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Wood Apple *(Feronia Limonia L.)* Jelly: Development and Storage Studies

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ABSTRACT

Among the number of underutilized fruits, wood apple (Feronia Limoia) is commonly known as poor man's fruit in India. Utilization of wood apple is now expanding from poor man to common man due to its own medicinal and nutritional qualities. In spite of, native to India and great demand for medicinal purposes, the main problem in its increasing popularity of utilization is the lack of knowledge of processing technology. Processing technology of wood apple is, therefore, very important to popularize its utilization and to harvest its medicinal and nutritional values. Considering the above facts, wood apple was processed and two jelly samples ($S_1$and S_2), based on sweeteners i.e. sugar (artificial) and honey (natural), were developed. Developed samples were stored at refrigerated temperature for 90 days. The quality characteristics of jelly samples were evaluated at every 15^{th} days of intervals in terms of total soluble solids (TSS), browning index, ascorbic acid, titratable acidity and pectin content. The sensory characteristics in terms of colour, flavour, taste and texture of jelly sample were also evaluated. The effects of storage, sweeteners and their interaction were found significant ($p<0.05$) on TSS, browning index and ascorbic acid. Except titratable acidity sweetener type has effected significantly ($p<0.05$) on all quality parameters. The pectin content of honey based wood apple jelly was found to be higher than sugar based jelly. This study is, therefore, very useful for processing and preservation of wood apple and can be basis to provide fundamental knowledge for commercial level design and production of wood apple products.

Keywords: *Wood apple processing; natural sweetener, jelly, nutritional, sensory, quality.*

INTRODUCTION

Today human health is more cause of concern due to modern food, life style and increasing pollution day by day. As, the economical and intellectual prosperity/ or productivity of any country is directly depends on the health of their citizens. The main issue before any government is, thus, how to maintain the people's health in today's hectic era. Availability of healthy and low cost food for the people can play a key role in achieving of such goal. Several fruits and vegetables are available in India that can be used for the production of healthy, nutritious and cheap food products. Wood apple (*Feronia Limonia L.*) is an example of among such fruits [1]. Traditionally wood apple is named as poor man's food has important medicinal and nutritional values. India is the native place of wood apple. Curd fruit, Monkey fruit, Kathbel (elephant apple), etc are some common names in India based on language, culture and place. Wood apple is also cultivated in Bangladesh, Malaysia, Pakistan, Sri Lanka, Thailand, etc. [1-4]. The popularity of wood apple's disease curative nature because of presence of phytochemicals (coumarins, polyphenols, phytosterols, saponins, tannins, etc.), vitamins (thiamine, riboflavin, niacin, vitamin C, etc.), minerals and amino acids is now extending day-by-day [5]. Using its medicinal properties many diseases such as hiccough, cold, constipation, capillary bleeding, influenza, piles, joint pain, sore throat, etc. can be cured.

Unripe wood apples are used in folk medicine for treating diarrhea and dysentery and ripe fruits are used in India as liver and cardiac tonic [6]. According to WHO (World Health Organization) medicines for healthcare of about 80% of world's total population, especially in developing countries like India, are derived from plants or plant's parts (root, shoot, fruits, skin, leaves, etc.) [7]. Antifungal, antiphrastic, astringent and alexipharmic properties of wood apple make fruits more valuable for enhancing

the digestive health system. Use of pulp and juice of ripe fruits as cardiotonic, tonic for liver and lungs, diuretics, etc. are more common. Diengngan et al. [8] have reported its nutritional value (carbohydrate: 7.1%; protein: 3.7%; fibre: 5.0%; mineral matters 1.9%) and said wood apple is a rich source of calcium, phosphorus, iron and vitamin C.

Developments of various processed food products, in this context, from wood apples to harvest its medicinal qualities have now gained of an interest among the researchers. Several value added products such as candy, chutney, juice, jam, jelly, sherbet, squash, etc. have been developed using the wood apple pulp. Pulps of wood apple are mixed with coconut milk to make delicious and healthy beverages and also, sometimes, it frozen into an ice cream [9]. Similarly, jam, jelly, marmalades, preserves and conserves all are made from fruits, preserve by sugar and thickened to some extent can also be made using wood apple fruits. Jelly is a mixture of fruit juice and sweetened material (sugar) that firm enough to hold its shape. Kumar and Deen [10] have developed jelly using wood apple extract and sugar and reported that wood apple had best organoleptic qualities. Sugar is an important ingredient in jelly which is not only sweetened the jelly but also it works with pectin and fruit acid to form jell structure and also it acts like as preservative. But, consumption of high sugar in jelly may causes serious health issues such as obesity, diabetes and heart disease. Natural sweetener, honey, can be used in place of artificial sweetener to avoid such serious health issues. Honey, contains fructose (30%), glucose (40%), water (17.8%) and minerals (iron, calcium, potassium and magnesium), is used as cough suppressant, antiseptic, antibacterial, antiviral, anti-inflammatory and antiallergenic. Due to present of flavonoids content, honey acts as a healthier alternative to sugar and is a source of antioxidants.

Considering above medicinal and health facts of wood apple and honey, the main purpose of present study was taken as to develop the wood apple jelly and to study the changes in quality parameters during storage at different temperatures.

MATERIALS AND METHODS

Fully mature and ripe fruits were only used for the preparation of wood apple jelly. Fruits were purchased from the local market of Hardoi districts of Utter Pradesh (U.P., India) and brought to the laboratory in the Department of Post Harvest Engineering and Technology, Aligarh Muslim University, Aligarh. Fruit's with external disease and defects/decay were discarded strictly during procuring with the help of skilled person. Fruit's maturity, however, was confirmed by dropping it from 30 cm height on the firm cemented floor [1-2]. If any fruit bounced back, it was considered as immature and completely discarded, vice-versa. Thus collected mature fruits were spreaded and kept under sun light at the drying yard at the department for 10 to 14 days to reach the fruit at fully ripen stage [11]. Once fruits were ripened, the pulps of the fruits were taken out with the help of knife and spoon after cracking it using wooden hammer. Wood apple juice was then extracted using the pulps. Technique for extracting juice from wood apple has been described in Fig 1 [2]. Water added in wood apple pulps in 1:2 ratios and mixed thoroughly. This mixture heated at 88-99^{0}C in an open pan. Because of the heating, wood apple juice extracted in the water and before boiling, the mixture (juice) was strained using muslin cloth along with water. Such collected wood apple juice was cooled down at ambient temperature (28±2^{0}C), packed in glass bottles and stored at refrigerated condition (5^{0}C) for further use (Khan et al. 2019a). Method described by Srivastava and Kumar [12] was followed in the development of wood apple jelly from the extracted juice. Based on two different sweeteners (honey and sugar), two type of wood apple jelly was prepared, packed in pet jar and stored in refrigeration condition.

Quality Analysis of Wood Apple Jelly

Quality characteristics of wood apple jelly were analyzed at same day of preparation (fresh) and also at every 15th days of interval during 90 days of storage in terms of TSS, titratable acidity, ascorbic acidity, browning index and pectin content. Digital refractometer (model NR151, EXTECH instruments) was used for TSS (total soluble solids) analysis. Few drops of thoroughly mixed and filtered (with muslin cloth) juice were taken on the prism of instrument. New piece of cloth was used for filtering each sample. Direct reading on the scale was read at room temperature (32 $^{\circ}$C) [13]. Similarly, the AOAC [13] method was used for analysis of titratable acidity of wood apple jelly. However, for the analysis of ascorbic acid, pectin content, browning index and ascorbic acid, the analytical method described by

Ranganna [14] was followed. Among the sensory quality characteristics: colour, flavor and texture, important for jelly food were studied using 9-point Hedonic rating test [14].

Data Analyses

All experiments were carried out in triplicate. Experimental data obtained were statistically analyzed using SPSS software (version 16) to test significance by ANOVA. The maximum, minimum and coefficient of variation (CV) were obtained using Microsoft Excel (2007) software.

Results And Discussion

Quality Characteristics of Fresh Wood Apple Jelly

Table 1 represents various quality characteristics evaluated at same day of preparation (fresh condition) of wood apple (WA) jelly sweetened with two different sweetener i.e. honey and sugar. The TSS content of honey sweetened WA jelly was found lower than the jelly sweetened with sugar. This was might be due to the fact that honey is a natural sweetener and sweetest than sugar, less quantity is needed for same level of sweetness. The presence of monosaccharide; fructose and glucose as main components (60 to 85%) are main reason of high sweetening power of the honey [15]. Similarly, browning index of sugar sweetened WA jelly was found to be higher than the honey based WA jelly. This was might be due to the effect of antioxidant property of honey [16] and wood apple [17]. Ozcan and Juhaimi [16] have already been claimed that honey is a natural source of antioxidant. It is also rich in phenolic acids and flavonoids and other antioxidants including glucose oxidase catalase, ascorbic acid, carotenoids derivatives, organic acids, amino acids and proteins [18]. However, the other quality characteristics such as titratable acidity, ascorbic acid and pectin content were found higher in WA jelly prepared from honey than from sugar as sweetener. Furthermore, among the sensory characteristics, color parameter was rated higher for honey sweetened WA jelly than the sugar sweetened WA jelly. In contrast, the other sensory characteristics (flavour, taste and texture) of honey sweetened WA jelly were found to be rated slightly lower than the WA jelly sweetened with sugar (Table 1).

Table1. *Quality characteristics of sugar and honey based wood apple jelly.*

Quality Parameters	Wood apple jelly type	
	Sugar sweetened jelly	Honey sweetened jelly
Biochemical characteristics		
TSS (^{0}brx)	65.5±0.42	58.3±0.11
Browning Index	0.245±0.006	0.22±0.002
Titratable Acidity, %	0.623±0.004	0.826±0.001
Ascorbic Acid (Vit. C) , %	31.76±1.04	33.04±0.87
Pectin content, %	1.35±0.50	1.76±0.32
Sensory characteristics		
Color	8.2 ± 0.42	8.5 ± 0.53
Taste	8.3 ± 0.95	8.0 ± 0.38
Flavor	8.4±0.52	8.1±0.43
Texture	8.5±0.53	8.4 ± 0.52

**Each value is a mean ± standard deviation of 3 replicate*

Quality Characteristics of WA Jelly during Storage

Total Soluble Solids

TSS of WA jelly samples, sweetened with sugar (S_1) and honey (S_2), were determined at every interval of 15th days during 90 days of storage at refrigerated temperature. The Table 2 shows the effect of storage on TSS of both samples. From the Table it is evident that the TSS of both samples (sugar sweetened and honey sweetened) increased significantly ($p<0.01$) with the storage period. This phenomenon may be due to increase in total soluble solids content of both jellies during storage which is desirable for the preservation of good quality of jelly. The total soluble solids content in the jelly increased apparently during storage, which might be due to hydrolysis of polysaccharides into monosaccharide and increase in concentration of jelly due to dehydration. Similar results have also been reported by Panchal et al. [19] dragon fruit jelly, Kuchi et al. [20] for guava jelly bar, Deen and Singh [21] for karonda jelly, Singh and Chandra [22] for guava-carrot jelly.

The other probable reason might have been the barrier property of pet jar with respect to permeation of water vapour from environment and release of water vapour during respiration with pet jar. The TSS of WA jelly sample S_1 was found to be highest (71.2 ^{0}brix) while the

lowest TSS was recorded for sample S_2 (63.23 ^{0}brix) at the 90 days of refrigerated storage. This was might be due to the uses of less quantity of honey as sweetener during the preparation of jelly than the use sugar in case of sugar sweetened jelly for the same level of sweetness. Table 3 shows the models developed during simple regression analysis between TSS and refrigerated storage (days) for wood apple jelly samples ($S_1$and S_2). The coefficients of determination (R^2) of both samples, $S_1$and S_2, during regression analysis were found to be as 0.981 to 0.946. Positive sign in the regression equation showed that the TSS of WA jelly samples was increased continuously during the 90 days of refrigerated storage. The correlation was found to almost perfect as the value of R^2 was approached to 1. The results of present study are in close conformity to the findings of Deen and Singh [21] in karonda jelly and Kuchi et al. [20] in guava jelly bar.

Browning (Optical Density)

Optical density is the physical property associated to the presence of pigments in any sample. Optical density of wood apple jelly samples was determined just after preparation and at every 15th days of storage interval till 90th days of refrigerated storage. Table 2 shows the obtained values of optical density before and during storage. As storage period advanced, the optical density of WA jelly samples were also found to be increased significantly ($p<0.01$). Browning index of WA jelly sample S_2 was found to be higher (0.395) than the sample S_1 (0.337) at 90th days of refrigerated storage. The increase in browning index was due to non-enzymatic browning also known as Maillard reaction which incorporates sugars and free amino acids during storage. The higher browning in sample S_2 may be due to the caramelization of fructose in addition to interaction of sugar and amino acids/ carbohydrates and proteins. Degradation of fructose during storage produced hydroxy methyl furfural (HMF) through Maillard reaction. This reaction causes formation of brown pigments and intermediate products, responsible for browning [23-24]. Higher formation of hydroxyl methyl furfural (HMF), sometimes, is an indicative of poor storage condition and excess heating of honey [25-26] or honey products. The present study is almost close conformity to the studies reported by Khan et al. [2] for wood apple-lemon squash, Kumar and Deen [10] for wood apple jelly, Deen and Singh [21] and Chaudhary et al. [27] for karoda jelly.

The simple linear regression analysis has also been done with respect to the refrigerated storage period. The linear regression equation and the coefficient of determination (R^2) are shown in Table. The value of coefficient of determination (R^2) was found 0.948 and 0.993. The positive sign in the regression equation showed continuous increment in browning index of WA jelly samples during 90 days of refrigerated storage. The correlation was found to be almost perfect as the R2 value was approached to be 1.

Table2. *Effect of refrigerated storage, sweeteners and their interaction on wood apple jelly samples (S_1, S_2)*

Samples (Sp)	**Refrigerated storage periods (days)**							**Mean**	**SE (±)**	**Significant**
	0	15	30	45	60	75	90			Storage (S)
Quality Parameters										
Total soluble solids, (^{0}brx)										
S_1	65.5	66.2	66.36	67.3	69.6	70.3	71.2	68.07	0.86	***
S_2	58.3	58.77	60.26	60.7	61.3	62.7	63.23	60.75	0.70	***
Mean	61.9	62.485	63.31	64.00	65.45	66.50	67.215	64.41	0.78	
Sig.	***	***	***	***	***	***	***	**Interaction (**S*Sp)		*** (Sig.)
Browning index, %										
S_1	0.245	0.235	0.263	0.273	0.293	0.317	0.337	0.28	0.01	***
S_2	0.22	0.265	0.325	0.345	0.364	0.374	0.395	0.33	0.02	***
Mean	0.233	0.25	0.294	0.309	0.3285	0.3455	0.366	0.30	0.02	
Sig.	***	***	***	***	***	***	***	**Interaction (**S*Sp)		*** (Sig.)
Vitamin C (Ascorbic acid), %										
S_1	31.76	30.62	29.45	27.63	26.66	24.76	23.4	27.75	1.16	**
S_2	33.04	31.13	29.43	27.22	25.36	23.22	22.1	27.36	1.54	**
Mean	32.40	30.875	29.44	27.425	26.01	23.99	22.75	27.56	1.35	
Sig.	***	***	***	***	***	***	***	**Interaction (**S*Sp)		** (Sig.)
Titratable acidity, %										
S_1	0.623	0.586	0.539	0.48	0.426	0.405	0.363	0.49	0.04	NS
S_2	0.826	0.754	0.733	0.72	0.682	0.643	0.615	0.71	0.03	NS
Mean	0.725	0.67	0.636	0.600	0.554	0.524	0.489	0.60	0.03	

Sig.	NS	NS	NS	NS	NS	NS	NS	**Interaction (**S*Sp)	NS
Pectin content, %									
S_1	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	0	NS
S_2	1.76	1.76	1.76	1.76	1.76	1.76	1.76	1.76	0	NS
Mean	1.555	1.555	1.555	1.555	1.555	1.555	1.555	1.56	0	
Sig.	**	**	**	**	**	**	**	**Interaction (**S*Sp)		NS

Ascorbic Acid (Vitamin C)

The results of refrigerated storage study of Vitamin C of WA jelly have been presented in the Table 2. During the refrigerated storage, Vitamin C of both jelly samples was found to be decreased significantly ($p<0.05$) with respect to storage periods. The vitamin C of samples S_1 (with sweetener: sugar i.e. artificial sweetener) and S_2 (with sweetener: honey i.e. natural sweetener) was found to be 23.40 % and 22.10 % at the 90th day of refrigerated storage from 31.76 % to 33.06 % at 0 day, respectively (Table 2). The decrement in sample S_1 was about 26 % while in S_2 was about 33%. The degradation in Vitamin C might be due to sensitivity of ascorbic acid to the heat and its oxidation quickly in the presence of oxygen in head space of packaging material. In addition, the effects of natural sweetener i.e. honey and its interaction with storage period was also found to be significant ($p<0.5$) (Table 2). A rapid loss in ascorbic acid during storage of wood apple jelly sweetened by honey was observed than the sugar sweetened jelly which may be due to the catalytic activity of fructose in the catabolization of vitamin C. Simple linear regression equation of vitamin C with respect to storage period was also studied. The values of coefficient of determination (R^2) of both samples, S_1 and S_2, were 0.994 and 0.996, respectively. The negative sign in the regression equation shows that there was continuous decrease in Vitamin C contents of WA jelly samples during 90 days of refrigerated storage. The correlation was found to be almost perfect as the value of R^2 of wood apple jelly sample was found to approach 1.

Titratable Acidity

The changes in titratable acidity (TA) of developed jelly samples (S_1 and S_2), during 90 days of refrigerated storage, were studied and have been reported in Table 2. From the Table 2, it is evident that titratable acidity decreased insignificantly ($p>0.05$) as the storage period increased. At the 90th day of storage, the TA of both samples, S_1 and S_2, was found to be as 0.363% and 0.615%, respectively. The decrease in acidity of jelly sample S_1 was about 42% while in sample S2 it was about 26%. The decrease in Acidity was may be due to the chemical interaction between the organic constituents of the juice induced by the temperature and action of enzymes. Similar results have also been reported by Misal et al. [28] for jamun-pomegranate jelly, Masoodi et al [29] for guava jelly and by Tomer et al. [30] for guava-papaya jelly. However, present study is contradictory to the trend reported by Panchal et al. [19] dragon fruit jelly, Kumar and Deen [10] for wood apple jelly, Kuchi et al. [20] for guava jelly bar, Deen and Singh [21] for karonda jelly.

Lower degradation in TA of honey sweetened jelly was might be due to the antioxidant property of honey. However, the effect of honey on TA of jelly was found insignificant. In addition, the effect of interaction of honey and storage factors o TA of jelly sample was also noticed insignificant ($p>0.05$). For better results and prediction of TA of jelly samples during 90 days of refrigerated storage, simple linear regression models were developed. The coefficient of determination (R^2) of both samples (R^2: 0.961 % for S_1 and 0.989% for S_2) showed that the simple linear regression was more fit to the data of TA of honey sweetened sample during analysis. The correlation was found to be almost perfect as the value of R^2 of wood apple jelly sample was found to approach 1. About 99% of data of TA of honey sweetened sample and 96% sugar sweetened jelly can be predicted on the basis storage period. The negative sign in the regression equation shows that there was continuous decrease in Acidity of wood apple jelly samples during 90 days of refrigerated storage.

Pectin Content

Initial pectin content of WA jelly samples, S_1 and S_2, were found to be 1.35 &1.76% respectively. Pectin is a natural carbohydrate found in jelly samples because of addition of commercial pectin and available in wood apple fruits. Pectin content in both WA jelly samples weather it is sweetened with artificial (sugar) of with natural (honey) sweetener found to be constant throughout the 90 days of refrigerated storage period. This was might be due to that the pectin (powder) can be stored in the freezer for one year. This study is close conformity to the

results reported by Vidhya and Narain [3] for fruit jam and Khan et al. [2] for wood apple squash. The effects of storage and interaction between storage and sweetener on pectin content of jelly samples were found to be insignificant ($p>0.05$). But, the effect of sweetener on pectin content of jelly samples was fond to be significant ($p<0.05$). Results obtained during the evaluation of pectin content at the 15^{th}, 30^{th}, 45^{th}, 60^{th}, 75^{th}, and 90^{th} days of storage for both jelly samples (S_1 and S_2) are given in the Table 2. Porrit [31] has reported almost similar results during the study of effect of on postharvest physiology and storage life of pears. He has concluded that there is no appreciable change in the juice of pears stored at 29^0C.

Actually, when sugar added during the jelly preparation, the commercial pectin (powder form) or pectin present in wood apple fruits was precipitated out and formed insoluble fiber which produced mesh like structures, traps juice like sponge and finally enabled jell to form. Use of too much commercial pectin, which will give tough and rubbery consistent nature, and jelly become difficult to spread, however, should be avoided [32]. Addition of correct amount of pectin helps to attain correct consistency of jams and jellies and it also improve the shelf life of the product.

At usual concentrations, high methoxylated pectin induced an undesirable modification of typical flavour and intensity of flavour and taste, whereas low methoxylated pectin induced few alterations [33]. The linear regression analysis of samples were done and found that R^2 values in the regression graph were not determined (Table 3).

Table3. *Regression equations and corresponding regression coefficient for TSS, browning index, vitamin C, titratable acidity and pectin content of wood apple jelly samples*

Quality parameters	Regression model	R-square	SE
Wood apple Jelly with sugar as sweetener (artificial)			
Total soluble solids (TSS)	$TSS(S_1) = 0.068D + 65.00$	0.946	0.855
Browning index/optical density (OD)	$OD = 0.0013D + 0.2185$	0.9932	0.014
Vitamin C/Ascorbic acid (AA)	$AA = -0.0943D + 31.996$	0.9948	1.158
Titratable acidity (TA)	$TA = -0.003D + 0.6233$	0.9895	0.037
Pectin content (PC)	$PC = 1.35$	0.00	0.000
Wood apple Jelly with Honey as sweetener (natural)			
Total soluble solids (TSS)	$TSS = 0.056D + 58.21$	0.981	0.697
Browning index/optical density (OD)	$BI = 0.0018D + 0.2475$	0.9069	0.024
Vitamin C/Ascorbic acid (AA)	$AA = -0.1255D + 33.005$	0.9964	1.540
Titratable acidity (TA)	$TA = -0.0022D + 0.8085$	0.9614	0.027
Pectin content (PC)	$PC= -1E-17D + 1.76$	#N/A	0.000

Sensory Characteristics

The effects of storage on sensory quality parameters of WA jelly samples (S_1 and S_2) are given the Table 4. From the table it is evident that all sensory parameters decreased with the advancement of storage periods. Initially all parameters (colour, flavour, taste and texture) of both samples were found to be rated either like very much or between like very much and like extremely score range as per nine points hedonic rating. This rating, however, degraded during refrigerated storage and at the 90^{th} days of storage the rating of all parameters: colour, flavour, taste and texture were found to lie between like moderately and like very much for both sample except taste factor of honey based WA jelly. The taste of honey sweetened jell was found near to like moderately. The higher degradation in taste in honey sweetened jelly might be due to the break-down of fructose. Among the sensory characteristics, only color parameter was found to be rated higher for honey sweetened wood apple jelly than the sugar based wood apple jelly. In contrast, the other sensory characteristics were rated lower than the wood apple sugar jelly. The reduction in sensory quality in jelly samples during storage was might be due to the undesirable changes in biochemical properties. Storage condition plays an important role in colour degradation (browning) and off flavour development in jelly. Results reported by Vijayanand et al [34], Chaudhary et al [27], Paul et al. [35], Deen and Singh [21], etc are close conformity to the current research.

Table4. *Effect of storage on sensory characteristics of jellies developed using honey and sugar as sweeteners*

Storage period	Wood apple jelly							
	Sweetened with sugar (S_1)				Sweetened with honey (S_2)			
	Colour	Flavor	Taste	Texture	Colour	Flavor	Taste	Texture
0	8.2±0.42	8.4±0.52	8.3±0.67	8.5±0.53	8.5±0.53	8.3±0.41	8±0.44	8.4±0.52
15	8.1±0.43	8.2±0.42	8.1±0.43	8.3±0.67	8.3±0.95	8.1±0.43	7.8±0.26	8.1±0.43
30	7.9±0.32	7.9±0.32	7.8±0.26	8.1±0.43	8.2±0.42	7.8±0.26	7.5±0.21	7.9±0.32
45	7.8±0.26	7.8±0.26	7.7±0.20	7.9±0.32	8±0.31	7.6±0.23	7.3±0.15	7.7±0.29
60	7.6±0.23	7.6±0.23	7.5±0.21	7.6±0.23	7.8±0.26	7.5±0.21	7.2±0.43	7.5±0.21
75	7.5±0.21	7.4±0.84	7.2±0.45	7.3±0.15	7.6±0.23	7.3±0.15	7.1±0.37	7.2±0.48
90	7.3±0.15	7.3±0.15	7.1±0.37	7.1±0.37	7.4±0.28	7.1±0.37	6.8±0.37	7.1±0.37

CONCLUSION

Various nutrients, vitamins and organic compounds (tannins, calcium, phosphorous, fiber, protein and iron), available in wood apple, are attributed broad array of health benefits. To harvest these medicinal and nutritional values, wood apple jellies were developed. The quality parameters such as TSS, browning index, vitamin C, except titratable acidity and pectin content, changes significantly with storage for both types of jelly. WA jelly sweetened with honey can be recommended to the diabetic person and daily use of normal person to avoid future sugar related problems because of highly assessment of antioxidants properties through honey. The quality of honey sweetened sample, however, found to be more effected during storage period due the break-down of fructose. This research, thus, revealed that the developed processing technologies can be adopted for accelerating the utilization of wood apple like underutilized fruit and subsequently losses can also be minimized.

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