Development and Quality Analysis of Pineapple (*Ananas comosus* L.) Sweetmeat blend with Bottle gourd (*Lagenaria siceraria*)

Abstract

The present investigation was carried out with title "Development and Quality Analysis of Pineapple (*Ananas comosus* L.) Sweetmeat blend with Bottlegourd (*Lagenaria siceraria*)." at Post Harvest Laboratory of Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj, Uttar Pradesh during the year 2022-2024. The experiment was conducted in Completely Randomized Design (CRD). Under this experiment, overall, 8 treatments were taken and 3 replications of each to evaluate physio-chemical analysis, organoleptic properties and cost of formulation of Pineapple Sweetmeat at different storage days. The sweetmeat samples were stored at ambient temperature (28 ± 5 °C) for 45 days and results were noted after every 15 days intervals. On the basis of results obtained during the present investigation T6 Pineapple (250gm/kg) + Bottle gourd (750gm/kg) + Jaggery + Cardamom powder + Cloves + Dry fruits was found superior in terms of Pineapple Sweetmeat syn. halwa on physio-chemical properties viz TSS, Acidity, Moisture and Ascorbic acid. Whereas, T5 Pineapple (750gm/kg) + Bottle gourd(250gm/kg) + Jaggery + Cardamom powder + Cloves + Dry fruits was found superior in terms of Reducing, Non- Reducing and Total Sugars, followed by T3 Pineapple(500gm/kg) + Bottle gourd (500gm/kg) + Sugar + Cardamom powder + Cloves + Dry fruits that was found to be superior in terms of Pineapple sweetmeat on all organoleptic tests viz. Colour and Appearance, Taste and Flavour, Body and Texture and Overall acceptability and the maximum Benefit cost ratio (1.33) was found for T3 Pineapple(500gm/kg) + Bottle gourd (500gm/kg) + Sugar + Cardamom powder + Cloves + Dry fruits.

***Keywords**: Pineapple, Bottle gourd, Organoleptic test, Sweetmeat, Benefit cost ratio.*

1. INTRODUCTION:

The perishable fruits are available as seasonal surpluses during certain parts of the year in different regions and are wasted in large quantities due to absence of facilities and know-how for proper handling, distribution, marketing and storage. Furthermore, massive amounts of the

perishable fruits and vegetables produced during a particular season results in a glut in the marketand become scarce during other seasons (**Vidhya and Narain 2011**). India is world's second largest fruit and vegetable producer, produced around 99.06 million tons fruits and 191.76 million tons of vegetables which accounts for nearly 15.0% of country's share in the

world production of vegetables in the year 2020. It ranked amongst the world's five largest producers of over 80% agricultural produce items, encounters a waste of close to 25% worth of produce (**NHB, 2020**).

Pineapple (*Ananas comosus*) is the world's most popular non-citrus tropical and subtropical fruitis an important fruit crop in India and belongs to the family Bromeliaceae. Pineapple is believed to be have been originated in Brazil and it was spread to other tropical parts of the world. (**Naidu et al., 2021**) Pineapple is a tropical plant with edible multiple fruit, is the most economically important plant and has pleasant taste and flavor. (**Maurer, 2001 and Orsini, 2006).** The genetic name Ananas is derived from the Indian 'nana'. Pineapple had spread to the other parts of tropical America by the time of Columbus, who took it to Europe. It reached India in the year 1548. (**Singh *et al.* 2000**). The ripe pineapple fruit is very refreshing, highly nutritive, good source of vitamin 'A' and 'B' and is rich in vitamin 'C' and calcium. It also contains phosphorus and iron. The pineapple fruits harvested in different months of the year are not of uniform quality (**Ahmed and Bora, 1989).** It contains an enzyme, bromelin. The 3-methyl-propinate esters comprise a significant fraction of the pineapple volatile components and have been adopted for use in pineapple flavours (**Flath, 1980**). It is widely used as health food and for fruit juice also for the developing of value-added products (**Ministry of Health and Welfare, Taiwan 2015**).

Bottle gourd (*Lagenaria siceraria* L.) belongs to the family Cucurbitaceae, is an important and

popular vegetable. Bottle gourd is one of the important vegetable crops which is cultivated all over the world. It has high medicinal value and hence it is being used in some Ayurvedic medicines. Bottle gourd is a good source of vitamin B-complex and ascorbic acid (**Kalra *et al.***

1988). *Lagenaria siceraria* commonly known as Bottle gourd Syn. Doodhi, syn Lauki (Hindi), Kadoo (Marathi)is one of the excellent fruits for human being, made and gifted by the nature having composition of all the essential constituents that are required for normal and good human health (**Rahaman, 2003**). Bottle gourd is rich source of minerals and possesses vitamins and is believed to help the liver function in a balanced fashion and makes up a staple in Indian cuisine, it can also be juiced for a nutrientpacked beverages and other value-added products such as sweetmeats. **(Menpara *et al.* 2014**).

Sweetmeat refers to many types of dense, wholesome and sweet confectionery or sweet food

made from various predominant ingredients prepared in north India. It is a type of desert with the consistency of a very thick pudding, made from various kinds of fruits, vegetables, grainsand lentils. Preparation of sweetmeat is not very easy as the raw material specification, their

proportion, sequence of adding and processing steps are very specific (**Mannan *et al.*1994**). Indian sweetmeats, Halwa, Jams etc. are undisputedly the best and the most popular, and is the

first choice of sweetmeat consumers both in India and abroad. Such as, its popularity that it has

now become one of the most sought-after items in the Indian food processing industry. (**Nandi**

and Dev 2007). Pineapple Sweetmeat (Halwa) is traditionally prepared by cooking of shredded

or grated fruits in ghee followed by addition of sugar and khoa with or without edible green color(**Bhat *et al*., 2018**)

2. MATERIALS and METHODS:

i. **Experimental Site:** The experiment was carried out in the Post-Harvest Laboratory conditions in the Department of Horticulture, Prayagraj, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj - Uttar Pradesh, during June 2023 to January 2024.The Pineapple sweetmeat blended with bottle gourd was prepared with 8 treatments, and stored for 45 days in order to assess the physicochemical properties.

ii. **Selection of fruits:** Healthy uniform sized fruits, free from diseases, pests and bruises were purchased from the local market of Goa and transported to experimental site. Bottle gourds were being purchased from the local market of Prayagraj.

iii. **Cultivars:** One variety of Pineapple namely Giant Kew was selected for present studies and was obtained from Goa.

iv. **Preparation of fruits:** The fruits were washed thoroughly by keeping them under running water and were wiped off with clean and dry clothes to remove adhering water.

Table 1. Details of treatment combination

Treatments	Ingredients			
	Pineapple (g)	Bottle gourd (g)	Sugar (g)	Jaggery (g)
T0	1000	-	250	-
T1	750	250	250	-
T2	250	750	250	-
T3	500	500	250	-
T4	1000	-	-	250
T5	750	250	-	250
T6	250	750	-	250
T7	500	500	-	250

2.1 Statistical analysis the statistical analysis of the data was carried out using STATISTICA (7.0) software.

3. RESULTS AND DISCUSSION

3.1 Physico-chemical analysis of Pineapple sweetmeat blend with Bottlegourd

The prepared Pineapple sweetmeat blend with bottle gourd was evaluated for various physio-chemical properties viz. T.S.S, total acidity, moisture content, ascorbic acid content, reducing sugars, non-reducing sugars and total sugars which is represented in Table 2.

3.1.1Effect of various treatment combinations on T.S.S. of Pineapple sweetmeat at different days of storage

The T.S.S. of Pineapple sweetmeat was increased during advancement of storage. Significantly maximum T.S.S. was recorded in treatment T6 Pineapple (250gm/kg) + Bottle gourd (750gm/kg) + Jaggery + Cardamom powder + Cloves + Dry fruits (69.22 B^0) followed by T1 Pineapple (750gm/kg) + Bottle gourd (250gm/kg) + Sugar + Cardamom powder + Cloves + Dry fruits (69.20 B^0). However significantly minimum total soluble solid was recorded in T0 (control) with (19.48 B^0). The total soluble solid increased with gradual passage of storage time, this might due to conversion of polysaccharides into sugar during hydrolysis process during storage. Similar observations were reported by **Aslam *et al.* (2019)** and **Santos *et al.* (2020)** in Plum fruit halwa and Pineapple jam.

3.1.2 Effect of various treatment combinations on Acidity of Pineapple sweetmeat at different days of storage

Maximum Acidity was recorded in treatment T6 Pineapple (250gm/kg) + Bottle gourd (750gm/kg) + Jaggery + Cardamom powder + Cloves + Dry fruits (0.726 %) followed by T1 Pineapple(750gm/kg) + Bottle gourd (250gm/kg) + Sugar + Cardamom powder + Cloves + Dry fruits which attained (0.725 %). However significantly minimum Total acidity was recorded in T2 Pineapple(250gm/kg) + Bottle gourd(750gm/kg) + Sugar + Cardamom powder + Cloves + Dry fruits with (0.635 %). Maximum acidity was reported in sweetmeat at 45 days of storage. The increased acidity is due the fermentation of sugars to acids with course of time, which also prevents the growth of harmful bacteria and molds increasing the self-life of sweetmeat. Similar results were obtained by **Kanwal *etal.*(2017)** and also the increase in acidity may be due to acid formation, degradation of polysaccharides and oxidation of reducing sugars or by break down of pectin in to pectenic acid was seen by the findings of **Shakir *et al.* (2007**).

3.1.3. Effect of various treatment combinations on Moisture content of Pineapple sweetmeat at different days of storage.

Significantly maximum Moisture content was recorded in treatment T6 Pineapple (250gm/kg) + Bottle gourd (750gm/kg) + Jaggery + Cardamom powder + Cloves + Dry fruits (32.22 %) followed by T2 Pineapple (250gm/kg) + Bottle gourd (750gm/kg) + Jaggery + Cardamom powder + Cloves + Dry fruits which attained (32.18 %). However significantly minimum moisture content was recorded in control with (30.55 %). The increase in moisture content is due to the dehydration phenomenon. Similar results were obtained by **Ferdous and Alim (2018)** and similarly the decreasing trend of moisture with storage was given by **Tomkins (1979)**.

3.1.3. Effect of various treatment combinations on Ascorbic acid content of Pineapple sweetmeatat different days of storage.

Statistical analysis revealed that significantly maximum Ascorbic acid content was recorded in treatment T1 Pineapple(750gm/kg) + Bottle gourd(250gm/kg) + Sugar + Cardamom powder + Cloves + Dry fruits (22.60mg/100ml) followed by T5 Pineapple(750gm/kg) + Bottlegourd (250gm/kg) + Jaggery + Cardamom powder + Cloves + Dry fruits which attained (22.57 mg/100ml). However significantly minimum Ascorbic acid content was recorded in T0 (control) with (8.63 mg/100ml). Ascorbic acid of Pineapple sweetmeat was observed to be decreased gradually up till the end of experiment under ambient storage conditions.Similarly, the decreasing trend of the ascorbic acid over storage period was given by **Patel *et al.*, (2015)** in Pineapple blended with banana jam.

3.1.3. Effect of various treatment combinations on Reducing sugars of Pineapple sweetmeatat different days of storage.

Statistical analysis revealed that significantly maximum Reducing Sugars were recorded in treatment T5 Pineapple (750gm/kg) + Bottle gourd (250gm/kg) + Jaggery + Cardamom powder + Cloves + Dry fruits (47.81 %) followed by T1 Pineapple (750gm/kg) + Bottle gourd (250gm/kg) + Sugar + Cardamom powder + Cloves + Dry fruits which attained (47.79 %). However significantly minimum Reducing Sugars were recorded in T2 Pineapple(250gm/kg) + Bottlegourd (750gm/kg) + Sugar + Cardamom powder + Cloves + Dry fruits with (41.44 %).The Reducing Sugars increased with gradual passage of storage time, this might be due to the slow continuing hydrolysis of sucrose and some enzymatic activities.Similar results were obtained by **Richa *et al.* (2017)** in sapota jam.; **Singh *et al.***

(2005) reported the decreasing trend in the Non-reducing sugars in mixed fruit pineapple jam.

3.1.3. Effect of various treatment combinations on Non- reducing sugars ofPineapple sweetmeatat different days of storage.

Statistical analysis revealed that significantly maximum Non-Reducing Sugars were recorded in treatment T5 Pineapple (750gm/kg) + Bottle gourd (250gm/kg) + Jaggery + Cardamom powder + Cloves + Dry fruits (11.15 %) followed by T1 Pineapple(750gm/kg) + Bottle gourd (250gm/kg) + Sugar + Cardamom powder + Cloves + Dry fruits which attained (11.13 %). However significantly minimum Non-Reducing Sugars were recorded in T3Pineapple (500gm/kg) + Bottle gourd (500gm/kg) + Sugar + Cardamom powder + Cloves + Dry fruits with (6.25 %). The Non-Reducing Sugars decreased with gradual passage of storage time, this might be due to the hydrolysis. Additionally, as the sucrose molecules are hydrolyzed, the proportion of non-reducing sugars like sucrose decreases while the content of reducing sugars, glucose and fructose, increases. Similar results were obtained by Jayashree and **Jayasheela (2018)**. in the jackfruit halwa similarly **Singh *et al.* (2005)** gave the increasing trend in the reducing sugars in mixed fruit pineapple jam.

3.1.3. Effect of various treatment combinations on Total sugars of Pineapple sweetmeatat different days of storage.

Statistical analysis revealed that significantly maximum Total Sugars were recorded in treatment T5 Pineapple (750gm/kg) + Bottle gourd(250gm/kg) + Jaggery + Cardamom powder + Cloves + Dry fruits (68.19 %) followed by T1 Pineapple (750gm/kg) + Bottle gourd (250gm/kg) + Sugar + Cardamom powder + Cloves + Dry fruits which attained (68.05 %). However significantly minimum Total Sugars were recorded in T3 Pineapple (500gm/kg) + Bottle gourd (500gm/kg) + Sugar + Cardamom powder + Cloves + Dry fruits with (55.66 %). The Total Sugars increased with gradual passage of storage time, this pattern of increasing of total sugars (%) during storage might be due to the breakdown of insoluble polysaccharides into simple sugars by solubilization of juice constituents during storage and hydrolysis of polysaccharides including pectin, starch, heating process for concentration and higher temperature of ambient storage condition led to increase in total sugars in jam. Such identical increase in total sugars in various products had been reported

by **Sawant *et al*. (2009)** in kokam + pineapple blended jam and **Relekar *et al*. (2011)** in sapota jam.

3.2 Organoleptic evaluation of Pineapple sweetmeat blend with Bottle gourd

The prepared Pineapple sweetmeat blend with Bottlegourd was evaluated for and organoleptic properties viz. colour and appearance, flavour and taste, body and texture and overall acceptability which is represented in Table 3.

3.2.1 Effect of various treatment combinations on Colour and Appearance of Pineapple sweetmeat at different days of storage

Statistical analysis revealed that significantly maximum colour and appearance was recorded in treatment T3 Pineapple(500gm/kg) + Bottle gourd (500gm/kg) + Sugar + Cardamom powder + Cloves + Dry fruits (7.33) followed by T6 Pineapple(500gm/kg) + Bottle gourd (500gm/kg) + jaggery + Cardamom powder + Cloves + Dry fruits which attained (7.17). However significantly minimum colour and appearance was recorded in T0 (control) with (6.17). The sensory evaluation shows, gradual reduction in mean score for overall acceptability after 45 days of storage. It has showed decreasing trend during the storage period due to the increased rate of oxidation of phenolic compounds and organic acids, which was responsible for increase the production of black compounds resulting in browning of product. These observations were also similar to findings of **Shakir *et al.* (2007)** in apple and pear mixed fruit jam and **Patel *et al*. (2015)** in mixed fruit jam banana blend with pineapple.

3.2.1 Effect of various treatment combinations on Flavour and Taste of Pineapple sweetmeat at different days of storage

Statistical analysis revealed that significantly maximum Flavour and Taste was recorded in treatment T3 Pineapple(500gm/kg) + Bottle gourd (500gm/kg) + Sugar + Cardamom powder + Cloves + Dry fruits (7.40) followed by T6 Pineapple(500gm/kg) + Bottle gourd (500gm/kg) + jaggery + Cardamom powder + Cloves + Dry fruits which attained (7.30). However significantly minimum Flavour and Taste was recorded in T0 (control) with (5.50). Over the storage month sensory evaluation of sweetmeat revealed fewer amounts of change in Flavour and Taste. The sensory evaluation shows, gradual reduction in mean score for overall acceptability after 45 days of storage. Whereas, it has showed decreasing trend during the storage period due to the loss of highly volatile aromatic compound which

is very sensitive to high storage temperature as well as enzymatic degradation of phenols and oxidative changes of sugars had taken place which was responsible for loss of flavour during storage. Similar types of results are also in accordance with **Priya *et al.* (2010)** in mixed fruit jam and **Relekar *et al.* (2011)** in sapota jam.

3.2.1 Effect of various treatment combinations on Body and Texture of Pineapple sweetmeat at different days of storage

Statistical analysis revealed that significantly maximum Body and Texture was recorded in treatment T3 Pineapple(500gm/kg) + Bottle gourd (500gm/kg) + Sugar + Cardamom powder + Cloves + Dry fruits (7.30) followed by T6 Pineapple(500gm/kg) + Bottle gourd (500gm/kg) + jaggery + Cardamom powder + Cloves + Dry fruits which attained (7.10). However significantly minimum Body and Texture was recorded in T0 (control) with (5.70). Over the storage month sensory evaluation of sweetmeat revealed fewer amounts of change in Body and Texture. The sensory evaluation shows, gradual reduction in mean score for overall acceptability after 45 days of storage. Whereas, it showed decreasing trend during the storage period due to the adverse effect of atmospheric temperature and moisture. Similar observations were found by **Priya *et al.* (2010)** in mixed fruit jam and **Relekar *et al.* (2011)** in sapota jam.

3.2.1 Effect of various treatment combinations on Overall acceptability of Pineapple sweetmeat at different days of storage

Statistical analysis revealed that significantly maximum Overall acceptability was recorded in treatment T3 Pineapple(500gm/kg) + Bottle gourd (500gm/kg) + Sugar + Cardamom powder + Cloves + Dry fruits (7.37) followed by T6 Pineapple(500gm/kg) + Bottle gourd (500gm/kg) + jaggery + Cardamom powder + Cloves + Dry fruits which attained (7.15). However significantly minimum Overall acceptability was recorded in T0 (control) with (5.63). Over the storage month sensory evaluation of sweetmeat revealed fewer amounts of change in Overall acceptability. The sensory evaluation shows, gradual reduction in mean score for overall acceptability after 45 days of storage. it showed decreasing trend during the storage period due to the decline the colour, texture, taste and flavour with increasing storage period. Such identical findings were also observed by **Priya *et al.* (2010)** in mixed fruit jam and **Relekar *et al.* (2011)** in sapota jam.

Table 2: Effect of various treatment combinations on [Physico-chemical analysis of Pineapple sweetmeat blend with Bottle gourd.

Treatment notation	Treatment combination	T.S.S. (^{0}Brix)	Total acidity (%)	Moisture content (%)	Ascorbic acid (mg/100g)	Reducing sugar (%)	Non reducing sugar (%)	Total sugars (%)
T0	Pineapple (100%) + Sugar(250gm) + cloves + cardamom powder+ dry fruits	68.82	0.702	30.55	8.63	43.75	8.74	58.06
T1	Pineapple(750gm/kg) + Bottlegourd(250gm/kg) + Sugar + Cardamom powder + Cloves +Dryfruits	69.20	0.725	30.81	22.60	47.79	11.13	68.05
T2	Pineapple (250gm/kg) + Bottle gourd (750gm/kg) + Sugar + Cardamom powder + Cloves + Dry fruits	69.07	0.635	32.18	21.05	42.56	10.62	64.27
T3	Pineapple (500gm/kg) + Bottle gourd (500gm/kg) + Sugar + Cardamom powder + Cloves + Dry fruits	68.77	0.658	31.04	18.95	41.44	6.25	55.66
T4	Pineapple (100%) + jaggery(250gm)+ Cardamom powder+ Cloves + Dry fruits	69.00	0.684	30.59	8.69	44.73	9.23	58.84
T5	Pineapple (750gm/kg) + Bottle gourd (250gm/kg) + Jaggery + Cardamom powder + Cloves + Dry fruits	69.10	0.704	31.08	22.57	47.81	11.15	68.19
T6	Pineapple (250gm/kg) + Bottle gourd (750gm/kg) + Jaggery + Cardamom powder + Cloves + Dry fruits	69.22	0.726	32.22	20.70	44.75	10.64	60.46

T7	Pineapple (250gm/kg) + Bottle gourd (750gm/kg) + Jaggery + Cardamom powder + Cloves + Dry fruits	68.85	0.66	30.85	19.25	42.58	8.75	57.81
	C.V.	21.607	2.606	1.3	0.19	1.06	1.98	0.09
	'F' Test	S	S	S	S	S	S	S
	S.E.(d)	0.394	0.009	0.05	0.03	0.23	0.09	0.05
	C.D. at 5%	0.836	0.027	0.15	0.06	0.7	0.28	0.10

Table 3: Effect of various treatment combinations on organoleptic evaluation of Pineapple sweetmeat blend with Bottle gourd

Treatment notation	Treatment combination	Colour and appearance	Flavour and taste	Body and texture score	Overall acceptability
T0	Pineapple (100%) + Sugar (250gm) + cloves + cardamom powder+ dry fruits	6.17	5.50	5.70	5.63
T1	Pineapple(750gm/kg) + Bottle gourd(250gm/kg) + Sugar + Cardamom powder + Cloves + Dry fruits	6.42	6.10	6.20	6.10
T2	Pineapple (250gm/kg) + Bottle gourd (750gm/kg) + Sugar + Cardamom powder + Cloves + Dry fruits	6.67	6.70	6.80	6.73
T3	Pineapple (500gm/kg) + Bottle gourd (500gm/kg) + Sugar + Cardamom powder + Cloves + Dry fruits	7.33	7.40	7.30	7.37
T4	Pineapple (100%) + jaggery (250gm) + Cardamom powder + Cloves + Dry fruits	6.33	5.70	6.00	5.85
T5	Pineapple (750gm/kg) + Bottle gourd (250gm/kg) + Jaggery + Cardamom powder + Cloves + Dry fruits	6.83	6.50	6.60	6.51
T6	Pineapple (250gm/kg) + Bottle gourd (750gm/kg) + Jaggery + Cardamom powder + Cloves + Dry fruits	7.17	7.20	7.10	7.15
	Pineapple (250gm/kg) + Bottle gourd				

T7	(750gm/kg) + Jaggery + Cardamom powder + Cloves + Dry fruits	6.5	6.30	6.50	6.34
	C.V.	4.32	14.257	17.256	4.18
	'F' Test	S	S	S	S
	S.E.(d)	0.17	0.260	0.282	0.17
	C.D. at 5%	0.52	0.552	0.597	0.5

CONCLUSION:

On the basis of results obtained during the present investigation T6 Pineapple (250gm/kg) + Bottle gourd (750gm/kg) + Jaggery + Cardamom powder + Cloves + Dry fruits was found superior in terms of Pineapple Sweetmeat syn. halwa on physio-chemical properties viz.TSS, Acidity, Moisture and Ascorbic acid. Whereas, T5 Pineapple (750gm/kg) + Bottle gourd(250gm/kg) + Jaggery + Cardamom powder + Cloves + Dry fruits was found superior in terms of Reducing, Non- Reducing and Total Sugars, followed by T3 Pineapple(500gm/kg) + Bottle gourd (500gm/kg) + Sugar + Cardamom powder + Cloves + Dry fruits that was found to be superior in terms of Pineapple sweetmeat on all organoleptic tests viz. Colour and Appearance, Taste and Flavour, Body and Texture and Overall acceptability and the maximum Benefit cost ratio (1.33) was found for T3 Pineapple(500gm/kg) + Bottle gourd (500gm/kg) + Sugar + Cardamom powder + Cloves + Dry fruit.

REFERENCES:

Ahmed, F. and Bora, P.C. (1989). Changes in quality of Kew pineapple fruit at different times. *Journal of Food Science Technology*., 26 (1): 51-52.

Aslam, A., Zahoor, T., Khan, M. R., Khaliq, A., Nadeem, M., Sagheer, A., & Sajid,M.W. (2019). Studying the influence of packaging materials and storage on the physiochemical and microbial characteristics of black plum (*Syzygium cumini*) halwa. *Journal of food processing and preservation*, 43(5), e13941**.**

Bhat, S., Singh, C. S., Sharma, H. K. (2018) Process development of bottle gourd sweetmeat by microwave heating: Changes in rheological, textural, sensory and morphological parameters. *Food Bioscience Journal; Volume* 24, 95-102.

Ferdous, M. J., & Alim, M. A. (2018). Physico-chemical properties of mixed jam from pineapple and sweet gourd. *Journal of Bangladesh Agricultural University*.16(2): 309–314.

Flath, R.A. (1980). Tropical and Subtropical Fruits: Composition, Properties and Uses. Eds. (S. Nagy and P.E. Shaw). A.V.I. Publosher Westport, Connecticut, U.S.A. pp.157-83.

Jayashree, S. and Jayasheela, D.H. (2018). Standardisation, nutritional and sensory analysis of jackfruit Halwa. *Food Science Research Journal*., 9(1): 48-52.

Kalra, M.S., Laxminarayan, H., and Dudani, D. (1988). Use of nisin for extending shelf-life of processed bottlegourd cheese and khoa. *Journal of Food Science Technology*., 10, 92-94.

Kanwal, N., Randhawa, M. A., & Iqbal, Z. (2017). Influence of processing methods and storage on physico-chemical and antioxidant properties of guava jam. *International Food Research Journal*, 24(5).

Mannan, A.K.M., Hossain, M.S., and Islam, M.N. (1994). Standard and Standardization of Sweetmeats. *Washington D.C. B.A.U. Research Programme*., 8: 410- 413.

Maurer, H. R. (2001) Pineapple: biochemistry, pharmacology and medical use (Review).

Cell Molecular Life Science. 58:1234-1245.

Menpara, D., Desai, D., Rathod, T., and Chanda, S. (2014). Evaluation of nutraceutical bottle gourd (*Lagenaria siceraria*) as a potential source of natural antimicrobial agent. *Am. Journal Phytomed. Clin. Ther, 2*, 375-389.

Naidu, S. A., Prasad, V. M., Bahadur, V., and Priya, M. K. (2021). Studies on Preparation of value-added pineapple cheese blended with guava (Ananas comosus – Psidium guajava). *The Pharma Innovation Journal.* 10(9): 1282-1285.

Nandi, P., and Dev, R. (2007). Production of sweetmeat utilising solar thermal energy: economic and thermal analysis of a case study. Journal of Cleaner Production, 15(4), 373-377.

NHB (2020). nhb.gov.in/statistics/2013-14. Area and Production of Horticulture Crops All India. Visited on 08/10/2021.

Orsini, R. A. (2006) Pineapple nutritional, Bromelain Plastic and Reconstructive Surgery Pareek OP (1983). The Ber ICAR, New Delhi, India. 118(7):1640-1644.

Patel, N. V., and Naik, A. G. (2015). Studies on standardization of pulp proportion for banana-pineapple blended jam during storage. *International Journal of Processing and Post-Harvest Technology*, Vol. 4, No. 2, 63-69.

Priya, B., Shankar and Murari, R. (2010). Optimization of process for mixed fruit jam using sweeteners. *Beverage & Food World*, 37(7): 56- 58.

Rahman, A. H. (2003). Bottle gourd (Lagenaria siceraria) a vegetable for good health. *Natural product radiance*, 2(5), 249-250.

Relekar, P.P., Naik, A.G. and Padhiar, B.V. (2011). Qualitative changes in value added product of sapota (Manilkara achras (MILL) FOSBERG) cv. Kalipatti during storage. *Indian Journal Horticulture Scienes.*, 68(3): 413-418.

Richa, M., Kulshrestha, K., and Kushwaha, A. (2017). Quality and safety of market vs homemade carrot halwa: designing a safe process. *International Journal of Food Science Technology*, *7*, 1-12.

Santos, B. A., Teixeira, F., Soares, J. M., do Amaral, L. A., de Souza, G. H. O., da Silva, T., & Novello, D. (2020). Pineapple jam physicochemical and sensory evaluation with added pineapple peel. *International Journal of Research*. Vol 8(07), 374 – 383.

Sarkar, T., Salauddin, M., Paul, A., Choudhury, T., Chakraborty, R., & Imran, F. (2023). The essence of Bengal's ethnic sweetmeats: An exploratory journey through history, tradition, and culture. *Journal of Food Quality*, *2023*.

Sawant, A. A., Kad, V. P., & Thakor, N. J. (2009). Preparation of kokum-pineapple blended jam. *Beverage and Food World*, *36*(12), 28-30.

Shakir, I., Durrani, Y., Hussainm, I., Qazi, I. M. and Zeb, A. (2007) Physicochemical analysis of apple and pear mixed fruit jam prepared from varities grown in azad Jammu and Kashmir. *Pakistan Journal of Nutrition* 7(1): 177-180.

Singh, P., Shukla, A., Singh, R., and Kumar Singh, A. (2005). Utilization of guava juice by value addition through blended beverages. In I International Guava Symposium 735 (pp. 639-645).

Singh, R. (1978). Cost benefit analysis and marketing of mushroom in Haryana. *Agricultural Economics Research Review*, *23*(1), 165-172.

Tomkins, B.D. (1979) Post Harvest Technology. *Texas University Journal of Horticultural Research*; 128.

Vidhya, R., and Anandhi Narain, A. N. (2011). Formulation and evaluation of preserved products utilizing under exploited fruits. *American-Eurasian Journal of Agricultural & Environmental Sciences*, Vol. 10, No. 1, 112-118.