www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(6): 4423-4431

www.thepharmajournal.com
Received: 10-03-2023
Accepted: 17-04-2023

Parthavi Patel
Masters Student, Department of Biochemistry, B.A. College of Agiculture, Anand Agricultural University, Anand, Gujrat, India

J JDhruv
Research Scientist & Head, Department of Biochemistry, B. A. Collage of Agriculture, Anand Agriculture University, Anand, Gujrat, India

Amar Sakure
Professor & Head, Department of Genetics and Plant Breeding, B. A. Collage of Agriculture, Anand Agricultural University, Anand, Gujrat, India

Yashwanth Amara
Masters Student, Department of Biochemistry, B.A. College of Agiculture, Anand Agricultural University, Anand, Gujrat, India

Nirali Gamit
Masters Student, Department of Biochemistry, B.A. College of Agiculture, Anand Agricultural University, Anand, Gujrat, India

NJ Patel
Associate Professor, Department of Biochemistry, B.A. College of Agriculture, Anand Agricultural University, Anand, Gujrat, India

Corresponding Author:
Parthavi Patel
Masters Student, Department of Biochemistry, B.A. College of Agiculture, Anand Agricultural University, Anand, Gujrat, India

Evaluation of phytonutrients from potato (*Solanum tuberosum* L.) cultivars

Parthavi Patel, J JDhruv, Amar Sakure, Yashwanth Amara, Nirali Gamit and NJ Patel

Abstract
One of the most significant vegetable crops grown worldwide is the potato (*Solanum tuberosum* L.). Important phytonutrients like phenolics, flavonoids, polyamines, and carotenoids, which are found in potatoes, are much desired in a diet due to their positive effects on human health. The present investigation was carried out to evaluate phytonutrients from forty-three potato cultivars. The biochemical characters such as starch and total soluble sugars (2.68 %) were found higher in cv. 22-(P-4-400). The Kufri Chipsona-1 was registered with the minimum reducing sugars. The higher accumulation of crude protein and true protein content were observed in cv. 24-(P-48-800) and M. Modipuram C-10-400, respectively. The maximum accumulation of total phenol, and chlorogenic acid content was found in Kufri Nilkanth and Kufri Khyati, respectively. While, significantly higher amount of caffeic acid and salicylic acid were observed in cultivars22-(P-4-400) and Kufri Pukhraj, respectively. Total antioxidant activity was detected lower in Kufri Chipsona-1. Overall among the forty-three cultivars the cultivars 22-(P-4-400), Kufri Khyati, Kufri Nilkanth and Kufri Mohan have high nutritional value, which may use for table purposes. The breeder may use these cultivars for their quality improve potato programme. The cultivar Kufri chipsona-1 and cultivar 7(P-14-800) registered with lower content of anti-nutritional compounds such as glycoalkaloids, oxalate and phytate, respectively which may use for processing purposes.

Keywords: Moisture, sugars, protein, total phenols, total flavonoids, total antioxidant activity, phenolics, anti-nutritional compounds

Introduction
Potato is the fourth-most important food crop in the world after rice, wheat and maize, it is the only major food crop that is a tuber. In comparison to cereals, potatoes are a more efficient food crop, providing more dry matter, protein, and minerals per unit area. In affluent nations where potatoes are a staple diet, each person consumes 130 kcal of energy daily compared to 41 kcal in poor nations where potatoes are still regarded as vegetables. In addition to being a strong source of carbohydrate, potatoes also have a lot of small molecules and secondary metabolites that are crucial for a variety of functions [1]. Because of the many chemicals in potatoes that have positive health effects, potatoes are highly desirable in the human diet [2]. In nations where potatoes constitute the main staple meal, nutritional deficiencies are not commonly known [3]. Increasing the availability of nutrients to a large segment of the world's population is one of the global health goals.
The potato is a very healthy food that is very nutritious, easy to digest, and contains 79.3 % water. Its average dry matter composition is 17.5 % carbohydrates, including 15.4 % starch and 2.2 % dietary fibres; 2 % proteins; 0.09 % fats; 0.019 % vitamin C; and a significant amount of other vitamins and minerals [4-5]. It is a good source of several phytochemicals; the main polyphenol is chlorogenic acid. The two basic glycoalkaloids in potatoes are solanine (0.075 mg/g) and chaconine (0.12 mg/g) [6-7].
Secondary metabolites of plants known as phenolic substances share a common structural foundation with aromatic rings that have one or more hydroxyl substituents [8]. Because of their high consumption rates, potatoes have a greater total phenolic content than other common fruits and vegetables like carrots, onions, or tomatoes. This makes them good sources of phenolic compounds [9]. In order to protect itself from bacteria, fungi, viruses, and insects, the potato plant generates phenolic substances. Antioxidant capabilities and other attributes of phenolic compounds may contribute to health improvement. Both the potato peel and the flesh contain phenolic chemicals, yet studies have indicated that the peel has a higher content.

Phenolic acids are the phenolic chemicals that are most prevalent in potatoes. In potatoes, phenolic acids including caffeic, chlorogenic, p-coumaric, and ferulic acids are measured. There are also trace amounts of other phenolic acids such salicylic acid, syringic acid, vanillic acid, and sinapic acid [10].

The purpose of this study was to evaluate total phenolic content, total flavonoid content, antioxidant activity, phenolic compounds, and anti-nutritional substances from 43 potato cultivars. Consumers and producers might be interested in tubers with higher levels because they may have an influence on human health, particularly in areas where potatoes are the primary staple crop.

Materials and Method

An experiment consisting of 43 cultivars of potato wasconducted in completelyrandomized design with threereplications at the Department of Biochemistry Anand Agricultural University, Anand. Observations wererecorded moisture content (AOAC, 1970) [11], starch (Dubois *et al.*, 1956) [12], total soluble sugars (Dubois *et al.*, 1956) [12], reducing sugars (Miller, 1959) [13], true protein (Lowry *et al.*, 1951) [14], crude protein (AOAC, 1970) [11], total phenol (Bray and Thorpe, 1954) [15], total flavonoids (Sadasivam and Manickam, 1992) [16], antioxidant activity (Sadasivam and Manickam, 1992) [16], glycoalkaloids (Bushway *et al.*, 1983) [17], oxalate (Chai and Liebman, 2005) [18], phytate (Sadasivam and Manickam, 1992) [16] and Phenol profiling Rebey *et al.* (2012) [19] were determined from potato tuber.

As described by Panse and Sukhatme (1967) [20], the statistical analysis of variance technique is applied to the data collected for various observations. The "Analysis of Variance" method used a CRD, and treatment means for all characters were further compared using crucial differences at a 5% threshold of significance using the "F" test.

Results and discussion

Moisture

The moisture content was analyzed from potato tuber and the data were depicted in Table 1. The maximum and minimum moisture content was observed in Kufri Mohan (80.13 %) and 22-(P-4-400) (71.79 %), respectively. However, cultivars 22-(P-4-400), 14-(P-30-600), 6-(C-5-400), 20-(P-42-600), 4-(C-20-200), M.Modipuram (C-10-400), 13-(P-28-200), Kufri Sindhuri, 27-(PH-3-400), 10-(P-23-400), 12-(P-25-600) were found significantly at par with each other.

The moisture content is important for keeping the quality and shelf life of potato tuber as it decreases the probability of microbial growth, unwanted fermentation and many undesirable biochemical changes normally associated with these processes. The present experimental data indicated that most of the cultivars can be used for table purposes due to their higher moisture content. While the cultivars22-(P-4-400), 14-(P-30-600), 6-(C-5-400), 20-(P-42-600) may be used for processing purposes due to their lower moisture content. Our results are agreement with various scientists (Bandana *et al.*, 2016; Das *et al.*, 2021) [21-22].

Starch

Data pertaining to starch content are presented in Table 1. The average of starch content of potato cultivars was ranged between 12.21 to 16.46 %. The starch accumulation was found higher in cv. 22-(P-4-400) (16.46%). The cultivars 14-(P-30-600), 13-(P-28-200) and 22-(P-4-400) were also found to be at par with each other.

Table 1: Influence of cultivars on moisture, starch, total soluble sugars, reducing sugars and non-reducing sugars

Sr. No.	Name of cultivars	Moisture (%)	Starch (%)	Total soluble sugars (%)	Reducing sugars (%)
C1	7-(P-14-800)	76.59	13.52	2.32	0.76
C2	12-(P-25-600)	75.23	12.90	2.32	0.77
C3	19-(P-40-500)	76.50	14.20	2.15	0.71
C4	5-(C-28-200)	75.61	14.35	2.17	0.71
C5	20-(P-42-600)	74.21	14.75	2.40	0.80
C6	13-(P-28-200)	74.56	16.35	2.01	0.66
C7	28-(RH-2-600)	76.08	13.88	2.43	0.80
C8	4-(C-20-200)	74.41	15.22	2.25	0.74
C9	14-(P-30-600)	73.82	15.62	2.52	0.82
C10	23-(P-46-500)	77.24	12.75	1.86	0.61
C11	27-(PH-3-400)	74.81	13.31	2.12	0.70
C12	24-(P-48-800)	76.58	12.58	2.31	0.76
C13	22-(P-4-400)	71.79	16.46	2.68	0.89
C14	10-(P-23-400)	74.92	14.31	2.53	0.73
C15	16-(P-34-600)	75.89	12.94	2.41	0.80
C16	6-(C-5-400)	74.15	15.51	2.40	0.76
C17	11-(P-24-200)	76.49	12.73	1.76	0.57
C18	18-(P-36-400)	75.68	14.80	2.18	0.71
C19	26-(P-57-200)	76.50	14.65	2.08	0.69
C20	Kufri Lalit	77.51	12.77	1.95	0.64
C21	M. Modipuram P-35-400	78.53	13.39	1.96	0.64
C22	M. Modipuram C-10-400	74.51	14.41	2.05	0.68
C23	Kufri Lalima	77.31	13.04	2.04	0.69
C24	Kufri Ashoka	78.10	12.75	2.06	0.67
C25	Kufri Bahar	77.74	13.88	2.13	0.71
C26	Kufri Khyati	79.72	13.02	1.44	0.58
C27	Kufri Himalini	79.93	12.40	1.61	0.53
C28	Kufri Chandramukhi	76.16	15.02	1.38	0.57

C29	Kufri Sindhuri	74.75	15.25	2.21	0.67
C30	Kufri Mohan	80.13	12.95	1.97	0.65
C31	Kufri Surya	77.20	12.33	1.36	0.52
C32	Kufri Kesar	75.40	14.67	2.26	0.75
C33	Kufri Nilkanth	78.03	13.41	2.07	0.69
C34	Kufri Ganga	78.01	13.79	2.25	0.74
C35	Kufri Chipsona-1	76.39	15.20	2.34	0.52
C36	Kufri Jyothi	75.41	15.09	2.36	0.57
C37	Kufri Gaurav	78.10	14.40	2.13	0.70
C38	Kufri Anand	79.03	12.21	2.46	0.82
C39	Kufri Garima	77.75	14.99	2.01	0.66
C40	Kufri Arun	76.32	12.78	2.47	0.62
C41	Kufri Lima	78.04	12.78	1.59	0.52
C42	Kufri Pukhraj	76.30	13.00	2.15	0.72
C43	Kufri Badshah	77.24	14.30	2.04	0.68
	S.Em. ±	1.24	0.31	0.04	0.02
	CD at 5%	3.48	0.86	0.12	0.05
	CV %	2.80	3.81	3.47	4.86

Our major source of carbohydrates, which provide us energy and are essential to a healthy diet, are starchy foods. Thus the data indicated that due to higher accumulation of the starch cv. 22-(P-4-400), 13-(P-28-200), 14-(P-30-600), 6-(C-5-400), Kufri Sindhuri, 4-(C-20-200) and Kufri Chipsona-1 may use for processing purposes. While cv. Kufri Anand, Kufri Surya, Kufri Himalini and 24-(P-48-800) have lower accumulation of starch so they may be used for table purposes. The results are concomitant with the various scientists (Kaur and Aggrawal, 2014; Abbas *et al.*, 2011; Hassanpanah *et al.*, 2011) [23-25]. They have concluded that the potato cultivar possesses the starch content between 9 to 20 %.

Sugars

Sugar provides energy to body muscles and acts as a source of energy for brain and nervous system. Soluble sugars have various functions such as metabolic resources and structural constituents of cells, an important role in the defense reaction and signals regulating various processes associated with plant growth and development. The sugars analyzed from potato tubers and the data are presented in Table 1 Significantly the highest total soluble sugars content was recorded for cultivar 22-(P-4-400) (2.68 %). The cv. Kufri Surya has the lowest (1.36 %) total soluble sugars content which is significantly at par with Kufri Chandramukhi, Kufri Khyati. The results were found to be similar with reported by Kaur and Khurana (2017) [26] total soluble sugars content presented in potato was 3.29-0.56 %.

Reducing the amount of sugar in potato tubers has a significant impact on potato quality, particularly on the colour of processed products. The maximum and minimum reducing sugars content was observed in KufriChipsona-1(0.52 %) and 22-(P-4-400) (0.89 %), respectively (Table 1). Our results are also agreement with Kaur and Khurana (2017) & Kaur and Aggrawal (2014) [23, 26]. They have stated that reducing sugars content presented in potato was 0.06-0.87 %, in general.

The present study thus concludes that cultivars Kufri Surya, Kufri Chandramukhi, Kufri Lima, Kufri Chipsona-1, Kufri Himalini, Kufri Khyati, 11-(P-24-200) and 23-(P-46-500) being low in total and reducing sugars are the most suitable cultivars for processing. The rest of the cultivar is used for making good quality potato products but is unfit for processing due to high sugar content.

Protein

Data pertaining to crude protein are shown in Figure 1. The maximum and minimum crude protein content was observed in 24-(P-48-800) (2.81 %) and 28-(RH-2-600) (1.55 %), respectively. Crude protein percentage in different cultivars 28-(RH-2-600), Kufri Gaurav, Kufri Mohan, M.Modipuram (P-35-400) were found significantly at par each other. The similar pattern of results was obtained by Galdon *et al.* (2010) [27] and Ngobese *et al.* (2017) [28] in which they found protein content 1.71-2.38 % and 1.57-2.87 %, respectively in potato tuber. Data collected from the experiment for true protein content are recorded in Figure 2. True protein content was occurring maximum in M.Modipuram (C-10-400) (1.84 %) and minimum in 28-(RH-2-600) (0.90 %). According to Fernandes *et al.* (2015) [29] and Gikundi *et al.* (2021) [30] protein content presented in potato tuber was 1.6-1.8 % and 1.63-1.76 %, respectively.

Proteins are building blocks of all living organisms and they help in normalgrowth and development. They are also responsible for the maintenance and repair ofbody tissue. Plant proteins play various enzymatic, structural and functional roles. Thus the result indicated that the cultivars Kufri Chandramukhi, Kufri Surya, 6-(C-5-400), 7-(P-14-800), 22-(P-4-400), 12-(P-25-600), 24-(P-48-800), 20-(P-42-600), 27-(PH-3-400) and M. Modipuram C-10-400 may use as nutraceutical as well as table purposes because of their higher protein content.

Total phenols

Total phenols were analyzed from 43 potato cultivars and data are presented in Figure 3. Significantly the higher phenol content was recorded for Kufri Nilkanth (139 mg/100g) which is at par with cultivar 12-(P-25-600), 5-(C-28-200), Kufri Lima. The result of lower phenol content showed in 7-(P-14-800) (80 mg/100g), which is followed by 20-(P-42-600) (86 mg/100g), 27-(PH-3-400) (87 mg/100g) and Kufri Garima (89 mg/100g).

Phenolics are considered as widest secondary metabolites in the plant kingdom. Because of their redox qualities, which include acting as reducing agents, hydrogen donors, phenol singlet oxygen quenchers, and superior antioxidants, they are also useful. The findings of this study agree with the mentioned data of Jang and Yoon (2012) [31] that the highest amount of total phenols was observed in cultivar Blue (153 mg/100g) and the lowest in cultivar Superior (113 mg/100g).

Singh *et al.* (2009) [32] further reported that the total phenols content range varied from 43-110 mg/100g.Where has Valcarcel and his coworkers (2015) [8] revealed that the phenolics content range varied in potato tuber flesh from 9-203 mg/100g.

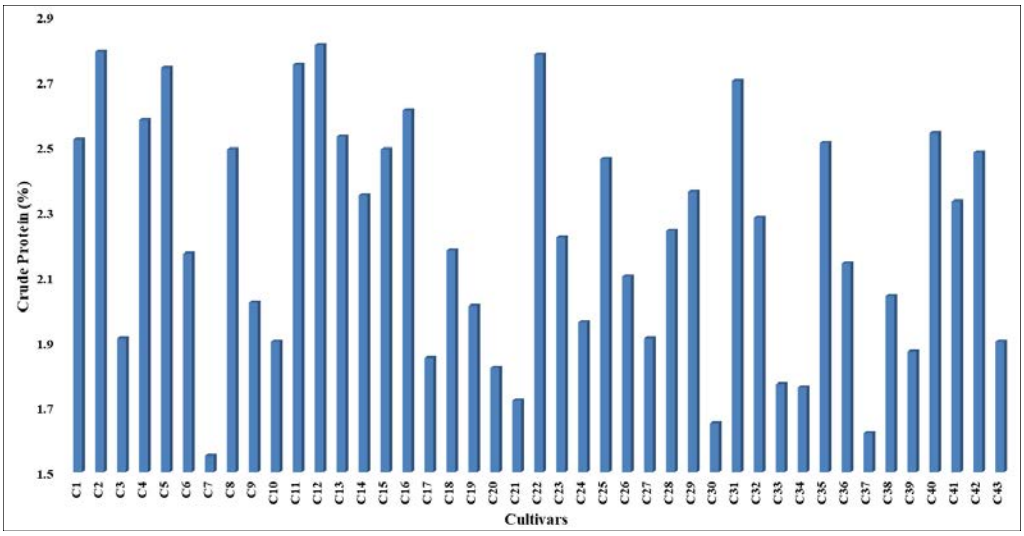

Fig 1: Influence of crude protein on potato cultivars

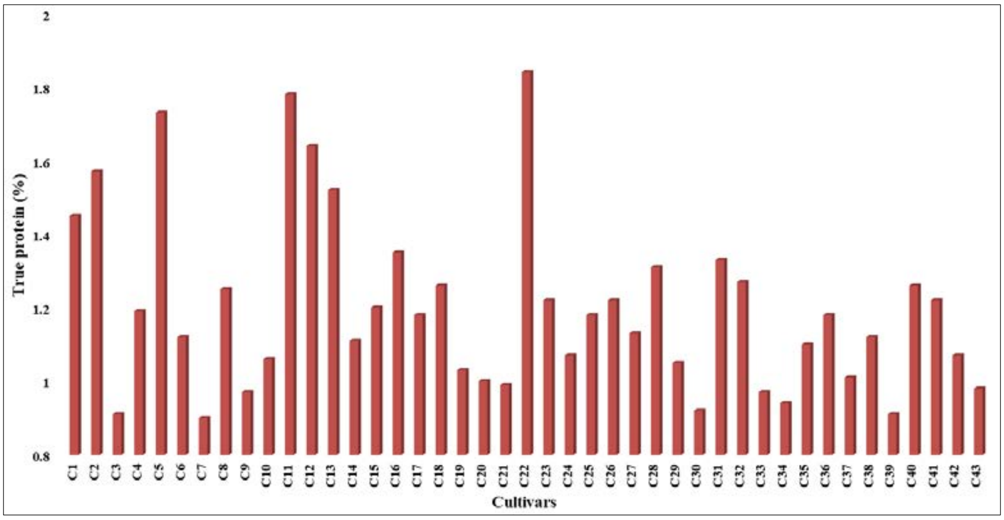

Fig 2: Influence of true protein on potato cultivars

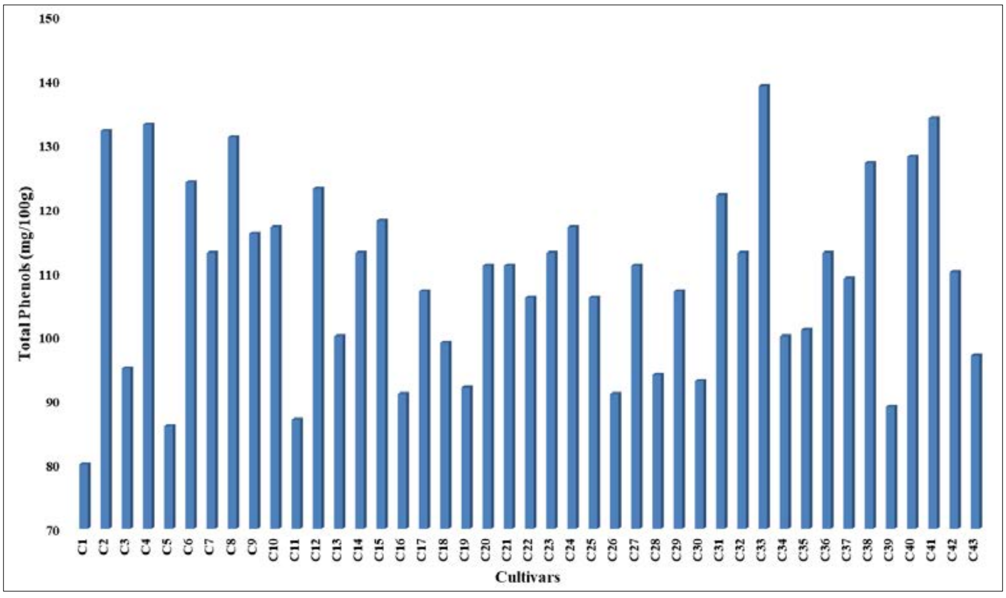

Fig 3: Influence of total phenols on potato cultivars

Flavonoids
Flavonoids are a class of polyphenolic compounds that have anti-inflammatory, free radical scavenging and hydrolytic oxidative enzyme inhibitory activities. The data presented in Figure 4. indicated that significantly lower flavonoid content was detected in Kufri Khyati (48 mg/100g) which was at par with Kufri Garima, Kufri Ganga, Kufri Gaurav and Kufri Chipsona-1. While a higher amount offlavonoid content was recorded for 5-(C-28-200) (87 mg/100g). Flavonoids are a class of polyphenolic compounds that have anti-inflammatory, free radical scavenging and hydrolytic oxidative enzyme inhibitory activities. Similar results were obtained by Valcarcel *et al.* (2015) [8] and Akyol *et al.* (2016) [10] they noted that the total flavonoid content range in potato tuber from 9-203 mg/100g.

Total antioxidant activity
Totalantioxidant activity ofthe potato tuber was analyzed and data are depicted in Figure **5.** The higher totalantioxidant activity was recorded for cultivar Kufri Jyothi (119 mg/100 g). The lower totalantioxidant activity was detected in KufriChipsona-1(78 mg/100g). Antioxidants delay or prevent oxidation. When a cell oxidizes, free radicals are created, which harm the cell. Antioxidants stop the chain process by eliminating free radicals. Similar findings were obtained by various scientists Al-Saikhan *et al.* (1995) [33] and Navarre *et al.* (2011) [34] in which the antioxidant activity range ofthe potato tuber from 27 to 219 mg/100g.

Phenolics
Different phenolic acids were studied from different potato cultivars are shown in Table 2. Phenolic acids (caffeic acid, p-coumaric acid, salicyclic acid, chlorogenic acid and vanillic acid) were detected in the various potato cultivars.

Phenolic acids, a subgroup of plant phenolics. The antibacterial, anticancer, antiviral, antifungal, anti-inflammatory, anti-mutagenic, and anti-diabetic effects of phenolic acids are well recognized. Different phenolic acids were studied from different potato cultivars are shown in Table 2. Phenolic acids (caffeic acid, p-coumaric acid, salicyclic acid, chlorogenic acid and vanillic acid) were detected in the various potato cultivars.

Chlorogenic acid derivatives represented the most dominant soluble phenolic acids in the analysed samples. Chlorogenic acid provides several benefits for your health, including anti-oxidant, anti-carcinogenic, anti-inflammatory, analgesic, antibacterial, neuroprotective, and cardioprotective properties. Increased insulin sensitivity, decreased intestinal glucose absorption, and slowed gluconeogenesis were all effects of chlorogenic acid.

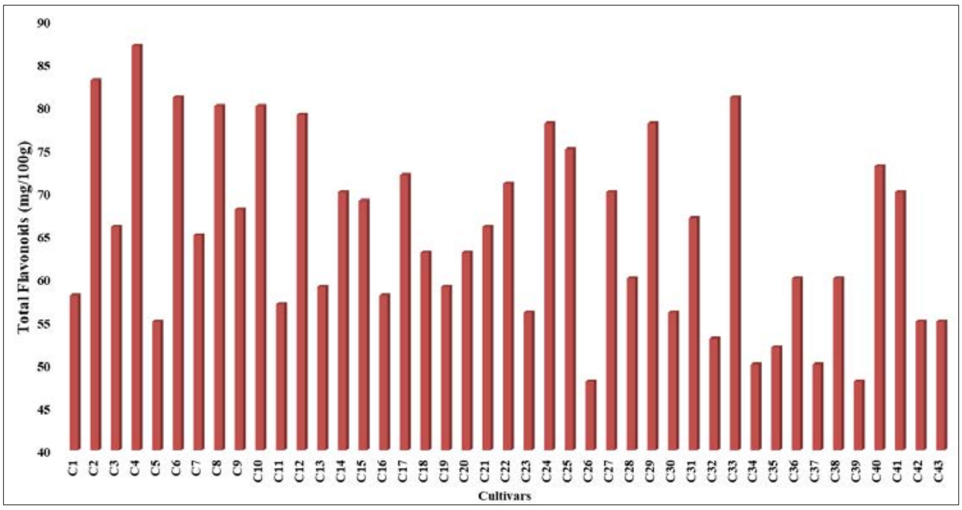

Fig 4: Influence of total flavonoids on potato cultivars

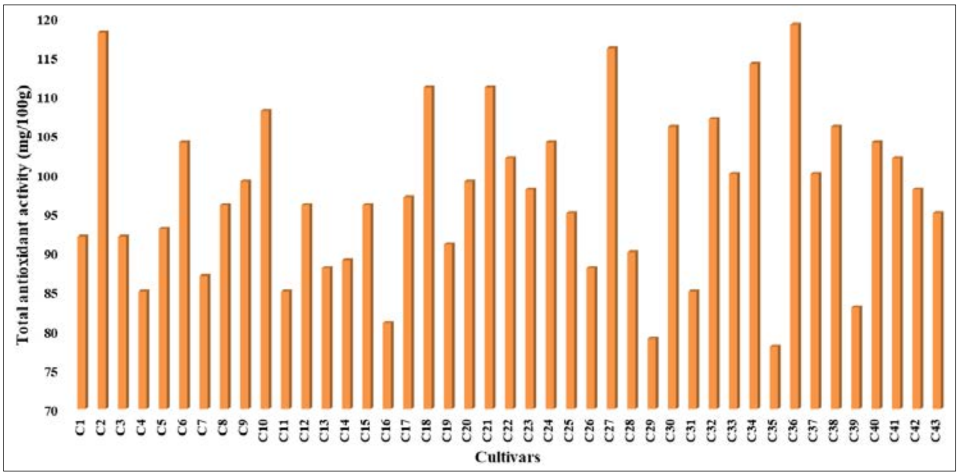

Fig 5: Influence of total antioxidants on potato cultivars

Chlorogenic acid was found in the range between 8.45-99.10 mg/100g in potato cultivars. The cultivar Kufri Khyati has a higher amount of chlorogenic acid (99.10 mg/100g) and 12-(P-25-600) has a lower amount of chlorogenic acid (8.45 mg/100g) (Table 2). p-Coumaric acid was detected maximum in cultivar Kufri Mohan (0.2610 mg/100g) followed by Kufri Badshah, Kufri Sindhuri, Kufri Chandramukhi and Kufri Chipsona-1. The cultivar 28-(RH-2-600) has lower amount of p-coumaric acid 0.0524 mg/100g (Table 2).

Table 2: Influence of cultivars on chlorogenic acid, caffeic acid, p-Coumaric acid, vanillic acid, salicylic acid

Sr. No.	Name of cultivars	Chlorogenic acid (mg/100g)	Caffeic acid (mg/100g)	p-Coumaric acid (mg/100g)	Vanillic acid (mg/100g)	Salicylic acid (mg/100g)
C1	7-(P-14-800)	13.00	0.119	0.159	0.0095	0.0135
C2	12-(P-25-600)	8.45	0.036	0.129	0.0059	0.0031
C3	19-(P-40-500)	33.20	0.131	0.069	0.0275	0.0141
C4	5-(C-28-200)	28.80	0.180	0.131	0.0075	0.0028
C5	20-(P-42-600)	25.00	0.090	0.087	0.0022	0.0024
C6	13-(P-28-200)	27.90	0.084	0.072	0.0124	0.0057
C7	28-(RH-2-600)	15.60	0.064	0.052	0.0148	0.0082
C8	4-(C-20-200)	33.00	0.161	0.130	0.0064	0.0041
C9	14-(P-30-600)	33.80	0.311	0.165	0.0069	0.0076
C10	23-(P-46-500)	48.60	0.198	0.068	0.0027	0.0028
C11	27-(PH-3-400)	44.90	0.279	0.185	0.0000	0.0061
C12	24-(P-48-800)	21.40	0.077	0.086	0.0273	0.0083
C13	22-(P-4-400)	89.80	0.311	0.134	0.0117	0.0485
C14	10-(P-23-400)	23.50	0.075	0.064	0.0000	0.0065
C15	16-(P-34-600)	27.40	0.116	0.153	0.0095	0.0080
C16	6-(C-5-400)	15.40	0.066	0.074	0.0050	0.0013
C17	11-(P-24-200)	17.90	0.068	0.081	0.0046	0.0013
C18	18-(P-36-400)	28.90	0.093	0.088	0.0000	0.0032
C19	26-(P-57-200)	32.20	0.081	0.081	0.0041	0.0038
C20	KufriLalit	48.50	0.179	0.060	0.0086	0.0033
C21	M.Modipuram P-35-400	38.70	0.259	0.103	0.0050	0.0045
C22	M.Modipuram C-10-400	20.80	0.126	0.193	0.0025	0.0039
C23	KufriLalima	32.20	0.153	0.087	0.0046	0.0091
C24	KufriAshoka	76.60	0.247	0.074	0.0314	0.0047
C25	KufriBahar	28.40	0.112	0.130	0.0000	0.0019
C26	KufriKhyati	99.10	0.256	0.157	0.0161	0.0038
C27	KufriHimalini	21.80	0.095	0.130	0.0048	0.0039
C28	KufriChandramukhi	43.20	0.143	0.214	0.0026	0.0033
C29	KufriSindhuri	56.30	0.258	0.221	0.0034	0.0033
C30	Kufri Mohan	69.00	0.243	0.261	0.0000	0.0025
C31	Kufri Surya	25.50	0.099	0.103	0.0040	0.0024
C32	KufriKesar	66.50	0.211	0.123	0.0069	0.0653
C33	KufriNilkanth	40.50	0.157	0.083	0.0083	0.0070
C34	Kufri Ganga	56.60	0.132	0.143	0.0027	0.0053
C35	Kufri Chipsona-1	41.30	0.153	0.212	0.0122	0.0068
C36	KufriJyothi	63.40	0.226	0.103	0.0153	0.0070
C37	Kufri Gaurav	34.30	0.109	0.074	0.0000	0.0027
C38	KufriAnand	28.20	0.157	0.168	0.0000	0.0017
C39	KufriGarima	51.50	0.208	0.110	0.0058	0.0019
C40	KufriArun	35.50	0.165	0.114	0.0044	0.0029
C41	Kufri Lima	50.00	0.284	0.164	0.0052	0.0061
C42	KufriPukhraj	60.90	0.216	0.130	0.0144	0.0998
C43	KufriBadsahah	26.50	0.148	0.243	0.0082	0.0049

Caffeic acid ranged between 0.0364-0.3110 mg/100g in potato cultivars. 22-(P-4-400) and 14-(P-30-600) had higher amounts of Caffeic acid and Lower content was found in 12-(P-25-600) (Table 2). The cultivars Kufri Ashoka and 20-(P-42-600) found maximum (0.0314 mg/100g) and minimum (0.0022mg/100g) amounts of vanillic acid, respectively (Table 2). Vanillic acid was not detected in cv. 27-(PH-3-400), 10-(P-23-400), 18-(P-36-400), Kufri Bahar, Kufri Mohan, Kufri Gaurav and Kufri Anand. Higher content of salicylic acid was found in cv. Kufri Pukhraj (0.0998 mg/100g) and lower in 6-(C-5-400) and11-(P-24-200) (0.0013 mg/100g) (Table 2). According to various scientists (Mattila and Hellstrom, 2007; Navarre *et al.*, 2011 and Akyol *et al.*, 2016) [10, 34, 35] chlorogenic acid (0.40-473 mg/100g), caffeic acid (0-4.1 mg/100g), vanillic acid (0-0.6 mg/100g) and p-coumaric acid (0.2-3.0 mg/100g) phenolics were present in potato cultivars.

Anti-nutrients

Different anti-nutritional factors were analyzed like glycoalkaloids, oxalate and phytate from various potato cultivars.

Glycoalkaloids content of potato cultivars represented in Figure 6 wasinthe range of 13.47 to 25.37 mg/100g. Kufri

Chipsona-1 having the lower value 13.47 mg/100g and 5-(C-28-200) having remarkably higher value 25.37 mg/100g which was followed by 11-(P-24-200) (23.50mg/100g). Potatoes naturally contain glycoalkaloids, which are harmful to humans in high concentrations. The glycoalkaloids -solanine and -chaconine are significant components of potatoes. They probably serve as stress metabolites or phytoalexins in nature, protecting the potato from pests like fungi and insects. These results are concomitant with those obtained by Bushway *et al.* (1983) [17] reported that total glycoalkaloids range from 1.8 to 106.8 mg/100g. Valkonen and his coworkers (1996) [36] reported that a higher concentration of glycoalkaloids more than 20 mg/100g can have a toxic effect on the animal and human kingdom. Overall it can be revealed that most of cultivars are use as nutraceutically except Kufri Mohan, Kufri Lima, Kufri Himalini, 13-(P-28-200), Kufri Khyati, Kufri Lalit, 28-(RH-2-600), 4-(C-20-200), 11-(P-24-200), 5-(C-28-200).

Oxalate content from potato cultivars was analyzed and data are depicted in Figure 7. The oxalate content was observed from 27.51 to 110.25 mg/100g. The lower value has occurred in Kufri Chipsona-1(27.51 mg/100g) which was significantly at par with cultivar 27-(PH-3-400) (29.4mg/100g), Kufri Surya (31.29mg/100g), Kufri Bahar (31.5mg/100g). The higher value was recorded for 26-(P-57-200) (110.25 mg/100g). The scrutiny of data was compared with Lewu *et al*. (2010) [37] who reported a 261.60 ± 16.72 mg/100g average range of oxalate content. According to Lo and his coworkers (2018) [38] oxalate content in potato tuber was 26 mg/100g and 40-50 mg/100g.

Thus the data indicated that due to lower accumulation of oxalate content in cv. Kufri Chipsona-1, 27-(PH-3-400), Kufri Surya, Kufri Bahar and Kufri Arun may be used for table purposes.

Phytate detected in potato cultivar is shown in Figure 8. The phytate contents were recorded from 28.62 mg/100g to 226.64 mg/100g. However significantly the highest and the lowest phytate content was recorded for cultivar 23-(P-46-500) (226.64 mg/100g) and 7-(P-14-800) (28.62 mg/100g), respectively. The partial retention of phytates is beneficial for their contribution to health benefits such as antidiabetic, antioxidant and anticancer effects. Similar results were observed by Lo *et al.* (2018) [38] who stated that the average range of phytate content in potato tubers was 40-50 mg/100g.

Thus it can be concluded that cultivars 7-(P-14-800), Kufri Chipsona-1, Kufri Jyothi and Kufri Bahar may be use for processing and table purposes due to lower accumulation of phytate content.

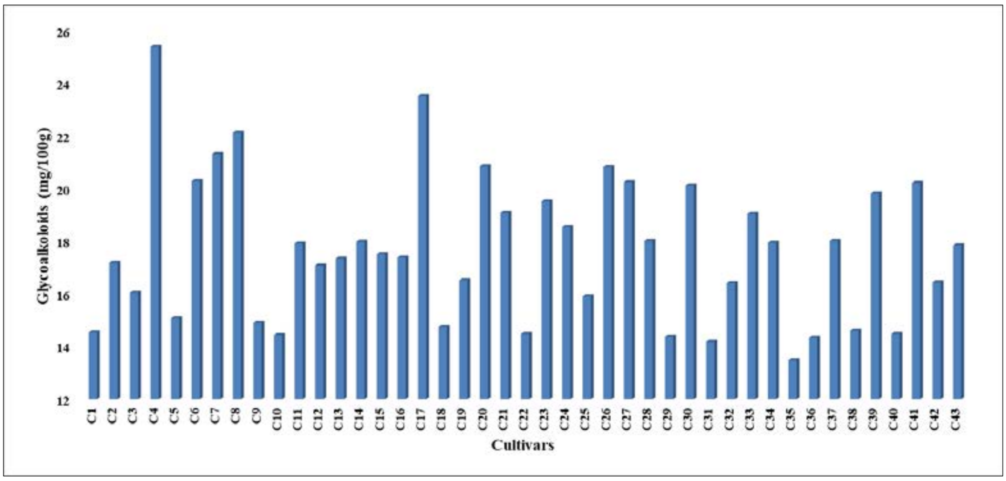

Fig 6: Influence of glycoalkoloids on potato cultivars

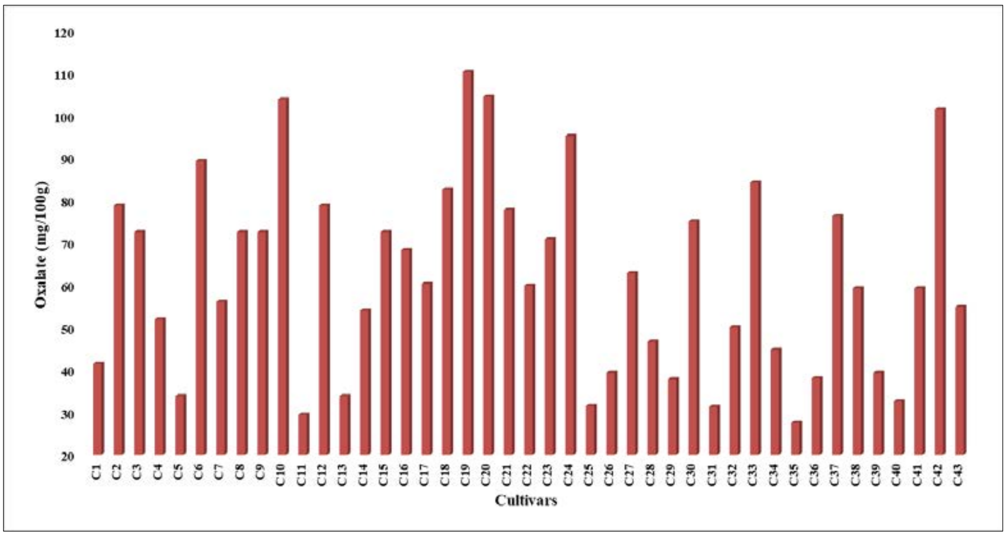

Fig 7: Influence of oxalate on potato cultivars

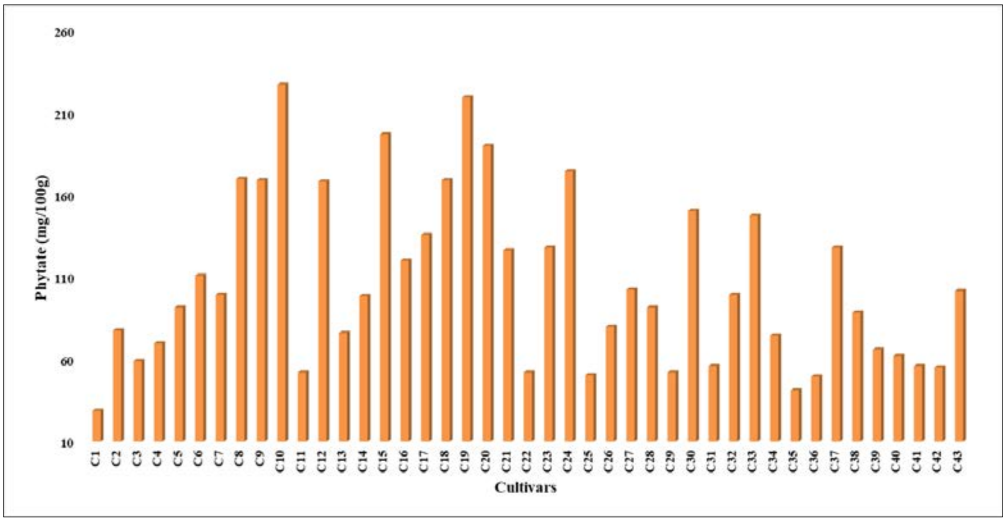

Fig 8: Influence of phytate on potato cultivars

Conclusion

Thus from the above results it can be concluded that the cv. 22-(P-4-400), KufriKhyati, KufriNilkanth and Kufri Mohan having highly nutritional value, which may use for table purpose. The breeder may use these cultivars for their quality improve potato programme. The cv. Kufri chipsona-1 and cv. 7(P-14-800) registered with lower content of antinutrition molecules such as glycoalkaloids, oxalate and phytate, respectively which may use for processing purpose.

References

1. Friedman M. Chemistry, biochemistry, and dietary role of potato polyphenols. A review. Journal of agricultural and food chemistry. 1997;45(5):1523-1540.
2. Katan MB, De Roos NM. Promises and problems of functional foods. Critical Reviews in Food Science and Nutrition. 2004;44:369–377.
3. McCay CM, McCay JB, Smith O. The nutritive value of potatoes. 1987.
4. Anonymous. Food and agriculture organization of the United Nations statistical database FAO, Rome. 2011. Retrieved from https://www.fao.org/faostat/en/#home retrieved on 31/05/2022.
5. Anonymous. USDA Nutrient database retrieved 2013. from https://data.nal.usda.gov/dataset/usda retrieved on 31/05/2022.
6. Kolasa K. The potato and human nutrition. American Potato Journal 1993;70:75-84.
7. Burlingame B, Mouille B, Charrondiere R. Nutrients, bioactive non-nutrients and anti-nutrients in potatoes. Journal of Food Composition and Analysis. 2009;22(6):494-502.
8. Valcarcel J, Reilly K, Gaffney M, O'Brien NM. Antioxidant activity, total phenolic and total flavonoid content in sixty varieties of potato (*Solanum tuberosum* L.) grown in Ireland. Potato Research. 2015;58(3):221-244.
9. Chun O, Kim D, Smith N, Schroeder D, Han J, Lee C. Daily consumption of phenolics and total antioxidant capacity from fruit and vegetables in the American diet. Journal of the Science of Food and Agriculture. 2005;85(10):1715-1724.
10. Akyol H, Riciputi Y, Capanoglu E, Caboni MF, Verardo V. Phenolic compounds in the potato and its by-products: an overview. International Journal of Molecular Sciences. 2016;17(6):835.
11. AOAC. Association of official Analytical chemists, XI Edn. Washington D. C. 1970.
12. Dubois M, Gilles KA, Hamilton JK, Rebers PT, Smith F. Colorimetric method for determination of sugars and related substances. Analytical chemistry. 1956;28(3):350-356.
13. Miller GL. Use of dinitrosalicylic acid reagent for determination of reducing sugar. Analytical Chemistry. 1959;31(3):426–428.
14. Lowry OH, Rosebrough NJ, Farr AL, Randall RJ. Protein measurement with the folin phenol reagent. Journal of Biological Chemistry. 1951;23:193-265.
15. Bray HG, Thorpe WV. Methods of Biochemical Analysis. 1954;1:27-52.
16. Sadasivam S, Manickam A. Biochemical Methods for Agricultural Sciences. Wiley eastern limited, 1992.
17. Bushway RJ, Bureau JL, McGann DF. Alpha- chaconine and alpha-solanine content of potato peels and potato peel products. Journal of Food Science. 1983;48:84-86.
18. Chai W, Liebman M. Effect of different cooking methods on vegetable oxalate content. Journal of Agricultural and Food Chemistry. 2005;53(8):3027-3030.
19. Rebey IB, Bourgou S, Debez IBS, Karoui IJ, Sellami IH, Msaada K, Marzouk B. Effects of extraction solvents and provenances on phenolic contents and antioxidant activities of cumin (*Cuminum cyminum* L.) seeds. Food and Bioprocess Technology. 2012;5(7)2827-2836.
20. Panse VG, Sukhatme PV. *Statistical methods for agricultural workers*. 2 nd Edition, Indian Council of Agricultural Research, New Delhi (India). 1967.
21. Bandana Sharma V, Kaushik SK, Singh B, Raigond P. Variation in biochemical parameters in different parts of potato tubers for processing purposes. Journal of Food Science and Technology. 2016;53(4):2040-2046.
22. Das S, Mitra B, Saha A, Mandal S, Paul PK, El-Sharnouby M. Evaluation of quality parameters of seven processing type potato (*Solanum tuberosum* L.) cultivars in the Eastern Sub-Himalayan plains. Foods, 2021;10(5):1138.
23. Kaur S, Aggarwal P. Studies on Indian potato genotypes for their processing and nutritional quality attributes. International Journal of Current Microbiology

Applied Sciences. 2014;3(8):172-177.
24. Abbas G, Frooq K, Hafiz IA, Hussain A, Abbasi NA, Shabbir G. Assessment of processing and nutritional quality of potato genotypes in Pakistan. Pakistan Journal of Agricultural Sciences. 2011;48(3):169-175.
25. Hassanpanah D, Hassanabadi H, Chakherchaman ASH. Evaluation of cooking quality characteristics of advanced clones and potato cultivars. American Journal of Food Technology. 2011;6(1):72-79.
26. Kaur R, Khurana DS. Growth, yield and quality of different processing cultivars of potato (*Solanum tubersum* L.). International Journal of Pure and Applied Bioscience. 2017;5:594-599.
27. Galdon BR, Mesa DR, Rodriguez ER, Romero CD. Amino acid content in traditional potato cultivars from the Canary Islands. Journal of Food Composition and Analysis. 2010;23(2):148-153.
28. Ngobese NZ, Workneh TS, Alimi BA, Tesfay S. Nutrient composition and starch characteristics of eight European potato cultivars cultivated in South Africa. Journal of Food Composition and Analysis. 2017;55:1-11.
29. Fernandes AM, Soratto RP, Moreno LDA, Evangelista RM. Effect of phosphorus nutrition on quality of fresh tuber of potato cultivars. Bragantia. 2015;74(1):102-109.
30. Gikundi EN, Sila DN, Orina IN, amp; Buzera AK. Physico-chemical properties of selected Irish potato varieties grown in Kenya. African Journal of Food Science. 2021;15(1):10-19.
31. Jang HL, Yoon KW. Cultivar differences in phenolic contents/biological activities of color-fleshed potatoes and their relationships. Horticulture Environment and Biotechnology. 2012;53(2):175- 181.
32. Singh SV, Marwaha RS, Kumar D, Kumar P, Pandey SK. Suitability of potato varieties grown in north-eastern Indian plains for processing. Potato Journal. 2009;36(1-2):25-34.
33. Al-Saikhan MS, Howard LR, Miller Jr, JC. Antioxidant activity and total phenolics in different genotypes of potato (*Solanum tuberosum* L.). Journal of Food Science, 1995;60(2):341-343.
34. Navarre DA, Pillai SS, Shakya R, Holden MJ. HPLC profiling of phenolics in diverse potato genotypes. Food Chemistry. 2011;127:34–41.
35. Mattila P, Hellstrom J. Phenolic acids in potatoes, vegetables and some of their products. Journal of Food Composition and Analysis. 2007;20(3-4):152-160.
36. Valkonen JP, Keskitalo M, Vasara T, Pietila L, Raman KV. Potato glycoalkaloids: A burden or a blessing? Critical Reviews in Plant Sciences. 1996;15(1):1-20.
37. Lewu MN, Adebola PO, Afolayan AJ. Comparative assessment of the nutritional value of commercially available cocoyam and potato tubers in South Africa. Journal of Food Quality. 2010;33(4):461-476.
38. Lo D, Wang HI, Wu WJ, Yang RY. Anti-nutrient components and their concentrations in edible parts of vegetable families. Centre for Agriculture and Bioscience International Reviews. 2018;13(15):10-1079.