	7.50 ± 0.50^{bc}	0.14 ± 0.03^{cd}	25.90 ± 1.00^{a}
2	MLT-CIP-SWA	6.30 ± 0.03^{fg}	9.16 ± 0.29^{de}	0.05 ± 0.01^{a}	41.52 ± 0.02^{f}
Cream flesh					
3	URT-TSP-12-10	6.03 ± 0.01^{e}	8.50 ± 0.50^{cd}	0.05 ± 0.01^{a}	32.84 ± 0.04^{e}
4	GP-HUB-25	5.58 ± 0.06^{ab}	8.00 ± 0.50^{bc}	0.16 ± 0.04^{d}	29.20 ± 0.64^{c}
5	GP-HUB-26	5.48 ± 0.08^{a}	8.00 ± 0.50^{bc}	0.09 ± 0.03^{abc}	26.71 ± 0.01^{ab}
6	GP-HUB-35	5.76 ± 0.06^{cd}	5.50 ± 0.50^{a}	0.09 ± 0.03^{abc}	29.04 ± 0.04^{c}
7	GP-HUB-36	5.68 ± 0.06^{bc}	8.00 ± 0.50^{bc}	0.11 ± 0.03^{bcd}	26.22 ± 0.02^{ab}
8	GP-HUB-44	6.18 ± 0.01^{ef}	11.83 ± 0.29^{f}	0.06 ± 0.03^{ab}	32.81 ± 1.00^{e}
9	GP-HUB-95	7.00 ± 0.20^{i}	11.50 ± 0.50^{f}	0.09 ± 0.30^{abc}	26.04 ± 0.04^{a}
10	MLT- 440127	6.44 ± 0.02^{gh}	7.33 ± 0.58^{b}	0.04 ± 0.12^{a}	31.53 ± 0.03^{d}
11	MLT- Gouri	6.50 ± 0.10^{h}	9.83 ± 0.29^{e}	0.06 ± 0.01^{ab}	27.31 ± 0.05^{b}
12	Sreebhadra	5.54 ± 0.02^{ab}	11.33 ± 0.29^{f}	0.08 ± 0.01^{abc}	29.26 ± 0.06^{c}
Orange flesh					
13	GP-HUB-66	5.58 ± 0.04^{ab}	8.50 ± 0.50^{cd}	0.07 ± 0.02^{ab}	27.00 ± 1.00^{ab}
Purple flesh					
14	URT-TSP-12-12	6.18 ± 0.08^{ef}	8.50 ± 0.50^{cd}	0.06 ± 0.17^{ab}	41.20 ± 0.20^{f}
Check (White flesh)					
15	MLT -Vikram	5.86 ± 0.03^{d}	8.16 ± 0.14^{bcd}	0.06 ± 0.03^{ab}	41.43 ± 0.03^{f}
	Mean	5.98 ± 0.05	8.77 ± 0.41	0.08 ± 0.05	31.20 ± 0.27
	F value	110.74	45.32	6.95	428.41
	S. Em. ±	0.04	0.25	0.01	0.27
	C. D. @ 1% level	0.16 **	0.99**	0.04 **	1.07 **

Note: Means are average of three replications ± SD, ** - Significant at 0.01 level.

by the genotypes MLT-CIP-SWA, URT-TSP-12-10 and MLT-440127 (0.05, 0.05 and 0.04 g %, respectively) and were on par with each other statistically. The genotypes GP-HUB-26 (0.09 g %), GP-HUB-35 (0.09 g %) and GP-HUB-95 (0.09 g %) and Sreebhadra (0.08 g %) were on par with each other in terms of titratable acidity. The dry matter content in the sweet potato genotypes ranged from 25.90 g per 100g to 41.52 g per 100g (Fig. 2). Significantly higher dry matter content was recorded in the genotypes MLT-CIP-SWA (41.52 g %), check variety MLT-Vikram (41.43 g %) and URT-TSP-12-12 (41.20 g %) which were on par with each other and the genotype GP-HUB-95 (26.04 g %) and GP-HUB-14 (25.90 g %) showed significantly lower dry matter content and were on par with each other statistically.

4.2. Nutrient composition of sweet potato genotypes

Sweet potato contains higher amounts of carbohydrates, various vitamins, minerals, and protein than other roots and tubers. It also contains much higher levels of provitamin A, vitamin C and minerals than rice or wheat.

4.2.1. Proximate composition of sweet potato genotypes on fresh weight basis

Proximate composition of sweet potato genotypes on fresh weight basis is given in table 4. Significant differences existed between the genotypes in terms of proximate principles except ash. The genotypes GP-HUB-14, GP-HUB-95, GP-HUB-36 and GP-HUB-26 had significantly higher moisture content and were statistically on par with each other (74.10, 73.96, 73.78 and 73.29 g %, respectively). The genotypes URT-TSP-12-12, check variety MLT-Vikram and MLT-CIP-SWA (58.80, 58.47 and 58.40 g %, respectively) had significantly lower moisture content and were on par with each other statistically. The protein content of the genotypes ranged from 1.75 to 3.17 g per cent on fresh weight basis. The genotypes URT-TSP-12-10 (3.17 g %) and URT-TSP-12-12 (3.12 g %) had significantly higher protein content and were on par with each other. Significantly lower protein content was seen in the genotype GP-HUB-66 (1.44 g %) on fresh weight basis. The check variety MLT-Vikram had higher fat content (0.68 g %) and the genotype GP-HUB-36 (0.05 g %) had lower fat. The fat content of the genotypes GP-HUB-66, URT-TSP-12-12, GP-HUB-14, GP-HUB-95, GP-HUB-35 and URT-TSP-12-10 (0.31, 0.31, 0.27, 0.27, 0.26 and 0.26 g %, respectively) was statistically on par with each other. The ash content in the sweet potato genotypes ranged from 0.80 to 1.36 g per cent and did not differ statistically. Significantly higher crude fibre content was seen in the genotype GP-HUB-14 (4.97 g %) and significantly

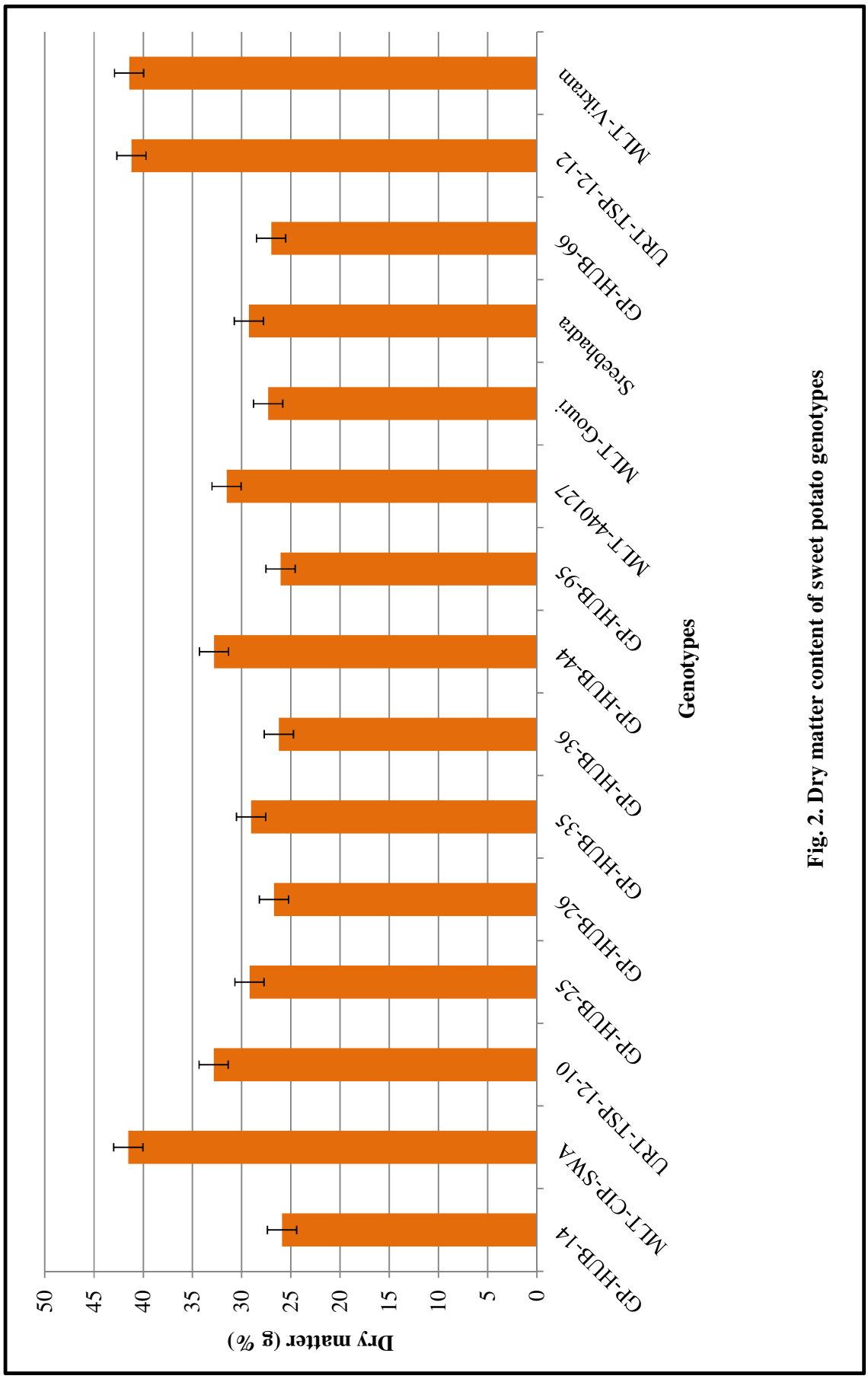


Fig. 2. Dry matter content of sweet potato genotypes

Table 4. Proximate composition of sweet potato genotypes on fresh weight basis

Proximate composition (g %)									
Sl. No	**Genotypes**	**Moisture**	**Protein**	**Fat**	**Ash**	**Crude fibre**	**Total Carbohydrate**	**Available carbohydrate**	**Energy (Kcal)**
White flesh									
1	GP-HUB-14	74.10 ± 1.00^{e}	1.87 ± 0.10^{abc}	0.27 ± 0.10^{bcd}	1.13 ± 0.01	4.97 ± 1.00^{c}	22.63 ± 1.12^{b}	17.66 ± 2.12^{a}	81 ± 7.54^{a}
2	MLT- CIP- SWA	58.40 ± 0.10^{a}	2.95 ± 0.01^{de}	0.40 ± 0.01^{d}	1.36 ± 1.00	1.23 ± 0.01^{b}	36.89 ± 2.11^{g}	35.66 ± 2.12^{f}	158 ± 4.39^{e}
Cream flesh									
3	URT-TSP-12-10	67.16 ± 0.02^{b}	3.17 ± 0.03^{e}	0.26 ± 0.03^{bcd}	1.12 ± 1.00	1.16 ± 0.02^{ab}	28.29 ± 1.06^{ef}	27.13 ± 1.08^{de}	123 ± 4.01^{d}
4	GP-HUB-25	71.13±0.03^{cd}	2.75 ± 0.01^{cde}	0.19 ± 0.01^{abc}	0.81 ± 0.10	0.95 ± 0.04^{ab}	25.12 ± 0.19^{abcd}	24.17 ±0.23^{bcd}	109 ± 0.63^{c}
5	GP-HUB-26	73.29 ± 1.00^{e}	2.21± 0.01^{abcde}	0.15 ± 0.01^{ab}	0.80 ± 0.05	0.97 ± 0.05^{ab}	23.55 ± 1.09^{abc}	22.57 ± 1.14^{bc}	100 ± 4.33^{bc}
6	GP-HUB-35	70.96±0.02^{cd}	1.89 ± 0.10^{abc}	0.26 ± 0.10^{bcd}	1.20 ± 0.10	0.73 ± 0.03^{ab}	25.69 ± 0.26^{bcde}	24.96 ±0.29^{cde}	109 ± 0.10^{c}
7	GP-HUB-36	73.78 ± 0.08^{e}	2.23 ±0.04^{abcde}	0.05 ± 0.01^{a}	0.80 ± 0.20	0.66 ± 0.03^{ab}	23.14 ± 1.32^{abc}	22.48 ± 1.35^{bc}	99 ± 0.99^{bc}
8	GP-HUB-44	67.19 ± 0.02^{b}	2.60 ± 0.05^{defg}	0.35 ± 0.04^{cd}	1.05 ± 0.04	0.98 ± 0.09^{ab}	28.81 ± 0.37^{f}	27.82 ± 0.43^{e}	124 ± 0.35^{d}
9	GP-HUB-95	73.96 ± 0.02^{e}	2.51 ± 0.06^{bcde}	0.27 ± 0.05^{bcd}	1.21 ± 1.00	0.97 ± 0.04^{ab}	22.05 ± 1.10^{a}	21.08 ± 1.14^{b}	96± 3.94^{b}
10	MLT- 440127	68.47 ± 1.00^{b}	2.44 ± 0.03^{bcde}	0.43 ± 0.06^{d}	0.83 ± 0.04	0.63 ± 0.05^{ab}	27.83 ± 1.03^{def}	27.20 ± 0.98^{de}	122 ± 3.94^{d}
11	MLT-Gouri	72.68±0.09^{cde}	1.75 ± 0.02^{ab}	0.40 ± 0.03^{d}	1.05 ± 0.04	0.50 ± 0.30^{a}	24.11 ± 0.32^{abc}	23.61 ± 0.59^{bc}	105 ± 1.48^{bc}
12	Sreebhadra	70.74 ± 2.00^{c}	2.03 ± 0.07^{abcd}	0.21 ± 0.10^{abc}	1.22 ± 0.05	0.81 ± 0.03^{ab}	25.80 ± 2.09^{cde}	24.99 ±2.13^{cde}	109 ± 8.15^{c}
Orange flesh									
13	GP-HUB-66	73.00 ± 1.00^{de}	1.44 ± 0.03^{a}	0.31 ± 0.07^{bcd}	1.09 ± 0.03	0.78 ± 0.04^{ab}	24.15 ± 1.08^{abc}	23.37 ± 1.12^{bc}	102 ± 4.16^{bc}
Purple flesh									
14	URT-TSP-12-12	58.80 ± 2.00^{a}	3.12 ± 0.03^{e}	0.27 ± 0.03^{bcd}	1.14 ± 0.05	0.96 ± 0.07^{ab}	36.67 ± 2.10^{g}	35.71 ± 2.17^{f}	157 ± 8.33^{e}
Check (White flesh)									
15	MLT- Vikram	58.47 ± 0.07^{a}	2.51 ± 0.04^{bcde}	0.68 ± 0.04^{e}	1.15 ± 0.06	1.32 ± 0.08^{b}	37.19 ± 0.07^{g}	35.87 ± 0.15^{f}	160 ± 0.16^{e}
	Mean	68.80 ± 0.36	2.36 ± 0.04	0.03 ± 0.0.04	1.06 ± 0.25	1.17 ± 0.10	27.46 ± 1.02	26.28 ± 1.13	117 ± 3.50
	F value	124.64	5.61	12.18	0.45	46.24	56.26	51.31	88.58
	S.Em ±	0.51	0.21	0.04	0.26	0.15	0.70	0.76	2.56
	C. D. @ 1% level	2.01**	0.84**	0.16**	NS	0.61**	2.74**	2.99**	9.96**

Note: Means are average of three replications ± SD, ** - Significant at 0.01 level, NS- Non-significant.

lower crude fibre content was seen in the genotype MLT-Gouri (0.50 g %). The crude fibre content of all other genotypes except GP-HUB-14, MLT-CIP-SWA, MLT-Gouri and check variety MLT-Vikram was statistically on par with each other. The total carbohydrate content in the genotypes ranged from 22.05 g per 100 g to 37.19 g per 100 g. The check variety MLT-Vikram (37.19 g %), MLT-CIP-SWA (36.89 g %) and URT-TSP-12-12 (36.67 g %) had statistically similar and significantly higher total carbohydrate content. Significantly lower total carbohydrate content was seen in the genotype GP-HUB-95 (22.05 g %). The total carbohydrate content of the genotypes GP-HUB-66, GP-HUB-26, MLT-Gouri and GP-HUB-36 was statistically on par with each other (24.15, 23.55, 24.11 and 23.14 g %, respectively). Significantly higher available carbohydrate content was seen in the check variety MLT-Vikram (35.87 g %), URT-TSP-12-12 (35.71 g %) and MLT-CIP-SWA (35.66 g %). Significantly lower available carbohydrate content was seen in the genotype GP-HUB-14 (17.66 g %) followed by GP-HUB-95 (21.08 g %). The energy content when computed using Atwater factors ranged from 81 to 160 kcal. The check variety MLT-Vikram (160 kcal) and the genotypes MLT-CIP-SWA (158 kcal), URT-TSP-12-12 (157 kcal) had significantly higher energy content. Significantly lower energy content was seen in the genotype GP-HUB-14 (81 kcal).

4.2.2. Proximate composition of sweet potato genotypes on dry weight basis

Table 5 shows the proximate composition of sweet potato genotypes on dry weight basis. Significant differences existed between the genotypes in terms of all the proximates. The moisture content in the sweet potato genotypes ranged from 6.28 g per cent in GP-HUB-66 to 8.34 g per cent in MLT-440127 on dry basis. The genotypes MLT-CIP-SWA (6.31 g %) and GP-HUB-66 (6.28 g %) had significantly lower moisture content. The moisture content of all the other genotypes except GP-HUB-66, MLT-CIP-SWA and MLT-440127 were statistically on par with each other. Significantly higher protein content was seen in the genotypes URT-TSP-12-10, GP-HUB-95 and GP-HUB-25 (9.68, 9.65 and 9.56 g %, respectively) and they were on par with each other statistically and the genotype GP-HUB-66 (5.36 g %) had significantly lower protein content. The check variety MLT-Vikram (1.65 g %) had significantly higher fat content and the genotype GP-HUB-36 (0.22 g %) had significantly lower fat content. The fat content of the genotypes GP-HUB-44, GP-HUB-14, and GP-HUB-95 was statistically on par with each other (1.09, 1.07 and 1.06 g

Table 5. Proximate composition of sweet potato genotypes on dry weight basis

Sl. No	Genotypes	Proximate composition (g %)							
		Moisture	Protein	Fat	Ash	Crude fibre	Total carbohydrate	Available carbohydrate	Energy (Kcal)
White flesh									
1	GP-HUB-14	7.02 ± 0.01^{ab}	7.23 ± 0.03^{ef}	1.07 ± 0.20^{i}	4.36 ± 0.01^{l}	4.96 ± 0.03^{n}	80.30 ± 0.18^{bcd}	75.34 ± 0.15^{b}	340 ± 0.18^{a}
2	MLT-CIP-SWA	6.31 ± 1.00^{a}	7.10 ± 0.02^{e}	0.97 ± 0.18^{h}	3.29 ± 0.01^{g}	2.96 ± 0.03^{h}	82.33 ± 1.19^{efg}	79.37 ± 1.17^{defg}	354 ± 3.88^{de}
Cream flesh									
3	URT-TSP-12-10	7.05 ± 0.10^{ab}	9.68 ± 0.29^{k}	0.80 ± 0.20^{f}	3.41 ± 0.01^{h}	3.55 ± 0.01^{k}	79.05 ± 0.21^{b}	75.50 ± 0.19^{b}	347 ± 0.28^{bcd}
4	GP-HUB-25	7.74 ± 1.00^{ab}	9.56 ± 0.02^{k}	0.67 ± 0.20^{d}	2.85 ± 0.01^{c}	3.32 ± 0.04^{j}	79.16 ± 1.04^{b}	75.84± 1.07^{b}	347 ± 4.02^{bc}
5	GP-HUB-26	6.73 ± 0.10^{ab}	8.28 ± 0.06^{h}	0.59 ± 0.20^{c}	3.01 ± 0.01^{d}	3.66 ± 0.03^{l}	81.38 ± 0.19^{cdefg}	77.72 ± 0.19^{cd}	349 ± 0.22^{bcd}
6	GP-HUB-35	7.16 ± 0.10^{ab}	6.53 ± 0.03^{cd}	0.90 ± 0.20^{g}	4.15 ± 0.01^{k}	2.52 ± 0.04^{d}	81.24 ± 0.21^{cdef}	78.71 ± 0.24^{defg}	349 ± 0.03^{bcd}
7	GP-HUB-36	7.24 ± 1.00^{ab}	8.51 ± 0.03^{hi}	0.22 ± 0.17^{a}	3.08 ± 0.01^{e}	2.66 ± 0.03^{e}	80.94 ± 1.00^{cde}	78.28 ± 0.99^{cdef}	349 ± 3.93^{bcd}
8	GP-HUB-44	6.95 ± 1.00^{ab}	8.86 ± 0.06^{j}	1.09 ± 0.20^{i}	3.22 ± 0.01^{f}	2.99 ± 0.04^{h}	79.87 ± 1.02^{bc}	76.87 ± 0.98^{bc}	352 ± 3.91^{cde}
9	GP-HUB-95	7.96 ± 0.01^{ab}	9.65 ± 0.02^{k}	1.06 ± 0.17^{i}	4.68 ± 0.01^{m}	3.75 ± 0.04^{m}	76.65 ± 0.14^{a}	72.89 ± 0.11^{a}	339 ± 0.09^{a}
10	MLT- 440127	8.34 ± 1.00^{b}	7.77 ± 0.03^{g}	1.37 ± 0.24^{k}	2.67 ± 0.01^{a}	2.02 ± 0.04^{b}	79.84± 1.04^{bc}	77.81 ± 1.05^{cd}	354± 3.90^{de}
11	MLT-Gouri	7.07 ± 0.01^{ab}	6.41 ± 0.01^{bc}	0.75 ± 0.69^{e}	3.86 ± 0.01^{i}	1.84 ± 0.01^{a}	81.90 ± 0.21^{defg}	80.06 ± 0.21^{g}	352 ± 0.07^{cde}
12	Sreebhadra	7.46 ± 1.00^{ab}	6.96 ± 0.06^{de}	0.49 ± 0.20^{b}	4.16 ± 0.02^{k}	2.77 ± 0.02^{f}	80.92 ± 0.96^{cde}	78.15 ± 0.94^{cde}	344 ± 3.96^{ab}
Orange flesh									
13	GP-HUB-66	6.28 ± 0.01^{a}	5.36 ± 0.03^{a}	1.15 ± 0.20^{j}	4.05 ± 0.02^{j}	2.89 ± 0.04^{g}	83.14 ± 0.23^{g}	80.24 ± 0.24^{g}	352 ± 0.25^{cde}
Purple flesh									
14	URT-TSP-12-12	6.63 ± 0.01^{ab}	7.58 ± 0.03^{fg}	0.67 ± 0.18^{d}	2.80 ± 0.02^{b}	2.35 ± 0.03^{c}	82.31 ± 0.23^{efg}	79.96 ± 0.25^{fg}	356 ± 0.19^{e}
Check (White flesh)									
15	MLT- Vikram	6.57 ± 1.00^{ab}	6.06 ± 0.03^{b}	1.65 ± 0.24^{l}	2.78 ± 0.01^{b}	3.19 ± 0.04^{i}	82.92 ± 0.85^{fg}	79.73 ± 0.88^{efg}	358 ± 3.94^{e}
	Mean	7.10 ± 0.49	7.70 ± 0.05	0.90 ± 0.23	3.49 ± 0.01	3.03 ± 0.03	80.79 ± 0.56	77.76 ± 0.57	350.00 ± 1.92
	F value	2.20	144.54	659.47	7653.31	1884.36	17.50	26.82	12.28
	S. Em. ±	0.39	0.11	0.01	0.00	0.01	0.41	0.41	1.55
	C. D. @ 1% level	1.53*	0.43**	0.05**	0.02**	0.06**	1.59**	1.59**	6.03**

Note: Means are average of three replications ± SD, *- Significant at 0.05 level, ** - Significant at 0.01 level.

%, respectively). Significantly higher ash content was seen in the genotype GP-HUB-95 (4.68 g %) and significantly lower ash content was seen in the genotype MLT-440127 (2.67 g %). The genotype GP-HUB-14 showed significantly higher crude fibre content (4.96 g %) and the genotype MLT-Gouri showed significantly lower crude fibre content (1.84 g %) on dry weight basis. The total carbohydrate content in the genotypes ranged from 76.65 g per 100 g in GP-HUB-95 to 83.14 g per 100 g in GP-HUB-66. Significantly higher total carbohydrate content was seen in the genotype orange fleshed genotype GP-HUB-66 (83.16 g %). Significantly lower total carbohydrate content was seen in the genotype GP-HUB-95 (76.65 g %). The genotypes GP-HUB-66 (80.24 g %) and MLT-Gouri (80.06 g %) exhibited significantly higher available carbohydrate content and they were on par with each other statistically. Significantly lower available carbohydrate content was seen in the genotype GP-HUB-95 (72.89 g %) on dry weight basis. The energy content on dry weight basis in the genotypes ranged from 340 kcal in GP-HUB-14 to 358 kcal in check variety MLT-Vikram. The genotype URT-TSP-12-12 (356 kcal) and check variety MLT-Vikram (358 kcal) exhibited significantly higher energy content and were on par with each other statistically. The genotype GP-HUB-14 and GP-HUB-95 having equal energy content of 340 kcal were statistically on par with each other. The energy content of the genotypes GP-HUB-35, GP-HUB-36, GP-HUB-26 and URT-TSP-12-10 were statistically on par with each other (349, 349, 347 and 347 kcal respectively).

4.2.3. Vitamin C content of sweet potato genotypes

Fig 3 and appendix V shows the vitamin C content of sweet potato genotypes. Significant differences existed between the vitamin C content of sweet potato genotypes. The genotypes URT-TSP-12-10 (23.88 mg/100 g) and GP-HUB-44 (22.67 mg/100 g) showed statistically similar and significantly higher vitamin C content. The genotypes GP-HUB-36 (8.39 mg/100g), GP-HUB-95 (7.99 mg/100g), GP-HUB-26 (7.28 mg/100 g), GP-HUB-35 (6.93 mg/100 g) and GP-HUB-66 (7.33 mg/100 g) showed lower vitamin C content and were statistically on par with each other.

4.2.4. Mineral content of sweet potato genotypes

A perusal of table 6 indicates that significant differences existed between the genotypes regarding the macro and micro minerals. The genotypes GP-HUB-26 and GP-HUB-44 showed significantly higher and equal calcium content (950 mg/100 g) on dry

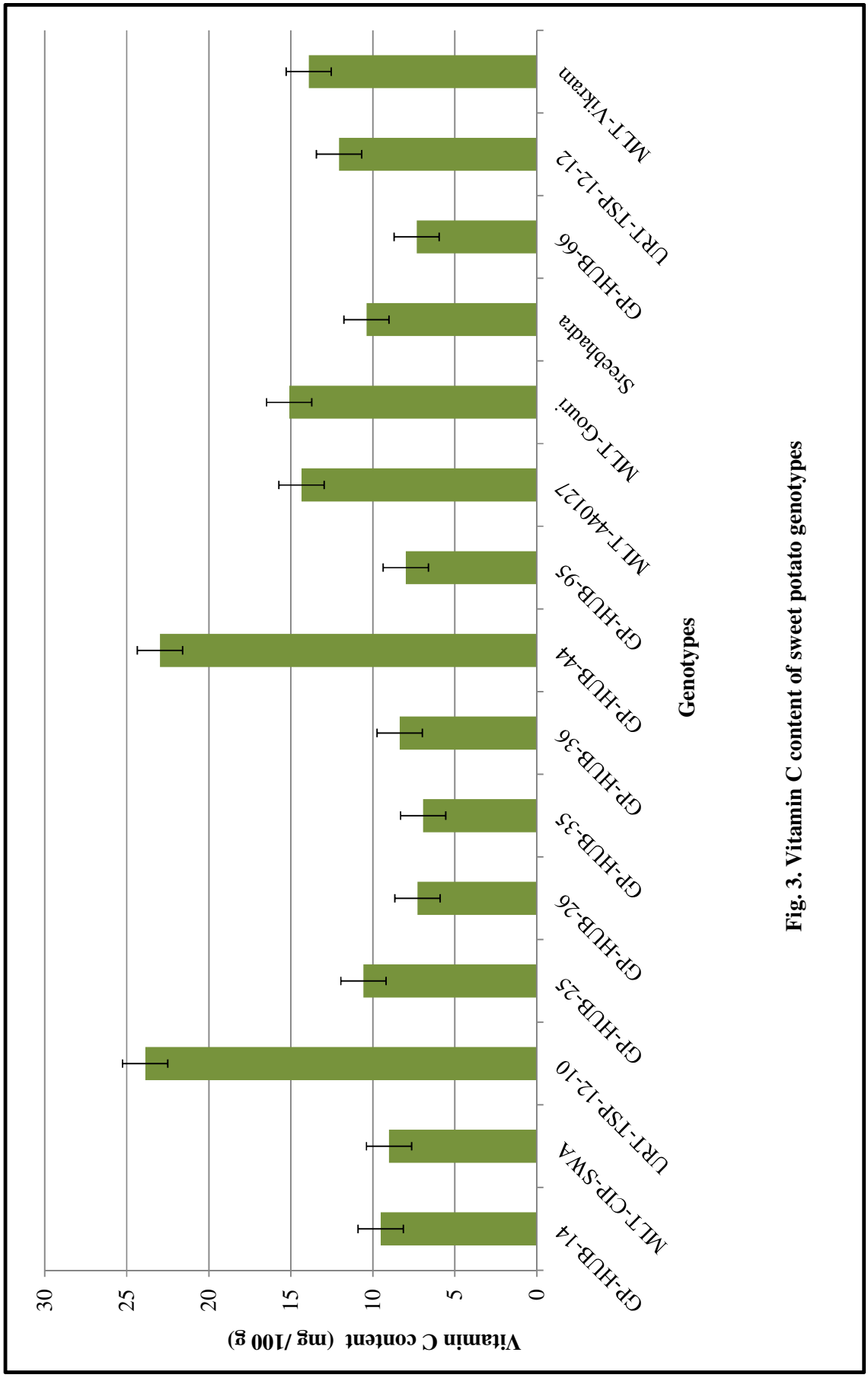


Fig. 3. Vitamin C content of sweet potato genotypes

Table 6. Minerals content of sweet potato genotypes

Sl. No	Genotypes	Minerals content (mg/100 g dwb)					
		Calcium	Magnesium	Phosphorus	Copper	Iron	Zinc
White flesh							
1	GP-HUB-14	500 ± 1.00^{a}	570 ± 2.00^{j}	183.65 ± 1.00^{m}	0.21 ± 0.02^{ab}	4.99 ± 0.09^{bc}	1.08 ± 0.04^{ab}
2	MLT-CIP-SWA	702 ± 2.00^{c}	420 ± 1.00^{e}	101.19 ± 0.30^{c}	0.37 ± 0.07^{de}	6.53 ± 0.03^{cd}	0.82 ± 0.02^{a}
Cream flesh							
3	URT-TSP-12-10	750 ± 3.00^{d}	600 ± 1.00^{k}	102.13 ± 0.30^{c}	0.30 ± 0.04^{bcde}	6.32 ± 1.00^{cd}	0.98 ± 0.07^{ab}
4	GP-HUB-25	650 ± 5.00^{b}	300 ± 3.00^{a}	136.44 ± 0.34^{i}	0.21 ± 0.03^{ab}	6.46 ± 1.00^{cd}	1.18 ± 1.00^{ab}
5	GP-HUB-26	950 ± 5.00^{g}	450 ± 4.00^{f}	111.50 ± 0.40^{d}	0.38 ± 0.02^{e}	5.56 ± 0.06^{bcd}	1.10 ± 0.02^{ab}
6	GP-HUB-35	800 ± 8.00^{e}	480 ± 5.00^{g}	145.23 ± 0.03^{l}	0.24 ± 0.04^{ab}	5.27 ± 1.00^{bcd}	1.34 ± 0.05^{ab}
7	GP-HUB-36	850 ± 8.00^{f}	390 ± 4.00^{d}	141.48 ± 0.02^{j}	0.22 ± 0.03^{ab}	6.72 ± 1.00^{cd}	1.14 ± 0.01^{ab}
8	GP-HUB-44	950 ± 3.00^{g}	720 ± 2.00^{l}	111.50 ± 0.02^{d}	0.16 ± 0.03^{a}	5.26 ± 1.00^{bcd}	0.90 ± 0.06^{ab}
9	GP-HUB-95	750 ± 7.00^{d}	540 ± 10.00^{i}	133.06 ± 0.08^{h}	0.35 ± 0.08^{cde}	6.81 ± 1.00^{d}	1.52 ± 0.07^{b}
10	MLT- 440127	750 ± 2.00^{d}	510 ± 5.00^{h}	96.51 ± 0.02^{b}	0.39 ± 0.03^{e}	5.67 ± 0.04^{bcd}	0.77 ± 0.05^{a}
11	MLT-Gouri	800 ± 3.00^{e}	450 ± 4.00^{f}	143.36 ± 1.00^{k}	0.22 ± 0.04^{ab}	5.47 ± 0.06^{bcd}	1.00 ± 0.05^{ab}
12	Sreebhadra	800 ± 5.00^{e}	360 ± 6.00^{c}	124.63 ± 0.03^{f}	0.27 ± 0.03^{bcd}	4.53 ± 0.03^{b}	1.23 ± 0.07^{ab}
Orange flesh							
13	GP-HUB-66	850 ± 1.00^{f}	390 ± 1.00^{d}	127.43 ± 1.00^{g}	0.27 ± 0.02^{bcd}	2.32 ± 1.00^{a}	1.02 ± 0.04^{ab}
Purple flesh							
14	URT-TSP-12-12	800 ± 4.00^{e}	450 ± 6.00^{f}	89.00 ± 0.06^{a}	0.24 ± 0.02^{abc}	5.86 ± 0.04^{bcd}	1.00 ± 0.05^{ab}
Check (White flesh)							
15	MLT- Vikram	650 ± 3.00^{b}	330 ± 3.00^{b}	116.19 ± 0.04^{e}	0.26 ± 0.06^{abc}	5.20 ± 0.02^{bcd}	1.05 ± 0.06^{ab}
	Mean	770.13 ± 4.00	464.00 ± 4.06	124.22 ± 0.30	0.27 ± 0.03	5.53 ± 0.49	1.07 ± 0.11
	F value	1931.88	1855.04	8092.31	8.90	8.01	1.61
	S. Em. ±	2.64	2.57	0.27	0.02	0.39	0.15
	C. D. @ 1% level	10.27**	10.02**	1.05**	0.09**	1.53**	0.58*

Note: Means are average of three replications ± SD, *- Significant at 0.05 level, ** - Significant at 0.01 level.

weight basis and the genotype GP-HUB-14 (500 mg/100 g) showed significantly lower calcium content followed by check variety MLT-Vikram (650 mg/100 g) and GP-HUB-25 (650 mg/100 g). The calcium content of the genotypes GP-HUB-35, MLT-Gouri, Sreebhadra and URT-TSP-12-12 were statistically equal (800 mg/100 g). The magnesium content in the genotypes ranged from 300 mg/100 g in GP-HUB-25 to 720 mg/100 g in GP-HUB-44. The sweet potato genotypes GP-HUB-26, MLT-Gouri and URT-TSP-12-12 contained statistically equal amounts of magnesium (450 mg/100 g). Higher phosphorus content was seen in the genotype GP-HUB-14 (183.65 mg/100 g) and lower phosphorus content was seen in the genotype URT-TSP-12-12 (89.00 mg/100 g) on dry weight basis. The phosphorus content of the genotypes GP-HUB-26 (111.50 mg/100 g) and GP-HUB-44 (111.50 mg/100 g) was equal. The copper content in the sweet potato genotypes ranged from 0.16 mg/100 g in GP-HUB-44 to 0.39 mg/100g in MLT-440127. The genotypes GP-HUB-36, MLT-Gouri, GP-HUB-14 and GP-HUB-25 were statistically on par with each other in terms of copper content (0.22, 0.22 0.21 and 0.21 mg/100 g respectively). The genotype GP-HUB-95 possessed significantly higher iron content (6.81 mg/100 g) while the genotype GP-HUB-66 (2.32 mg/100 g) contained significantly lower iron content. The iron content of the genotypes URT-TSP-12-12, MLT-440127, GP-HUB-26, MLT-Gouri, GP-HUB-35, GP-HUB-44 and check variety MLT-Vikram was statistically on par with each other (5.86, 5.67, 5.56, 5.47, 5.27, 5.26 and 5.20 mg/100 g respectively). The genotype GP-HUB-95 had significantly higher zinc content of 1.52 mg/100 g and significantly lower zinc content was recorded in the genotype MLT-440127 (0.77 mg/100 g). All other genotypes recorded statistically similar amount of zinc.

4.2.5. Carbohydrate profile of sweet potato genotypes

Carbohydrate profile of sweet potato genotypes is given in table 7. Significant differences existed between the sweet potato genotypes in terms of reducing sugar, non-reducing sugar, total sugar and starch content on dry weight basis. The genotype GP-HUB-66 exhibited significantly higher reducing and total sugar content (5.00 and 11.80 g %, respectively) and the genotype Sreebhadra showed lower reducing and higher non- reducing sugar content (1.80 and 7.47 g %, respectively) with significantly lower starch content (46.50 g %). The reducing sugar content of the genotypes GP-HUB-25 (4.80 g %), GP-HUB-14 (4.60 g %), GP-HUB-26 (4.60 g %) and MLT-440127 (4.58 g %) were

Table 7. Carbohydrate profile of sweet potato genotypes

Sl. No	Genotypes	Carbohydrate profile (g % dwb)			
		Reducing sugar	Non-reducing sugar	Total sugar	Starch
White flesh					
1	GP-HUB-14	4.60 ± 0.20^{fg}	6.27 ± 0.19^{f}	11.20 ± 0.20^{k}	65.00 ± 0.50^{n}
2	MLT-CIP-SWA	3.50 ± 0.17^{e}	4.08 ± 0.19^{cd}	7.80 ± 0.10^{e}	62.00 ± 0.50^{l}
Cream flesh					
3	URT-TSP-12-10	2.60 ± 0.17^{bc}	3.98 ± 0.09^{cd}	6.80 ± 0.10^{c}	57.33 ± 0.29^{i}
4	GP-HUB-25	4.80 ± 0.20^{fg}	5.63 ± 0.19^{e}	10.73 ± 0.15^{j}	50.50 ± 0.50^{d}
5	GP-HUB-26	4.60 ± 0.17^{fg}	5.31 ± 0.25^{e}	10.20 ± 0.20^{i}	49.33 ± 0.29^{c}
6	GP-HUB-35	3.23 ± 0.06^{de}	3.70 ± 0.16^{bc}	7.13 ± 0.15^{d}	54.50 ± 0.50^{f}
7	GP-HUB-36	2.83 ± 0.06^{cd}	3.48 ± 0.15^{b}	6.50 ± 0.10^{c}	56.00 ± 0.50^{g}
8	GP-HUB-44	3.36 ± 0.21^{e}	2.59 ± 0.11^{a}	6.10 ± 0.10^{b}	51.33 ± 0.76^{d}
9	GP-HUB-95	4.46 ± 0.31^{f}	3.45 ± 0.24^{bc}	8.10 ± 0.20^{e}	53.00 ± 0.50^{e}
10	MLT- 440127	4.58 ± 0.20^{fg}	3.67 ± 0.19^{d}	8.50 ± 0.10^{f}	63.33 ± 0.29^{m}
11	MLT-Gouri	2.26 ± 0.12^{b}	4.30 ± 0.14^{d}	6.80 ± 0.10^{c}	66.50 ± 0.50^{o}
12	Sreebhadra	1.80 ± 0.20^{a}	7.47 ± 0.34^{g}	9.66 ± 0.15^{h}	46.50 ± 0.50^{a}
Orange flesh					
13	GP-HUB-66	5.00 ± 0.20^{g}	6.45 ± 0.17^{f}	11.80 ± 0.10^{l}	48.00 ± 0.76^{b}
Purple flesh					
14	URT-TSP-12-12	2.60 ± 0.20^{bc}	6.20 ± 0.12^{f}	9.40 ± 0.20^{g}	59.00 ± 0.50^{i}
Check (White flesh)					
15	MLT- Vikram	2.20 ± 0.17^{ab}	3.29 ± 0.11^{b}	5.66 ± 0.15^{a}	60.50 ± 0.50^{k}
	Mean	3.49 ± 0.17	4.66 ± 0.17	8.41 ± 0.14	56.18 ± 0.49
	F value	103.97	180.45	590.43	514.43
	S. Em. ±	0.10	0.10	0.08	0.28
	C. D. @ 1% level	0.41**	0.41**	0.31**	1.09**

Note: Means are average of three replications ± SD, ** - Significant at 0.01 level.

statistically on par with each other. Significantly lower non-reducing sugar content was seen in the genotype GP-HUB-44 (2.59 g %). The non-reducing sugar of the genotypes GP-HUB-66, URT-TSP-12-12 and GP-HUB-14 was statistically on par with each other (6.45, 6.20 and 6.27 g %, respectively). The check variety MLT-Vikram had significantly lower total sugar content (5.66 g %). The total sugar content of the genotypes URT-TSP-12-10 and MLT-Gouri (6.80 g %) were equal. The starch content (Fig. 4) of the genotype MLT-Gouri was significantly higher (66.50 g %). All the genotypes differed significantly with regard to total sugar and starch content.

4.2.6. Dietary fibre content of sweet potato genotypes

Table 8 indicates the dietary fibre content of sweet potato genotypes. Significant differences existed between the soluble, insoluble and total dietary fibre content of sweet potato genotypes. The genotype GP-HUB-95 showed significantly higher soluble (5.76 g %) and total (15.20 g %) dietary fibre content. The genotype GP-HUB-44 showed significantly lower soluble dietary fibre content (3.03 g %). The soluble fibre content of the genotypes GP-HUB-26 (3.50 g %) and Sreebhadra (3.70 g %) was statistically on par with each other. The genotype Sreebhadra showed significantly lower insoluble (4.13 g %) and total dietary fibre content (7.83 g %).

4.3. Cooking quality and acceptability of sweet potato genotypes

Cooking methods have significant impact on nutritional values and sensory characteristics of sweet potatoes. Sweet potatoes can be consumed after boiling, pressure cooking, steaming, baking, microwaving or frying. Sweetness, derived from sugars in the raw sweet potato tuber and maltose formed during cooking, is the predominant attribute controlling the taste of cooked sweet potato products.

4.3.1. Cooking quality of sweet potato genotypes on boiling

Fig. 5(a) and appendix VI depicts the time taken for cooking of sweet potato genotypes. The genotype GP-HUB-14 could be cooked in around 22 min and the genotype GP-HUB-44 and GP-HUB-25 took shorter time of 15.50 min for cooking. The time taken for cooking of the genotypes GP-HUB-66, GP-HUB-36, GP-HUB-35, URT-TSP-12-10 and MLT-Gouri was statistically on par with each other (18.66, 18.66, 18.50, 18.33 and 18.33 min, respectively).

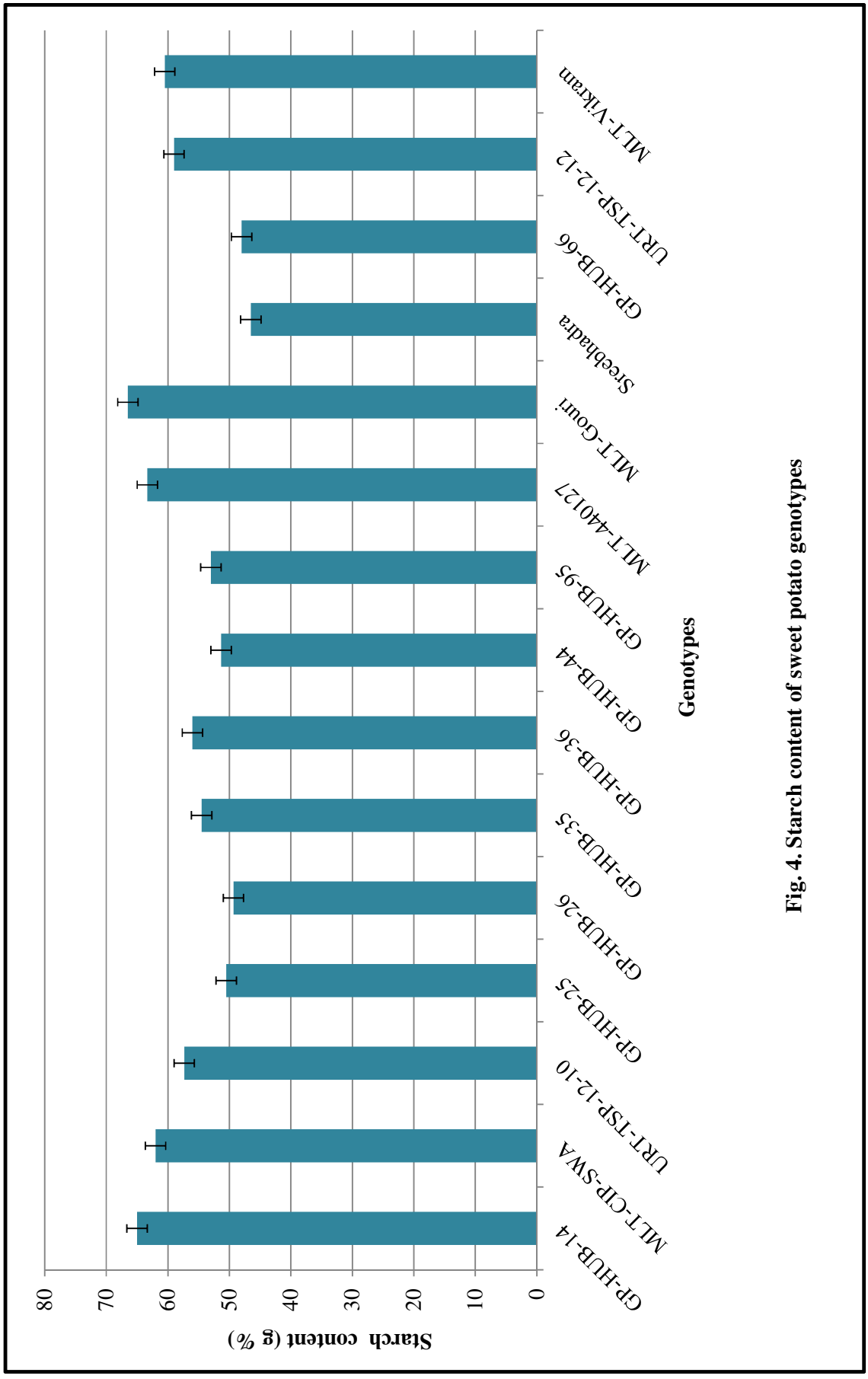


Fig. 4. Starch content of sweet potato genotypes

Table 8. Dietary fibre content of sweet potato genotypes

Sl. No	Genotypes	Dietary fibre (g % dwb)		
		Soluble	Insoluble	Total
1	GP-HUB-26	3.50 ± 0.70^{ab}	8.60 ± 0.42^{c}	12.10 ± 0.35^{c}
2	GP-HUB-36	5.00 ± 0.20^{c}	5.36 ± 0.25^{b}	10.36 ± 0.45^{b}
3	GP-HUB-44	3.03 ± 0.15^{a}	10.16 ± 0.35^{e}	13.20 ± 0.20^{d}
4	GP-HUB-95	5.76 ± 0.25^{d}	9.43 ± 0.06^{d}	15.20 ± 0.20^{e}
5	Sreebhadra	3.70 ± 0.17^{b}	4.13 ± 0.23^{a}	7.83 ± 0.21^{a}
	Mean	4.20 ± 0.29	7.54 ± 0.26	11.74 ± 0.28
	F value	116.90	314.28	296.66
	S. Em. ±	0.10	0.14	0.16
	C. D. @ 1% level	0.47**	0.66**	0.72**

Note: Means are average of three replications ± SD, ** - Significant at 0.01 level.

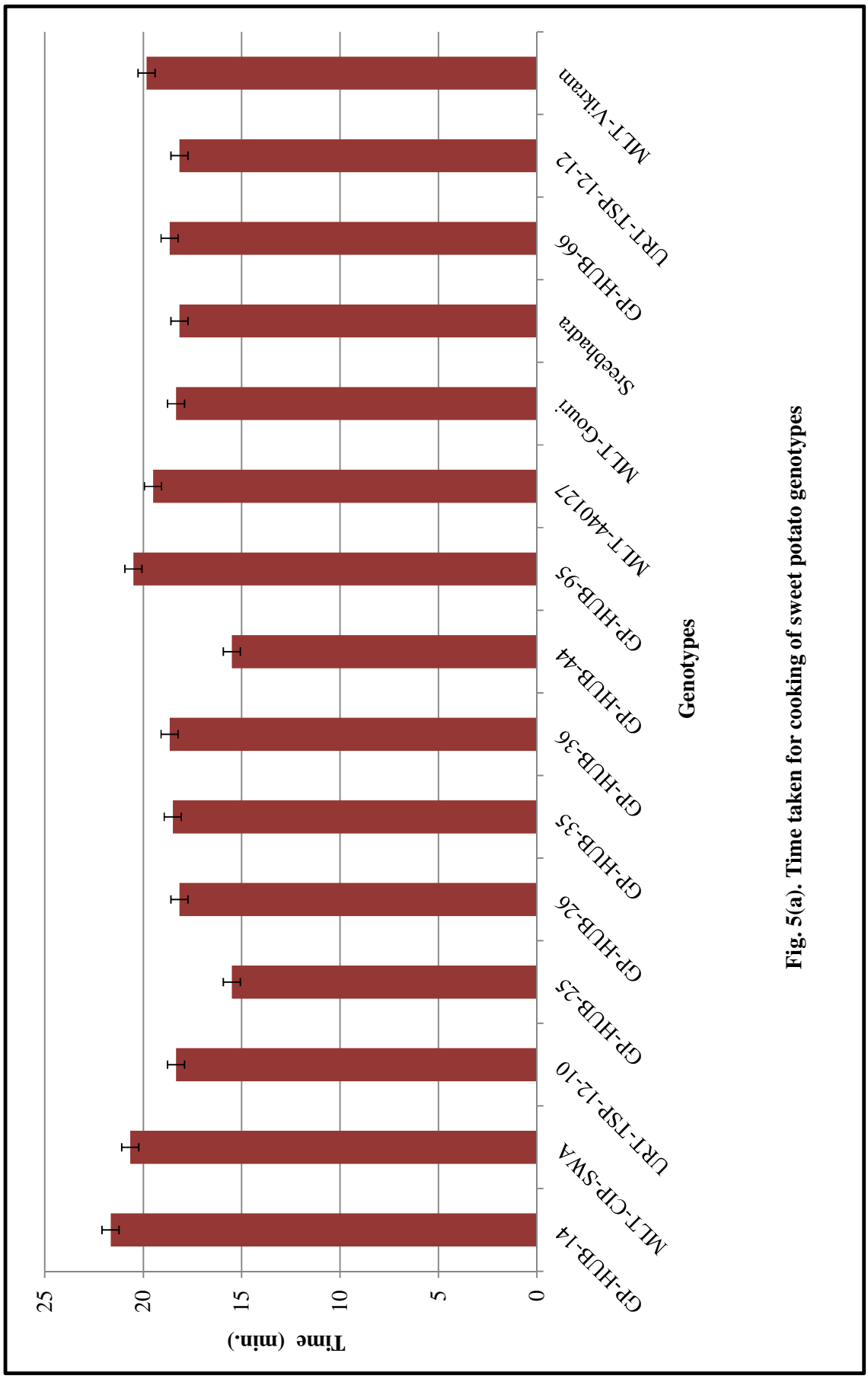


Fig. 5(a). Time taken for cooking of sweet potato genotypes

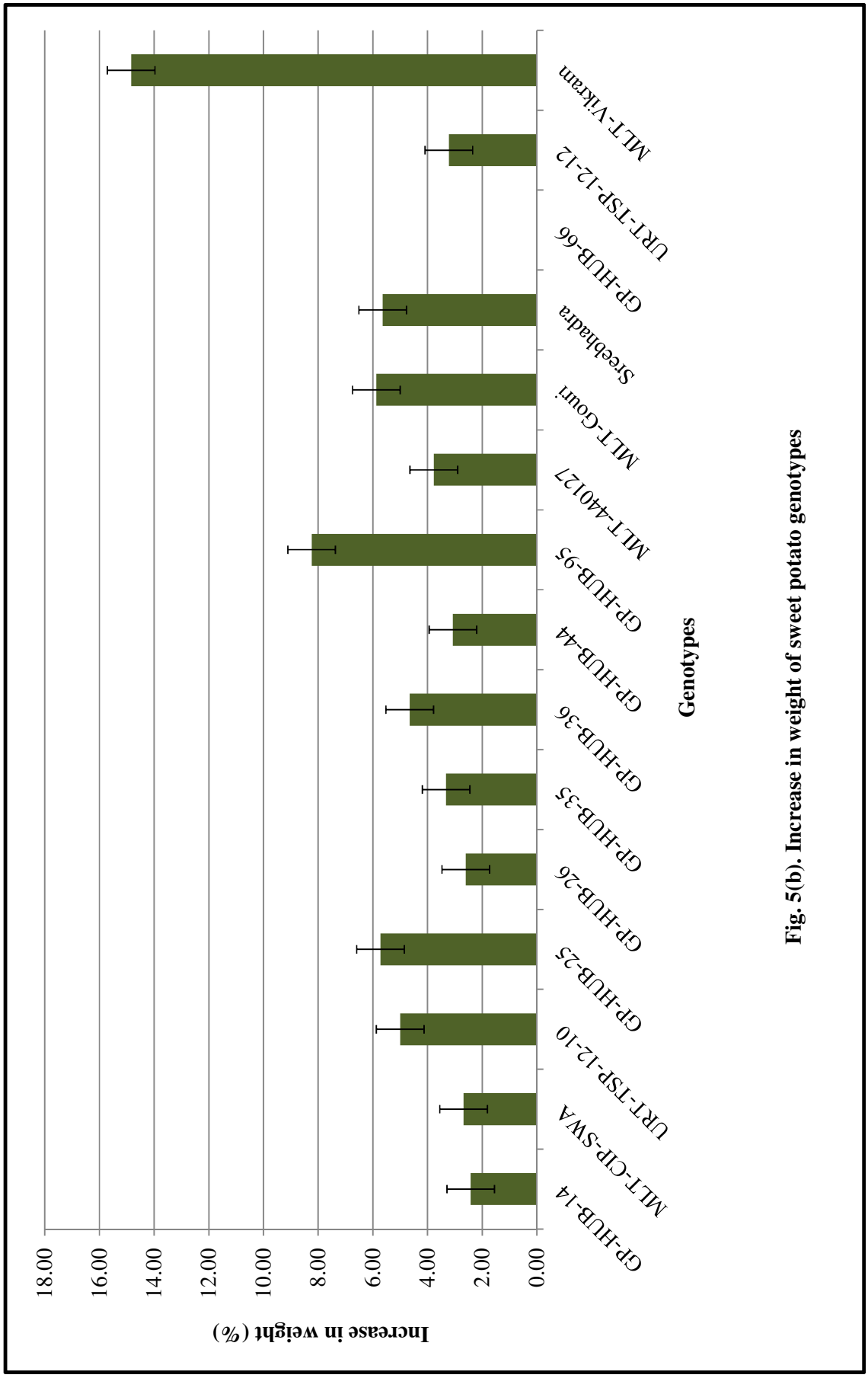


Fig. 5(b). Increase in weight of sweet potato genotypes

Fig 5(b) and appendix VI shows the increase in weight of sweet potato genotypes on cooking. The check variety MLT-Vikram showed significantly higher increase in weight (14.70 %) on boiling and the genotype GP-HUB-66 did not increase in weight after boiling. The genotypes GP-HUB-25 (5.71 %), MLT-Gouri (5.88 %) and Sreebhadra (5.63 %) were statistically on par with each other in terms of increase in weight on boiling.

4.3.2. Acceptability scores of boiled sweet potato genotypes

A Perusal of table 9 indicates that significant differences existed in the boiled sweet potato genotypes (Plate 3) in terms of appearance and colour. The flavour, taste, texture and over all acceptability of the sweet potato genotypes did not differ significantly. The genotypes were scored between 6 (like slightly) to 8 (like extremely). The genotypes GP-HUB-44 (7.80), GP-HUB-25 (7.70), URT-TSP-12-10 (7.60), GP-HUB-95 (7.60), GP-HUB-66 (7.60), GP-HUB-36 (7.40), Sreebhadra (7.40), GP-HUB-35 (7.30), GP-HUB-26 (7.20) and check variety MLT-Vikram (7.20) showed significantly higher scores for appearance. Purple fleshed sweet potato genotype URT-TSP-12-12 received lower scores for appearance (5.70) and colour (6.00). Significantly higher scores for colour were exhibited by the genotypes GP-HUB-44 (7.90), Sreebhadra (7.80), GP-HUB-66 (7.80), URT-TSP-12-10 (7.80) and GP-HUB-25 (7.70). The colour scores of the genotypes GP-HUB-35 (7.30), GP-HUB-36 (7.30), check variety MLT-Vikram (7.10), GP-HUB-26 (7.10), MLT-CIP-SWA (6.50) and MLT-Gouri (6.50) were statistically on par with each other. The flavour, taste, texture and over all acceptability scores in the genotypes ranged from 6.70 (URT-TSP-12-12) to 7.70 (GP-HUB-44 and GP-HUB-95), 6.80 (MLT-440127 and GP-HUB-66) to 7.80 (GP-HUB-44), 6.80 (GP-HUB-14) to 7.80 (GP-HUB-25 and GP-HUB-35) and 6.70 (URT-TSP-12-12) to 7.80 (GP-HUB-44) respectively.

4.3.3. Acceptability scores of pressure cooked sweet potato genotypes

The acceptability scores of pressure cooked sweet potato genotypes (Plate 4) are given in table 10. The genotype GP-HUB-36 showed significantly higher score for appearance (8.30) and colour (8.20). On pressure cooking, MLT-Vikram received lower sensory scores for appearance, colour, flavour, taste, texture and over all acceptability (5.40, 5.40, 4.70, 4.80, 5.20 and 5.00, respectively). The appearance scores of the genotypes URT-TSP-12-10 (7.60), GP-HUB-25 (7.60), MLT-CIP-SWA (7.50), GP-HUB-26 (7.50), GP-HUB-95 (7.50) and MLT-Gouri (7.50) were statistically on par with each other. The colour scores of the

Table 9. Acceptability scores of boiled sweet potato genotypes

Sl. No	Genotypes	Appearance	Colour	Flavour	Taste	Texture	Overall acceptability
White flesh							
1	GP-HUB-14	6.50 ± 1.00^{ab}	6.30 ± 0.93^{ab}	6.90 ± 1.56	7.10 ± 1.32	6.80 ± 1.00	6.90± 0.83
2	MLT-CIP-SWA	6.60± 1.57^{ab}	6.50 ±1.58^{abc}	7.20 ± 1.31	7.10 ± 1.28	7.20 ± 1.39	7.10 ± 1.28
Cream flesh							
3	URT-TSP-12-10	7.60 ± 0.69^{b}	7.80 ± 0.63^{c}	7.30 ± 0.70	7.20 ± 0.78	7.00 ± 0.81	7.20 ± 0.63
4	GP-HUB-25	7.70 ± 1.05^{b}	7.70 ± 0.94^{c}	7.30 ± 1.05	7.40 ± 0.96	7.80 ± 0.91	7.50 ± 0.97
5	GP-HUB-26	7.20 ± 0.91^{b}	7.10 ±0.87^{abc}	7.10 ± 0.87	6.90 ± 0.73	7.60 ± 0.69	7.05 ± 0.96
6	GP-HUB-35	7.30 ± 0.82^{b}	7.30 ±0.94^{abc}	7.30 ± 1.05	7.40 ± 1.17	7.80 ± 1.03	7.45 ± 0.89
7	GP-HUB-36	7.40 ± 0.69^{b}	7.30 ±0.67^{abc}	7.40 ± 0.84	7.30 ± 0.82	7.70 ± 0.82	7.40 ± 0.84
8	GP-HUB-44	7.80 ± 0.91^{b}	7.90 ± 0.87^{c}	7.70 ± 0.48	7.80 ± 0.42	7.50 ± 0.52	7.80 ± 0.63
9	GP-HUB-95	7.60 ± 0.96^{b}	7.50 ± 0.97^{bc}	7.70 ± 0.82	7.60 ± 0.69	7.30 ± 1.15	7.50 ± 0.70
10	MLT- 440127	6.90 ± 1.19^{ab}	6.70 ±0.82^{abc}	7.30 ± 0.67	6.80 ± 0.63	7.10 ± 0.87	6.90 ± 0.56
11	MLT-Gouri	6.40 ± 1.17^{ab}	6.50 ±1.17^{abc}	7.20 ± 0.78	7.40 ± 0.96	7.20 ± 0.63	7.20 ± 1.03
12	Sreebhadra	7.40 ± 0.96^{b}	7.80 ± 1.03^{c}	7.20 ± 0.91	7.50 ± 1.08	7.40 ± 1.07	7.60 ± 0.96
Orange flesh							
13	GP-HUB-66	7.60 ± 0.84^{b}	7.80 ± 1.03^{c}	7.00 ± 1.15	6.80 ± 0.78	7.50 ± 0.70	7.60 ± 0.96
Purple flesh							
14	URT-TSP-12-12	5.70 ± 1.41^{a}	6.00 ± 1.49^{a}	6.70 ± 1.33	7.00 ± 1.82	6.90 ± 1.28	6.70 ± 1.25
Check (White flesh)							
15	MLT-Vikram	7.20 ± 1.03^{b}	7.10 ±0.87^{abc}	7.40 ± 0.84	7.60 ± 0.84	7.40 ± 0.69	7.20 ± 0.79
	Mean	7.13 ± 1.57	7.15 ± 0.94	7.25 ± 1.05	7.26 ± 1.17	7.35 ± 0.91	7.27 ± 0.96
	F value	3.18	3.62	0.70	0.92	1.10	1.14
	S.Em ±	0.33	0.32	0.31	0.31	0.29	0.28
	C. D. @ 1% level	1.22**	1.20**	NS	NS	NS	NS

Note: 9 point hedonic scale: 9- like extremely; 1- dislike extremely, ** - Significant at 0.01 level, NS- Non-significant.

1. GP-HUB-14

2. MLT-CIP-SWA

3. URT-TSP-12-10

4. GP-HUB-25

5. GP-HUB-26

6. GP-HUB-35

7. GP-HUB-36

8. GP-HUB-44

9. GP-HUB-95

10. MLT-440127

11. MLT-Gouri

12. Sreebhadra

13. GP-HUB-66

14. URT-TSP-12-12

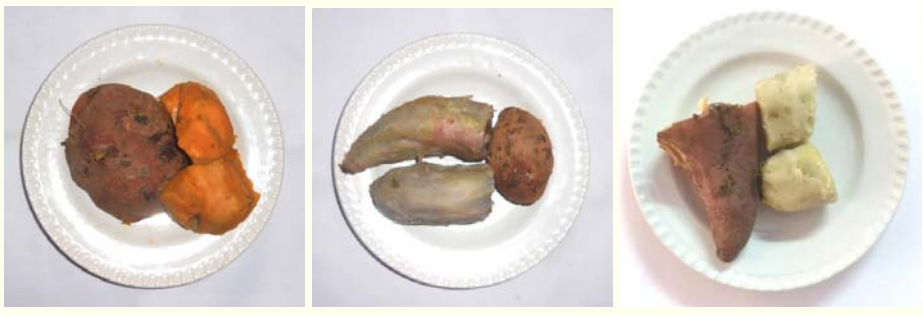
15. MLT-Vikram

Plate 3. Boiled sweet potato genotypes

1. GP-HUB-14 2. MLT-CIP-SWA 3. URT-TSP-12-10 4. GP-HUB-25

5. GP-HUB-26 6. GP-HUB-35 7. GP-HUB-36 8. GP-HUB-44

9. GP-HUB-95 10. MLT-440127 11. MLT-Gouri 12. Sreebhadra



13. GP-HUB-66 14. URT-TSP-12-12 15. MLT-Vikram

Plate 4. Pressure cooked sweet potato genotypes

Table 10. Acceptability scores of pressure cooked sweet potato genotypes

Sl. No	Genotypes	Appearance	Colour	Flavour	Taste	Texture	Overall acceptability
White flesh							
1	GP-HUB-14	6.60 ± 1.58^{abc}	7.50 ± 0.88^{de}	7.60 ± 1.13^{cde}	7.70 ± 1.22^{cde}	7.40 ± 1.22^{bc}	7.50 ± 1.22^{cde}
2	MLT-CIP-SWA	7.50 ± 1.08^{cd}	7.30 ± 0.95^{cde}	7.40 ± 0.96^{cde}	7.30 ±1.15^{cde}	7.20± 0.79^{bc}	7.20 ± 1.03^{cde}
Cream flesh							
3	URT-TSP-12-10	7.60 ± 0.84^{cd}	7.60 ± 0.69^{de}	7.40 ± 0.96^{cde}	7.40 ± 1.07^{cde}	7.20 ± 1.23^{bc}	7.40 ± 0.97^{cde}
4	GP-HUB-25	7.60 ± 0.96^{cd}	7.40 ± 0.84^{de}	7.40 ± 0.69^{cde}	7.60 ± 0.84^{cde}	7.60 ± 1.07^{bc}	7.50 ± 1.08^{cde}
5	GP-HUB-26	7.50 ± 0.84^{cd}	7.40 ± 0.84^{de}	7.00 ± 0.47^{cde}	6.90 ± 0.74^{cde}	7.40 ± 0.96^{bc}	7.10 ± 0.88^{cde}
6	GP-HUB-35	6.40 ± 0.96^{abc}	6.60 ± 1.26^{abcd}	6.50 ± 0.53^{cd}	6.40 ± 0.69^{bcd}	6.90 ± 0.74^{bc}	6.40 ± 0.69^{bcd}
7	GP-HUB-36	8.30 ± 0.82^{d}	8.20 ± 0.79^{e}	8.10 ± 0.74^{e}	7.90 ± 0.99^{de}	8.00 ± 0.94^{bc}	8.10 ± 0.87^{e}
8	GP-HUB-44	7.10 ± 0.74^{bcd}	7.30 ± 1.06^{de}	7.70 ± 0.94^{de}	7.80 ± 1.03^{de}	8.20 ± 0.71^{c}	7.70 ± 0.94^{de}
9	GP-HUB-95	7.50 ± 0.97^{cd}	7.60 ± 0.96^{cd}	8.00 ± 0.82^{e}	8.10 ± 0.74^{e}	7.30 ± 1.34^{bc}	8.00 ± 0.81^{e}
10	MLT-440127	5.40 ± 0.84^{a}	5.60 ± 0.84^{a}	5.10 ± 1.59^{ab}	5.20 ± 1.39^{ab}	4.90 ± 1.66^{a}	5.20 ± 1.68^{ab}
11	MLT-Gouri	7.50 ± 0.70^{cd}	7.50 ± 1.08^{de}	6.90 ± 0.88^{cde}	6.80 ± 0.63^{cde}	7.00 ± 0.82^{bc}	7.40 ± 0.69^{cde}
12	Sreebhadra	7.10 ± 0.74^{bcd}	7.10 ± 0.74^{bcde}	7.50 ± 0.84^{cde}	7.50 ± 1.08^{cde}	7.80 ± 1.03^{bc}	7.30 ± 0.82^{cde}
Orange flesh							
13	GP-HUB-66	6.30 ± 1.41^{abc}	6.10 ± 1.10^{abc}	6.40 ± 0.84^{cd}	6.20 ± 1.62^{bc}	6.60 ± 2.17^{b}	6.20 ± 1.68^{abc}
Purple flesh							
14	URT-TSP-12-12	6.10 ± 1.37^{ab}	5.90 ± 1.10^{ab}	6.20 ± 1.32^{bc}	7.70 ± 1.05^{cde}	7.30 ± 0.82^{bc}	7.50 ± 0.70^{cde}
Check (White flesh)							
15	MLT-Vikram	5.40 ± 1.26^{a}	5.40 ± 1.42^{a}	4.70 ± 1.94^{a}	4.80 ± 2.04^{a}	5.20 ± 0.92^{a}	5.00 ± 1.56^{a}
	Mean	6.92 ± 0.96	6.96 ± 1.26	6.92 ± 0.94	7.02 ± 0.99	7.07 ± 1.23	7.03 ± 1.08
	F value	6.82	7.18	8.94	7.43	6.36	7.15
	S. Em. ±	0.32	0.31	0.33	0.36	0.36	0.34
	C. D. @ 1% level	1.21**	1.15**	1.22**	1.33**	1.35**	1.28**

Note: 9 point hedonic scale: 9- like extremely; 1- dislike extremely, ** - Significant at 0.01 level.

genotypes URT-TSP-12-10 (7.60), GP-HUB-95 (7.60), MLT-Gouri (7.50), GP-HUB-14 (7.50), GP-HUB-25 (7.40) and GP-HUB-26 (7.40) were statistically on par with each other. The genotype GP-HUB-36 (8.10) and GP-HUB-95 (8.00) showed significantly higher scores for flavour and were statistically on par with each other. The flavour scores of the genotypes GP-HUB-14 (7.60), Sreebhadra (7.50), URT-TSP-12-10 (7.40), MLT-CIP-SWA (7.40), GP-HUB-25 (7.40), GP-HUB-26 (7.00) and MLT-Gouri (6.90) were statistically on par with each other. The genotype GP-HUB-95 (8.10) showed significantly higher scores for taste. The taste scores of the genotypes GP-HUB-14 (7.70), URT-TSP-12-12 (7.70), GP-HUB-25 (7.60), Sreebhadra (7.50), URT-TSP-12-10 (7.40), MLT-CIP-SWA (7.30), GP-HUB-26 (6.90) and MLT-Gouri (6.80) were statistically on par with each other. The genotype GP-HUB-44 (8.20) showed significantly higher score for texture. The texture scores of the genotypes GP-HUB-44 (8.20) and GP-HUB-36 (8.00) received scores between 8 and 9. These were scored between like very much and like extremely. Based on the overall acceptability scores, the most acceptable genotypes were GP-HUB-36 (8.10) and GP-HUB-95 (8.00) and also they were statistically on par with each other. The least acceptable one was check variety MLT-Vikram (5.00). The overall acceptability scores of the genotypes GP-HUB-14 (7.50), URT-TSP-12-12 (7.50), GP-HUB-25 (7.50), URT-TSP-12-10 (7.40), Sreebhadra (7.30) and MLT-CIP-SWA (7.20) were statistically on par with each other.

4.3.4. Acceptability scores of baked sweet potato genotypes

Table 11 shows the acceptability scores of baked sweet potato genotypes (Plate 5). Significant differences existed between the baked sweet potato genotypes in terms of appearance, colour, flavour, taste, texture and overall acceptability. Irrespective of genotypes appearance, colour, flavour, taste, texture and over all acceptability were scored between 7.02, 7.03, 7.09, 7.17, 7.16 and 7.17, respectively. The genotype GP-HUB-95 (8.20) showed significantly higher score for appearance followed by MLT-Gouri (8.00). The genotype MLT-CIP-SWA (5.10) showed significantly lower score for appearance. The appearance scores of the genotypes GP-HUB-26 (7.80), Sreebhadra (7.80), GP-HUB-35 (7.60) and URT-TSP-12-10 (7.50) were statistically on par with each other. The colour scores of the genotypes MLT-Gouri (8.10), GP-HUB-26 (8.00) and GP-HUB-95 (8.00) were significantly higher and statistically on par with each other. The genotype URT-TSP-12-12 (5.10) showed significantly lower score for colour followed by MLT-CIP-SWA (5.20). The colour scores of

Table 11. Acceptability scores of baked sweet potato genotypes

Sl. No	Genotypes	Appearance	Colour	Flavour	Taste	Texture	Overall acceptability
White flesh							
1	GP-HUB-14	6.10 ± 1.20^{abc}	6.20 ± 1.32^{abc}	6.10 ± 0.97^{a}	6.30 ± 1.11^{a}	6.10 ± 1.05^{a}	6.20 ± 1.05^{ab}
2	MLT-CIP-SWA	5.10 ± 2.13^{a}	5.20 ± 2.04^{ab}	6.20 ± 2.09^{ab}	6.20 ± 2.29^{a}	6.10 ± 1.91^{a}	6.10 ± 1.31^{a}
Cream flesh							
3	URT-TSP-12-10	7.50 ± 0.97^{cde}	7.60 ± 0.96^{cd}	6.60 ± 1.34^{abc}	6.50 ± 1.26^{ab}	6.90 ±0.73^{ab}	7.20 ± 0.78^{abc}
4	GP-HUB-25	6.40 ± 0.69^{abcd}	6.60 ±0.96^{abcd}	6.70 ± 0.94^{abc}	7.00 ± 1.41^{ab}	7.10 ±1.28^{ab}	6.80 ± 1.03^{abc}
5	GP-HUB-26	7.80 ± 1.32^{cde}	8.00 ± 1.15^{d}	7.50 ± 0.97^{abc}	7.70 ± 1.05^{ab}	7.70 ±0.67^{ab}	7.70 ± 0.94^{bc}
6	GP-HUB-35	7.60 ± 0.96^{cde}	7.60 ± 0.96^{cd}	7.70 ± 1.05^{bc}	7.60 ± 1.34^{ab}	7.80 ± 1.13^{b}	7.70± 1.05^{bc}
7	GP-HUB-36	6.70 ± 1.05^{abcde}	6.80 ± 1.13^{bcd}	7.50 ± 0.97^{abc}	7.60 ± 1.07^{ab}	7.30 ±0.82^{ab}	7.25 ± 1.03^{abc}
8	GP-HUB-44	7.90 ± 0.88^{de}	7.40 ± 1.43^{cd}	7.00 ± 1.05^{abc}	6.90 ± 0.99^{ab}	7.40 ±0.96^{ab}	7.40 ± 1.07^{abc}
9	GP -HUB-95	8.20 ± 0.78^{e}	8.00 ± 0.94^{d}	7.80 ± 0.78^{c}	8.20 ± 0.91^{b}	7.90 ± 1.19^{b}	8.20 ± 0.91^{c}
10	MLT- 440127	6.30 ± 0.94^{abcd}	6.50 ±1.08^{abcd}	7.40 ± 1.07^{abc}	7.60 ± 0.84^{ab}	7.50 ±0.84^{ab}	7.50 ± 0.84^{abc}
11	MLT-Gouri	8.00 ± 0.94^{de}	8.10 ± 0.87^{d}	7.20 ± 1.03^{abc}	7.00 ± 1.05^{ab}	7.60 ±0.96^{ab}	7.60 ± 1.17^{bc}
12	Sreebhadra	7.80 ± 0.91^{cde}	7.80± 1.03^{cd}	7.00 ± 1.05^{abc}	6.90 ± 0.99^{ab}	6.90 ±1.19^{ab}	7.00 ± 1.05^{abc}
Orange flesh							
13	GP-HUB-66	7.20 ± 1.39^{bcde}	7.60 ± 1.17^{cd}	6.80 ± 1.13^{abc}	6.70 ± 1.25^{ab}	6.90 ±1.10^{ab}	6.80 ± 1.13^{abc}
Purple flesh							
14	URT-TSP-12-12	5.70 ± 2.31^{ab}	5.10 ± 1.96^{a}	7.20 ± 1.39^{abc}	7.50 ± 1.50^{ab}	6.70 ±2.31^{ab}	6.40 ± 1.83^{ab}
Check (White flesh)							
15	MLT-Vikram	7.00 ± 1.41^{bcde}	7.00 ± 1.41^{cd}	7.70 ± 0.67^{bc}	7.90 ± 0.87^{ab}	7.50 ±0.97^{ab}	7.70 ± 0.82^{bc}
	Mean	7.02 ± 1.19	7.03 ± 1.22	7.09 ± 1.10	7.17 ± 1.19	7.16 ± 1.14	7.17 ± 1.06
	F value	5.34	5.68	2.13	2.34	2.12	3.10
	S. Em. ±	0.40	0.40	0.36	0.39	0.38	0.34
	C. D. @ 1% level	1.49**	1.49**	1.34*	1.45*	1.42*	1.28**

Note: 9 point hedonic scale: 9- like extremely; 1- dislike extremely,*- Significant at 0.05 level, ** - Significant at 0.01 level, NS- Non-significant.

1. GP-HUB-14 2. MLT-CIP-SWA 3. URT-TSP-12-10 4. GP-HUB-25

5. GP-HUB-26 6. GP-HUB-35 7. GP-HUB-36 8. GP-HUB-44

9. GP-HUB-95 10. MLT-440127 11. MLT-Gouri 12. Sreebhadra

13. GP-HUB-66 14. URT-TSP-12-12 15. MLT-Vikram

Plate 5. Baked sweet potato genotypes

the genotypes Sreebhadra (7.80), URT-TSP-12-10 (7.60), GP-HUB-35 (7.60), GP-HUB-66 (7.60), GP-HUB-44 (7.40) and check variety MLT-Vikram (7.00) were statistically on par with each other. The genotype GP-HUB-95 (7.80) showed significantly higher score for flavour. Significantly lower score for flavour was seen in the genotype GP-HUB-14 (6.10) followed by MLT-CIP-SWA (6.20). The check variety MLT-Vikram (7.70) and GP-HUB-35 (7.70) were scored between like moderately and like very much. The genotype GP-HUB-95 (8.20) showed significantly higher score for taste. Significantly lower score for taste was exhibited by the genotype GP-HUB-14 (6.30) and MLT-CIP-SWA (6.20). All other genotypes were statistically on par with each other in terms of taste scores. The genotypes GP-HUB-95 (7.90) and GP-HUB-35 (7.80) showed significantly higher score for texture. The genotype GP-HUB-14 (6.10) and MLT-CIP-SWA (6.10) showed significantly lower score for texture and they were equal. The texture scores of all other genotypes were statistically on par with each other. Based on the overall acceptability scores, the genotype GP-HUB-95 (8.20) was the most acceptable one. The genotype MLT-CIP-SWA (6.10) was the least acceptable one followed by GP-HUB-14 (6.20). The genotypes MLT-440127 (7.50), GP-HUB-44 (7.40), GP-HUB-36 (7.25), URT-TSP-12-10 (7.20), Sreebhadra (7.00), GP-HUB-25 (6.80) and GP-HUB-66 (6.80) were statistically on par with each other in terms of overall acceptability scores.

4.3.5. Acceptability indices based on cooking methods

Acceptability indices based on cooking methods is shown in table 12. Significant differences existed between the sweet potato genotypes in terms of cooking methods. The genotype GP-HUB-44 (86.11) showed significantly higher acceptability index on boiling. The genotype URT-TSP-12-12 (72.22) showed significantly lower acceptability index on boiling. All the other genotypes except were statistically on par with each other in terms of acceptability index on boiling. The genotype GP-HUB-36 (90.00) showed significantly higher acceptability index on pressure cooking followed by GP-HUB-95 (86.11). The check variety MLT-Vikram (56.46) and the genotype MLT-440127 (58.14) were not acceptable for pressure cooking. The genotypes URT-TSP-12-10 (82.59), GP-HUB-14 (82.03), Sreebhadra (82.03), MLT-CIP-SWA (81.29), GP-HUB-26 (80.18) and MLT-Gouri (79.81) were statistically on par with each other in terms of acceptability index on pressure cooking. The genotype GP-HUB-95 (89.44) showed significantly higher acceptability index on baking followed by

Table 12. Acceptability indices based on cooking methods

Sl. No	Genotypes	Cooking methods			Mean
		Boiling	Pressure cooking	Baking	
White flesh					
1	GP-HUB-14	75.00 ± 11.45^{ab}	82.03 ±10.47^{bcde}	68.33 ± 10.56^{ab}	76.04 ± 12.22
2	MLT-CIP-SWA	77.22 ± 14.31^{ab}	81.29 ± 5.91^{bcde}	64.81 ± 18.86^{a}	73.35 ± 15.36
Cream flesh					
3	URT-TSP-12-10	80.37 ± 7.91^{ab}	82.59 ± 8.60^{bcde}	78.33 ± 9.32^{abcd}	80.43 ± 8.52
4	GP-HUB-25	84.07 ± 9.81^{ab}	83.51 ± 7.97^{cde}	75.18 ± 9.32^{abcd}	81.97 ± 9.13
5	GP-HUB-26	79.53 ± 8.26^{ab}	80.18 ± 6.82^{bcde}	85.92 ± 10.69^{cd}	81.88 ± 8.92
6	GP-HUB-35	82.50 ± 9.95^{ab}	72.59 ± 6.80^{bc}	85.18 ± 11.51^{cd}	80.09 ± 10.80
7	GP-HUB-36	82.40 ± 7.77^{ab}	90.00 ± 7.36^{e}	79.90 ± 10.45^{abcd}	84.10 ± 9.41
8	GP-HUB-44	86.11 ± 5.80^{b}	84.92 ± 8.02^{cde}	81.48 ± 10.10^{bcd}	84.17 ± 8.13
9	GP-HUB-95	83.70 ± 8.36^{ab}	86.11 ± 14.49^{de}	89.44 ± 8.94^{d}	85.12 ± 11.15
10	MLT- 440127	77.22 ± 7.30^{ab}	58.14 ± 12.29^{a}	79.25 ± 9.39^{abcd}	71.54 ± 13.57
11	MLT-Gouri	77.59 ± 9.04^{ab}	79.81 ± 6.20^{bcde}	84.25 ± 9.08^{cd}	80.55 ± 8.97
12	Sreebhadra	83.14 ± 10.45^{ab}	82.03 ± 7.31^{bcde}	80.37 ± 9.61^{abcd}	81.25 ± 8.97
Orange flesh					
13	GP-HUB-66	82.03 ± 9.32^{ab}	70.00 ± 14.52^{b}	77.77 ± 12.65^{abcd}	76.60 ± 12.95
Purple flesh					
14	URT -TSP -12- 12	72.22 ± 13.69^{a}	75.37 ± 9.07^{bcd}	71.48 ± 18.80^{abc}	73.02 ± 14.01
Check (White flesh)					
15	MLT- Vikram	81.29 ± 9.92^{ab}	56.46 ± 13.32^{a}	82.96 ± 12.84^{bcd}	78.98 ± 12.15

	F Value	S. Em. ±	C. D. @ 1% level
Genotypes (G)	5.58	0.27	1.08**
Methods (M)	2.94	0.51	2.11**
Interaction (GxM)	3.98	0.96	1.99**

Note: ** - Significant at 0.01 level.

GP-HUB-26 (85.92), GP-HUB-35 (85.18) and MLT-Gouri (84.25). The genotype MLT-CIP-SWA (64.81) showed significantly lower acceptability index on baking. Irrespective of the cooking methods, the genotype GP-HUB-95 had higher mean of 85.12 followed by GP-HUB-44 (84.17) and GP-HUB-36 (84.10). The genotype, MLT-440127 had lower mean of 71.54 followed by MLT-CIP-SWA (73.35) and URT-TSP-12-12 (73.02).

4.4. Flour production potential and characterisation of flour of sweet potato genotypes

Processing of sweet potato into flour is the most satisfactory method of creating a product that is not only functionally adequate, but also remains stable for an extended period without spoilage. This flour has its properties that enhance their wide utilization which include water and oil absorption capacity, foaming capacity, foam stability, bulk density, gelation capacity, emulsion capacity etc.

4.4.1. Yield and physical properties of flour of sweet potato genotypes

The flour of sweet potato genotypes is depicted in Plate 6. A perusal of table 13 indicates that significant differences existed between the flour yield and bulk density of flour of sweet potato genotypes. The genotype MLT-CIP-SWA showed significantly higher flour yield (42.24 g %) followed by MLT-Gouri (37.54 g %) and check variety MLT-Vikram (36.02 g %). The genotypes GP-HUB-26 (26.42 g %), GP-HUB-36 (26.22 g %) and GP-HUB-66 (25.95 g %) showed significantly lower yield of flour and were statistically on par with each other. The flour of genotypes GP-HUB-44 (0.87 g/ml) showed significantly higher bulk density followed by MLT-440127 (0.86 g/ml) and URT-TSP-12-12 (0.86 g/ml) and were statistically on par with each other and that of the genotype GP-HUB-66 (0.67 g/ml) showed significantly lower bulk density followed by GP-HUB-95 (0.71 g/ml), GP-HUB-14 (0.72 g/ml), GP-HUB-26 (0.72 g/ml) and GP-HUB-35 (0.73 g/ml). Fig. 6 and appendix VII shows the pH of flour of sweet potato genotypes. The genotype URT-TSP-12-12 (6.98) showed significantly higher pH. Significantly lower pH was seen in the genotype GP-HUB-66 (6.44). All the other genotypes except GP-HUB-66 and URT-TSP-12-12 were statistically on par with each other in terms of pH.

4.4.2. Particle size distribution of flour of sweet potato genotypes

Particle size distribution of flour of sweet potato genotypes is given in table 14. Particle size of the flour indicates the functionality and physico-chemical characters.

1. GP-HUB-14 2. MLT-CIP-SWA 3. URT-TSP-12-10 4. GP-HUB-25

5. GP-HUB-26 6. GP-HUB-35 7. GP-HUB-36 8. GP-HUB-44

9. GP-HUB-95 10. MLT-440127 11. MLT-Gouri 12. Sreebhadra

13. GP-HUB-66 14. URT-TSP-12-12 15. MLT-Vikram

Plate 6. Flour of sweet potato genotypes

Table 13. Yield and physical properties of flour of sweet potato genotypes

Sl. No	Genotypes	Yield (g %)	Bulk density (g/ml)
White flesh			
1	GP-HUB-14	28.54 ± 0.02^{bc}	0.72 ± 0.01^{b}
2	MLT-CIP-SWA	42.24 ± 1.00^{i}	0.78 ± 0.02^{de}
Cream flesh			
3	URT-TSP-12-10	31.90 ± 0.03^{e}	0.82 ± 0.02^{fe}
4	GP-HUB-25	28.87 ± 0.07^{bc}	0.76 ± 0.02^{cd}
5	GP-HUB-26	26.42 ± 0.04^{a}	0.73 ± 0.01^{bc}
6	GP-HUB-35	27.75 ± 1.00^{b}	0.73 ± 0.01^{bc}
7	GP-HUB-36	26.22 ± 0.04^{a}	0.82 ± 0.02^{fe}
8	GP-HUB-44	33.66 ± 0.04^{f}	0.87 ± 0.01^{h}
9	GP-HUB-95	29.08 ± 1.00^{c}	0.71 ± 0.02^{b}
10	MLT- 440127	30.49 ± 0.09^{d}	0.86 ± 0.01^{gh}
11	MLT-Gouri	37.54 ± 0.04^{h}	0.78 ± 0.02^{de}
12	Sreebhadra	29.40 ± 0.40^{cd}	0.78 ± 0.01^{de}
Orange flesh			
13	GP-HUB-66	25.95 ± 1.00^{a}	0.67 ± 0.02^{a}
Purple flesh			
14	URT-TSP-12-12	32.56 ± 0.06^{ef}	0.86 ± 0.01^{gh}
Check (White flesh)			
15	MLT-Vikram	36.02 ± 0.01^{g}	0.80 ± 0.01^{ef}
	Mean	31.10 ± 0.32	0.78 ± 0.01
	F value	231.57	40.95
	S. Em. ±	0.30	0.00
	C. D. @ 1% level	1.18**	0.03**

Note: Means are average of three replications ± SD, ** - Significant at 0.01 level.

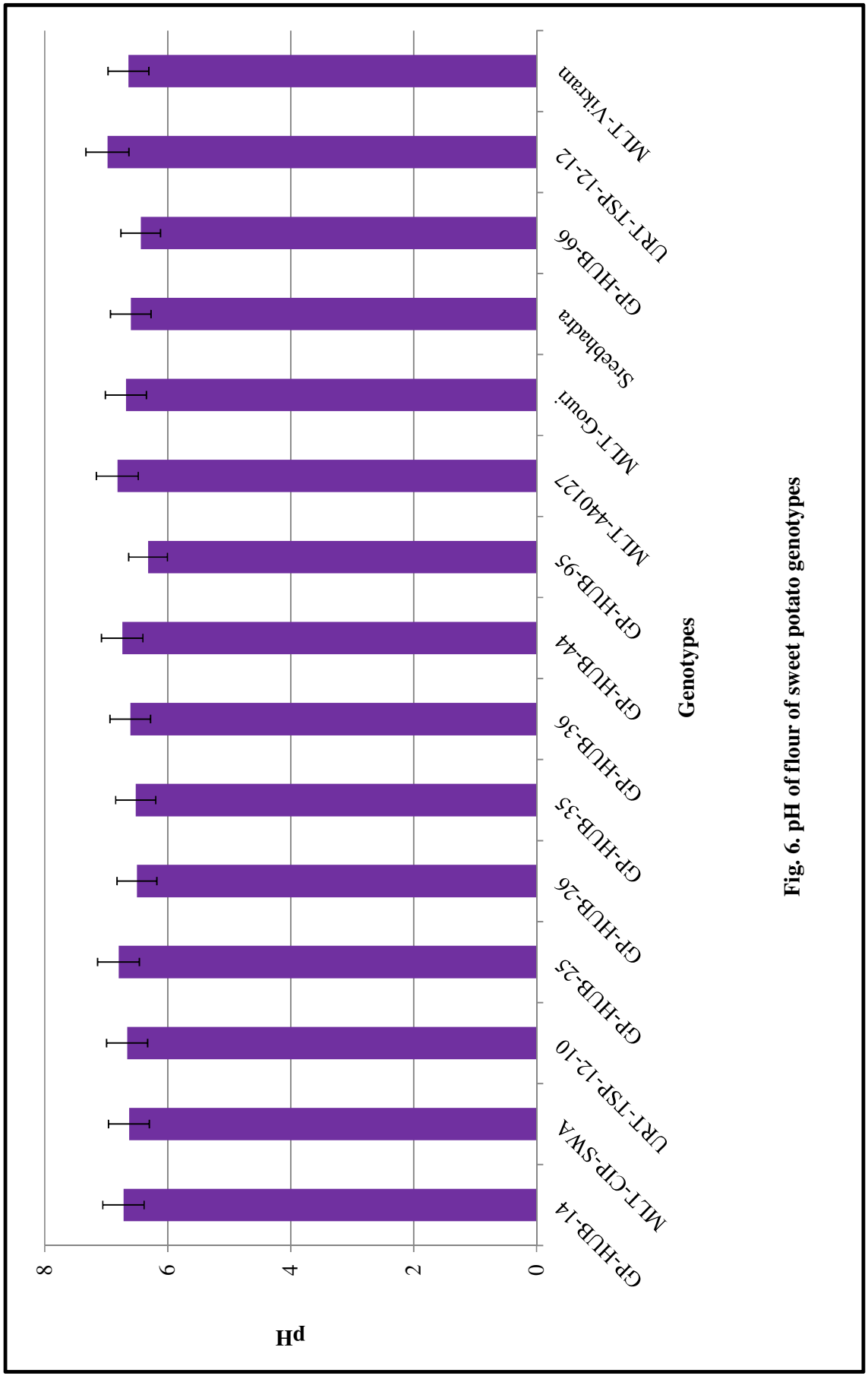


Fig. 6. pH of flour of sweet potato genotypes

Table 14. Particle size distribution of flour of sweet potato genotypes

Sl. No	Genotypes	BSS Standards						
		> 60 (0.250 µm)	> 85 (0.180 µm)	> 100 (0.150 µm)	> 150 (0.106 µm)	> 200 (0.075 µm)	> 240 (0.063 µm)	> 300 (0.053 µm)
White flesh								
1	GP-HUB-14	29.42 ± 1.04^{g}	46.10 ± 0.94^{cd}	5.49 ± 1.04^{a}	1.96 ± 0.51^{abc}	12.31 ± 0.97^{f}	2.31 ± 0.29^{d}	2.31 ± 0.29^{e}
2	MLT-CIP-SWA	9.38 ± 0.48^{a}	40.00 ± 1.02^{b}	6.47 ± 0.56^{a}	6.98 ± 0.53^{e}	34.32 ± 0.04^{g}	2.82 ± 0.55^{d}	0.03 ± 0.01^{a}
Cream flesh								
3	URT-TSP-12-10	22.01 ± 1.15^{e}	51.38 ± 1.47^{ef}	18.96 ± 0.91^{e}	3.17 ± 0.49^{bcd}	2.69 ± 0.57^{c}	0.87 ± 0.07^{b}	0.87 ± 0.07^{c}
4	GP-HUB-25	25.96 ± 1.06^{f}	52.51 ± 0.88^{f}	18.06 ± 0.90^{e}	1.59 ± 0.56^{ab}	1.70 ± 0.45^{abc}	0.08 ± 0.01^{a}	0.08 ± 0.01^{ab}
5	GP-HUB-26	39.94 ± 0.89^{i}	41.23 ± 1.84^{b}	14.76 ± 0.98^{cd}	1.65 ± 0.46^{ab}	2.24 ± 0.52^{bc}	0.08 ± 0.01^{a}	0.08 ± 0.01^{ab}
6	GP-HUB-35	34.20 ± 0.99^{h}	45.58 ± 1.09^{c}	16.17 ± 0.52^{d}	1.36 ± 0.12^{ab}	2.61 ± 0.48^{c}	0.07 ± 0.02^{a}	0.07 ± 0.02^{ab}
7	GP-HUB-36	30.18 ± 0.51^{g}	57.46 ± 1.89^{g}	7.10 ± 0.55^{ab}	0.54 ± 0.18^{a}	1.57 ± 0.56^{abc}	1.57 ± 0.56^{c}	1.57 ± 0.56^{d}
8	GP-HUB-44	20.95 ± 0.38^{e}	47.30 ± 0.76^{cd}	18.58 ± 0.93^{e}	11.95 ± 1.56^{f}	0.40 ± 0.17^{a}	0.40 ± 0.17^{ab}	0.40 ± 0.17^{abc}
9	GP-HUB-95	27.07 ± 0.61^{f}	44.90 ± 1.99^{c}	14.29 ± 0.56^{cd}	3.01 ± 0.57^{bcd}	9.32 ± 0.24^{e}	0.69 ± 0.24^{ab}	0.69 ± 0.24^{bc}
10	MLT- 440127	17.73 ± 0.59^{d}	47.66 ± 2.67^{cde}	23.30 ± 1.18^{f}	3.80 ± 0.29^{d}	6.66 ± 1.13^{d}	0.41 ± 0.03^{ab}	0.41 ± 0.03^{abc}
11	MLT-Gouri	11.46 ± 1.11^{b}	34.50 ± 1.36^{a}	7.24 ± 0.47^{ab}	6.11 ± 0.62^{e}	39.32 ± 0.29^{h}	0.70 ± 0.05^{ab}	0.70 ± 0.05^{bc}
12	Sreebhadra	26.66 ± 1.03^{f}	57.82 ± 2.36^{g}	12.99 ± 0.71^{c}	1.83 ± 0.64^{ab}	0.69 ± 0.11^{ab}	0.07 ± 0.01^{a}	0.07 ± 0.01^{ab}
Orange flesh								
13	GP-HUB-66	17.92 ± 1.13^{d}	40.41 ± 0.37^{b}	18.80 ± 1.17^{e}	12.84 ± 1.13^{f}	9.47 ± 0.96^{e}	0.27 ± 0.09^{ab}	0.27 ± 0.09^{abc}
Purple flesh								
14	URT-TSP-12-12	9.77 ± 0.73^{ab}	38.76 ± 1.97^{b}	8.84 ± 0.64^{b}	3.63 ± 0.83^{cd}	34.27 ± 1.57^{g}	2.35 ± 0.67^{d}	2.35 ± 0.67^{e}
Check (White flesh)								
15	MLT-Vikram	15.71 ± 0.49^{c}	49.60 ± 1.63^{def}	22.07 ± 0.40^{f}	4.21 ± 0.98^{d}	7.16 ± 0.55^{d}	0.57 ± 0.06^{ab}	0.57 ± 0.06^{abc}
	Mean	22.56 ± 0.81	46.35 ± 1.48	14.21 ± 0.76	4.31 ± 0.63	10.98 ± 0.57	0.88 ± 0.18	0.70 ± 0.15
	F value	336.20	52.65	161.82	79.33	1103.41	30.74	28.59
	S. Em. ±	0.49	0.92	0.46	0.41	0.40	0.16	0.14
	C. D. @ 1% level	1.91**	3.60**	1.81**	1.62**	1.57**	0.64**	0.56**

Note: Means are average of three replications ± SD, ** - Significant at 0.01 level

Irrespective of genotypes around 46.35 g of flour of sweet potato genotypes was of size 0.180 µm (>85 mesh size), 22.56 g of flour was of the size 0.250 µm (>60 mesh size). Irrespective of the genotypes 0.70 g of the sweet potato flour was of finer size (0.053 µm). More than 50 percent of the flour of sweet potato genotypes Sreebhadra (57.82 g), GP-HUB-36 (57.46 g), GP-HUB-25 (52.51 g) and URT-TSP-12-10 (51.38 g) was of 0.180 µm. More than 0.250 µm (>60 mesh size) of flour was significantly higher in GP-HUB-26 (39.94 g) and lower was seen in MLT-CIP-SWA (9.38 g). Yield of fine flour of 0.053 µm (>300 mesh size) was significantly lower in all the flours and also significant difference was observed between the sweet potato genotypes. Fine flour was significantly higher in URT-TSP-12-12 (2.35 g), and was on par with GP-HUB-14 (2.31 g).

4.4.3. Functional properties of flour of sweet potato genotypes

A perusal of table 15 indicates that significant differences existed between the sweet potato genotypes in terms of water absorption capacity, oil absorption capacity, solubility and swelling power of flour. The genotype GP-HUB-66 showed significantly higher water absorption and oil absorption capacity (1.88 g/g and 0.81 g/g respectively) followed by GP-HUB-36 (1.80 g/g and 0.71 g/g respectively). The genotype MLT-440127 (1.02 g/g) showed significantly lower water absorption capacity while GP-HUB-95 exhibited significantly lower oil absorption capacity of (0.57 g/g). The genotypes GP-HUB-14 (1.35 g/g) and URT-TSP-12-10 (1.34 g/g) were statistically on par with each other in terms of water absorption capacity. The oil absorption capacity of the genotypes GP-HUB-36 (0.72 g/g) and MLT-Gouri (0.72 g/g) was statistically on par with each other. The genotype GP-HUB-95 (35.08 %) showed significantly higher solubility and the genotype GP-HUB-66 (21.34 %) showed significantly lower solubility. The genotypes GP-HUB-14 (32.02 %) and GP-HUB-25 (32.07 %) were statistically on par with each other in terms of solubility. Significantly higher swelling power was seen in the genotype URT-TSP-12-12 (10.55 g/g) followed by GP-HUB-44 (10.21 g/g) and significantly lower swelling power was seen in the genotypes GP-HUB-14 (6.81 g/g) and GP-HUB-95 (6.85 g/g). The genotypes URT-TSP-12-10 (9.00 g/g), GP-HUB-66 (8.89 g/g) and MLT-Gouri (8.65 g/g) were statistically on par with each other in terms of swelling power. The genotypes GP-HUB-36 (7.85 g/g), MLT-CIP-SWA (7.82 g/g) and check variety MLT-VIkram (7.77 g/g) were statistically on par while the genotypes GP-HUB-35 (7.52 g/g) and MLT-440127 (7.55 g/g) were statistically similar with each other in terms of swelling power.

Table 15. Functional properties of flour of sweet potato genotypes

Sl. No	Genotypes	Water absorption capacity (g/g)	Oil absorption capacity (g/g)	Solubility (%)	Swelling power (g/g)
White flesh					
1	GP-HUB-14	1.35 ± 0.01^{e}	0.68 ± 0.01^{cdefg}	32.02 ± 0.86^{gh}	6.81 ± 0.08^{a}
2	MLT-CIP-SWA	1.25 ± 0.01^{d}	0.70 ± 0.01^{efg}	30.81 ± 0.74^{fg}	7.82 ± 0.05^{c}
Cream flesh					
3	URT-TSP-12-10	1.34 ± 0.02^{e}	0.64 ± 0.01^{bcdef}	25.14 ± 0.59^{cd}	9.00 ± 0.03^{d}
4	GP-HUB-25	1.45 ± 0.05^{f}	0.65 ± 0.05^{bcdef}	32.07 ± 0.93^{gh}	7.13 ± 0.09^{ab}
5	GP-HUB-26	1.65 ± 0.01^{i}	0.69 ± 0.03^{defg}	28.58 ± 0.36^{e}	9.73 ± 0.09^{e}
6	GP-HUB-35	1.60 ± 0.02^{h}	0.63 ± 0.01^{abcd}	31.08 ± 0.80^{fg}	7.52 ± 0.03^{bc}
7	GP-HUB-36	1.80 ± 0.01^{j}	0.71 ± 0.01^{fg}	23.75 ± 0.21^{bc}	7.84 ± 0.07^{c}
8	GP-HUB-44	1.43 ± 0.01^{g}	0.64 ± 0.04^{abcde}	23.75 ± 0.21^{bc}	10.21 ± 0.08^{ef}
9	GP-HUB-95	1.47 ± 0.02^{g}	0.57 ± 0.01^{a}	35.08 ± 0.69^{i}	6.85 ± 0.06^{a}
10	MLT- 440127	1.02 ± 0.01^{a}	0.68 ± 0.08^{cdefg}	26.46 ± 1.16^{d}	7.55 ± 0.13^{bc}
11	MLT-Gouri	1.14 ± 0.01^{c}	0.71 ± 0.01^{fg}	22.39 ± 0.43^{ab}	8.65 ± 0.03^{d}
12	Sreebhadra	1.28 ± 0.01^{d}	0.59 ± 0.01^{ab}	32.93 ± 0.59^{h}	7.33 ± 0.05^{abc}
Orange flesh					
13	GP-HUB-66	1.88 ± 0.01^{k}	0.81 ± 0.01^{h}	21.34 ± 0.22^{a}	8.89 ± 0.02^{d}
Purple flesh					
14	URT-TSP-12-12	1.10 ± 0.01^{b}	0.61 ± 0.01^{abc}	24.58 ± 0.22^{c}	10.55 ± 1.00^{f}
Check (White flesh)					
15	MLT-Vikram	1.42 ± 0.01^{f}	0.73 ± 0.08^{g}	29.58 ± 0.96^{ef}	7.77 ± 0.58^{c}
	Mean	1.41 ± 0.01	0.67 ± 0.02	27.97 ± 0.59	8.25 ± 0.15
	F value	597.36	13.84	125.10	46.76
	S. Em. ±	0.01	0.01	0.38	0.17
	C. D. @ 1% level	0.03**	0.06**	1.50**	0.68**

Note: Means are average of three replications ± SD, ** - Significant at 0.01 level.

4.5 Correlations between nutrient composition and functional properties of sweet potato genotypes

Correlations with respect to proximate composition, carbohydrate profile and functional properties calculated using Pearson's correlation were presented under following subheadings:

4.5.1. Correlation between carbohydrate profile and functional properties of sweet potato genotypes

Table 16 shows the correlation between carbohydrate profile and functional properties of sweet potato genotypes. Solubility of sweet potato genotypes was significantly and negatively correlated to swelling power (r = - 0.669) indicating that increase in solubility decreased the swelling power. Total sugar of sweet potato genotypes was significantly and positively correlated to reducing (r = 0.629) and non-reducing sugar (r = 0.829). Water absorption capacity of the genotypes is significantly and negatively correlated to starch content (r = - 0.595) indicating that increase in starch content decreased the water absorption capacity.

4.5.2. Correlation between proximate composition and functional properties of sweet potato genotypes

Correlation between proximate composition and functional properties of sweet potato genotypes are presented in table 17. Protein is significantly and negatively correlated (r = - 0.538) while total carbohydrate is significantly and positively correlated (r = 0.510) to oil absorption capacity. Available carbohydrate (r = - 0.515) and energy (r = - 0.534) are significantly and negatively correlated to solubility.

4.5.3. Classification of sweet potato genotypes based on quality

Table 18 shows the classification of sweet potato genotypes based on quality. The table indicates that the sweet potato genotype GP-HUB-95 was better in terms of total soluble solids, moisture, protein, crude fibre, iron, zinc, acceptability indices of boiled and baked sweet potato genotypes and solubility followed by GP-HUB-66 in terms of available carbohydrate, calcium, reducing, non-reducing, total sugar, water absorption and oil absorption capacity.

Table 16. Correlation between carbohydrate profile and functional properties of sweet potato genotypes

	Water absorption capacity	Oil absorption capacity	Solubility	Swelling power	Total sugar	Reducing sugar	Non-reducing sugar	Starch
Water absorption capacity	1	0.368	-0.100	-0.006	0.158	0.301	-0.007	-0.595**
Oil absorption capacity		1	-0.494	0.094	0.101	0.185	-0.004	0.190
Solubility			1	-0.669*	0.181	0.148	0.129	-0.130
Swelling power				1	-0.114	-0.177	-0.026	-0.130
Total sugar					1	0.629**	0.829**	-0.323
Reducing sugar						1	0.086	-0.171
Non-reducing sugar							1	-0.294
Starch								1

Note: *- Correlation is significant at 5% level; **- Correlation is significant at 1% level.

Table 17. Correlation between proximate composition and functional properties of sweet potato genotypes

	Water absorption capacity	Oil absorption capacity	Solubility	Swelling power
Moisture	-0.192	-0.200	0.265	-0.359
Protein	-0.050	-0.538**	0.210	0.017
Fat	-0.199	0.254	0.077	-0.143
Ash	0.211	-0.183	0.336	-0.398
Crude fibre	0.267	-0.083	0.494	-0.270
Total carbohydrate	0.087	0.510**	-0.415	0.322
Available carbohydrate	-0.022	0.450	-0.515**	0.360
Energy	-0.189	0.315	-0.534**	0.477

Note: **- Correlation is significant at 1% level.

Table 18. Classification of sweet potato genotypes based on quality

Parameters	Rank				
	I	II	III	IV	V
Total soluble solids	GP-HUB-44	GP-HUB-95	Sreebhadra	MLT-CIP-SWA	URT-TSP-12-10, URT-TSP-12-12, GP-HUB-66
Titratable acidity	GP-HUB-25	GP-HUB-14	GP-HUB-36	GP-HUB-26, GP-HUB-35	GP-HUB-95,Sreebhadra
Dry matter	MLT-CIP-SWA	MLT-Vikram	URT-TSP-12-12	URT-TSP-12-10	GP-HUB-44
Moisture	MLT-440127	GP-HUB-95	GP-HUB-25	Sreebhadra	GP-HUB-36
Protein	URT-TSP-12-10	GP-HUB-95	GP-HUB-25	GP-HUB-44	GP-HUB-26
Crude fibre	GP-HUB-14	GP-HUB-95	GP-HUB-26	URT-TSP-12-10	GP-HUB-25
Available carbohydrate	GP-HUB-66	MLT Gouri	URT-TSP-12-12	MLT-Vikram	MLT-CIP-SWA
Calcium	GP-HUB-26, GP-HUB-44	GP-HUB-36, GP-HUB-66	GP-HUB-35, MLT-Gouri, URT-TSP-12-12	GP-HUB-95, MLT-440127, URT-TSP-12-10	MLT-CIP-SWA
Phosphorus	GP-HUB-14	GP-HUB-35	MLT-Gouri	GP-HUB-36	GP-HUB-25
Copper	MLT-440127	GP-HUB-26	MLT-CIP-SWA	GP-HUB-95	URT-TSP-12-10
Iron	GP-HUB-95	GP-HUB-36	MLT-CIP-SWA	GP-HUB-25	URT-TSP-12-10
Zinc	GP-HUB-95	GP-HUB-35	Sreebhadra	GP-HUB-25	GP-HUB-36
Reducing sugar	GP-HUB-66	GP-HUB-25	GP-HUB-26, GP-HUB-14	MLT-440127	GP-HUB-95
Non-reducing sugar	Sreebhadra	GP-HUB-66, URT-TSP-12-12	GP-HUB-14	GP-HUB-25	GP-HUB-26
Total sugar	GP-HUB-66	GP-HUB-14	GP-HUB-25	GP-HUB-26	Sreebhadra
Starch	MLT-Gouri	GP-HUB-14	MLT-440127	MLT-Vikram	URT-TSP-12-12
Acceptability index of BSG	GP-HUB-36	GP-HUB-44	GP-HUB-95	Sreebhadra	GP-HUB-35
Acceptability index of PCSG	GP-HUB-36	GP-HUB-44	GP-HUB-25	GP-HUB-14	URT-TSP-12-10
Acceptability index of BaSG	GP-HUB-95	GP-HUB-26	GP-HUB-35	MLT-Gouri	GP-HUB-44
Flour yield	MLT-CIP-SWA	MLT-Gouri	MLT-Vikram	GP-HUB-44	URT-TSP-12-10
Bulk density	GP-HUB-44	MLT-440127	URT-TSP-12-10	GP-HUB-36	MLT-Vikram
Water absorption capacity	GP-HUB-66	GP-HUB-36	GP-HUB-26	GP-HUB-35	GP-HUB-95
Oil absorption capacity	GP-HUB-66	MLT-Vikram	GP-HUB-36, MLT- Gouri	MLT-CIP-SWA	GP-HUB-26
Solubility	GP-HUB-95	Sreebhadra	GP-HUB-25	GP-HUB-14	GP-HUB-36
Swelling power	URT-TSP-12-12	GP-HUB-44	GP-HUB-26	URT-TSP-12-10	GP-HUB-66

Note: BSG - Boiled sweet potato genotypes; PCSG - Pressure cooked sweet potato genotypes; BaSG - Baked Sweet potato genotypes.

Discussion

5. DISCUSSION

The sweet potato [*Ipomoea batatas* (L.) Lam] belongs to the Convolvulaceae or morning glory family (Jones, 1965). Sweet potato is among the world's most important and under-exploited crop. It is commonly referred to as subsistence, food security or famine relief crop, its uses being diversified considerably in the developing countries (Sathe and Salunkhe, 1999).

Sweet potatoes contains many nutritional and non nutritional components including carbohydrates (80 % to 90 % of the dry weight of the roots), with starch being the most abundant component (Woolfe, 1992). Sweet potato contains endogenous amylolytic enzymes with the three major ones being α-amylase, β-amylase and starch phosphorylase (Hagenimana *et al*, 1992). The presence of amylases in sweet potato roots influences their utilization, especially in the food industry, due to hydrolytic effect of the enzymes on sweet potato starch which also affects the properties of sweet potatoes, there is need to have knowledge of their physicochemical properties and the effect that the different processing methods have on these properties and functionality of the different components.

Sweet potato can be used in various ways; boiled, steamed, baked, fried and also have the potential to be processed into various products (Tian *et al*, 1991). In the developing world, they are most commonly consumed after boiling, steaming, roasting or drying (Nagujja and Yanggen, 2005).

Genotypes developed by the Horticultural Universities needs to be screened for quality parameters for cultivation and utilization of quality sweet potato. The ultimatum of any genotype to sustain among farmers is its marketability and acceptability by the consumers. Hence the current research was planned and the results are discussed in this chapter under the following sub-headings:

5.1. Colour and physico-chemical properties of sweet potato genotypes

5.2. Nutrient composition of sweet potato genotypes

5.3. Cooking quality and acceptability of sweet potato genotypes

5.4. Flour production potential and characterisation of flour of sweet potato genotypes

5.1. Colour and physico-chemical properties of sweet potato genotypes

Physical characteristics of agricultural products are the most important parameter in the design of grading, handling, processing and packaging systems. Among these physical characteristics, length, width, thickness, circumference, mass and volume are important.

The colour determines the visual appearance of the product, it is influenced by the *in situ* components present. In the present study, wide variation was observed between the skin and flesh colour of the sweet potato genotypes. The differences in colour (Table 1) could be due to genetic differences and compositional variations of the sweet potato tubers selected for the study. The white colour of the flesh in the sweet potato genotypes (GP-HUB-14 and MLT-CIP-SWA) could be attributed to the presence of anthoxanthin pigment, orange colour (GP-HUB-66) may be due to beta-carotene (Low and Van, 2008) and anthocyanin content (Suda *et al.*, 2003) might have contributed to the purple colour (URT-TSP-12-12).

The weight and volume are important parameters influencing the marketability and economic importance of the crop. Significant differences existed among the genotypes for weight and volume so also bulk density (Table 2). Genetic make up, varietal variations, cultivation practices, climatic conditions, maturity of the tuber at harvest, soil conditions and other environmental factors might have contributed to these variations. Similar variations in physical parameters of sweet potato were reported by Egbe *et al.* (2012); Teye and Abano (2012) and Rahman *et al.* (2013).

The pH is an indicator of hydrogen ion concentration, while titratable acidity indicates the sourness and total soluble solids, an indicator of sweetness. Statistically significant differences were found between the pH, total soluble solids and titratable acidity of the sweet potato genotypes (Table 3). These differences were due to the genetic set up of the sweet potato tubers. Similar results were reported by Feltran *et al.* (2004) in eighteen potato cultivars, KoKo *et al.* (2014) in three cassava cultivars, Saha *et al.* (2014) in potato tubers, Ali *et al.* (2015) in 114 sweet potato accessions and 2 check varieties.

Dry matter content relates to good cooking qualities and extended storage life as it indirectly indicates presence of moisture. The dry matter content of the sweet potato genotypes varied from 25.90 to 41.52 g per cent with an average of 31.20 g per cent (Table 3 and Fig 2). These differences could be attributed to the differences in initial moisture content of the tubers (Table 4 and 5), water availability to the plant during growth (Novoplansky *et*

al., 2001 and Hagiwara *et al.*, 2008) and the condition in which the tubers were harvested and stored (Devereau, 1994; Dandago and Gungula, 2011) besides the time and maturity at harvest. Similar results were reported by Ji *et al.* (2015); Namo *et al.* (2016) and Nwankwo *et al.* (2016).

5.2. Nutrient composition of sweet potato genotypes

Nutrients are environmental substances used for energy, growth, and bodily functions by organisms. Depending on the nutrient, these substances are needed in small amounts or larger amounts. Those that are needed in large amounts are called macronutrients *viz.* carbohydrates, lipids (fats), proteins.

Nutrients including proximate principles, minerals and vitamins contribute to the health and wellness of individuals. Sweet potato serves as an important source of protein, starch and other carbohydrates for many world populations (Benjamin, 2007). The carbohydrate content of the tubers varies from 25 to 30 per cent on fresh weight basis, while the rest is composed of water, micro nutrients like minerals and vitamins. It is a good source of dietary fibre and are low in fat and cholesterol. It contains various micro-nutrients like vitamin C, thiamine, riboflavin and niacin, small quantities of pantothenic acid, pyridoxine, folic acid and satisfactory quantities of vitamin E are present. Sweet potato also contains essential minerals like calcium and potassium (Woolfe, 1992) and trace elements having especially high quantities of iron.

The amount of nutrients present in fresh food indicates the availability of these nutrients on fresh consumption. The newly developed sweet potato genotypes employed in the present study exhibited higher amounts of moisture and lower amounts of other proximates in line with fresh tubers and green leafy vegetables (Gopalan *et al.*, 2011). The genotype MLT-CIP-SWA having lower moisture contained higher amounts of other nutrients. The check variety MLT-Vikram employed in the study depicted the medium contents of proximate when analysed on fresh weight basis. However drying is a method of preservation by removal of moisture, thus ensuring concentration of nutrients. The sweet potato genotypes when dried contained less than 10 per cent of moisture, a level prescribed for better preservation of grains. The proximate composition enhanced in dried sweet potato genotypes to a level on par with cereals (Table 5). Irrespective of the genotypes the protein content was found to be similar to the values reported for rice (Gopalan *et al.*, 2011). The computed

carbohydrate content and energy were similar to those reported for cereals and pulses indicating the fact that tubers like sweet potato can replace cereals in turn providing food security to the tuber growing populations. Amino acid composition of sweet potato protein shows it to be limiting in total sulphur-containing amino acids. There is an excess of lysine, suggesting usefulness as a supplement to grain products (Purcell *et al.*, 1978). The variations reported in the proximates can be attributed to genetic variations, agro cultural practices, cultivar, farm yard manure and fertigation employed, location, climate, day length, soil condition, pests, diseases, maturity, gaps between the harvesting time and analysis. The results were in agreement with that of Lyimo *et al*. (2010), Omodamiro *et al*. (2013), Agbemafle *et al*. (2014), Anthony *et al.* (2014), Ji *et al*. (2015), Shekhar *et al*. (2015) and Alam *et al*. (2016).

Sugars are the major contributors of sweetness. The uniqueness of sweet potato is its sweetness owing to the presence of sucrose, fructose and glucose (Zhang *et al.*, 2002). Variations found between the sweet potato genotypes in the present study with regard to total, reducing and non-reducing sugar can be reasoned to the difference in sugar components. The genotype GP-HUB-66 contained higher amounts of total, reducing and non-reducing sugar compared to other genotypes and check variety (Table 7). Total sugar was significantly and positively correlated to reducing (r = 0.629) and non reducing sugar (r = 0.829) indicating that with increase in reducing and non-reducing sugars, increase in total sugar was evident. This was expected since reducing sugar was substracted from total sugar for estimating non-reducing sugar. Starch is the storage form of energy for future growth of the plant. It serves as reserve energy. In the present study, it varied from 46.50 to 66.50 g per cent (Table 7 and Fig 4). Differences were seen between the genotypes with regard to sugars and starch content because of time of harvest, capability of plant to synthesize starch, moisture availability, availability of sunlight and climatic effect. The results are in concurrence with that of Agbemafle *et al*. (2014), Krochmal-Marckzak *et al*. (2014), Ali *et al*. (2015) and Shekhar *et al*. (2015).

Dietary fibre acts as bioactive compound and it is indigestible portion of food derived from plants. It consists of soluble fibre having the capacity to regulate blood glucose and reducing cholesterol level, whereas insoluble fibre is capable of relieving constipation. The soluble, insoluble and total dietary fibre varied significantly in the tubers tested. The total

dietary fibre (Table 8) content of tubers varied from 7.83 to 15.20 g/100 g, indicating that the consumption of 100 g of tuber provides half to one third suggested fibre intake which is 30g/day (Anon, 2009). Soluble fibre, which dissolves in water, is easily fermented in the colon by the colonic bacteria into physiologically active by products and can be prebiotic and viscous. The soluble fibre content of sweet potato genotypes in the present study varied from 3.03 to 5.76 g per cent (Table 8). The presence of soluble fibre in humans can result in an extended feeling of fullness owing to the capacity of soluble fibre to increase the viscosity of the intestinal contents. On the contrary, insoluble dietary fibre comprising of cellulose, lignin, hemicelluloses, etc. ranged from 4.13 to 10.16 g per cent. Being insoluble in water, it is metabolically inert and provides bulking. Bulking fibres absorb water as they move through the digestive system, easing defecation.

Micronutrients support macronutrients in metabolism and thus conversion of food to energy. They play crucial roles in human nutrition, including the prevention and treatment of various diseases and conditions, as well as optimization of physical and mental functioning. Vitamins and minerals are the two types of micronutrients.

Minerals are inorganic chemical elements that the body needs for healthy growth and metabolism. They are also involved in making hormones and enzymes. Minerals are just as important as vitamins, and in fact work in conjunction with vitamins to perform many bodily functions such as bone formation, heart function and digestion. The sweet potato tubers were found to be a good source of minerals. Total minerals of sweet potato genotypes varied from 2.67 to 4.68 g per cent (Table 5). The mineral content of the sweet potato tubers varied significantly (Table 6). Calcium is required by the body for maintenance of bones and teeth strong, thereby supporting skeletal structure and function. The rest of the calcium in the body plays key roles in cell signaling, blood clotting, muscle contraction and nerve function. The calcium in the sweet potato genotypes in the present study varied from 500 to 950 mg/100 g with a mean value of 770.13mg/100 g. Consuming 100 g of sweet potato flour meets half of the calcium requirement for pregnant women whereas to meet the same requirement it becomes essential to consume 300 g of ragi flour (Anon, 2009). The genotypes GP-HUB-26 and GP-HUB-44 containing 950 mg/100 g of calcium meets full requirement of adolescents (Anon, 2009). Iron is an essential element for production of red blood cells. About 70 per cent of human body's iron is found in the red blood cells in the form of

haemoglobin and in muscle cells in the form of myoglobin. Haemoglobin is essential for transferring oxygen in blood from the lungs to the tissues. The iron content in the present study varied from 2.32 to 6.81 mg/100 g with a mean value of 5.53 mg/100 g. Consumption of 100 g of sweet potato flour meets the one fourth requirement of iron for adolescent girls (Anon, 2009). Differences were found between the sweet potato genotypes with regard to mineral content because of genotypical variation. High mineral content may be due to fertilizer application, humus applied and mineral status of soil. The results are in agreement with Senanayake *et al.* (2013) in ten sweet potato cultivars and Salvador *et al.* (2014) in cassava tubers. Though sweet potato genotypes are rich sources of minerals, its bioavailability is a question because of presence of high amounts of dietary fibre. Further studies on the bioavailability of calcium and iron in sweet potato are needed.

Vitamin C, also known as L-ascorbic acid, is a water-soluble vitamin that is naturally present in some foods, added to others and available as a dietary supplement. Humans, unlike most animals are unable to synthesize vitamin C endogenously, so it is an essential dietary component (Li *et al.*, 2007). It is required for wound healing, providing immunity and for health of bones and tissues. In the present study, the vitamin C content varied from 6.93 to 23.88 mg/100 g. The genotype URT-TSP-12-10 possessed around 24 mg/100 g of the vitamin. Though sweet potatoes are fair sources of vitamin C, the body gets it only when they are consumed fresh. Processing including boiling, pressure cooking, microwaving or any other means of thermal treatment results in the loss of vitamin C. Differences seen in the vitamin among the sweet potato genotypes can be attributed to genetic make up and time gap between harvesting and analysis. The results are in concurrence with that of Krochmal-Marczak *et al.* (2014) in three sweet potato cultivars and Salvador *et al.* (2014) in cassava tubers.

5.3. Cooking quality and acceptability of sweet potato genotypes

Sweet potato is usually cooked by baking, boiling, microwaving, steaming, or frying. When tender, it can also be consumed raw. These cooking processes would certainly bring about a number of changes in the physical characteristics and chemical composition of sweet potatoes. On boiling, higher per cent increase in weight 14.84 per cent was seen in the check variety MLT-Vikram (Fig 5.b.) may be because of its low initial moisture content (Table 4) and fibre content (Table 5) besides the water holding capacity (Table 15) .The genotype GP-HUB-14 could be cooked in around 22 min (Fig 5.a.) compared to other genotypes (15-20

min). Higher cooking time could be because of its hard and fibrous nature (Table 5) and may be the characteristic of the peel.

Food acceptance is a complex field influenced by many factors requiring both acceptance, perceptual and physical and chemical information. The acceptability of foods is determined by how they are perceived in sensory, utilitarian, imagery and attitudinal terms, coupled with the consumer's reaction to and trading-off of these various perceived characteristics (Williams *et al.*, 1983 and Thomson, 1988).

In the present study, the fourteen sweet potato genotypes and one check variety selected were processed by boiling, pressure cooking and baking to enumerate the suitability of processing methods. Since boiling is the traditional method employed for processing sweet potato, all the genotypes received the scores of more than 7 (like moderately) out of 9 (like extremely). However the genotype URT-TSP-12-12 received lowest score of 72.22 may be due to the mashy texture on boiling. The check variety MLT-Vikram and the genotype MLT-440127 were found not suitable for pressure cooking as the acceptability index was 56.46 and 58.14, respectively. This may be because of its typical astringent taste after pressure cooking (Table 10). The astringency was not evident in boiling and baking, may be due to leaching out or vapourisation of the components. However, these genotypes received better scores on boiling and baking. The genotype MLT-CIP-SWA was found not suitable for baking as the acceptability index was 64.81 (Table 12). The genotype turned greyish in colour and tougher on baking probably due to the toughening of tissues by formation of resistant starch (Siljestrom and Asp, 1985). The greyish colour can be reasoned to the presence of phenols in the genotypes. The purple colour of the genotype URT-TSP-12-12 was not accepted by the panel members though it was having higher sugars and polyphenols, beneficial for health and wellness.

5.4. Flour production potential and characterization of flour of sweet potato genotypes

Flour is fine powder made from cereals legumes and nuts, root and tubers such as sweet potato, yam, cassava or other starch based produce. Flour of tubers once prepared can be used to replace cereals in a variety of food products, including those meant for celiac disease. Besides, the conversion of tuber to flour reduces the bulk thus facilitating easy storability and transport.

In the present study, fourteen genotypes and one check variety of sweet potato were evaluated for flour production potential and their suitability. The yield of flour of sweet potato

genotypes was in the range of 25.95 to 42.24 g per cent (Table 13). Higher flour yield was found in the genotype MLT-CIP-SWA may be because of its high dry matter content (Table 3) and low moisture content (Table 4). Similarly low dry matter content and high moisture content were the reasons for low flour yield in the genotype GP-HUB-36. Similar results were reported by Rodrigues *et al.* (2016) in two varieties of sweet potato.

Bulk density is generally affected by the composition, particle size and density of the flour and it is very important in determining the packaging requirement, material handling and application in wet processing in the food industry (Karuna *et al.*, 1996). Higher bulk density offers greater packaging advantage as greater quantity of flour can be packed within a constant volume. Low bulk density would be an advantage in the formulation of complementary foods. The bulk density differed significantly between the sweet potato genotypes and ranged from 0.67 to 0.87 g/ml (Table 13). The high bulk density of the flour of MLT-440127 and URT-TSP-12-12 indicates its heaviness suggesting its suitability as a drug binder and disintegrant in pharmaceuticals (Zaku *et al.*, 2009). Lower bulk density was seen in the genotype GP-HUB-66 because of low protein content (Table 5) indicating its suitability for preparation of supplementary foods. Similar results were reported by Anthony *et al.* (2014) and Mohd. Hanim *et al.* (2014).

The pH of a flour suspension determines certain functional properties such as solubility, emulsifying activity and foaming properties. High pH starches have been reported to have increased solubility because of increased hydrophilic characters of the starch at these pH values (Tsakama *et al.*, 2010). pH values ranging from 5 to 7 have been reported to stimulate retrogradation and this is attributed to the absence of monovalent ions and cations that have been found to retard retrogradation (Chen *et al.*, 2003). The pH of the flour of sweet potato genotypes investigated (Fig 6), indicates that it will readily but easily retrograde. Nabubuya *et al.* (2012) and Anthony *et al.* (2014) also reported pH range of sweet potato to be 6.01 to 6.64 and 6.04 to 6.26, respectively.

The water absorption capacity is a term which describes the ability of the flour to absorb or to take in water during processing. The higher values of water absorption capacity recorded for the flours from sweet potatoes may be due to the high polar amino acid residue of protein having affinity for molecule of water (Yusuf *et al.*, 2008). The major chemical compositions that enhance the water absorption capacity of flours are proteins and

carbohydrates, since these constituents contain hydrophilic parts such as polar or charged side chain (Lawal and Adewale, 2004). The increase in water absorption capacity may be due to increase in solubility and loss of starch crystalline structure. The flour with high water absorption may have more hydrophilic constituents such as polysaccharides. In the present study the water absorption capacity ranged from 1.02 to 1.88 g/g. Similar results were reported by Eleazu *et al*. (2013); Idowu *et al*. (2013) and Agbemafle *et al*. (2013). Good water absorption capacity may prove useful in products where higher viscosity is required such as soups and gravies. Water absorption capacity is significantly and negatively correlated to starch (r = -0.595) indicating that decrease in starch content leads to an increase in water absorption capacity.

The oil absorption capacity of food protein depends upon intrinsic factors like amino acid composition, protein conformation and surface polarity or hydrophobicity. Hence, the major chemical component affecting oil absorption capacity is protein which is composed of both hydrophilic and hydrophobic parts. Fat absorption is an important property in food formulations because fats improve the flavour and mouth feel of foods (Odoemelam, 2005). The mechanism of fat absorption is attributed mainly to the physical entrapment of oil and the binding of fat to apolar chain of protein (Wang and Kinsella, 1976). Higher oil absorption capacity was found in the genotype GP-HUB-66 (Table 15) may be because of denaturation and dissociation of constituent proteins that may occur on heating which unmasks the non-polar residues from the interior of protein molecule. The results were in comparison with that of Adeleke and Odedeji (2010).

In the present study, the solubility ranged from 22.39 to 35.08 per cent. Higher solubility was seen in GP-HUB-95 may be because of its higher content of soluble sugar and pigment compounds compared to other genotypes. The results were in concurrence with that of Otalunde *et al.* (2015) and Rodrigues *et al.* (2016). Yadav *et al*. (2006) reported solubility of 20 to 30 per cent. Jangchud *et al*. (2003) 21.4 to 51.3 per cent (orange and purple fleshed sweet potato flours). Shih *et al.* (2009) 18.2 to 52 per cent (extruded orange and yellow sweet potato flours). Ahmed *et al.* (2010) 22.40 to 27.23 per cent (sweet potato flours) and Abegunde *et al*. (2013) 8.56 to 19.97 per cent (starches extracted from different varieties of sweet potato). Solubility of the flour of sweet potato genotypes was significantly and negatively correlated to swelling power (r = - 0.669) which indicated that increase in

solubility leads to a decrease in swelling power. Available carbohydrate (r = - 0.515) and energy (r = - 0.534) were significantly and negatively correlated to solubility, indicating that increase in available carbohydrate and energy leads to a decrease in solubility.

Swelling power is an indication of the water absorption index of the granules during heating (Loos *et al.*, 1981). The swelling power of sweet potato flour depends on the capacity of its starch molecules to hold water through hydrogen bonding. The high swelling capacity results in high uptake of water resulting in granule expansion and leaching of amylose into solution (Pomeranz, 1990). Several studies have shown that swelling capacity is well correlated to amylose and its properties; flour with high amylose content tends to have high swelling capacity (Nuwamanya *et al.*, 2011). In the present study, the swelling power ranged from 6.85 to 10.55 g/g. Higher swelling power was found in URT-TSP-12-12 may be because of higher starch (Fig 3) content. Lower was found in GP-HUB-95 may be because of formation of protein-amylose complex in native starches. Similar results were reported by Yadav *et al.* (2004); Adeleke and Odedeji (2010) and Agbemafle *et al.* (2014). The high swelling power of sweet potato flours studied in the present study renders it suitable for producing food product with gelatinized granules. Such example of this kind of food may be noodle production (Chen *et al.*, 2003).

The particle size of flour is one of the most important characteristics, which may influence other physicochemical properties such as swelling power, flour flowability and water-binding capacity (Singh *et al.*, 2003). With respect to particle size, on an average higher proportion of sweet potato flour was coarser and lower proportion of flour was finer (Table 14). The coarser size may due to the effect of domestic mixer for converting dry chips to flour and also may be because of high fibre and starch content. The limitations of the study that commercial mill could not be used for flour production. Mechanical milling if employed might result in fine flour.

Overall sweet potato flour poses good functional property and hence can be used for value addition at domestic, commercial and industrial level for the replacement of cereal flours in traditional and conventional products or formation of novel products.

Table 19 provides categorisation of sweet potato genotypes for end use. Based on the results, the genotypes GP-HUB-36, GP-HUB-95, GP-HUB-44, GP-HUB-26, GP-HUB-25

Table 19. Categorisation of sweet potato genotypes for end use

Table purpose	Value addition	Industrial purpose	Therapeutic use
Based on acceptability index	Based on crude fibre, protein, sugar, available carbohydrate and energy content	Based on flour yield and characteristics	Based on beta-carotene, total carotenoids, poly phenols and anthocyanin content
GP-HUB-36	MLT-Gouri	MLT-CIP-SWA	GP-HUB-66 (Orange fleshed)
GP-HUB-95	MLT-440127	GP-HUB-44	URT-TSP-12-12 (Purple fleshed)
GP-HUB-44	URT-TSP-12-12	GP-HUB-66	
GP-HUB-26	GP-HUB-66	GP-HUB-95	
GP-HUB-25	GP-HUB-14	URT-TSP-12-12	
GP-HUB-35	GP-HUB-25	MLT-Gouri	
	MLT-Vikram	MLT-440127	
		MLT-Vikram	
		Sreebhadra	
		URT-TSP-12-10	
		GP-HUB-26	
		GP-HUB-36	

and GP-HUB-35 having higher acceptability index (Table 12) on boiling, pressure cooking and baking were found to be suitable for table purpose. The genotypes MLT-Gouri, MLT-440127, URT-TSP-12-12, GP-HUB-66, GP-HUB-14, GP-HUB-25 and check variety MLT-Vikram can be recommended for value addition. These genotypes can be converted into value added products like flour, chips, crisps (fried and baked), ready to drink beverage, wine, bread, cookies, noodles, halwa and laddu, since these genotypes contain low crude fibre, high protein, sugar, available carbohydrate and energy content. Out of all the genotypes studied, few genotypes possessed higher flour yield and better flour characteristics like bulk density, water and oil absorption capacity, solubility and swelling power; hence they can be employed for industrial purpose. The list of such genotypes includes MLT-CIP-SWA, GP-HUB-44, GP-HUB-66, GP-HUB-95, URT-TSP-12-12, MLT-Gouri, MLT-440127, GP-HUB-36, MLT-Vikram, Sreebhadra, URT-TSP-12-10, GP-HUB-26 and GP-HUB-36. Industrially these can be converted to flour and commercialized. Orange fleshed genotype GP-HUB-66 contains good amount of beta-carotene and total carotenoids (Haskell *et al*., 2004). Similarly the genotype URT-TSP-12-12 having purple fleshed (Table 1) is assumed to possess poly phenols and anthocyanins (Steed *et al*., 2008). Since beta-carotene, total carotenoids, poly phenols and anthocyanins are rightly called neutraceutical components, the sweet potato genotypes rich in these components can be employed for the production of health foods.

Future line of work

- Utilization of flour for traditional and novel products
- Analysing the neutraceutical components and antioxidant potential of sweet potato genotypes.

Summary and Conclusions

6. SUMMARY AND CONCLUSIONS

India has a long history of sweet potato cultivation. It is an important tuber crop grown in almost all parts of India. Sweet potato is cultivated in about 0.14 million hectares. In 2014-15, sweet potato was cultivated in about 1.11 million hectares, the total production was 11.3 million tonnes and productivity was 10.1 tonnes/hectare. The major area under this crop in India is spread over states: Karnataka, Orissa, Bihar, Uttar Pradesh and West Bengal. About 22% of sweet potato production of the country is in Uttar Pradesh. In Karnataka, the area for cultivation of sweet potatoes is 24,000 Ha, the production is 1.57 million tonnes and the productivity is 6,637 kg/hectare annually. Sweet potato is used mostly as vegetable and snack food. Sweet potato is an important source of protein, starch and other carbohydrates, besides being low in fat and cholesterol. The tuber is also a good source of vitamin C, vitamin E, dietary fibre, potassium and iron. Fresh sweet potato roots are bulky and highly perishable therefore sweet potato roots can be sliced, dried, and ground to produce flour which possesses good shelf life.

The present study entitled “Nutrient composition and value addition to sweet potato genotypes” was carried out in Department of Food Science and Nutrition, College of Community Science, UAS, Dharwad with the objectives to record the colour and physico-chemical properties, to estimate the nutrient composition, to evaluate the cooking quality and acceptability, to investigate the flour production potential and characterization of flour of sweet potato genotypes.

Fourteen sweet potato genotypes with varied skin and flesh colour and one check variety (MLT-Vikram) were collected from Regional Horticultural Research and Extension Centre, Dharwad, University of Horticultural Sciences, Bagalkote. The physicochemical properties and nutrient composition were analysed using standard procedures. Cooking quality of the sweet potato genotypes was analysed and acceptability of the tubers was evaluated organoleptically employing a panel of ten semi-trained judges of the Department of Food Science and Nutrition, College of Community Science, UAS, Dharwad. The sweet potato tubers were cooked by three different methods boiling, pressure cooking and baking and evaluated for appearance, colour, flavour, taste, texture and overall acceptability on nine point hedonic scale. The sweet potato tubers were converted to flour. Flour production potential, particle size and functional properties of the flours were studied.

The salient findings of the study are summarised below:

- The skin colour varied from pale rose, gulf red to pale cream. The flesh colour varied from white cream, light cream, dark cream, orange to purple. The check variety MLT-Vikram had gulf red skin and white flesh.
- Significant differences existed between the sweet potato genotypes for physical parameters except bulk density. The check variety MLT-Vikram was lengthier (18.91 cm), the genotype GP-HUB-95 was wider and had higher circumference (10.91 cm and 28.98 cm), the genotype GP-HUB-14 was heavier, had higher volume and lower bulk density (397.9 g, 477.00 ml and 0.80, respectively).
- Significant differences existed between sweet potato genotypes in terms of pH, total soluble solids, titratable acidity and dry matter. The pH, total soluble solids, titratable acidity and dry matter ranged from 5.48 to 7.00, 5.50 to 11.83 °B, 0.04 to 0.16 g per cent, 25.90 to 41.52 g per cent respectively.
- All the proximate principles except ash on fresh weight basis differed significantly between the sweet potato genotypes. The genotype GP-HUB-14 had higher moisture and crude fibre (74.10 and 4.97 g per cent, respectively), the genotype URT-TSP-12-10 had higher protein content (3.17 g per cent), the check variety MLT-Vikram had higher fat, total and available carbohydrate, energy (0.68, 37.19, 35.87 g per cent, 160 kcal, respectively).
- All the proximate principles on dry weight basis differed significantly between the sweet potato genotypes. The moisture, protein, fat, ash, crude fibre, total carbohydrate, available carbohydrate and energy ranged from 6.28 to 8.34 g per cent, 5.36 to 9.68 g per cent, 0.22 to 1.65 g per cent, 2.67 to 4.36 g per cent, 1.84 to 4.96 g per cent, 76.65 to 83.14 g per cent, 72.89 to 80.24 g per cent, 339 to 358 kcal respectively.
- The vitamin C content on fresh weight basis varied significantly between the sweet potato genotypes. The genotypes URT-TSP-12-10 (23.88 mg/100 g) and GP-HUB-44 (22.67 mg/100 g) contained significantly higher vitamin C and were statistically on par with each other. The genotype GP-HUB-66 contained significantly lower amount of vitamin C (7.33 mg/100 g).

- All the macro minerals and micro minerals differed significantly between the sweet potato genotypes. The calcium, magnesium, phosphorus, copper, iron and zinc content ranged from 500 mg/100 g in GP-HUB-14 to 950 mg/100 g in GP-HUB-44, 300 mg/100 g in GP-HUB-25 to 720 mg/100 g in GP-HUB-44, 89.01 mg/100 g in URT-TSP-12-12 to 183.65 mg/100 g in GP-HUB-14, 0.16 mg/100 g in GP-HUB-44 to 0.39 mg/100 g in MLT-440127, 2.32 mg/100 g in GP-HUB-66 to 6.81 mg/100 g in GP-HUB-95, 0.77 mg/100 g in MLT-440127 to 1.52 mg/100 g in GP-HUB-95.
- Carbohydrate profile including reducing sugar, non-reducing sugar, total sugar and starch varied significantly. Significantly higher reducing sugar (5.00 g %), non-reducing sugar (6.46 g %) and total sugar (11.80 g %) were found in the genotype GP-HUB-66. Significantly higher starch content was seen in the genotype MLT-Gouri (66.50 g %).
- Total sugar was significantly and positively correlated to reducing (r = 0.629) and non reducing sugar (r = 0.829).
- Significantly higher soluble (5.76 g %) and total dietary fibre (15.20 g %) content was seen in the genotype GP-HUB-95. The genotype GP-HUB-44 showed significantly higher insoluble dietary fibre (10.16 g %).
- Increase in weight (%) after cooking varied significantly and ranged from 0.00 to 14.84 %. The check variety MLT-Vikram showed significantly higher increase in weight (14.84 %) and the genotype GP-HUB-66 did not gain weight after cooking.
- Cooking time of the sweet potato genotypes ranged from 15.50 to 21.66 min. The genotype GP-HUB-14 took lengthier time for cooking (21.66 min) and the genotype GP-HUB-25 could be cooked in 15.50 min.
- Significant differences were found between the sweet potato genotypes for sensory scores of boiled tubers except flavour, taste and texture. The genotype GP-HUB-44 was highly acceptable one with sensory scores for appearance (7.80), colour (7.90), flavour (7.70), taste (7.80), texture (7.50) and over all acceptability (7.80).
- Acceptability scores of pressure cooked sweet potato genotypes differed significantly. The genotype GP-HUB-36 was highly acceptable with sensory scores for appearance (8.30), colour (8.20), flavour (8.10), taste (7.90), texture (8.00) and over all

acceptability (8.10). The genotype MLT-440127 (5.20) and the check variety MLT-Vikram (5.00) were the least acceptable one and were on par with each other.

- Significant differences were found between the sweet potato genotypes for sensory scores of baked tubers. The genotype GP-HUB-95 was highly acceptable one with sensory scores for appearance (8.20), colour (8.00), flavour (7.80), taste (8.20), texture (7.90) and over all acceptability (8.20). The genotype MLT-CIP-SWA was the least acceptable one with sensory scores for appearance (5.10), colour (5.20), flavour (6.20), taste (6.20), texture (6.10) and over all acceptability (6.10).
- The acceptability indices of sweet potato genotypes cooked by different methods varied significantly. In terms of boiling, the genotype GP-HUB-44 was highly acceptable (86.11). The genotype GP-HUB-36 was highly acceptable one (90.00) on pressure cooking. In terms of baking, GP-HUB-95 was highly acceptable one (89.44).
- The flour yield and bulk density of sweet potato genotypes varied significantly. The genotype MLT-CIP-SWA had significantly higher flour yield (42.24 g %) while the genotype GP-HUB-26 had significantly lower flour yield (26.42 g %). Significantly higher (0.86 g/ml) bulk densities was seen in the genotype MLT-440127 and significantly lower (0.67 g/ml) bulk density was seen in the genotype GP-HUB-66.
- Significant differences were found between the pH of flour of sweet potato genotypes. The pH of the sweet potato flour was slightly acidic and ranged from 6.44-6.98.
- Yield of more of coarser flour and less of finer flour was found among the sweet potato genotypes. Yield of finer flour was more in GP-HUB-14 (2.31 g/100 g) and less was seen in MLT-CIP-SWA (0.03 g/100 g). Yield of coarser flour was more in Sreebhadra (57.82 g/100 g) and less was seen in MLT-Gouri (34.50 g/100 g).
- The water absorption capacity of the sweet potato genotypes ranged from 1.02 g/g in MLT-440127 to 1.88 g/g in GP-HUB-66. Significantly higher oil absorption capacity was seen in the genotype GP-HUB-66 (0.81 g/g) while the genotype GP-HUB-95 exhibited lower oil absorption capacity (0.57 g/g).
- The solubility in the sweet potato flour ranged from 21.34 to 35.08 g per cent with the genotype URT-TSP-12-12 (10.55 g/g) having significantly higher swelling power and the genotype GP-HUB-14 (6.81 g/g) showed significantly lower swelling power.

- Solubility of the sweet potato genotypes is significantly and negatively correlated to swelling power (r = - 0.669). Water absorption capacity is significantly and negatively correlated to starch (r = - 0.595). Available carbohydrate (r = - 0.515) and energy (r = - 0.534) are significantly and negatively correlated to solubility.

Conclusion

The sweet potato genotypes were rich in protein, total sugars, reducing sugars, vitamin C, starch, dietary fibre and minerals. Sweet potato genotypes could be successfully cooked by three different methods i.e. boiling, pressure cooking and baking. Among all the sweet potato genotypes and check variety MLT-Vikram, the genotype GP-HUB-95 was better in terms of parameters like total soluble solids, moisture, protein, crude fibre, iron, zinc, acceptability scores of boiled and baked sweet potato genotypes and solubility. The sweet potato flour can be used in the preparation of various food products and could be used to enhance the quality such as colour, flavour, natural sweetness and supplemented nutrients.

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Appendices

APPENDIX I

Estimation of sugars

Principle: Sugars contain free aldehyde or keto group in them. Hence, when heated with alkaline copper tartrate reduce the copper from the cupric to cuprous state and thus cuprous oxide is formed. When cuprous oxide is treated with arsenomolybdic acid, the reduction of molybdic acid to molybdenum blue takes place.

Reagents:

1. Alkaline copper tartrate –

   (a) Dissolve 2.5 g anhydrous sodium carbonate, 2 g sodium bicarbonate, 2.5 g potassium sodium tartrate and 20 g anhydrous sodium sulphate in 80 ml water and make up to 100 ml.

   (b) Dissolve 15 g copper sulphate in a small volume of distilled water, add one drop of sulphuric acid and make up to 100 ml.

   Mix 4 ml of solution b and 96 ml of solution a before use.

2. Arsenomolybdate reagent – Dissolve 2.5 g ammonium molybdate in 45 ml water. Add 2.5 ml sulphuric acid and mix well. Then add 0.3 g disodium hydrogen arsenate, dissolve in 25 ml water. Mix well and incubate at 37 °C for 24-48 hr.

3. Stock glucose solution: Dissolve 100 mg of glucose in 100 ml distilled water.

4. Working standard solution: 10 ml of stock diluted to 100 ml distilled water.

Reducing sugars

1. Known amount of sample (100 mg) was homogenized with 80% hot alcohol and extract was made up to the known volume (20 ml).

2. From this 1 ml was taken and it was made up to 5 ml.

3. Aliquots were taken in series of test tubes and 1ml of freshly prepared alkaline copper reagent was added, mixed well and placed in a boiling water bath for 20 min.

4. Tubes were cooled under tap water without shaking.

5. 1 ml of arsenomolybdate reagent was added and mixed immediately.

6. The volume was made up to 20 ml with distilled water and read at 510 nm against reagent blank.

7. The amount of reducing sugar present was calculated from the standard graph of D-glucose and the values were expressed as milligrams per gram of reducing sugar present in the sample.

Total sugars

1. 1 ml of sample extract was taken from 5 ml (step 2) and evaporated in a boiling water bath.
2. The test tube was cooled after complete evaporation of alcohol and was made up to a known volume (5 ml) with distilled water.
3. To 1 ml of this alcohol evaporated extract, 1 ml of 1 N HCl was added and placed in a water bath maintained at 50-60 °C for 20 min.
4. The tube was cooled, a drop of phenolphthalein indicator was added and mixed well, 1 N NaOH was added drop wise till the solution turned pink, 0.1 N HCl was added drop wise till the solution became colourless.
5. The contents of the tube were made up to known volume (10 ml) with distilled water. Aliquots were taken to estimate total sugar present (Nelson-Somogyi's method).

Non-reducing sugars

The quantity of reducing sugar was substracted from that of total sugar and multiplied by a conversion factor 0.95 to get non-reducing sugar.

$$\text{Non-reducing sugars} = \text{Total sugar} - \text{Reducing sugar} \times (0.95)$$

APPENDIX II

Estimation of starch

Principle: Carbohydrates are first hydrolysed into simple sugars using dilute hydrochloric acid. In hot acidic medium glucose is dehydrated to hydroxymethyl furfural. This compound forms green colour with anthrone reagent.

Materials

Glass wares: Volumetric flask, conical, flask, beakers.

Reagents: 80 % ethanol, 52 % perchloric acid, anthrone sulphuric acid – 2g anthrone in 95 % cold sulphuric acid, Standard stock: 100 mg glucose in 100 ml water. Ten times diluted for a working standard.

Procedure

- Weigh 0.5g of flour into a 50 ml centrifuge tube.
- Add few drops of 80 % ethanol to wet the flour and prevent clumping, add 5 ml of water and stir thoroughly.
- Add 25 ml of hot 80 % ethanol, mix well and centrifuge after 5 min of standing.
- Decant and discard alcoholic solution.
- Add 30 ml of fresh hot 80 % ethanol, stir and centrifuge as before.
- Discard the alcoholic solution. Repeat the washing twice for a total 4 washings or until a test with anthrone is negative.
- To the residue after final centrifugation, add 5 ml of water.
- Cool in ice water and while stirring add 6.5 ml of diluted perchloric acid reagent.
- Stir for about 5 min with a glass rod.
- Keep for 15 minutes, stir occasionally, add 20 ml of water and centrifuge.
- Pour the aqueous starch solution in 100 ml volumetric flask cooled in ice water and stir while adding 6.5 ml diluted perchloric acid reagent.
- Solubilise as before for 30 minutes at 0 °C with occasional stirring and wash the contents into a 100 ml flask containing the first extract.
- Dilute the combined solutions to 100 ml and filter.

Determination of starch

- Take 0.1 ml, 0.3 ml, 0.5 ml aliquots for analysis.
- Prepare standards by taking 0 to 1 ml of working standards.
- Make up volume to 1 ml in all test tubes.
- Add 4 ml of anthrone reagent.
- Heat for eight minutes in a boiling water bath.
- Cool rapidly and read the green to dark green colour at 630 nm.
- From the standard curve obtained, calculate the concentration of starch in the sample.

APPENDIX III

Estimation of dietary fibre

Materials required

Glass wares: crucibles, beakers, volumetric flasks.

Reagents: 95 % ethanol, 78 % ethanol, 0.08 M Phosphate buffer (pH=6), pepsin, pancreatin, α-amylase heat stable solution.

Procedure

1 g of duplicate sample was weighed accurate to 0.1 mg into 500 ml beakers. Heat stable α-amylase solution (0.1 ml) was added. The beakers were covered with aluminium foil and placed in boiling water bath. It was ensured that the contents of the beakers reach 100 °C and incubated for 15 min at this temperature. The solution was cooled to room temperature and the pH adjusted to 7.5 with NaOH solution.

Protease solution 0.1 ml was added to the beaker. The beaker was covered with aluminium foil and incubated for 30 min at 60 °C with continuous agitation. The crucible was weighed with a fritted disc containing 1 g celite to constant weight. The celite in the crucible was made into a bed using a stream of 78% ethanol and applying suction. The suction was maintained and the precipitate was transferred quantitatively from enzyme digest to crucible using filtration module.

Estimation of soluble dietary fibre

Four volumes of pre-heated (60 °C) 95 % ethanol is added to the filtrate obtained during the estimation of IDF and allowed the precipitation to complete for 60 min, it is filtered through an accurately weighed crucible with celite.

Total dietary fibre is the sum of insoluble and soluble dietary fibres.

$$\text{Insoluble dietary fibre (g \%)} = \frac{(D_1 - B_1) - B_1 \times 100}{W}$$

B_1= (crucible weight with celite – weight of dry crucible)

$$\text{Soluble dietary fibre (g \%)} = \frac{(D_2 - I_2) - B_2 \times 100}{W}$$

B_2= (crucible weight with celite – weight of dry crucible)

Where, W – Sample weight (g)

D – Weight after drying (g)

I – Weight after incineration (g)

B – Weight of ash free blank (g)

Total dietary fibre (g %) = Soluble dietary fibre (g %) + Insoluble dietary fibre (g %)

APPENDIX IV

Estimation of magnesium

Magnesium was estimated by Derderian (1961) method.

Principle: Zirconyl oxychloride forms insoluble salt with orthophosphates at the pH of 5.5 – 6.5. Erichrome black T and murexide indicator for calcium and calcium + magnesium respectively is added to phosphate free sample solution which was then titrated with EDTA. For calcium EDTA titration will give sky blue color and for calcium + magnesium violet color.

Reagents:

a) Ammonium hydroxide 1:1 (NH_4 OH: H_2O)

b) Bromocresol green 0.1 % aqueous solution

c) EDTA 0.01 N – dissolve 2 g EDTA disodium salt in distilled water and make up volume to 1,000 ml, standardize against 0.01N $CaCO_3$ solution.

d) Zirconyl oxychloride 2 % in water

e) Erichrome black T indicator- 0.50 g (EBT) in 100 ml methanol + 4.5 g hydroxylamine hydrochloride

f) Murexide indicator- grind 0.1 g murexide with 20 g K_2SO_4 (prepare fresh every week and dry)

g) NH_4Cl - NH_4OH buffer – 67.5 g of NH_4Cl + 570 ml NH_4OH and dilute to 1,000 ml with distilled water

h) NaOH 4 N – 10 g NaOH in 100 ml distilled water.

Procedure: Transfer an aliquot of the plant digest, preferably not exceeding 40ml and containing not more than 1 mEq of calcium into a 50 ml volumetric flask. Add 3 to 4 drops of bromocresol green (yellowish organic color) and 2 ml of 2% zirconyl oxychloride solution. Add 1:1 ammonium hydroxide drop wise until color turns blue. Wash on the sides of the flask with water the addition of each reagent. Make the solution to a known volume with distilled water and mix. Filter through a dry filter paper and collect filtrate in a beaker. Discard the residue without washing. Estimate calcium and magnesium in the filtrate.

For calcium and magnesium: Pipette out 10 ml aliquot of filtrate into a china dish and add 10 drops of NH_4Cl - NH_4OH buffer and 2-3 drops of EBT indicator. It gives a wine red color. Titrate with 0.01 N EDTA till color turns from wine red to sky blue. Note down the volume of EDTA consumed (TV_1).

Pipette out another 10 ml aliquot of filtrate into china dish, add a pinch of muroxide indicator. It gives rose red color to it. Now add 1 ml of 4 N NaOH. Titrate it with 0.01 N EDTA till color changes to violet. Note down the volume of EDTA consumed (TV_2).

Calculation:

Titre value of calcium (Ca) = TV_2

Titre value of magnesium (Mg) = TV_1-TV_2

$$\% \text{ Ca} = \frac{TV_2 \times \text{N of EDTA} \times \text{Eq. wt. of Ca}}{1000} \times \frac{\text{Volume of plant digest}}{\text{Weight of plant sample}} \times \frac{\text{Vol. made after treatment}}{\text{Vol. of digest taken}} \times \frac{1}{\text{Vol. of filtrate used for titration}}$$

$$\% \text{ Mg} = \frac{(TV_1 - TV_2) \times \text{N of EDTA} \times \text{Eq. wt. of Ca}}{1000} \times \frac{\text{Volume of plant digest}}{\text{Weight of plant sample}} \times \frac{\text{Vol. made after treatment}}{\text{Vol. of digest taken (pretreated)}} \times \frac{1}{\text{Vol. of filtrate used for titration}}$$

APPENDIX V

Estimation of trace elements

Principle: The sample is treated with a mixture of mineral acids (tri) and heated for more rapid decomposition. The volatile constituents disappear and non-volatile mineral elements enter into the solution. Heating is continued until digest is reduced to a few ml of clear white residue. The residue is dissolved in 6 N HCl, filtered and made to a known volume with distilled water for various elemental analyses.

Materials required: Whatman No. 42 paper, sand bath, double distilled water, tray with ice cubes.

Chemicals required: Concentrated nitric acid, concentrated sulphuric acid, perchloric acid, hydrochloric acid.

Reagents required: Tri acid mixture mix: 100 ml of conc. Nitric acid, 10 ml of conc. Sulphuric acid, 40 ml of 60 % perchloric acid or 30 ml of 72 % perchloric acid (Nitric acid: Sulphuric acid: Perchloric acid in the ratio of 10:1:4, respectively), hydrochloric acid and conc. Nitric acid.

Glassware required: Conical flask – 50 ml, volumetric flask, petri plate, reagent bottles (brown), funnel, glass rod.

Preparation of reagents:

To prepare 50 ml of triacid mixture

Nitric acid: 150 ml – 100 ml

50 ml - ?

(100 x 50) / 150 = 33.3 ml nitric acid

Sulphuric acid: 150 ml – 10 ml

50 - ?

(50 x 10) / 150 = 3.3 ml sulphuric acid

Perchloric acid: 150 – 40 ml

50 ml - ?

(50 x 40) / 150 = 13.3 ml perchloric acid

Preparation of 200 ml of 6N HCl:

Grams of compound required= N desired x equivalent mass x volume in litres

= 6 x 36.46 x 0.2

= 43.75 g

Volume of concentration needed = g of acid needed x % concentration x specific gravity

= 43.75 x 0.35 x 1.16

= 17.76 ml in 200 ml

Procedure:

a. Pre-digestion of sample with nitric acid: 1 g of sample was transferred to 100 ml conical flask and the sample was wetted with 10 ml of conc. Nitric acid and kept over night.

b. Digestion with the tri acid mixture: 5 ml of tri acid mixture was added and kept on the hot sand bath until dense fumes subsides, leaving about 3 ml of colorless solution in the conical flask which on cooling gives white residue.

c. Preparation of test solution: 5 ml of 6 N HCl was added to the residue. The content was swirled and then transferred to 50 ml volumetric flask by filtering through Whatman No. 42 filter paper. The procedure was reapeated 3 – 4 times with additional quantity of 6 N HCl until the entire residue was filtered. The conical flask was rinsed with distilled water and the contents were transferred to the volumetric flask. The volume was made up to 50 ml with distilled water or with 6 N HCl, washing off the residue on filter paper. The flask was stoppered and preserved for elemental analysis. Then the readings were taken in atomic absorption spectrophotometer.

Calculation:

$$\text{ppm of micronutrient} = \frac{\text{ppm of the sample}}{1000} \times \frac{\text{volume of sample digest}}{\text{weight of the sample}} \times 1000 \times \text{dilution factor}$$

= …….. mg / kg

= …….. mg / 100 g.

APPENDIX VI

Score card for organoleptic evaluation of cooked sweet potato genotypes

Rating: 9-like extremely; 8-like very much; 7-like moderately; 6-like slightly; 5-neither like nor dislike; 4-dislike slightly; 3-dislike moderately; 2-dislike very much; 1-dislike extremely.

Kindly evaluate the samples independently and mention the appropriate score in the cells.

Parameters	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Appearance															
Colour															
Flavour															
Taste															
Texture															
Overall acceptability															

Comments:

Name of the judge: Signature:

APPENDIX VII

Vitamin C content of sweet potato genotypes

Sl. No	Genotypes	Vitamin C (mg/100 g) fwb
White flesh		
1	GP-HUB-14	9.52 ± 0.64^{ab}
2	MLT-CIP-SWA	9.55 ± 2.37^{ab}
Cream flesh		
3	URT-TSP-12-10	23.88 ± 0.80^{d}
4	GP-HUB-25	10.57 ± 0.64^{abc}
5	GP-HUB-26	7.28 ± 0.57^{a}
6	GP-HUB-35	6.93 ± 0.63^{a}
7	GP-HUB-36	8.39 ± 0.57^{a}
8	GP-HUB-44	22.67 ± 0.49^{d}
9	GP-HUB-95	7.99 ± 2.00^{a}
10	MLT- 440127	13.91 ± 2.19^{c}
11	MLT-Gouri	14.56 ± 2.29^{c}
12	Sreebhadra	10.65 ± 2.31^{abc}
Orange flesh		
13	GP-HUB-66	7.33 ± 1.26^{a}
Purple flesh		
14	URT-TSP-12-12	13.39 ± 2.32^{bc}
Check (White flesh)		
15	MLT-Vikram	13.63 ± 2.36^{c}
	Mean	12.02 ± 1.42
	F value	31.21
	S. Em. ±	0.93
	C. D. @ 1% level	3.64**

Note: Means are average of three replications ± SD, ** - Significant at 0.01 level

APPENDIX VIII

Cooking quality of sweet potato genotypes on boiling

Sl. No	Genotypes	Raw weight (g)	Cooked weight (g)	Increase in weight (%)	Time taken for cooking (min)
White flesh					
1	GP-HUB-14	84.00 ± 1.00^{gh}	86.00 ± 1.00^{de}	2.42 ± 0.03^{b}	21.66 ± 0.29^{f}
2	MLT-CIP-SWA	77.00 ± 2.00^{f}	74.66 ± 2.51^{c}	2.68 ± 0.80^{b}	20.66 ± 0.57^{ef}
Cream flesh					
3	URT-TSP-12-10	40.00 ± 2.00^{b}	42.00 ± 2.00^{a}	5.00 ± 0.25^{de}	18.33 ± 0.57^{bc}
4	GP-HUB-25	69.33 ± 1.15^{de}	73.66 ± 0.57^{c}	5.72± 0.95^{e}	15.50 ± 0.50^{a}
5	GP-HUB-26	115.00 ± 2.00^{j}	117.67 ± 2.51^{g}	2.60 ± 0.46^{b}	18.16 ± 0.28^{b}
6	GP-HUB-35	90.33 ± 1.52^{i}	93.33 ± 1.52^{f}	3.32 ± 0.05^{bcd}	18.50 ± 0.50^{bc}
7	GP-HUB-36	86.66 ± 1.53^{hi}	90.66± 1.52^{ef}	4.65 ± 0.09^{cde}	18.66 ± 0.57^{bc}
8	GP-HUB-44	65.00 ± 2.00^{cd}	67.00 ± 2.00^{b}	3.07 ± 0.95^{bc}	15.50 ± 0.50^{a}
9	GP -HUB-95	146.00 ± 3.00^{k}	157.67 ± 2.51^{h}	8.24 ± 0.13^{f}	20.50 ± 0.50^{de}
10	MLT- 440127	79.00 ± 2.00^{fg}	81.66 ± 2.51^{d}	3.77 ± 1.17^{bcd}	19.50 ± 0.50^{c}
11	MLT-Gouri	70.00 ± 2.00^{de}	73.66 ± 2.08^{c}	5.87 ± 1.77^{e}	18.33 ± 0.57^{bc}
12	Sreebhadra	71.00 ± 3.00^{e}	75.00 ± 3.00^{c}	5.64 ± 0.23^{e}	18.16 ± 0.28^{b}
Orange flesh					
13	GP-HUB-66	83.00 ± 1.00^{gh}	82.66 ± 1.52^{d}	0.00 ± 0.00^{a}	18.66 ± 0.57^{bc}
Purple flesh					
14	URT -TSP -12-12	62.00 ± 2.00^{c}	64.33 ± 1.52^{b}	3.22 ± 0.10^{b}	18.16 ± 0.28^{b}
Check (White flesh)					
15	MLT-Vikram	34.00 ± 4.00^{a}	41.66 ± 3.51^{a}	14.84 ± 1.75^{g}	19.83 ± 0.28^{de}
	Mean	78.15 ± 2.01	81.44 ± 2.01	4.74 ± 0.58	18.67 ± 0.39
	F value	471.85	517.60	66.39	38.06
	S. Em. ±	1.24	1.24	0.41	0.27
	C. D. @ 1% level	4.85**	4.83**	1.62**	1.05**

Note: Means are average of three replications ± SD, ** - Significant at 0.01 level

APPENDIX IX

pH content of flour of sweet potato genotypes

Sl.No	Genotypes	pH
White fleshed		
1	GP-HUB-14	6.72 ± 0.05^{ab}
2	MLT-CIP-SWA	6.63 ± 0.03^{ab}
Cream fleshed		
3	URT-TSP-12-10	6.66 ± 0.06^{ab}
4	GP-HUB-25	6.80 ± 0.20^{ab}
5	GP-HUB-26	6.50 ± 0.50^{ab}
6	GP-HUB-35	6.52 ± 0.02^{ab}
7	GP-HUB-36	6.61 ± 0.01^{ab}
8	GP-HUB-44	6.74 ± 0.02^{ab}
9	GP-HUB-95	6.32 ± 0.42^{ab}
10	MLT- 440127	6.82 ± 0.02^{ab}
11	MLT-Gouri	6.68 ± 0.02^{ab}
12	Sreebhadra	6.60 ± 0.30^{ab}
Orange fleshed		
13	GP-HUB-66	6.44 ± 0.04^{a}
Purple fleshed		
14	URT-TSP-12-12	6.98 ± 0.02^{b}
Check (White flesh)		
15	MLT-Vikram	6.64 ± 0.02^{ab}
	Mean	6.64 ± 0.09
	F value	2.10
	S. Em. ±	0.11
	C. D. @ 1% level	0.43**

Note: Means are average of three replications ± SD, ** - Significant at 0.01 level

NUTRIENT COMPOSITION AND VALUE ADDITION TO SWEET POTATO [*Ipomoea batatas* (L.) Lam] GENOTYPES

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ABSTRACT

A study was conducted during 2016-17 in UAS, Dharwad, to evaluate physico-chemical properties, nutrient composition, cooking quality, acceptability and flour production potential of sweet potato genotypes (14) with MLT-Vikram as check. The genotypes were obtained from AICRP on tuber crops, RHREC, Dharwad, UHS, Bagalkote.

The weight and volume were higher in GP-HUB-14 (397.90 g and 477.00 ml, respectively) and bulk density was higher in GP-HUB-66 (2.01). The TSS and dry matter were higher in GP-HUB-44 (11.83 °B) and MLT-CIP-SWA (41.52 g %) respectively. GP-HUB-14 exhibited higher values of moisture, titratable acidity, ash, crude fibre and phosphorus (74.10, 0.14, 4.38 and 4.96 g % and 183.65 mg/100 g, respectively). Higher amounts of protein and vitamin C were recorded in URT-TSP-12-10 (9.68 g % and 23.88 mg/100 g, respectively). Higher fat, total carbohydrate and energy were seen in MLT-Vikram (1.65, 82.95 g % and 358 kcal, respectively). The genotypes GP-HUB-26 and GP-HUB-44 contained higher values of calcium (950 mg/100g each). pH, iron ,zinc, soluble and total dietary fibre were higher in GP-HUB-95 (7.00, 6.81, 1.52 mg/100 g, 5.76 and 15.20 g % respectively). Higher values of reducing, non-reducing and total sugar were recorded in GP-HUB-66 (5.00, 6.46 and 11.80 g %, respectively). Higher values of starch were seen in MLT-Gouri (66.50 g %). GP-HUB-14 took longer time for cooking (21.66 min). Greater increase in weight on boiling was observed in the check variety (14.84 %). On boiling, pressure cooking and baking, GP-HUB-44, GP-HUB-36 and GP-HUB-95, respectively, were most acceptable with acceptability indices of 86.11, 90.00 and 89.44, respectively. Greater flour yield was observed in MLT-CIP-SWA (42.24 g %). GP-HUB-66 possessed better water and oil absorption capacities (1.88 and 0.81 g/g, respectively). Solubility was higher in GP-HUB-95 (35.08 %) while swelling power and pH were greater in URT-TSP-12-12 (10.55 g/g and 6.98, respectively).