Review Article

Pummelo: A potential underutilized nutraceutical crop for multiple health benefits

ABSTRACT

Phytochemical-rich fruits are gaining attention worldwide due to a rise in consumer awareness of the nutraceutical potential of these phytochemicals. Consumers prefer such fruits for maintaining good health as they play an important role in the prevention of many diseases. One such wonder crop is 'Pummelo' (*Citrus maxima*). Pummelo is a member of the citrus family and bears exceptional medicinal benefits. The literature survey revealed that this fruit is a rich source of phytochemicals and bears several pharmacological properties *viz.* antioxidant, antidiabetic, hepatoprotective, anticancer activities, *etc.* Despite its tremendous nutritional benefits, it is considered an underutilized fruit in India with limited use *i.e.* majorly for domestic consumption. For increasing the consumption and availability of this important fruit crop to the Indian population, there is a need to develop processed value-added products. This review aims to put light on the immense nutritional value and value-added products of pummelo. The value-added products of pummelo have nutraceutical value, there is a lot of scope in preparing phytochemical-rich value-added product in near future as this area of research still need to be explored.

Keywords: Pummelo, nutraceutical, value-added products, medicinal property, fruit juice

1. INTRODUCTION

Fruits are important sources of various nutrients like vitamins, minerals, and phytochemicals. Currently, there is renewed interest in the pharmacological properties of fruits rich in phytochemicals. There is an increasing demand trend in the market for a value-added product with high nutraceutical potential. Citrus fruits are considered a high-value crop as it contains large amounts of phytochemical constituents with multiple uses in the pharmaceutical, cosmetics, and food industries. It has the highest value among fruit crops in the international market and it has been recommended in herbal medicine as the source of diabetic medication[1]. Pummelo (*Citrus maxima*) is the largest of the citrus fruits with a diameter ranging from 15-25cm, round to oblong in shape. It is also called Chinese grapefruit, shaddock, and pomelo. It has several names in Indian languages also. It is called *batabilebu* in Bengali, *papnus* in Gujarati and Marathi, *chakotra* in Hindi, *chakkota* in Kannada, *bombilimas* in Malayalam and Tamil and *pamparapanasa* in Telagu [2]. The fruit is seeded to seedless with a very thick (3-4 cm) rind. The outer skin surface is green to yellow. The fruit has 16-18 segmented flesh [3]. The color of flesh varies from white, pink to red-colored. The juice recovery percentage is around 55–60%. The total soluble solids (TSS) content of fruit juice ranges between 8 and 12 °Brix. The fruit

tastes sweet and is slightly acidic with a hint of bitterness. It is a rich source of ascorbic acid and calories. The nutritive value of pummelo fruit is shown in Table 1 [4]. Pummelo is a mono-embryonic species and cross-pollinated due to which it exhibits great genetic diversity for its qualitative and quantitative attributes. Pummelo fruits have been used for traditional medicine as an antipyretic, anti-inflammatory, anti-diabetes, cardiac stimulant, anti-oxidative characteristics, and used to cure insomnia, and sore throat [5,6,7,8].

Table 1 Nutritional value of fruit juice of *Citrus maxima*

Nutritional value per 100 g	
Energy	159 kJ
Carbohydrates	9.62 g
Dietary fiber	1 g
Fat	0.04 g
Protein	0.76 g
Thiamine (B_1)	0.034 mg
Riboflavin (B_2)	0.027 mg
Niacin (B_3)	0.22 mg
Vitamin B_6	0.036 mg
Vitamin C	61 mg
Iron	0.11 mg
Magnesium	6 mg
Manganese	0.017 mg
Phosphorus	17 mg
Potassium	216 mg
Sodium	1 mg
Zinc	0.08 mg

(Wikipedia[4], Shivananda et al. [7], Abdul et al.[8])

Despite its tremendous health benefit and medicinal property, there is no commercial cultivation in India, it is consumed less and utilized when compared to other fruits like orange, mango, and papaya. It comes under the category of underutilized fruit. In India, it is grown in backyard gardens and is valued during the festival, but after that, it remains underutilized. There is an enormous opportunity in India for the exploitation of this fruit as an export crop as it is a high-demand crop in the international market. Pummelo consumption needs to be popularized by highlighting its nutritional benefits. To increase its consumer demand, the development of value-added products having high nutraceutical value is very much required.

2. PUMMELO AS A NUTRACEUTICAL

Many biologically active phytochemicals have been isolated from pummelo and evaluated for their nutraceutical properties. Not only the fruit juice but the fruit peel, seed, flower, and leaves are also known to have medicinal properties. Several reports [9,10,11,12,13,14] are available

regarding the chemical constituents in various parts of the plant *C. maxima* which include alkaloids, amino acids, benzenoids, carbohydrates, carotenoids, coumarins, flavonoids, terpenoids, and steroids (Table 2). Kumar et al. [15] assessed the phytochemical content of different varieties of pummelo across India. The study was carried out for analyzing phytochemical properties such as total soluble solids (TSS), acidity, and secondary metabolites like total phenols, limnonin, hesperidin, and naringin content. Results revealed that Devanahalli pummelo had a high juice percentage (21.45%), TSS (10.9^0 Brix), acidity (2.12%), pH (4.44) content whereas the Manipur variety had a high amount of limonin (15.31 ppm) and total phenol content (10.16 mg/100 ml).

Table 2 Some of the important chemical constituents present in various parts of *C. maxima*

Compound	*Plant part*	*References*
Alkaloids	Root, bark, stem	Huang et al.[14], Takemura [16]
Amino acids	Leaf	Ma et al.[17]
Carotenoids	Peel	Sawamura et al. [18], Gohary[13],
Flavonoids	Juice, peel, leaf,	Mizuno et al.[19]
Terpenes	Peel, leaf, seed, and juice	Yang et al.[20]
Coumarins	Peel, root, stem bark	Feng and Pie [21]
Steroids	Peel, root	Ma et al.[17]

2.1 ANTICANCER PROPERTY

The outer peel of pomelo is rich in flavonoids. Flavonoid plays an important role in preventing breast cancer by eliminating extra estrogen. The anticancer property of rind extracts was analyzed using HeLa cell line of Chinese pummelo varieties [22]. Kundusen *et al*. [23] evaluated the antitumor activity of pummelo leaves by administrating the mice with 200 and 400 mg/kg of methanol extract of pummelo leaves for 9 days in Enrlich's ascites carcinoma cell-treated mice. Results revealed that the administration of methanol extract of pummelo leaves significantly decreased tumor volume and count. Thus, the author concluded that pummelo leaves exhibited antitumor activity in a dose-dependent manner.

2.2 REDUCE BLOOD PRESSURE LEVELS

Pummelo is a rich source of potassium, which plays an important role in regulating blood pressure and is helpful for people with high blood pressure problems[24].

2.3 ANTIOXIDANT, ANTI-HYPERLIPIDEMIC, ANTI-DIABETIC, AND ACETYL-CHOLINESTERASE INHIBITORY POTENTIAL

The regular consumption of pummelo juice reduces the risk of oxidative stress by improving its antioxidant status. Oyedepo [24] demonstrated the anti-hyperlipidemic properties

of pummelo fruit extract, which helps to reduce blood cholesterol and triglycerides levels in alloxan-induced diabetic rats. Abirami et al. [25] reported that juice samples of pummelo varieties not only showed high antioxidant potential and free radical scavenging properties but also demonstrated excellent inhibitory potential against Alzheimer's disease-related enzymes acetylcholinesterase and butyrylcholinesterase, diabetes mellitus related enzymes α-glucosidase and α- amylase *in vitro*. Bhandurge et al. [26] and Makynen et al. [6] evaluated the antidiabetic and hyperlipidemic effects of pummelo fruit juice on diabetic rats. Experimental rats were administered with eight different extracts of pummelo peel among them ethyl acetate, ethanolic extract, and pummelo juice showed significant antidiabetic activity and reduced total cholesterol and triglyceride level due to naringin content in pummelo juice. Thus, the author concluded that pummelo juice had antidiabetic and hypocholesterolemic effects.

2.4 ANTIMICROBIAL ACTIVITIES

Abirami et al. [25] reported the in vitro antibacterial activity of methanolic extracts of a red and white-fleshed variety of pummelo leaf, peel, and pulp extract against selected pathogenic bacterial strains *Streptomyces aureus*, *Klebsiella* pneumoniae, *Pseudomonas aeruginosa*, *Salmonella Typhi*, and *Escherichia coli*. Methanolic extracts of leaves and pulp were found to have maximum activity as compared to peel extracts against all tested bacterial strains.

Singh and Navneet [9] reported the antibacterial activities of pummelo seed extract. They studied the effect of different solvent extracts. The methanolic extract showed the highest antibacterial activity among all solvents followed by acetone, water as control, and petroleum ether. Maximum inhibition zone was found against *Streptomyces aureus* (24±0.88 mm) followed by *Streptomyces pneumoniae* (21.78±0.36 mm), *Heamophilus influenzae* (19.74±0.22 mm), *Pseudomonas aeruginosa* (18.54±0.62), *Streptomyces pyogens* (10.93±0.69 mm), and *Candida albicans* (7.66±0.32 mm).

2.5 IMMUNITY BOOSTER, PROTECTION AGAINST COMMON COLD AND FLU

Pummelo provides a good amount of vitamin c, which improves immunity and provides protection against the common cold and influenza [15]. In folk medicine, fruit juice with honey is taken to improve urinary flow, and the decoction of flowers, leaves, and pericarp of the fruit is used as a sedative for coughs and ulcers [27].

2.6 ANTIDEPRESSANT PROPERTY

The ethanolic leaf extract of pummelo was reported to have anti-depressant activity. The study was done with the Forced Swim Test and Tail suspension test in various animal depression models. The results suggested that antidepressant activity of pummelo extract might be mediated by inhibition of norepinephrine uptake which resulted in an increase in norepinephrine level in synapses [28, 29].

2.7 PREVENTS CONSTIPATION

Pummelo is a good source of dietary fiber, which plays an important role in preventing constipation. Consequently, lowers the risk of colon cancer by protecting against piles [30].

3. VALUE-ADDED PRODUCTS OF PUMMELO

Though there is a great potential for pummelo-derived products, the industrial processing of pummelo is limited due to its slightly bitter aftertaste. The juice is sweet, but during juice extraction due to the conversion of limonoate ring-A lacton to limonin in ruptured tissues, it becomes slightly bitter, which is responsible for a slightly bitter aftertaste. Therefore, it is a challenging task to prepare processed products from pummelo at a large scale as manual juice extraction will be costly. To increase its commercial demand, the development of value-added products is needed. Pummelo juice and juice concentrate can be promoted as neutraceutical drinks. Juice concentrate can be used for making jellies, soft drink ingredients, as a flavoring agent, and for various medicinal uses

3.1 BLENDED JUICE

Bohra et al. [31] prepared a low-cost, blended beverage of pummelo. Mango ginger and kokum juice were blended with pummelo juice in the ratio of [65:30:5] for the preparation of syrup. Physicochemical constituents analysis and sensory evaluation were done after storing the product for 120 days in ambient conditions of storage. Results indicated that the best recipe was 25% juice, 70 °Brix total soluble solids, and 1.5% acidity with a score of 6.3 out of 7.0 for overall acceptability. Bitter after taste of pummelo was suppressed by mango ginger juice and imparted its characteristic taste and flavor to the product.

Nair [32] collected different accession of pummelo from Kerala and Bangalore based on different quantitative and qualitative parameters like fruit size, shape, the volume of juice, TSS, and ascorbic acid content and found that accessions from Bangalore were better than Kerala. The study standardized process of removing the outer peel of pummelo fruit. They suggested that dipping fruit segments in 15 percent brine solution for 15 minutes followed by steaming for 15 minutes was found to be the most effective peeling method. The study also reported that blending pummelo juice with orange juice in the ratio of 70: 30 was most acceptable for color, taste, and overall acceptability.

Keshani et al. [33] developed an acceptable pummelo juice. The prepared juice concentrates (20, 30.4, 40.4, 53.4, and 60.4 ^{0}Brix) were stored at 4 ^{0}C to evaluate the effect of temperature and concentration on rheological properties. Results showed that pummelo juice of all concentrations showed good quality in cold storage conditions.

3.2 SQUASH

Bohra et al. [34] also standardized the squash preparation recipe from pummelo juice by blending with kokum (*Garcinia indica*) and mango ginger (*Curcuma amada*). Nair [39] prepared

squash with pummelo juice blended with different concentrations of orange juice in the ratio of 70: 30 proportion was found to be acceptable.

3.3 JAM AND RTS

Yadav et al. [35] developed jam and ready-to-serve (RTS) beverages. Jams were prepared at two levels of pulp (45 and 50%), with pummelo pulp alone and as pomelo-papaya blended jam. Pomelo-papaya blended jam containing 45% pulp had the best organoleptic scores and was most acceptable. Similarly, in the case of pummelo-based RTS beverages, pomelo-orange blended RTS beverages different treatments were tested like pure pummelo juice RTS beverage, orange-pummelo blended with different ratios of pummelo and orange. Out of which pummelo-orange blended RTS with a blend ratio of 1:1 had the best scores for quality attributes and were most acceptable. Blended products obtained high scores and were most acceptable compared to pure pomelo products, which may be due to the characteristic bitterness of pomelo fruits which was observed in the pure pomelo products to some extent. The RTS prepared with sweetened pummelo juice blended with orange juice at 70: 30 proportion was not found as a good product [31].

3.4 NECTAR

Bohra et al.[36] standardized nectar preparation recipe from pummelo juice by blending with kokum (*Garcinia indica*) and mango ginger (*Curcuma amada*) in the ratio of 65:30:5 (v:v:v) and diluted in different proportions by adjusting Total Soluble Solids (TSS) to 15°Brix, 17 °Brix and 19 °Brix. Overall acceptability scores of the product showed that 20% blended juice, 19 °Brix TSS, and 0.3% acidity were the best recipe which was rated 6.5 on a 7-point hedonic scale.

3.5 WINE

Li-Ming and Jin-duo [37] developed a pummelo wine to evaluate the effect of its fermentation process and antioxidant effect. Anjana et al. [38] also prepared pummelo wine using *S. cerevisiae* and spontaneous fermentation which had high antioxidant activity.

3.6 FORTIFIED BREAD

Reshmi et al. [39] used pummelo segments for the development of pummelo fortified bread. They reported that supplemented bread with 20% fresh and 5% dry pummelo segment was acceptable to customers. The supplemented brown bread had more bioactive components. They also reported that the naringin of pummelo fruit inhibited digestive enzymes and contributed to a lower glycemic index.

3.7 MINIMALLY PROCESSED READY-TO-EAT SEGMENT

Gandalati [40] developed minimally processed ready-to-eat pummel segments. The study reported that the pummelo segment with an edible coating of calcium chloride (5%), ascorbic

acid (5%), and pummelo peel essential oil (1%) with gum arabic (18%) as base material extended the self-life of the pummelo segments and had better acceptance than an uncoated segment in terms of sensory attributes. The study also revealed that vacuum-packed segments were better than normal packaging conditions for quality parameters like vitamin C content, antioxidants, TSS, and TA.

4. FUTURE LINE OF WORK

It is evident from the available literature that pummelo is a rich source of nutrients and various phytochemicals with excellent medicinal properties. Most of the research works undertaken are concentrated on the nutraceutical potential of fresh fruit juice, but some wide gaps and challenges need to be addressed concerning the utilization of pummelo fruit in making processed products with high nutraceutical potential. A review of the literature reveals that there are few reports on the preparation of processed products like Jam, squash, and blended juices but work on the edible coating, packaging, and extension of shelf-life of pummelo fruit is rare, that needs to be exploited. Blended juice prepared from pummelo with juice like orange is preferred by the consumer due to less bitterness. The blending can be tried with other low-cost local fruits like guava, litchi, papaya, etc. Apart from the preparation of value-added processed products from pummelo, it will be worthwhile to explore, evaluate, and understand the potential bioavailability and metabolism of phytochemicals and nutrients in processed value-added products.

5. CONCLUSION

The nutraceutical properties of pummelo have been discussed in this review. Pummelo has been found to have important nutrients and phytochemicals. As reviewed in this paper, pummelo has antidiabetic, anticancer, antidepressant, and antioxidant properties. Based on these several health benefits, pummelo can be recommended and must be taken as a part of our daily diet. The above-mentioned studies on processing and value-addition suggest that the nutritional and therapeutic characteristics of pummelo can be exploited further in the development of healthy products, which could be easily adopted by the pummelo growers for improving their income and reducing the postharvest losses. Finally, it is concluded that the underutilized status of pummelo can be changed by the development and popularization of different value-added products of pummelo.

REFERENCES

1. Kamran S H, Shoaib R M, Ahmad M, Ishtiaq S, Anwar R. Antidiabetic and renoprotective effect of *Fagonia cretica* L. methanolic extract and *Citrus paradise*

Macfad. juice in alloxan induced diabetic rabbit. J. Pharm. Pharmacogn. Res. 2017; 5(6):365-380.
2. Gopalan C, Sastri BV R, Balasubramanian S C. Nutritive value of Indian foods. 1989. National Institute of Nutrition, ICMR, Hyderabad.
3. Ladaniya M S. Citrus Fruit – Biology, Technology and Evaluation. Elsevier Inc., Atlanta, USA. 2008;1-10.
4. Wikipedia.2014. Pomelo. http://en.wikipedia.org/wiki/ Pomelo.
5. Merina K, Chandra J, Jibon K. Medicinal plants with potential anticancer activity: a review. Int. Res. J. Pharm. 2012;3:26-30.
6. Makynen K, Jitsaardkul S, Tachasamran P, Sakai N, Puranachoti S, Nirojsinlapachai N, Chattapat V, Caengprasath N, Ngamukote S, Adisakwattana S. Cultivar variation of antioxidant and antihyperlipidemic properties of pomelo pulp [*Citrus grandis* (L.) Osbeck] in Thailand. Food. Chem. 2013; 139: 735-743.
7. Shivananda A, Muralidhara D R, Jayaveera K N. Analgesic and anti-inflammatory activities of *Citrus maxima* (J. Burm) Merr in animal models. Res. J. Pharm. Biol. Chem. Sci. 2013;4:1800-1810.
8. Abdul M T, Shenoy A, Hegde K, Aamer S, Shabaraya A R. Evaluation of the anti-diabetic activity of ethanolic extract of *Citrus maxima* stem bark, Int. J. Pharma. Chem. Sci. 2014: 3: 642-650.
9. Singh A, Navneet. A review on medicinal plants and herbs of Uttrakhand (India): its traditional, ethnobotanical and antimicrobial potential. Nat. Sci. 2016b; 14(12):90-107.
10. Gutierrez P M, Aubrey J R, Antepuesto N, Eugenio B A L, Santos M F L. Larvicidal Activity of selected plant extracts against the dengue vector *Aedesa egypti* mosquito. Int. Res. J. Biol. Sci. 2014;3(4): 23-32.
11. Das S, Baroh M, Ahmed S. Antibacterial Activity of the Ethanolic extract of Leaves of *Citrus Maxima* (Burm.) Merr. On *Escherichia coli* and *Pseudomonas aeruginosa*. Asian J. Pharma. Clin. Res. 2013;6(4): 136-139.
12. Feng B M, Shay Peri Y H, Hua H M, Li W. Structure determination of the constituents from *Citrus grandis* Osbeck. China J. Chin. Materia Medica. 2001; 26(11):764-765.
13. Gohary H H. A study on the coumarin contents of *Citrus grandis* fruits growing in Egypt. Zagazig J. Pharma. Sci.1994; 3(1):20-24
14. Huang H C, Chen M T, Wu T S. Alkaloids and coumarins of *Citrus grandis*. Phytochem. 1989; 28(12):3574-3576.
15. Kumar D, Lamers H, Singh I P, Ladaniya, M S, Sthapit B. Phytochemical evaluation of pummelo fruits (*Citrus grandis*) in India for enhancing marketing opportunities. Indian J. Plant Genet. Resour. 2015; 28(1): 50-54.
16. Takemura Y. Structure of acriginine-1, the first naturally occurring acridonolignoid from citrus plans. Chem. Pharma. Bull.1993;41(2): 406-407.
17. Ma Y Q. Isolation and identification of water-soluble active principles in guangdong snake bite drug. Chung Ts'ao Yao 1982;13(5): 193-196.

18. Sawamura M, Bandon A, Ontas N, Kusunose H. Seasonal Changes of Isoprenoid-Related Substances in Citrus peels. Nippon Shokuhin Kogyo Gakkaishi.1986;33(8): 566-571.
19. Mizuno M, Linuma M, Tanaka T, Matoba Y, Fujii Y, Murata J, Murata H, Iwamasa M. Chemotaxonomy of the genus citrus based on polymethoxyflavones. Chem. Pharma. Bull. 1991;39(4): 945-949.
20. Yang X H, Zhang G X, Cui P. Gc/Ms analysis of the chemical constituents of Pomelo peel volatile oil. Wuhan Huagong Cueyuan Xuebao.2001;23(2): 13-15.
21. Feng B and Pei Y. Study on the coumarins from *Citrus grandis.* Shenyang Yaoke Daxue Xuebao. 2000;17(4): 253-255.
22. Shivananda A, Muralidhara D R, Jayaveera K N. Anticancer activity of extracts of various fractions of *Citrus maxima* (J. Burm.) Merr. on HeLa Cell Line. J. Pharma. Chem.2013;7(1):3-7.
23. Kundusen S, Gupta M, Mazumder U K, Haldar P K, Saha P, Bala A. Antitumor activity of *Citrus maxima* (Burm.) Merr. leaves in ehrlich's ascites carcinoma cell-treated mice. ISRN Pharmacol. 2011;138737.
24. Oyedepo T A. Antioxidant potential of Citrus maxima fruit juice in rats. Glob. Adv. Res. J. Med. Med Sci. 2012;1(5):122-126.
25. Abirami G, Nagarani P, Siddhuraju P. *In vitro* antioxidant, anti-diabetic, cholinesterase and tyrosinase inhibitory potential of fresh juice from *Citrus hystrix* and *C. maxima* fruits. Food Sci. Hum. Wellness. 2014; 3(1) :16-25.
26. Bhandurge P, Rajarajeshwari N, Alagawadi K R, Agrawal S. Antidiabetic and hyperlipidemic effects of *Citrus maxima* linn fruits on alloxan-induced diabetic rats. Int. J. Drug Dev. Res. 2010;2(2):273-278.
27. Dubey N K, Dubey R, Tripathi P.Global Promotion of Herbal Medicines: India's Opportunity. Curr. Sci. 2004; 86(1):37-41.
28. Sheik H S, Vedhaiyan N, Singaravel S. Evaluation of central nervous system activities of *Citrus maxima* leaf extract on rodents. J. Appl. Pharma. Sci. 2014;4(9): 77-82.
29. Podar V H, Kibile S J. Evaluation of antidepressant-like effect of *Citrus Maxima* leaves in animal models of depression. Iran. J. Basic Med. Sci. 2011;14(5):478-483.
30. Kumar R, Vijay S, Khan N. Comparative nutritional analysis and antioxidant activity of fruit juices of some citrus spp. Octa J. Biosci. 2013;1(1): 44-53.
31. Bohra P, Sreenivas, K N, Sreeramu B S. Development of a cost-effective, palatable and shelf-stable blended beverage of pummelo (*Citrus grandis* Linn.). Fruits. 2012; 67: 249-256.
32. Nair S G. Process optimization for production of value-added products from Pummelo (*Citrus grandis* (L) Osbeck), M.Sc. thesis, Kerala Agriculture University. 2006.
33. Keshani S, Chuah A L, Russly A R. Effect of temperature and concentration on rheological properties of pomelo fruit concentrates. Int. Food Res. J. 2012; 19(2): 553-562.

34. Bohra P, Sreenivas K N, Ramakrishna B M, Sreeramu B S, Waman A A. Blended spiced squash from pummelo-mango ginger-kokum blend. Spices India. 2011;24: 9-12.
35. Yadav P N, Ranganna B, Chandru R. Development of value-added products from pomelo fruit and their storage. Mysore J. Agril. Sci.. 2009; 43(2):249-254.
36. Bohra P and Srinivas K N. Development of nectar from pummelo (*Citrus grandis*), an underutilized fruit crop, by blending with kokum (*Garcinia indica*) and mango ginger (*Curcuma amada*). J. Andaman Sci. Assoc. 2015;19(1):70-74.
37. Li-Ming Z, Jin-Duo H. 2018. Fermentation process and antioxidant effect of majia Pomelo wine. J. Southern Agril.2018; 49(2):348-353.
38. Anjana P, Ancy P, Archa S, Archana C V, Nair, A G, Arya B, Sabu K R, Rajesh B R, Chandran P R. Evaluation of physicochemical and sensory properties of wine from *Citrus maxima* fruit. Int. J. Curr. Res. Biosci. Plant Bio. 2019; 6(4):24-31.
39. Reshmi S K, Sudha M L, Shashirekha M N. Starch digestibility and predicted glycemic index in the bread fortified with pomelo (*Citrus maxima*) fruit segments, *Food Chem.* 2017;237:957-965.
40. Gandalati G R. Evaluation of minimally processed pummelo fruit (*Citrus maxima*), M.Sc. thesis, University of Agriculture Sciences, Bangalore. 2017.