**Standardization of wood apple (*Limonia acidissima*) Pickle**


## ABSTRACT

The present investigation was carried out with title **"Standardization of wood apple (*Limonia acidissima*) Pickle"** 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. The experiment was conducted in Completely Randomized Design (CRD). Under this experiment, overall 8 treatment was taken $T_0$ (Wood apple (control), $T_1$ (Wood apple + Ginger + Jaggery), $T_2$ (Wood apple + Ginger + White Vinegar), $T_3$ (Wood apple + Ginger + Jamun vinegar), $T_4$ (Wood apple + Ginger + Sugar cane vinegar), $T_5$ (Wood apple + Ginger + green chilly), $T_6$ (Wood apple + Ginger + Honey), $T_7$ (Wood apple + Ginger + Lemon) and 3 replications in physio-chemical analysis & organoleptic properties test and cost of formulation of wood apple pickle. The pickle samples were stored at ambient temperature (28 ± 5 °C) for 60 days. On the basis of results obtained during the present investigation $T_5$ (Wood apple + Ginger + green chilly) was found superior in terms of wood apple pickle on physio-chemical properties and quality for pH and organoleptic test viz. Color and Appearance, texture, taste followed by $T_2$ (Wood apple + Ginger + White Vinegar) that was found to be superior in terms of wood apple picke on physio-chemical properties and quality for T.S.S. and organoleptic test viz. overall acceptability. Score of Colour and Appearance, Aroma, Taste, Texture, Overall acceptability of wood apple picke was found to be better at cold temperature than at room temperature. The maximum Benefit cost ratio (1.36) was found for $T_5$ (Wood apple + Ginger + green chilly).



***Keywords:*** *Wood Apple, Organoleptic test, Pickle, Storage period.*


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## INTRODUCTION

Due to a lack of resources and expertise for effective handling, distribution, marketing, and storage, perishable fruits that constitute seasonal surpluses at particular times of the year in certain places are wasted in significant amounts. Furthermore, the abundance of perishable fruits

and vegetables that are produced during one season causes a shortage throughout the following season. (**Vidhya and Narain 2011**).

"Fruits and vegetables have historically held a place in dietary guidance because of their concentrations of vitamins, especially vitamin A and C; minerals, especially electrolytes; and more recently phytochemicals especially antioxidant. India is the second-largest producer of fruits and vegetables in the world, producing 191.76 million tonnes of vegetables and 99.06 million tonnes of fruits, which represents about 15% of the country's share of global vegetable production in 2020. It was one among the top five producers of more than 80% of agricultural products worldwide, but it also experiences close to 25% of its production going to waste". (**NHB, 2020**).

"Wood apple is an indigenous fruit grown in South East Asian countries with excellent medicinal values. This fruit is under utilised because of many reasons such as seasonality and lack of awareness. The present study is oriented towards development of a pickle with wood apple and its organoleptic evaluation during and after storage of three months. Microbiological analysis was also done to assess shelf life. Findings revealed that the product has not changed in sensory properties and no visible signs of colonies were noticed. It calls for development of several such products for complete utilisation Limonia acidissima commonly known as wood apple or kath bael belonging to the family Rutacea is widely distributed in tropical and subtropical countries. It is native and common in india, Sri Lanka, China and Indonesia. According to Ayurveda wood apple is reported to be having many medicinal properties" **(Manthena *et al* 2014)**.

"The age of the plant varies from 13 to 70 years with yield potentiality in mother plants varying from 650 to 1085 kg of fruit per plant having the fruit weight between 130 and 225 gm. Fruit length varies between 7.3 to 8.9 cm while breadth between 7.2 and 8.4 cm. Fruit size (length × breadth) varies in relation to fruit weight. Wood apple has high nutritional value" **Sridhar *et al.*, (2019)**

"The wood apple pulp is a rich source of Beta carotene, a precursor of vitamin-A which also contains significant amount of vitamins-B such as riboflavin and thiamine and it had small quantities of ascorbic acid content" (**Kumar and Deen, 2017**).

"The pulp in ripened fruit is about 70% of total weight and seeds are embedded in the pulp. It contains about 70% moisture, 7.3% protein, 0.6% fat, 1.9% mineral matter, 2.3% acidity, 7.2% sugars, 0.07% iron, 0.08% phosphorus and it is a rich source of riboflavin (77 mg/100 mg) and calcium (0.17%). The pulp contains 3 to 5% of pectin (16% yield on dry-weight basis. Wood apple is a cheap, highly nutritious and seasonally available fruit that can be preserved for human consumption throughout the year" **(Prasad *et al* 2020)**.

"As such wood apple pickle prepared with oil is stored for long period of time loses texture and become soft which is not acceptable by the consumer. Further, it is difficult to carry pickle which is oily. Modernization has leaded to lack of time and there is a need for convenience food for working people. Drying is the most widely used primary method of food processing and preservation" (**Pal et al 2018**).

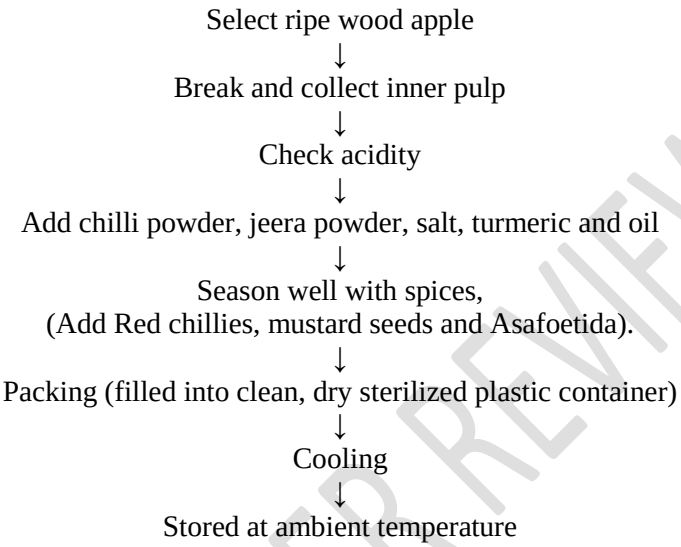
## MATERIALS AND METHODS

The present investigation entitled “Standardization of wood apple (Limonia acidissima) Picke” was conducted in the post-harvest laboratory of Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P.) India during the year 2022. The present investigation the design used for analysis of variables were completed Randomized Design (CRD) with 8 treatment and comprises four replication in term of days of storage. Details of treatment are present in table given below.

List 1 : list of the treatment notions and their treatment combination.

| Treatment Notion | Treatment combination |
|---|---|
| $T_0$ | Wood apple (control) |
| $T_1$ | Wood apple + Ginger + Jaggery |
| $T_2$ | Wood apple + Ginger + White Vinegar |
| $T_3$ | Wood apple + Ginger + Jamun vinegar |
| $T_4$ | Wood apple + Ginger + Sugar cane vinegar |
| $T_5$ | Wood apple + Ginger + green chilly |
| $T_6$ | Wood apple + Ginger + Honey |
| $T_7$ | Wood apple + Ginger + Lemon |

**Chart 1: Flow chart for preparation of wood apple pickle**






## RESULTS AND DISCUSSION

The experimental result of the present investigation, regarding the **Standardization of wood apple (*Limonia acidissima*) Pickle** have been discussed and interpreted in the light of previous research work done in India and abroad. The results of the experiment are summarized below.

The data with respect to total soluble solid is presented in table 1 indicate that there was a subsequence increase in total soluble solid and significant difference among all treatment. The maximum score for TSS were recorded in treatment $T_5$ Wood apple + Ginger + green chilly (34.32 $B^0$, 34.48 $B^0$, 34.84 $B^0$ and 35.12 $B^0$) followed by $T_2$ (Wood apple + Ginger + Jaggery) which attained (30.20 $B^0$, 29.12 $B^0$, 31.05 $B^0$and 32.38 $B^0$). However significantly minimum total soluble solid was recorded in $T_0$ (control) with (15.00 $B^0$, 16.79 $B^0$, 18.73 $B^0$ and 19.48 $B^0$)at 1 days as well as 30, 60 and 90 days of storage respectively. This might due to conversion of polysaccharides into sugar hydrolysis process during storage similar observation were reported by **Awadhesh and Bhagwan (2017)** in mature fruits of wood apple**.**

The data with respect to moisture content is presented in table 1 indicate that there was a gradual decrease in moisture content and significant difference among all treatment. The maximum score

for moisture content were recorded in treatment $T_5$ Wood apple + Ginger + green chilly (19.87 %, 19.24 %, 18.32 % and 18.14 %) followed by $T_2$ (Wood apple + Ginger + White Vinegar) which attained (18.21 %, 18.24 %, 18.48 %and 18.89 %). However significantly minimum moisture content was recorded in $T_0$ (control) with (17.19 %, 17.27 %, 17.12 % and 17.18 %)at 1 days as well as 30, 60 and 90 days of storage respectively. The decrease in moisture content is due to the dehydration phenomenon. similar observation were reported by **(Namdev *et al.* 2015 and Rathore *et al.* 2021)** found that moisture content of wood apple decreased with storage.

The perusal of Table 1 reveals that there was significant effect in all the treatment during the storage period. The maximum acidity was recorded in $T_5$ Wood apple + Ginger + green chilly (2.41 %, 3.01 %, 3.12 % and 3.25 %) followed by $T_2$ (Wood apple + Ginger + White Vinegar) which attained (2.08 %, 2.89 %, 2.68 %and 2.75 %). However significantly minimum acidity was recorded in $T_0$ (control) with (1.54 %, 2.30 %, 2.36 % and 2.48 %)at 1 days as well as 30, 60 and 90 days of storage respectively.

The statistically analyzed data presented in Table 2 that there was a slightly decreasing trend score card for colour and appearance among the treatment. The maximum score for colour and appearance were recorded in treatment $T_5$ Wood apple + Ginger + green chilly (7.89, 7.65, 7.41 and 7.23) followed by $T_2$ (Wood apple + Ginger + White Vinegar) which attained (8.14, 7.19, 7.01 and 6.73). However significantly minimum colour and appearance was recorded in $T_0$ (control) with (6.15, (5.35, 5.15 and 4.93)at 1 days as well as 30, 60 and 90 days of storage respectively whereas The statistically analyzed data presented in Table 2 that there was a slightly increasing trend score card the maximum score for flavor and taste were recorded in$T_5$ Wood apple + Ginger + green chilly (8.00, 8.34, 8.38 and 8.42) followed by $T_2$ (Wood apple + Ginger + White Vinegar) which attained (7.43, 7.98, 7.84and 7.61). However significantly minimum flavor and taste was recorded in $T_0$ (control) with (5.27, (5.86, 5.18 and 5.22) at 1 days as well as 30, 60 and 90 days of storage respectively. Browning of pickle with time is the possible cause of slight colour and flavor change. Significant increased sourness of pickle with storage time might be one of the possible reasons for flavor changes and reduction in overall acceptability. Consistency remains same and the taste declined, flavor change was observed, reduction in appearance and taste of pickle in storage occurred after 90 days of storage. Hence, maximum storage at 90 days at room temperature may give better acceptability. Similar results were obtained by **(Menthana *et al.* 2014 and Rathore *et al.* 2021)** found that colour and apperance of wood apple decreased with storage.

The statistically analyzed data presented in Table 2 that there was a slightly decreasing trend score card for Texture score among the treatment. The maximum score for Texture score were recorded in treatment $T_5$ Wood apple + Ginger + green chilly (7.95, 8.16, 8.32 and 8.78) followed by $T_2$ (Wood apple + Ginger + White Vinegar) which attained (7.98, 8.15, 8.43 and 8.59). However significantly minimum Texture score was recorded in $T_0$ (control) with (6.54, 6.86, 7.00 and 7.14)at 1 days as well as 30, 60 and 90 days of storage respectively whereas The statistically analyzed data presented in Table 2 that there was a slightly increasing trend score card the maximum score for overall acceptability were recorded in$T_5$ Wood apple + Ginger + green chilly (8.00, 8.24, 8.42 and 8.76) followed by $T_2$ (Wood apple + Ginger + White Vinegar) which attained (7.83, 8.13, 8.42 and 8.58). However significantly minimum flavor and taste was recorded in $T_0$ (control) with (5.99, 6.12, 6.21 and 6.34) at 1 days as well as 30, 60 and 90 days of storage respectively. Over the storage month sensory evaluation of pickle revealed fewer

amounts of change in colour, flavor, texture, test, and overall acceptability Similar result found by **Premi *et al.* 2002 and Hemalatha and Parameshwari 2019**. Freshly made wood apple pickle showed high overall acceptability which reduced with time of storage

## CONCLUSION

It was concluded from the experiment that treatment that treatment $T_5$ (Wood apple + Ginger + green chilly), was found superior over other treatment in term of physio-chemical analysis *viz.* pH, TSS, Moisture content and acidity. Regarding in term of organoleptic evaluation *viz.* colour and appearance, Taste and Flavour, Texture score and Overall acceptability score was also obtained in $T_5$.

**Table 1:** Effect of different treatment in term of physico-chemical analysis *viz.* TSS, moisture content and total acidity

| Treatment notion | Treatment combination | T.S.S. | | | | Moisture content (%) | | | | Total acidity (%) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Storage period (Days) | | | | Storage period (Days) | | | | Storage period (Days) | | | |
| | | 1 Days | 30 days | 45 days | 60 days | 1 Days | 30 days | 45 days | 60 days | 1 Days | 30 days | 45 days | 60 days |
| $T_0$ | Wood apple (control) | 15.00 | 16.79 | 18.73 | 19.48 | 17.19 | 17.27 | 17.12 | 17.18 | 1.54 | 2.30 | 2.36 | 2.48 |
| $T_1$ | Wood apple + Ginger + Jaggery | 30.20 | 29.12 | 32.38 | 31.05 | 18.00 | 18.27 | 18.35 | 18.42 | 1.34 | 1.68 | 1.88 | 1.94 |
| $T_2$ | Wood apple + Ginger + White Vinegar | 15.25 | 16.92 | 18.79 | 19.47 | 18.21 | 18.82 | 18.48 | 18.89 | 2.08 | 2.89 | 2.68 | 2.75 |
| $T_3$ | Wood apple + Ginger + Jamun vinegar | 15.04 | 16.76 | 18.74 | 19.36 | 17.46 | 17.87 | 17.68 | 17.57 | 1.41 | 1.98 | 2.11 | 2.05 |
| $T_4$ | Wood apple + Ginger + Sugar cane vinegar | 16.16 | 17.95 | 19.84 | 20.58 | 17.78 | 18.08 | 17.89 | 18.01 | 1.65 | 2.01 | 1.88 | 2.12 |
| $T_5$ | Wood apple + Ginger + green chilly | 34.32 | 34.48 | 34.84 | 35.12 | 19.87 | 18.24 | 18.32 | 18.14 | 2.41 | 3.01 | 3.25 | 3.12 |
| $T_6$ | Wood apple + Ginger + Honey | 16.02 | 17.90 | 19.78 | 20.40 | 17.31 | 17.67 | 17.77 | 17.78 | 2.00 | 2.58 | 2.85 | 2.39 |
| $T_7$ | Wood apple + Ginger + Lemon | 16.02 | 17.80 | 19.63 | 20.14 | 17.28 | 17.63 | 17.87 | 18.00 | 2.12 | 2.53 | 2.18 | 2.22 |
| **Mean** | | 19.75 | 20.96 | 22.84 | 23.20 | 17.89 | 17.98 | 17.94 | 18.00 | 1.82 | 2.37 | 2.40 | 2.38 |
| **C.V.** | | 2.74 | 2.63 | 2.10 | 2.37 | 1.67 | 1.71 | 2.98 | 1.97 | 2.31 | 2.11 | 2.23 | 2.89 |
| **F' Test** | | S | S | S | S | S | S | S | S | S | S | S | S |
| **S.E.(d)** | | 0.27 | 0.28 | 0.24 | 0.28 | 0.15 | 0.15 | 0.27 | 0.18 | 0.02 | 0.03 | 0.03 | 0.03 |
| **C.D. at 5%** | | 0.79 | 0.80 | 0.70 | 0.80 | 0.44 | 0.45 | 0.78 | 0.52 | 0.06 | 0.07 | 0.08 | 0.10 |

**Table 2:** Effect of different treatment in term of organoleptic evaluation *viz.* colour and appearance, Taste and Flavour, Texture score and Overall acceptability score

| Treatment notion | Treatment combination | Colour and Appearance (%) | | | | Flavour & Taste | | | | Texture Score | | | | Overall Acceptability | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Storage period (Days) | | | | Storage period (Days) | | | | Storage period (Days) | | | | Storage period (Days) | | | |
| | | 1 Days | 30 days | 45 days | 60 days | 1 Days | 30 days | 45 days | 60 days | 1 Days | 30 days | 45 days | 60 days | 1 Days | 30 days | 45 days | 60 days |
| $T_0$ | Wood apple (control) | 6.15 | 5.35 | 5.15 | 4.93 | 5.27 | 5.86 | 5.18 | 5.22 | 6.54 | 6.86 | 7.00 | 7.14 | 5.99 | 6.12 | 6.21 | 6.34 |
| $T_1$ | Wood apple + Ginger + Jaggery | 7.42 | 6.48 | 6.32 | 6.06 | 5.94 | 6.12 | 6.27 | 6.48 | 6.84 | 7.12 | 7.47 | 7.84 | 7.09 | 7.24 | 7.34 | 7.45 |
| $T_2$ | Wood apple + Ginger + White Vinegar | 8.14 | 7.19 | 7.01 | 6.73 | 7.43 | 7.98 | 7.61 | 7.84 | 7.98 | 8.15 | 8.43 | 8.59 | 8.00 | 8.13 | 8.42 | 8.58 |
| $T_3$ | Wood apple + Ginger + Jamun vinegar | 6.00 | 5.48 | 5.23 | 5.06 | 6.87 | 7.12 | 7.52 | 7.68 | 6.72 | 7.02 | 7.00 | 7.17 | 6.17 | 6.48 | 6.57 | 6.66 |
| $T_4$ | Wood apple + Ginger + Sugar cane vinegar | 7.02 | 6.12 | 5.89 | 5.70 | 6.00 | 6.23 | 6.45 | 6.56 | 7.12 | 7.49 | 7.58 | 7.69 | 7.97 | 8.09 | 8.12 | 8.36 |
| $T_5$ | Wood apple + Ginger + green chilly | 7.89 | 7.65 | 7.41 | 7.23 | 8.00 | 8.34 | 8.38 | 8.42 | 7.95 | 8.16 | 8.32 | 8.78 | 7.83 | 8.24 | 8.42 | 8.76 |
| $T_6$ | Wood apple + Ginger + Honey | 6.78 | 6.68 | 6.47 | 6.26 | 7.19 | 7.88 | 7.42 | 7.14 | 6.00 | 6.27 | 6.87 | 7.04 | 6.88 | 7.12 | 7.27 | 7.56 |
| $T_7$ | Wood apple + Ginger + Lemon | 6.45 | 6.18 | 5.97 | 5.76 | 6.47 | 6.78 | 6.87 | 6.94 | 7.27 | 7.68 | 7.83 | 7.89 | 7.37 | 7.64 | 7.80 | 7.89 |
| **Mean** | | 6.98 | 6.39 | 6.18 | 5.97 | 6.65 | 7.04 | 6.96 | 7.04 | 7.05 | 7.34 | 7.56 | 7.77 | 7.16 | 7.38 | 7.52 | 7.70 |
| **C.V.** | | 2.32 | 2.25 | 2.18 | 2.10 | 2.01 | 1.50 | 2.78 | 2.38 | 1.87 | 2.48 | 2.30 | 1.86 | 2.03 | 2.51 | 1.46 | 2.34 |
| **F' Test** | | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S | S |
| **S.E.(d)** | | 0.08 | 0.07 | 0.07 | 0.06 | 0.07 | 0.05 | 0.10 | 0.08 | 0.07 | 0.09 | 0.09 | 0.07 | 0.07 | 0.09 | 0.05 | 0.09 |
| **C.D. at 5%** | | 0.24 | 0.21 | 0.20 | 0.18 | 0.20 | 0.15 | 0.28 | 0.24 | 0.19 | 0.27 | 0.25 | 0.21 | 0.21 | 0.27 | 0.16 | 0.26 |

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