STUDIES ON EFFECT OF BLENDING IMPACT OF GUAVA (*Psidium guajava* L.) AND PAPAYA (*Carica papaya* L.) PULP ON RECIPE STANDARDIZATION OF BLENDED NECTAR AND RTS (Ready to Serve) BEVERAGES

M.Sc. (Hort) Thesis

by

Yuthika Kumari

DEPARTMENT OF FRUIT SCIENCE
COLLEGE OF AGRICULTURE
FACULTY OF AGRICULTURE
INDIRA GANDHI KRISHI VISHWAVIDYALAYA
RAIPUR (Chhattisgarh)
2016

STUDIES ON EFFECT OF BLENDING IMPACT OF GUAVA (*Psidium guajava* L.) AND PAPAYA (*Carica papaya* L.) PULP ON RECIPE STANDARDIZATION OF BLENDED NECTAR AND RTS (Ready to Serve) BEVERAGES

Thesis

Submitted to the

Indira Gandhi Krishi Vishwavidyalaya, Raipur

By

Yuthika Kumari

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF

Master of Science

in

Horticulture

(Fruit Science)

UE ID 20141520433 College ID 120114214

JULY, 2016

CERTIFICATE- I

This is to certify that the thesis entitled **"Studies on effect of blending impact of guava (*Psidium guajava* L.) and papaya (*Carica papaya* L.) pulp on recipe standardization of blended nectar and RTS (Ready to Serve) beverages"** submitted in partial fulfillment of the requirements for the degree of **Master of Science in Horticulture (Fruit Science)** of the Indira Gandhi Krishi Vishwavidyalaya, Raipur, is a record of the bonafide research work carried out by **Yuthika Kumari** under my/our guidance and supervision. The subject of the thesis has been approved by the Student's Advisory Committee and the Director of Instructions.

No part of the thesis has been submitted for any other degree or diploma or has been published/published part has been fully acknowledged. All the assistance and help received during the course of the investigation have been duly acknowledged by her.

Date: 07/7/2016

Chairman

(Dr. S.N. Dikshit)

THESIS APPROVED BY THE STUDENT'S ADVISORY COMMITTEE

Chairman (Dr. S.N. Dikshit) _____

Member (Dr. H.G. Sharma) _____

Member (Dr. C.S. Shukla) _____

Member (Dr. R.R. Saxena) _____

CERTIFICATE – II

This is to certify that the thesis entitled **"Studies on effect of blending impact of guava (*Psidium guajava* L.) and papaya (*Carica papaya* L.) pulp on recipe standardization of blended nectar and RTS (Ready to Serve) beverages"** submitted by **Yuthika Kumari** to the Indira Gandhi Krishi Vishwavidyalaya, Raipur, in partial fulfilment of the requirements for the degree of **Master of Science in Horticulture** in the Department of Fruit science has been approved by the external examiner and Student's Advisory Committee after oral examination.

Signature External Examiner

(M K Meena)

Date: 1.8.2016

Major Advisor _____

Head of the Department _____ 01/8/16

Faculty Dean _____

Approved/Not approved

Director of Instructions _____

ACKNOWLEDGEMENT

"A journey is easier when you travel together. Interdependence is especially more valuable than independence". I have been accompanied and supported by many people. It is a pleasant aspect that I got a golden opportunity to express my gratitude to all of them.

I feel immense pleasure in expressing my heartiest thank and deep sense of gratitude to my esteemed advisor ***Dr. S.N. Dikshit****, Professor, Department of Fruit Science, IGKV, Raipur, and Chairman of my advisory committee for his enduring interest, kind attitude, scholastic guidance, inspiring suggestions, constant supervision, sustained support, constructive criticism coupled with kindness and patience in leading my path to achieve the destination during the entire move despite his heavy schedule of work.*

I feel proud to convey my heartfelt sense of gratitude to Dr. H.G. Sharma, Professor, for his regular encouragement, timely advice whenever required, for enriching with productive scientific discussions and above all for being an excellent human being during the most tiring time in this tenure of research work. With a sense of high resolve and reverence, in a deep impact of gratefulness, thanks to the members of my advisory committee Dr. C.S. Shukla, Professor , Department of Plant Pathology and Dr. R.R. Saxena, Professor, Department of Statistics, Mathematics and Computer Science, for their kind cooperation, guidance, continued inspiration and valuable suggestions throughout the tenure of this investigation.

I am extremely grateful to Dr. Prabhakar Singh, Professor and Head of Department of Fruit Science for his support and encouragement.

I am highly obliged to Hon'ble Vice-Chancellor Dr.S.K.Patil, Dr.S.S. Rao, Dean, College of Agriculture, Dr. J.S. Urkurkar, Director Research Services and Dr.S.S. Shaw, Director of Instructions, IGKV, Raipur for providing necessary facilities to conduct the investigation.

It is great pleasure to extend profuse thanks to Dr. G.L. Sharma, Dr. G.D. Sahu, Dr. (Smt.) Pushpa Parihar, and other technical and non-technical staff members of the Department of Fruit Science, IGKV, Raipur for their help, affectionate encouragement and useful suggestions during the tenure of this investigation. I am also thankful to Dr. Neeraj Shukla, Professor and Head, Department of Floriculture and Lanscape Architecture for his support and encouragement.

I would like to thank the unrelenting support of non-technical staff of my department Shri Harinkhere Sir, Ganesh Yadav Sir, Purshottam bhaiya, Dinesh Patel bhaiya, Madhu bhaiya and Ganpat bhaiya for their help during this piece of work.

I would like to express my sincere gratitude to Dr. M. Pandey (Librarian, Nehru Llibrary, Raipur) and Shri U.K. Watti for giving me their kind help during my present study.

I am extremely thankful to all my respected seniors Nisha Chandel, Apurwa Kesharwani, Archana Dikshit, Kamlesh Diwan, Vikas Chandra who were always ready to give their guidance, help and suggetions in the present study.

I wish my sincere thanks to my colleagues Bhawna Panda, Dinesh kumar Soni, Priyanka Prajapati, Tikeshwar sahu, Kalyani Nagraj ,Vandana Patley and Ekta Usare for their kind support.

I am specially thankful to my friends and dear ones Shrity sundaram, Monika Bhatkar, Priyanka Prajapati, Barsha Tripathy, Dhani devi ,Sontara Kalita, Pinky Das, Khusbu Kumari, Kirti Gupta, Sabiha Perween, Nupur Saini and Ancy Sebastian for their support, affection, encouragement and cooperation which made my path easier.

Such endeavour is impossible without my family support and I am lucky to enjoy this at all stages. Thus, words cannot express heartiest gratitude for my mother Prabha Rani Pandit, father Nandlal Pandit, Elder brother Ranganath Pandit and younger brother Dhruva Bhaswar and other family members whose sincere prayers have become light for success of completion of this investigation.

I am deeply indebted to all my wishes who helped me directly or indirecly to complete this investigation. I have no words to convey their name, but each of them knows that they have my cordial thanks.

At last but not least, I am thankful to almighty God Lord Krishna and Bajrangbali for all the blessings bestowed upon me because of which I am at this position today.

Yuthika Kumari

Department of Fruit Science

College of Agriculture,

I.G.K.V, Raipur (C.G)

Date:

(Yuthika Kumari)

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

%	Per cent
^{o} Brix	Degree Brix
^{o}C	Degree Celsius
cc	Cubic centimetre
CD	Critical difference
cm	Centimetre
cv.	Cultivar
d.f.	Degree of freedom
et al.	And others/Co-workers
Fig.	Figure
g	Gram
i.e.	That is
kg	Kilogram
KMS	Potassium meta-bisulphite
mg	Milligram
ml	Millilitre
N	Normality
No.	Number
NS	Non-significant
ppm	Parts per million
RTS	Ready-to-Serve
SEm±	Standard error of mean
T	Treatment
TSS	Total soluble solids
Viz.	Namely
Vol.	Volume
Wt	Weight
µg	Microgram

THESIS ABSTRACT

a)	Title of the Thesis	:	Studies on effect of blending impact of guava (*Psidium guajava* L.) and papaya (*Carica papaya* L.) pulp on recipe standardization of blended nectar and RTS (Ready to Serve) beverages
b)	Full Name of the Student	:	Yuthika Kumari
c)	Major Subject	:	Fruit Science
d)	Name and Address of the Major Advisor	:	Dr. S.N. Dikshit, Professor Department of Fruit Science, College of Agriculture, IGKV, Raipur,(C.G.)
e)	Degree to be awarded	:	M.Sc.(Hort.) Fruit Science

Yuthika Kumari
Signature of Student

Signature of Major Advisor

Date : 8/07/16

Signature of Head of Department

ABSTRACT

The present investigation entitled "**STUDIES ON EFFECT OF BLENDING IMPACT OF GUAVA (*Psidium guajava* L.) AND PAPAYA (*Carica papaya* L.) PULP ON RECIPE STANDARDIZATION OF BLENDED NECTAR AND RTS (Ready to Serve) BEVERAGES**"was conducted at Horticulture Processing Laboratory, Department of Fruit Science, IGKV, Raipur (C.G.) during the year 2015-2016. The experimental material consisted of thirteen treatments with combination of four recipes including one standard recipe without blending and three blending ratio 25:75, 50:50 and 75:25 of guava and papaya with varying levels of TSS for nectar and RTS. The treatment combinations were 26 and replicated thrice under Completely Randomized Design.

The fruits of guava and papaya were analysed for physico-chemical chararacteristics. The blended nectar and RTS prepared from different recipes and blending ratio were also analysed periodically at 30 days interval for their various chemical constituents. The blended nectar and RTS were organoleptically evaluated by adopting 9

point Hedonic rating scale and observations were recorded for their chemical changes during storage for 3 months.

A critical analysis of physical composition of guava and papaya fruits revealed that average fruit weight was recorded 161.77 g and 1620 g, pulp weight 155.30 g and 1420 g, seed weight 5.85 g and 12.50 g, weight of non-edible waste 6.84 g and 89 g and pulp seed ratio 26.54 and 113.60, respectively. Among the chemical composition, the TSS was recorded 13.31% and 10.6%, acidity 0 .49% and 0.34%, ascorbic acid 241mg/100 ml and 66.62 mg/100 ml, pH 3.62 and 4.37, reducing sugar 4.78% and 7.69%, non-reducing sugar 5.51% and 1.70 % and total sugar 10.30% and 9.39% ,respectively.

Among various recipe tried in this investigation, the nectar prepared from the treatment T_6 (20% Juice-75% Guava: 25% Papaya: 18% TSS: 0.3% acidity) recorded highest ascorbic acid, non-reducing sugar, pH and organoleptic score with respect to aroma, taste and overall acceptability. Whereas, the nectar containing the recipe T_{10} (20% Juice- 25% Guava: 75% Papaya: 16 % TSS: 0.3% acidity) recorded highest acidity, reducing, total sugar and organoleptic score with respect to colour and appearance. Similarly, preparation of RTS with the treatment T_3 (10% Juice-75% Guava: 25% Papaya: 14% TSS: 0.3% acidity) recorded highest ascorbic acid, non-reducing sugar, pH and organoleptic score with respect to aroma, taste and overall acceptability. Whereas, the RTS containing the recipe T_{10} (10% Juice-25% Guava juice: 75% Papaya: 11% TSS: 0.3% acidity) recorded highest acidity, reducing, total sugar. During storage of nectar and RTS, the acidity, TSS, total sugar and reducing sugar showed an increasing trend with increasing period of storage (0 to 90 days) under ambient condition. While, there was a decreasing trend of ascorbic acid, pH, non-reducing sugar and organoleptic score during storage period upto 90 days of storage under ambient condition.

The lowest cost of production (Rs 646.96), highest net return (Rs. 853.04) and benefit: cost ratio (1.32) of blended guava and papaya nectar was recorded in the treatment of T_{10} (20% Juice-25% Guava: 75% Papaya: 16 % TSS: 0.3% acidity). While in case of blended guava and papaya RTS, treatment T_{10} (10% Juice-25% Guava: 75% Papaya: 11% TSS: 0.3% acidity) recorded for lowest cost of production (Rs 539.34), highest net return (Rs. 960.66) and benefit: cost ratio (1.78).

शोधग्रंथ सारांश

अ) शोधग्रंथ का शीर्षकः	"अमरुद (*सीडियम ग्वाजवा एल.*) एवं पपीता (*कैरिका पपाया एल.*) का गूदा सम्मिश्रण के प्रभाव की विधि मानकीकरण का मिश्रित नेक्टर और आरटीएस (रेडी-टु-सर्व) पेय पर अध्ययन"
ब) छात्रा का पूरा नामः	**यूथिका कुमारी**
स) मुख्य विषयः	फल विज्ञान
द) प्रमुख सलाहकार का नाम व पताः	डॉ० एस. एन. दीक्षित प्राध्यापक, फल विज्ञान विभाग, इं.गां.कृ.वि.वि., रायपुर, (छ.ग.)
इ) उपाधि से सम्मानित किया जाना हैः	एम.एस.सी.(उद्यानिकी) फल विज्ञान विभाग

यूथिका कुमारी
छात्रा के हस्ताक्षर

प्रमुख सलाहकार के हस्ताक्षर

दिनांकः 8/07/16

विभागाध्यक्ष के हस्ताक्षर

सारांश

वर्तमान शोध जांच **"अमरुद (*सीडियम ग्वाजवा एल.*) एवं पपीता (*कैरिका पपाया एल.*) का गूदा सम्मिश्रण के प्रभाव की विधि मानकीकरण का मिश्रित नेक्टर और आरटीएस (रेडी-टु-सर्व) पेय पर अध्ययन"** के अन्तर्गत वर्ष 2015–16 के दौरान उद्यानिकी प्रसंस्करण प्रयोगशाला, फल विज्ञान विभाग, इंदिरा गांधी कृषि विश्वविद्यालय, रायपुर (छ.ग.) में किया गया। प्रयोगात्मक सामग्री तेरह उपचार संयोजन के साथ चार विधि सहित एक मानक विधि सम्मिश्रण के बिना और अमरुद और पपीता के तीन सम्मिश्रण अनुपात 25:75, 50:50 तथा 75:25 को लेकर कुल विलेय ठोस पदार्थ (टीएसएस) के अलग–अलग स्तर पर नेक्टर एवं आरटीएस बनाये गये। इस प्रकार कुल उपचार संयोजन 26 थे और पूर्ण यादृच्छिक डिजाइन के अन्तर्गत तीन बार पुनरावृत्ति की गई।

अमरुद और पपीता के फलों का भौतिक और रसायनिक संगठन के लिए विश्लेषण किया गया। नेक्टर और आरटीएस का विभिन्न रसायनिक घटकों के लिए 30 दिनों के अंतराल पर समय–समय पर विश्लेषण किया गया। मिश्रित नेक्टर और आरटीएस का आर्गनोलेप्टिक मूल्यांकन 9 बिन्दु हेडोनिक स्केल अपनाकर किया गया और 3 माह के भंडारण की अवधि में उनके रसायनिक परिवर्तनों को दर्ज किया गया।

अमरुद और पपीता के फलों के भौतिक संगठन के महत्वपूर्ण विश्लेषण से पता चला है कि औसत फल का वजन 161.77 ग्राम और 1620 ग्राम, गूदा वजन 155.30 ग्राम और 1420 ग्राम, बीज वजन 5.85 ग्राम और 12.80 ग्राम, अपशिष्ट खाद्य पदार्थ 6.84 ग्राम और 89 ग्राम का वजन और गूदा बीज अनुपात 26.54 और 113.60, क्रमशः दर्ज किये गये। रसायनिक संगठन में टीएसएस 13.31 और 10.6 प्रतिशत, अम्लता 0.49 और 0.34 प्रतिशत, एस्कॉर्बिक एसिड 241 मिग्रा. प्रति 100 मिली. और 66.32 मिग्रा. प्रति 100 मिली. पी.एच. 3.62 और 4.37, अपचायक शर्करा 4.78 और 7.69 प्रतिशत, अन–अपचायक शर्करा 5.51 और 1.70 प्रतिशत और कुल शर्करा 10.30 और 9.39 प्रतिशत, क्रमशः पाया गया।

इस शोध के विभिन्न उपचारों में नेक्टर उपचार विधि T_6 (20 प्रतिशत रस–75% अमरुद : 25% पपीता : 18 प्रतिशत टीएसएस : 0.3 प्रतिशत अम्लता) में उच्चतम एस्कॉर्बिक एसिड, अन–अपचायक शर्करा, पीएच और खुशबु, स्वाद और समग्र स्वीकार्यता के आधार पर आर्गनोलेप्टिक मूल्य दर्ज किये गये। जबकि नेक्टर विधि T_{10} (20 प्रतिशत रस–25% अमरुद : 75% पपीता : 16 प्रतिशत टीएसएस : 0.3 प्रतिशत अम्लता) में उच्चतम अम्लता, अपचायक शर्करा, कुल शर्करा और रंग–रुप के आधार पर ऑर्गनोलेप्टिक मूल्य दर्ज किया गया। इसी तरह आरटीएस में उपचार T_3 (10 प्रतिशत रस–75% अमरुद : 25% पपीता : 14 प्रतिशत टीएसएस : 0.3 प्रतिशत अम्लता) में उच्चतम एस्कॉर्बिक एसिड, अन–अपचायक शर्करा, पीएच और खुशबु स्वाद और समग्र स्वीकार्यता के आधार पर ऑर्गनोलेप्टिक मूल्य दर्ज किया गया। जबकि आरटीएस विधि T_{10} (10 प्रतिशत रस–25% अमरुद : 75% पपीता : 11 प्रतिशत टीएसएस : 0.3 प्रतिशत अम्लता) में उच्चतम अम्लता, अपचायक शर्करा, कुल शर्करा दर्ज की गई। नेक्टर और आरटीएस में अम्लता, टीएसएस, कुल शर्करा और अपचायक शर्करा को अनुकूल कमरें के तापक्रम में भंडारण की अवधि 0 से 90 दिन में बढ़ती हुई प्रवृत्ति में देखी गई। जबकि, एस्कॉर्बिक एसिड, पीएच, अन–अपचायक के शर्करा और ऑर्गनोलेप्टिक मूल्य को 90 दिन के भंडारण की अवधि में घटते हुए क्रम में दर्ज किया गया।

मिश्रित अमरुद और पपीता के नेक्टर की विधि T_{10} (20 प्रतिशत रस–25% अमरुद : 75% पपीता : 16 प्रतिशत टीएसएस : 0.3 प्रतिशत अम्लता) में सबसे कम लागत रु. 646.96 में उच्चतम शुद्ध लाभ रु. 853.04 और लाभ लागत अनुपात रु. 1.32 दर्ज किया गया। जबकि, मिश्रित अमरुद और पपीता आरटीएस की विधि T_{10} (10 प्रतिशत रस–25% अमरुद : 75% पपीता : 11 प्रतिशत टीएसएस : 0.3 प्रतिशत अम्लता) में सबसे कम लागत रु. 539.34 में उच्चतम शुद्ध लाभ रु. 960.66 और लाभ लागत अनुपात रु. 1.78 दर्ज किया गया।

CHAPTER-I

INTRODUCTION

Fruits and vegetables are important constituents of the diet and provide significant quantities of nutrients, especially vitamins, sugars, minerals and fiber. Daily consumption of fruits and vegetables reduce the risk of cancer, heart disease, premature aging, stress and fatigue primarily due to the integrated action of oxygen radical scavengers such as β-carotene and ascorbic acid plus calcium and dietary fiber. Due to the perishable nature of the fruits and vegetables, they require immediate processing to avoid post harvest losses (20-25%). This may be attributed to change in dietary habits, taste preferences and the way of life of present day consumers. Fruit and vegetable beverages have higher nutritional, medicinal and calorific values compared to synthetic beverages. Moreover, owing to high acidity, astringency, bitterness and such other factors in some of the fruits and vegetables, the utilization of these fruits for the preparation of various processed products becomes limited, despite having high nutritional qualities. Therefore, blending of two or more fruit and vegetable juices for the preparation of ready-to-serve beverage may be a convenient alternative for the utilization of these fruits and vegetables.

Blending of different fruit juices helps in balancing out excessively strong flavors like high acidity, astringency, or bitterness, corrects low soluble solids level, improves poor colour or colour stability with other positive attributes. Nowadays, people finds drinking of blended fruit juice is fast and effective way to get their daily allowance of fruits. In Chhattisgarh region as area and production of papaya is more, as a result farmers are bound to sell fruits at low price and getting lower return. Both guava and papaya are perishable fruit crops, so a value-added drink can be prepared by blending of these two fruit juices enhancing the nutritive quality. Fruit juice blends can be produced from various fruits in order to combine all the basic nutrients present in these different fruits for use when combined. It can improve the vitamin and mineral content depending on the kind and quality of fruits and vegetables used. Sandhu and Sindhu (1992), Deka and Sethi (2001) reported that two or more fruits juice/pulp may be blended in various proportions

for the preparation of nectar, RTS beverages etc. The blending of juice may also improve aroma, taste and the nutritional quality of the juices. Moreover, one could think of a new product development through blending in the form of a natural health drink, which may also be served as an appetizer. So far, no more work has been carried out on mixed fruit juice and spiced beverage.

India is a country, well-known for its tradition and culture. Syrup or *Sharbet* are offered to guests and is an important homemade soft drink. Similarly, fruit juice and beverages also hold an important position due to their richness in essential minerals, vitamins and other nutritive constituents. Being delicious and appealing they have great demand and are appreciated by people of all age groups. Synthetic drinks which are more popular commercially are not so healthy or nutritive compared to natural once. Hence, if natural drinks could substitute synthetic drinks, it would provide numerous benefits to consumers as well as farmers. In view of the rising demands for natural and organic products, fruit juice and other fruit-based beverages have great scope.

Guava (*Psidium guajava* L.), a fifth important fruit crop of India, is an indigenous to Tropical America and belongs to family Myrtaceae. In India, guava is being grown in an area of about 228,500 ha and production of 2.71 MT with a productivity of 12.32 MT/ha (Anon., 2012). Chhattisgarh produces about 4.2% of total production of guava in the country. Area of guava in the state is 0.01 mha with productivity of 7.7MT/ha. Major guava producing belts in the state are Raipur, Durg and Jagdalpur. It excels from most of the other fruit crops in productivity, hardiness, adaptability and vitamin C content. Moreover, the guava fruit is an excellent source of vitamin C containing 70 to 350 mg/100 g, which is about two to five times more than orange and ten times to that of tomato. Apart from vitamin C, it is also a rich source of minerals like calcium, phosphorus, iron etc. The fruit contains substantial quantity of vitamin A, pantothenic acid, riboflavin, thiamine and niacin. It is a rich source of pectin also which ranges from 0.52 to 2.0 %. Guava fruit is recognized as a most promising and well accepted fruit among the processing industries due to its luscious taste, excellent flavor, attractive fragrance and nutritional value. Raw fruits are used for making of

several products *viz.*, RTS, nectar, squash, jam, jelly, ice cream, *sharbet*, cheese, toffee, etc, but it's diversified utilization gives potential to combat malnutrition by developing innovative and novel products which could be prepared from guava pulp as such and in combination with other fruit pulp by blending.

The Papaya (*Carica papaya* L.) belongs to family 'Caricaceae'. Papaya is a tropical fruit having commercial importance because of its high nutritive and medicinal value. Papaya cultivation had its origin in South Mexico and Costa Rica. Total annual world production is estimated to 6 million tonnes of fruits. India leads the world in papaya production with an annual output of about 3 million tonnes. Chhattisgarh is the sixth leading producer of papaya in the country with a share of 6%.The production is 0.25m.MT from an area of 0.01 mha with productivity of 23.3 MT/ha. It is a climacteric fruit and rich in vitamin A content (2020 IU) ranking second after mango (4800 IU). It also contains 0.04 mg vitamin B_2 and 40 mg vitamin C per 100 g fruit. The fruit contains 9.5 % carbohydrates and its calorific value is 40 per 100 gram. The principal carbohydrate at ripe stage is sucrose. Citric and maleic acids are the predominant acids in papaya. Carotenoids are responsible for yellow colour in papaya. However, red-fleshed papaya contains lycopene. Ripe papaya is usually consumed fresh as a breakfast or dessert fruit; it can also be processed and used in a variety of products such as jam, fruit juices, RTS, nectar, and ice cream. Unfortunately papaya fruit has not caught the fancy of the consumers as much as it deserves, mainly because of its odour which is not highly appealing and thus limits its commercial exploitation at processing levels whereas guava emits a sweet aroma which is pleasant, refreshing and acidic in flavour. Therefore, blending of these two fruits product could be an economic preposition to utilize them profitably. There is good possibility of enhancing the flavour and acceptability of papaya product by diversification i.e. by using blending technology.

Considering the above facts, an investigation entitled **"STUDIES ON EFFECT OF BLENDING IMPACT OF GUAVA (*Psidium guajava* L.) AND PAPAYA (*Carica papaya* L.) PULP ON RECIPE STANDARDIZATION OF BLENDED NECTAR AND RTS (Ready to Serve) BEVERAGES"** was carried out with the following objectives:-

1. To study the physico-chemical composition of guava and papaya fruits.
2. To find out optimum ratio of guava and papaya pulp to develop blended nectar and RTS.
3. To standardize the recipe of blended nectar and RTS prepared under this study.
4. To study physico-chemical composition and sensory evaluation in blended nectar and RTS during storage at ambient condition.

CHAPTER-II
REVIEW OF LITERATURE

Guava and papaya are the most widely grown commercial fruits of central India. Both the fruits are nutritive and may be used for processing .As guava fruit have soft pulp and easy to melt, while having very pleasant flavor with excellent quality can be mixed with papaya fruit having pulp blood red, good taste, to give a quality product after blending. This shows their pulp compatibility and suitability of blending and making mixed fruit products i.e. jam, jelly, leather, candy etc. thus it was planned to analyse quantitatively both guava and papaya pulp and the effect of blending ratio on nectar and RTS during storage period .Therefore, the experiment entitled **"Studies on effect of blending impact of guava (*Psidium guajava* L.) and papaya (*Carica papaya* L.) pulp on recipe standardization of blended nectar and RTS (Ready to Serve) beverages"** was conducted during the year 2015-16.A review of literature relevant to present investigation on various aspects is briefly described in this chapter to correlate the findings of the present experiment.

2.1 Physico - chemical composition of guava and papaya fruits.

2.2 Extraction of guava and papaya pulp.

2.3 Blended beverages.

2.4 Standardize recipe for blended nectar and RTS (Ready to Serve) of guava and papaya and some other fruits.

2.5 Organoleptic evaluation and changes during storage period in ambient condition.

2.1 Physico-chemical composition of guava and papaya fruit

2.1.1 Physico -chemical composition in guava

The guava bear mainly two crops in a year i.e., winter and rainy season crops. The fruits of rainy season crop are larger in size than winter crop as reported by number of workers (Sachan *et al*., 1969; Chundawat *et al*., 1976 and Singh and Rajput 1977). They also observed that the total soluble solids, total sugars, acidity, pectin and ascorbic acid content were higher in winter guava fruits than the rainy season fruits.

Sachan *et al.* (1969) reported that ripe fruits of cv. Allahabad Safeda in winter crop had 12.37^{o} Brix TSS. The cultivars Chittidar, Apple Colour and Red Fleshed have 11.27^{o}Brix, 14.92^{o}Brix, 17.25^{o} Brix TSS, respectively and concluded that acidity is a major quality attribute of guava fruit. It affects the shelf life and organoleptic rating of fruit.

Rajput *et al.* (1977) reported that guava fruits contained 9.9 per cent total soluble solids, 1.0 per cent acidity, 8.0 per cent total sugar, 5.05 per cent reducing sugar, 0.62 per cent pectin and 195 mg ascorbic acid per 100g pulp of fruit.

Singh and Rajput (1977) also observed highest TSS (11.59^{o}Brix), ascorbic acid (234 mg / 100g), total sugars (7.82%), reducing sugars (4.6%) and pectin (0.82%) in guava fruits, when 4 per cent urea spray was applied to plants. There was an abrupt increase in total soluble solids, reducing sugars, total sugars and ascorbic acid content from mature to ripe stage, whereas maximum ascorbic acid content and acidity was observed at ripe stage. The total pectin was found maximum at the maturity stage of fruits and gradually it decreased as the fruits get over-ripened.

Chundawat *et al.* (1978) reported that bagging (wrapping) of guava fruits with parchment paper improved the quality as compared to unbagged control. They further reported that composition of guava fruits of different varieties vary with variety-to-variety and observed 13.3 to 15.1 per cent total soluble solids, 0.572 to 0.832 per cent acidity, 278.33 to 351.73 mg ascorbic acid per 100 g pulp, 3.82 to 4.45 per cent reducing sugar and 2.09 to 4.19 per cent non-reducing sugar content.

Mehta and Tomar (1980) observed 10 per cent total soluble solids, 76.9 per cent moisture, 0.42 per cent acidity, 5.76 per cent total sugar, 3.68 per cent reducing sugar, 1.04 per cent pectin and 291 mg ascorbic acid per 100 g of guava fruits.

Pandey and Singh (1998) studied the chemical composition of fruits in four important varieties (Sardar, Allahabad Safeda, Apple Colour and Sangam) of guava and observed that fruit contains 12.10 to 14.02 per cent total soluble solids, 149 to 250 mg per 100g ascorbic acid, 3.59 to 5.32 per cent non-edible waste, 2.44 to 3.58 per cent seed and 0.40 to 0.59 per cent acidity.

Pandey and Singh (1999) studied physical composition of fruits in four important guava varieties (Sardar, Allahabad Safeda, Apple Colour and Sangam) and observed that pulp content was highest in Allahabad Safeda followed by Sardar guava. The seed per cent was highest in Sangam followed by Apple Colour and the percentage of non-edible waste was maximum in Apple Colour followed by Allahabad Safeda.

Reddy *et al.*(1999) conducted an experiment to see the physico-chemical characteristics of fruits and found that the cultivar L-49 had maximum fruit weight 187.6 g followed by Allahabad Safeda (157g).

Singh (2003) evaluated the performance of guava cultivars Seedless, Behat Coconut, Chittidar, Allahabad Safeda, Lucknow-49 and Red fleshed. The largest fruit (5.87 x 5.84 cm) and heaviest fruit (113.33 g) was recorded in Lucknow -49.

Aulakh (2004) studied the seasonal variation in yield and fruit quality of guava cultivars Allahabad Safeda, Apple Colour, Behat Coconut, Lucknow -49, Pear shaped and Red Fleshed. The maximam fruit weight and fruit size were recorded in Lucknow-49. The maximum total soluble solid content, ascorbic acid content and total sugar content was observed in Lucknow-49.

Jain and Asati (2004) observed that the guava pulp prepared from five cultivars i.e., 'Allahabad Safeda' 'L-49', 'Apple Colour' Chittidar and Red Fleshed analyzed for total soluble solids (TSS), acidity, and ascorbic acid contents initially and after storage of 30 and 60 days at low (6 + or -1^{o}C) temperature. Both chemical composition and organoleptic evaluation indicated that 'Allahabad Safeda' was best cultivar followed by 'L-49.

Patel *et al*. (2005) evaluated fruit quality in eight guava cultivars (Allahabad Safeda, Lucknow-49, Apple Colour, Dharidar, Hafsi, Seedless, Chittidar and Rewa- 72) and reported that Allahabad Safeda fruits had the highest TSS, total sugar (11.80%) and ascorbic acid (250.80 mg/100 g of pulp) contents, as well as the lowest level of acidity (0.25%).

Singh *et al*. (2008) studied the physico-chemical attributes of ten important cultivars of guava. The maximum fruit length, diameter and weight were recorded in the cv. L-49 followed by cv. Allahabad Safeda. Highest seed

weight was found in cv. Apple Colour and Banarsi Surkha. Maximum seed/pulp ratio, TSS, pectin, palatability rating and lowest level of acidity was noted in cv. Allahabad Safeda followed by L- 49. They also observed maximum ascorbic acid and total sugar in cultivar L-49 during both season.

Adrees *et al*. (2010) reported that maximum vitamin C (220.4 mg/100g) and total sugars (6.36%) were found in variety Hong Kong, TSS (11.87%) and dry matter (14.93%) in Sufaida, acidity (1.67%) and protein (1.85%) in Gola variety and ash content (0.85%) in Rubi x Supreme.

Jana *et al.* (2010) evaluated the physico-chemical properties of the guava genotypes and reported that the cultivar Spear Acid accounted for the maximum fruit weight (179.4 g) and ascorbic acid content (265.83 mg/100 gm pulp), whereas, the cultivar CHG-5 had higher T.S.S. content of 10.26^{O}B during rainy season. As winter crop, the cultivar Mild Flesh recorded the maximum fruit weight of 199.1 g whereas, the cultivars Seed Drop and Kerala Seedling exhibited highest T.S.S. content of 12.86^{O}B but later had the maximum ascorbic acid content of 358.33 mg/100 gm pulp. The only cultivar Barbados Superior did not produce fruit during winter. During summer season, six cultivars, viz. Mild Flesh, Seed Drop, Surkh Gudi, CHG-1, CHG-2 and Eskwala brought forth fruit. The cultivar Eskwala recorded the highest fruit weight of 139.8 g and the cultivar Seed Drop exhibited the maximum TSS content of 14.36^{O}B and ascorbic acid content of 337.5mg/100gm pulp. Hence, based on fruit morphology, quality and total yield CHG-1, Allahabad Safeda, Mild Flesh, Sardar, White Flesh, Spear Acid and Seed Drop were found promising for cultivation in the plateau region of Jharkhand.

Dubey *et al*. (2011) reported that among the guava cultivars (Allahabad Safeda, Lucknow-49 and Chittidar), L-49 had maximum content of TSS (17.01%), ascorbic acid (4.98 mg/100 g), reducing sugar (7.12%) and non-reducing sugar (9.42%).

Kaur *et al.* (2011) reported that six cultivars of guava, *viz*., Allahabad Safeda, Apple Colour, Behat Coconut, Lucknow-49, Pear Shaped and Red Fleshed were evaluated for their physical characteristics and biochemical composition

during the winter season. The data on physico–chemical characteristics and biochemical composition revealed that fruit yield (85 kg / tree), fruit weight (95 g), fruit size (6.5 x 5.4 cm) and vitamin-C content (266.0 mg/ 100 g pulp) were found to be higher in Lucknow – 49 when compared to the other cultivars. TSS (11.0 %), total sugars (3.60 %), total protein (0.595 %) contents were higher, while total phenol content was comparatively less in Allahabad Safeda(580.5µg/g).

Kocher *et al*. (2011) observed reducing sugars content of 3.40, 3.29, and 3.68% in Punjab Pink, Arka Amulya and Lucknow-49, respectively. The vitamin C content varied widely depending on the cultivars as ascorbic acid content of guava cultivars ranged from 149.0 to 250 mg per 100 g of pulp.

2.1.2 Physico- chemical composition of papaya

Madhav (1974) reported that the Indian papaya cultivar have 10.0 to 10.20 per cent total soluble solids.

Pal and Subramanyam (1980) found that the ascorbic acid content of papaya fruits ranged from 66.6 to 93.3 per cent.

Biswas *et al.* (1990) found the maximum fruit weight (1910 g) in Pusa Giant followed by CO-4 (1300-1500g) cultivar of papaya.

Othman (2009) observed certain physico-chemical characteristics in papaya fruit having high moisture content (>85.5%), low acidity (<0.18%c.a.), low crude fat (0.10 g/100 g-edible portion), moderate crude fibre (1.45 g/100g-edible portion), high ascorbic acid content (>84.5 mg/100g-fw), moderate total sugars (>13.0%) and soluble solids (>12.9%) content.

Das and Dinesh (2014) found that the weight of the fruits vary from 486.67g in Sunrise Solo to 1380.33g in Pusa Dwarf. The pulp thickness, TSS and ascorbic acids were found to be maximum in the hybrids 39 and 57. The lowest titrable acidity was observed in case of hybrids H-39 and H-57.

2.2 Extraction of pulp

Harnanan *et al.* (1980) observed that the yield of pulp is influenced by procedure adopted for the preparation of pulp. The Red Fleshed guava pulp yield was found to be the same for both methods viz., 54 per cent, whereas for the white

guava it was higher in the hot extraction method i.e., 54.4 as compared to 49 per cent by the cold extraction.

Godara and Pareek (1985) observed that certain amount of water is required for proper recovery of juice in certain fruits. Water and fruit pulp in equal quantity taken in a pressure cooker at 1 kg/cm^2 pressure for 10 minutes to extract the juice from date fruit was found to be the most suitable method.

Murari and Verma (1989) found that hot pulping method had higher values of per cent pulp recovery than that of cold pulping but development of pink discolouration was noticed in the former method, while cold pulping retains its original creamish colour in guava.

Pal and Roy (1989) reported that there was considerable increase in yield of pulp on baking as compared to boiling of green mangoes.

Singh and Singh (1995) reported that organoleptic quality of juice extracted with flesh and water ratio of 1:1 scored highest from litchi fruit.

Pandey and Singh (1999) found that water to pulp ratio of 1:1 is best for guava juice extraction.

2.3 Blended beverages

Khurdiya (1980) observed that ready-to-serve (RTS) beverage prepared from dried ber contain 33.3 per cent juice having acidity 0.56 per cent, pH 3.75 and TSS 19.60^0 Brix. The ber juice processed at 80^0 C for 10 minutes was stored for 9 months at room temperature (20-30^{0}C) and the beverage was organoleptically acceptable.

Kalra *et al.* (1991) evaluated mango-papaya blended beverages which had the ratio of 1:0, 1:1, 2:1, 3:1 and 0:1. The study indicated that 25-33 per cent papaya pulp could be incorporated in mango beverages without affecting the quality and acceptability of the product.

Tripathi *et al.* (1992) prepared RTS beverages from the mixture of pineapple and guava juices in different proportions. The RTS beverages prepared from pineapple-guava (90:10) blends secured 89±1.25 per cent marks with respect to overall quality parameters.

Vaidya *et al*. (1998) evaluated mixed guava juice with pomegranate and ber juice in different proportions like 0:100, 10:90, 20:80, 30:70, 40:60, 50:50 and

100:0 for preparations of RTS beverages using 10 per cent juice. Organoleptically guava-pomegranate (30:70) and guava-ber (40:60) combinations were found to be superior over others that recorded 8.44 and 8.13 scores, respectively.

Tiwari (2000) prepared RTS beverages from guava-papaya blends. He reported that the highest sensory score was found in guava-papaya blends (70:30) due to better consistency and flavour.

Mansy *et al.*(2005) prepared mango-papaya nectars by blending mango puree with papaya puree (one of the cheaper fruits in the Egyptian market) in different proportions (90:10, 80:20, 70:30, 60:40, 50:50, 40:60, 30:70, 20:80 and 10:90). The products were analysed for physico-chemical, sensory characteristics and rheological properties.

Bhardwaj and Mukherjee (2011) prepared different fruit juice blends as (Kinnow juice: Aonla juice: Ginger juice in 100: 0: 0, 95: 5: 0, 92: 5: 3 ratio and Kinnow juice: Pomegranate juice: Ginger juice in 90: 10: 0, 87: 10: 3 ratio) for improving flavour, palatability, nutritive and medicinal value. The juice blends were preserved by pasteurization (75°C for 15 min) and by addition potassium meta-bi-sulphite (750 ppm). These blends were stored in 200 ml colourless glass bottles at room temperature (28 ± 4°C) for six months and tested at two months interval for physico-chemical, sensory evaluation and microbial population.

Patil *et al.*(2011) prepared a rose apple pulp extract which was used for making flavoured beverage by blending with Jamun. The prepared product was stored under ambient temperature up to 90 days. The product was subjected to physico-chemical analysis at 30 days interval.

Byanna *et al.*(2012) blended RTS beverage with 15% juice content of sweet orange and pomegranate at varying level of juice ratios of 90 : 10, 80 : 20, 70 : 30,60 : 40 and 50 : 50 with fixed level TSS of 15^{o} Brix and acidity of 0.3% and stored up to six months in ambient conditions. Blended beverages were evaluated for quality parameters and storage stability at different intervals of 0, 3 and 6 months after storage.

Jakhar *et al.*(2012) conducted an experiment for standardization of the suitable blending of guava and barbados cherry fruit pulps, among different

blending ratios and recipes for the preparation of quality blended ready-to-serve (RTS) beverage and asses their storage stability at ambient temperature.

Jan and Masih (2012) were optimised to a blended beverages of pineapple (*Ananas comosus*), carrot (*Daucus carota*), and orange (*Citrus sinensis*) juices which was stored for 21 days in pet bottles (400 ml capacity) at refrigerated temperature. Physico-chemical and sensory analysis were evaluated. Marginal changes in pH, total soluble solids, acidity, vitamin C and β-carotene were observed.

Kausar *et al.* (2012) prepared a blend of drinks from cucumber (*Cucumis sativus*) and muskmelon (*Cucumis melo*) which was formulated and evaluated for its storage stability. Addition of muskmelon to cucumber juice increases the nutritional value of the drink and also provides various health benefits to consumers. These ready-to-use functional drinks were prepared by blending different ratios of cucumber and muskmelon (100:0, 90:10, 80:20, 70:30, and 60:40). The physico-chemical parameters and sensory characteristics of blended drinks were evaluated for four months at 15 days of storage interval.

Jain and Thakre (2013) conducted an experiment on storage study of blended nectar of papaya and banana under different storage conditions.The experimental material was consisted of well ripened papaya cv. Taiwan and banana cv. Dwarf Cavendish which were obtained from market. The papaya and banana were blended in the ratio of 50:50.

Selvi *et al*. (2013) conducted a study to evaluate the formulation of therapeutic drink guava-lime-ginger RTS beverage to boon health. The fixed ratio of fruit juices in guava-lime-ginger RTS beverage was 10:3:2. The prepared RTS was bottled in glass bottles and stored at room and refrigerated temperature.

Singh *et al.*(2013) prepared aonla based quality beverages from suitable blending ratio and results revealed that blended RTS, nectar and squash contains 25 per cent aonla pulp +75 per cent mango pulp imparts good flavor and colour and also scored highest organoleptic quality.

Bal *et al*. (2014) had undertaken an experiment for preparation of nectar using guava cv. Lalit with respect to pulp percentage and TSS (ºBrix) as per the treatments. Physico-chemical parameters viz., TSS, acidity, ascorbic acid, non-

reducing sugars, total sugars and viscosity as well as organoleptic attributes viz., colour, flavour, taste and overall acceptability of nectar were evaluated at an interval of 2 months up to 8 months of storage.

Malav *et al*. (2014) conducted an experiment comprising of two levels of preservative (750 ppm and 500 ppm KMS), three levels of recipe (orange, pomegranate, aonla and ginger juice) and two blending ratios (90:10:0, 86:10:4). These experiments have 9 treatment combinations viz., T-0 (control,100% orange juice with 750 ppm KMS), T-1(Orange-aonla-ginger (90:10:0) with 750 ppm KMS), T-2(Orange- aonla ginger(86:10:4) with 750 ppm KMS), T-3 (Orange-pomegranate-ginger (90:10:0) with 750 ppm KMS), T-4 (Orange-pomegranate-ginger (86:10:4) with 750 ppm KMS), T-5 (Orange-aonla-ginger (90:10:0) with 500 ppm KMS), T-6(Orange-aonla-ginger (86:10:4) with 500 ppm KMS), T-7(Orange-pomegranate-ginger (90:10:0) with 500 ppm KMS),T-8(Orange-pomegranate-ginger (86:10:4) with 500 90th days. At the end of storage period (90 days of storage), minimum TSS content of 13.03°Brix was observed in T-4 and maximum 13.53°Brix in T-3, the maximum acidity was found 0.60% in T-0 whereas, minimum of 0.43% in T-8, the maximum ascorbic acid content was observed 36.77mg/100ml in T-2 and minimum of 10.58mg/100ml in T-8. The sugars content showed an increasing trend whereas pH showed decreasing trend with advancement of storage period. Among various treatments T-4 (Orange-pomegranate-ginger (86:10:4) with 750 ppm KMS) was adjudged the best.

Sharma (2014) conducted a study on the manufacture of value- added product from jamun-mango blended fruit pulp. Jamun and mango fruits were blended in the ratios of 55:00:: jamun: mango pulp as control, 50:05, 45: 10, 40: 15 and 35: 20:: jamun: mango pulp for the preparation of jam.

Jumde *et al*.(2015) formulated the blend of watermelon juice and beetroot juice in different proportion (in v/v) asT1 (80:20), T2 (75:25), T3 (70:30), T4 (65:35) and T0 (100:00),respectively. The standard sample (T0) was made without blending these two juices (100% standard watermelon juice). Physico-chemical and sensory analysis were evaluated.

Kapoor *et al*. (2015) prepared an enriched beverage by supplementing pear juice with jamun pulp and assessed for antioxidant activity and quality. Jamun

pulp was supplemented at the levels of 5,10,15,20 and 25 per cent and optimized on the basis of sensory evaluation and color characteristics. Sensory scores were highest for pear juice supplemented with 20 per cent jamun pulp and was further chosen for storage studies.

Rani *et al*. (2015) undertaken a study to prepare value added products from guava blended with Aloe-vera and assess their storage behaviour and acceptability. By following a standardized protocol, nectar blends of guava and aloe were prepared. Pulps were extracted separately, blended at desired proportions, homogenized and used for making nectar blends. Products were preserved by pasteurization and packed in 200 ml glass bottles. In order to study storage stability and consumer acceptability, products were stored for a period of three months at 10 + 10°C and analyzed for physico-chemical quality and overall acceptability at monthly intervals.

Sasikumar (2015) investigated to prepare a functional beverage made from blend of Aloe vera and bael fruit. The blended juice extracts were prepared by using different proportions of Aloevera and bael fruits as 100:0 (T0), 90:10 (T1), 80: 20 (T2), 70:30 (T3) and 60:40 (T4). The different blends were homogenized and pasteurized at 300 rpm for 2 min and 90°C for 10 minutes,respectively. The prepared functional beverage (ready-to-serve) is complying with Indian standards for RTS fruits beverages.

Shaheel *et al*. (2015) prepared karonda juice blended with guava, papaya and pineapple juices in different proportions and evaluated for their physico-chemical properties and organoleptic evaluation. The blend of 25% karonda juice + 75% pineapple juice recorded highest total sugars (10.35%), reducing sugars (6.96%) and organoleptic score (7.42) followed by 50% karonda juice + 50% guava juice (T2) of 7.18.

Sindhumathi *et al*. (2015) conducted an experiment to study the feasibility of blended papaya and pineapple juice in combination with different naturally flavored extracts in different ratio for preparation of flavored and blended RTS beverage. The flavored and blended RTS was analyzed for its different physic-chemical as well as sensory qualities by adopting 9 point Hedonic scale.

2.4 Standardize recipe for blended nectar and RTS of guava and papaya and some other fruits

Kerure and Kjedkar(1982) observed that guava nectar having composition of 20 per cent pulp, 20 per cent total soluble solids and 0.3 per cent acidity was considered good nectar.

Singh and Dhawan (1983) reported that ideal nectar of papaya and guava fruits should contain 20 per cent pulp, 14 per cent total soluble solids and 0.3 per cent acidity, while ready-to-serve beverage with composition of 10 per cent pulp, 15 per cent total soluble solids and 0.3 per cent acidity was found to be ideal for guava fruits.

Singh (1988) reported that 10 per cent juice and 14 per cent total soluble solids with 0.3 per cent acidity were found suitable for ready-to-serve from litchi fruits while, 20 per cent juice and 15 per cent total soluble solids with 0.3 per cent acidity were found suitable for making nectar of litchi fruits.

Vyas *et al.* (1989) reported that 20 per cent juice content, 15^0Brix TSS and 0.35 per cent acidity was found best for preparation of nectar of rhodo-petals.

Kalra *et al.* (1991) worked on quality evaluation of some market fruit drinks. They prepared nectars from two mango varieties viz., Dashehari and Totapari having 20^o Brix, 0.3 per cent acidity and 15 per cent pulp.

Tripathi *et al*. (1992) prepared RTS beverages from the mixture of pineapple-guava containing 16^o Brix and 0.2 per cent acidity secured 89±1.25 per cent marks with respect to overall quality parameters.

Pandey and Singh (1999) noticed that recipe for commercial preparation of guava RTS beverages containing 11 per cent TSS was found most ideal.

Tiwari (2000) prepared RTS beverages from guava-papaya blends having 15 per cent pulp, 14^o Brix and 0.3 per cent acidity. He reported that the highest sensory score was found in guava-papaya blends (70:30) due to better consistency and flavour.

Shukla (2005) reported that nectar of guava and pineapple fruits should contain 20 per cent pulp, 17 per cent total soluble solids and 0.2 per cent acidity while ready-to-serve of guava and pineapple fruits should contain 10 per cent pulp, 11 per cent total soluble solids and 0.2 per cent acidity.

Bhardwaj *et al*. (2011) prepared different fruit juice blends as (Kinnow juice: Aonla juice: Ginger juice in 100: 0: 0, 95: 5:0, 92: 5: 3 ratio and Kinnow juice: Pomegranate juice: Ginger juice in 90: 10: 0, 87: 10: 3 ration) for improving flavour, palatability, nutritive and medicinal value. The juice blends were preserved by pasteurization (75°C for 15 min) and by addition potassium meta-bi-sulphite (750 ppm).

Patil *et al.(*2011)Prepared a squash recipes using 25 per cent pulp with three different proportions of juices of rose apple and Jamun i.e., 75:25, 50:50 and 25:75, respectively with TSS of 40 and 45 per cent and 1.0 per cent acidity.

Byanna *et al*. (2012) prepared a blended RTS beverage with 15% juice content of sweet orange and pomegranate at varying level of juice ratios of 90: 10, 80 : 20, 70 : 30, 60 : 40 and 50 : 50 with fixed level TSS of 15 ^{o}Brix and acidity of 0.3%.

Jain *et al*. (2013) prepared blended nectar of papaya and banana by following standardized recipe 20 per cent pulp, 18 per cent TSS and 0.3 per cent acidity.

Singh *et al.*(2013)has undertaken a study to evaluate suitable blending ratio for the preparation of aonla based quality beverages. Recipe standardization of blended RTS, nectar and squash contains 10%pulp, 0.3% acidity and 12% TSS, 20% pulp, 0.3% acidity and 14% TSS and 25% pulp,1% acidity and 45% TSS, respectively.

Malav *et al.* (2014) conducted an experiment comprised of two levels of preservative (750 ppm and 500 ppm KMS), three levels of recipe (orange, pomegranate, aonla and gingerjuice) and two blending ratios (90:10:0, 86:10:4). These experiments have 9 treatment combinations viz., T-0 (control, 100% orange juice with 750 ppm KMS), T-1(Orange-aonla-ginger (90:10:0) with 750 ppm KMS), T-2(orange- aonla-ginger (86:10:4) with 750 ppm KMS), T-3 (orange-pomegranate-ginger (90:10:0) with 750 ppm KMS), T-4 (orange-pomegranate-ginger (86:10:4) with 750 ppm KMS), T-5 (orange-aonla-ginger (90:10:0) with 500 ppm KMS), T-6(orange-aonla-ginger (86:10:4) with 500 ppm KMS), T-7(orange-pomegranate-ginger (90:10:0) with 500 ppm KMS),T-8(orange, pomegranate and ginger(86:10:4) with 500 ppm KMS).

Sharma (2014) carried out a work on blending of jamun and mango fruits pulp for preparation of jam in the ratios of 55: 00: jamun: mango pulp as control, 50: 05: jamun: mango, 45: 10: jamun: mango, 40: 15: jamun: mango and 35: 20: jamun: mango.Total soluble solids and acidity should be 68 ºBrix and 0.4%, respectively.

Yadav *et al*.(2014)conducted an experiment to develop banana RTS beverage using various sugar levels viz. 0.75, 1.00 and 1.25 kg/kg of banana pulp. The calculated amount of water was also added at 7 litre per kg of pulp and heated for 15 minutes over gas burner for proper dilution. The KMS and citric acid were added as preservative at 70 ppm and 2% per kg of pulp, respectively.

Bohra *et al*.(2015) blended pummelo fruit juice with mango ginger and kokum juices in the ratio of 65:30:5 (v:v:v) and diluted in different proportions by adjusting Total Soluble Solids (TSS) to 15 °B, 17 °B and 19 °B with 0.3% titrable acidity. Sodium benzoate was used as preservative.

Jumde *et al*.(2015)observed that pulp to water ratio should be 1:1(v/w) and the one standard (100% watermelon) and four blends of watermelon juice and beetroot juice were developed in different ratio as 80:20 (T1), 75:25 (T2), 70:30(T3) and 65:35(T4), respectively. Each blend was prepared to give about 12% total soluble solid with addition of sugar. Finally 350 ppm sodium benzoate was used as preservative.

Kapoor *et al*.(2015)conducted an experiment in which pear juice after extraction and filtration was blended with jamun pulp at the levels of 5, 10, 15, 20 and 25 per cent . Brix-adjustment was made by adding refined white sugar to fresh pear juice until 14^{o}Brix and acidification was achieved at 0.25 per cent by adding citric acid.

Sindhumathi *et al*.(2015) prepared flavored and blended RTS beverage using 15% of total soluble solids (TSS) and 0.3% of acidity and 10% of blended juices of different blending ratio of (A) 70% papaya juice + 30% pineapple juice, (B) 60% papaya juice + 40 % pineapple juice, (C) 50% papaya juice + 50 % pineapple juice and (D) 80% papaya juice + 20% pineapple juice.

2.5 Organoleptic evaluation and chemical changes during storage period in ambient condition

2.5.1 Organoleptic changes in beverages during storage

Rabbani and Singh (1988) reported that pasteurized RTS and nectar of mango lost their acceptability after two and four months, respectively at ambient temperature.

Singh and Singh (1994) reported decrease in organoleptic quality of litchi ready-to-serve, nectar and squash during storage. The products were acceptable upto 3 months.

Baramanray *et al.* (1995) observed that organoleptic quality like colour, flavour and taste of guava nectar deteriorated with increase in storage time.

Kumar and Manimegalai (2001) reported that in blended RTS beverage of pineapple, pear and pomegranate, the decline in score values for overall acceptability might be due to the degradation of colour and the changes occurred in appearance and taste of the stored products.

Mansy *et al.* (2005) observed that nectar consisting of 80% mango puree and 20% papaya puree with 17 ºBrix and having a sensory score of 93.1 was found to be the best.

Singh (2005) reported that there was a gradual change in the organoleptic evaluation of custard apple RTS and nectar during storage upto acceptability (90 days). The deterioration was very fast after 90 days of storage and the nectar was not fit for consumption. The factor responsible for the fast deterioration was mainly due to colour, taste and flavour which lead to the poor score value at 105 days of storage.

Singh *et al.* (2005) observed that RTS and nectar prepared from guava (70%) and pineapple (30%) juice recorded highest acceptability score after 4 months storage, while the decrease in organoleptic acceptability of the beverage was due to the changes in the composition of total soluble sugars, total sugars increased earlier and ascorbic acid decreases during the storage period of 4 months.

Choudhary and Dikshit (2006) reported that the organoleptic score of guava nectar decreases with all the cultivars of guava and recipe treatments at increasing period of storage upto 150 days at ambient condition.

Bhardwaj *et al*. (2011) reported that sensory evaluation score was also higher, better consistency and flavour score up to the end of storage. The formulation of mixed (blend) juice beverage (Kinnow juice: Aonla juice: Ginger juice in 100: 0: 0, 95: 5:0, 92: 5: 3 ratio and Kinnow juice: Pomegranate juice: Ginger juice in 90: 10: 0, 87: 10: 3 ratio) is possible to satisfy consumer taste and preferences. These juice blends can be stored effectively for a period of 6 months at room temperature.

Jain *et al.* (2011) observed that with the increase in storage period there was decrease in the rating of all organoleptic quality characters in both the fruit pulp. The analysis of organoleptic characters (colour, flavour, texture, taste and overall acceptability) and qualitative characters (TSS, pH, acidity, ascorbic acid content) of guava and papaya fruits was conducted on fresh fruit, prepared pulp and mixed pulp. During the storage of fruit pulp at low temperature (6±1°C), the decrease in overall acceptability of both the pulp was observed with an increase in storage period.

Patil *et al* (2011) found that in organoleptic score the beverage contained 25 per cent pulp, 45 per cent TSS and 1 per cent acidity and recorded highest score i.e., 4.60 after 90 days of storage.

Byanna *et al*. (2012) evaluated for quality parameters and storage stability at different intervals of 0, 3 and 6 months after storage of blended beverages. Sweet orange and pomegranate were mixed in the ratio of 50: 50 with 15% juice, TSS of 15^{o} Brix and 0.3% acidity was found to be the best in taste and overall acceptability. The RTS beverage had storage stability up to six months.

Jakhar *et al.* (2012) reported that among the different blending ratios and recipes, 10% blended pulp (50% guava pulp + 50% barbados cherry pulp) with, 12% TSS and 0.2% acidity was found to be the best on overall sensory score. According to the organoleptic score, the blended RTS was found to be acceptable upto five months of storage at ambient temperature with good appearance, flavour, taste and overall acceptability.

Kausar *et al*. (2012) concluded that cucumber-melon pulp functional drink prepared at 90:10 was the most acceptable for minimum changes in TSS, acidity, pH, reducing and non-reducing sugar. Sensory evaluation score was also higher for

this drink followed by ratio of 100:0. The data further revealed that all blended drinks remained acceptable during the storage period of 120 days.

Bal *et al*. (2014) conducted an experiment and organoleptic attributes viz., colour,flavour, taste and overall acceptability of nectar were evaluated at an interval of 2 months up to 8 months of storage. An overall result of fruit nectar prepared from guava was found better in the treatment P4B2 (20% pulp + 15°Brix TSS), which was statistically at par with P3B3 (16% pulp + 17°Brix TSS).

Bhargawa *et al*.(2014)found that storage period had insignificant effect on the crude fibre content of the kinnow nectar supplemented with aloe juice. Hence, the products exhibited much stability in respect of crude fibre content till the termination of storage period. Statistically, treatment and storage period exhibited non- significant effect crude fibre content of the aloe juice supplemented kinnow nectar.

Sharma (2014) observed that the blend/treatment T3(45:10:: jamun: mango) received the maximum score of 8.74 for body, 8.66 for colour, 8.64 for aroma and 8.74 for overall acceptability which decreased to 7.84, 7.80, 7.96 and 7.04 after six months of storage, respectively.

Yadav *et al*. (2014) reported that banana RTS beverage prepared with pulp to sugar ratio of 1:1 were found to be better organoleptically than those of other ratios and followed by the ratio of 1:1.25 and 1:0.75, respectively. It was also concluded that refrigerated storage method was found to be superior over other methods for storage of banana RTS beverage followed by BOD incubator in ambient storage conditions.

Borah *et al*.(2015) found the overall acceptability scores of the nectar prepared from blending of pummelo, garcinia and mango ginger showed that 20 % blended juice, 19 °B TSS and 0.3% acidity was the best recipe which was rated 6.5 on a 7-point hedonic scale.

Kapoor *et al.* (2015) observed that storage period of six months resulted in reduction of bioactive components and had a variable effect on physico-chemical characteristics of the blended pear-jamun juice. .On the basis of sensory evaluation, supplementation levels of jamun pulp from 5 to 25 per cent in pear juice were found to be acceptable but 20 per cent level received highest consumer

acceptability scores and was chosen for further studies. Colour characteristics were significantly affected by supplementation levels, resulting in darker product with increasing levels of jamun pulp in pear juice. Jamun supplemented pear juice had slightly higher sugars, ash and protein content.

Rani *et al*. (2015) found that blending of guava: aloe at 70:30 was highly acceptable with higher sensory score. In any blend, as the storage period increased, ascorbic acid and antioxidant activity declined but there was minimum decrease noticed in G: A at 60:40 which was found more shelf stable.

Sindhumathi *et al*. (2015) found the mean score for all the quality attributes initially 9.00 for flavoured papaya-pineapple blended RTS beverage. Slight changes were observed in all the treatments after120 days of storage. During storage it was observed that overall sensorial quality of blended therapeutic RTS slightly decreased during storage of 4 months.

2.5.2 Ascorbic acid

Singh and Singh (1994) reported that ascorbic acid content and organoleptic quality of litchi RTS, nectar and squash was decreased progressively during storage period and they were found to be acceptable upto 3 months.

Baramanray *et al.* (1995) observed that ascorbic acid content (mg/100 gm pulp) in guava nectar decreased significantly ($p < 0.01$) with increasing period of storage. During 90 days of storage, it was found to be reduced by 18 per cent amounting to 0.3 per cent acidity, 0.092 mg per 100 ml per day ($r = 0.991$).

Attri *et al*. (1998) reported that there was a significant decrease in ascorbic acid content in the blended juices of pear with apple, apricot and plum during six months of storage.

Deka and Bidyut (2000) also observed decrease in ascorbic acid in mango and pineapple blended RTS beverage.

Saravanan *et al.* (2004) found that there was a considerable reduction in ascorbic acid content in papaya nectar throughout the storage. The decline in ascorbic acid content might be due to its degradation into dehydro-ascorbic acid or hydroxy methyl furfuryl at room temperature.

Choudhary and Dikshit (2006) reported that ascorbic acid content in guava nectar was decreased during storage period. The decrease in ascorbic acid in nectar

during storage might be due to oxidation or irreversible conversion of L-ascorbic acid into dehydro ascorbic acid in the presence of enzyme ascorbic acid oxidase (ascorbinase) caused by trapped or residual oxygen in the glass bottles.

Byanna *et al.* (2012) observed the loss of ascorbic acid in storage was due to oxidation by trapped oxygen in glass bottles and formation of dehydro-ascorbic acid, processing and storage temperature in orange -pomegranate blended RTS.

Jakhar *et al*. (2012) observed that ascorbic acid content of the guava and barbados cherry blended beverage decreased gradually with the storage period.

Selvi *et al*. (2013) found a gradual reduction in the ascorbic acid content in all the samples during storage. The initial and final ascorbic acid content was 8.82 to 7.85 and 8.82-7.98 mg per 100 ml in Guava-Lime-Ginger RTS beverage.

Bal *et al*. (2014) reported that ascorbic acid of guava nectar decreased significantly during the entire storage period of nine months. This reduction might be due to oxidation of ascorbic acid into dehydro-ascorbic acid by oxygen.

Jumde *et al*. (2015) observed the addition of beetroot juice to watermelon juice reduced the vitamin C content. The ascorbic acid (vitamin C) content of the juice decreased during storage with the advancement of storage period , which was probably due to the fact that ascorbic acid being sensitive to oxygen, light and heat was easily oxidized in presence of oxygen by both enzymatic and non-enzymatic catalyst.

Malav *et al*. (2014) observed that ascorbic acid content of orange -based blended RTS beverages decreased with the advancement of storage period because the ascorbic acid is very sensitive to oxidation.

Rani *et al*. (2015) observed that both ascorbic acid and dehydro-ascorbic acid are highly volatile and unstable forms of vitamin C. Hence, throughout the storage period degradation of ascorbic acid was noticed in guava and aloe nectar.

2.5.3 Acidity

Kalra and Revanthi (1983) observed increase in acidity during storage of guava pulp. They further reported increase in acidity in Allahabad Safeda pulp from 0.44 to 0.49 per cent during 30 days storage at room temperature.

Godara and Pareek (1985) observed that total acid contents slightly increased when the date juice RTS beverage was stored for 148 days.

Singh and Singh (1994) reported that acidity of litchi RTS and nectar did not change upto three months of storage and thereafter it increased slightly.

Baramanray *et al.* (1995) observed that titrable acidity in guava nectar increased significantly ($p < 0.01$) with the increase in storage period.

Prasad and Mali (2000) also found increased acidity during storage of pomegranate squash. It could be due to the organic acid degradation.

Kumar and Manimegalai (2001) reported a gradual increase in the acidity of the blended RTS samples of pineapple, pear and pomegranate stored at room temperature condition and in refrigerator.

Choudhary and Dikshit (2006) found that the acidity in guava nectar and RTS increased with all the cultivars and recipe treatments, at increasing period of storage upto 150 days under ambient condition.

Byanna *et al.*(2012) observed that acidity increased during storage of orange –pomegranate blended RTS due to release of acids from pulp/juice particles due to autolysis of cells and simultaneous decrease of pH.

Kausar *et al*. (2012) found a significant decrease in acidity among treatments and significant increase during storage period of four months in cucumber melon drinks.

Selvi *et al*. (2013) noticed an increasing trend in the acid content of the guava, lemon and ginger RTS.

Bal *et al.* (2014) found that titrable acidity (%) of guava nectar increased significantly during storage. The increase in acidity might be due to the accelerated degradation of pectin substances in nectar and the acidity content in guava nectar showed the minimum change during storage.

Malav *et al*.(2014) found a sudden decrease in acidity observed during storage of orange- based blended RTS beverages which could be attributed to the chemical interaction between the organic constituents of orange-based blended RTS beverage affected by the temperature and action of enzymes.

Yadav *et al*. (2014) found that acidity of banana RTS beverage increased with increase in sugar level at different storage temperatures and conditions.

Jumde *et al*. (2015) found that addition of beetroot juice to watermelon juice reduced the titrable acidity while pH value increased. Acidity values for all the samples increases linearly during the storage period of 24 days.

Rani *et al*. (2015) observed that acidity of the guava and aloe blends witnessed an increasing trend on storage and there was no change noticed in any product upto 30 days. Degradation of pectic substances of guava pulp into soluble solids might have contributed towards an increase in acidity.

2.5.4 pH

Nidhi *et al*. (2008) observed a slight decrease in pH of ready-to-serve bael-guava blended beverage during 60 days of storage.

Byanna *et al.*(2012)found significant differences in pH of different sweet orange and pomegranate blended RTS beverages. Sweet orange and pomegranate (90: 10) blended RTS beverage had higher pH than other recipes. Least was found in sweet orange and pomegranate (50: 50) blended RTS beverage. This might be due to variation in composition due to recipes. Decrease in pH during storage was attributed to simultaneous increase in titrable acidity.

Jan and Masih (2012) found a significant decrease in pH during storage of pineapple juice blended with orange and carrot juice. This might be due to increase in titrable acidity, as acidity and pH are inversely proportional to each other.

Kausar *et al*. (2012) revealed significant increase in pH among treatments and significant decrease (4.89-4.82) during storage period of four months in cucumber and muskmelon drink. High acid and low pH may be due to production of acetic acid and lactic acid during storage.

Malav *et al*. (2014) found that the pH of orange-based blended RTS beverages decreases with increase in period of storage in all the treatments which might have resulted due to corresponding decrease in acidity. The treatment had a significant effect on pH content of orange based blended RTS beverage during entire period of storage.

Yadav *et al.* (2014) observed that pH decreases with increase in level of sugar and storage period of banana RTS.

Jumde *et al*. (2015) observed gradual decrease in pH indicating that the acidity of products increases.

Sasikumar (2015) observed significant decrease in pH during storage of functional beverages from Aloe-vera juice blended with bael fruit juice. This might be due to increase in acidity, as acidity and pH are inversely proportional to each other.

Sindumathi *et al*.(2015) observed a sudden fall in pH value from 3.79 to 3.50 in flavored papaya-pineapple blended RTS beverage.

2.5.5 Sugars

Godara and Pareek (1985) reported that total sugar and reducing sugar in ready-to-serve date juice beverage increased slightly under low temperature (13.2°C) and room temperature (25±5°C) storage. There was a corresponding decrease in non-reducing sugars.

Tripathi *et al*. (1992) reported that there was a continuous increase in the values of reducing sugars (4.8 to 11.5%) and total sugars (11.2 to 18.6%) in the RTS beverages prepared from pineapple-guava blends during three months of storage.

Baramanray *et al.* (1995) reported that there was a significant ($p<0.01$) increase in total sugar as well as reducing sugar content in stored guava nectar with increasing storage period. The increase in total sugar was upto level of 48.8 per cent at 90 days of storage .The increase in reducing sugar also corresponded with increase in TSS and total sugar.

Prasad and Mali (2000) observed that the changes occurred during storage were faster at room temperature (25-40^0 C) than at low temperature (4-5^0 C) .For longer storage (1 year) of pomegranate squash, low temperature storage was better. The low temperature storage did not much change the total sugar, while the level of reducing sugar increased but non-reducing sugar decreased during 6 months of storage.

Bons and Dhawan (2003) reported that no significant increase in total sugar was observed initially in guava juice concentrate and thereafter,a significant increase in sugars was noticed during 30-90 days of storage.

Saravanan *et al*. (2004) found that the total sugar content of papaya nectar increased slightly during storage under ambient condition. This might be due to the hydrolysis of polysaccharides like pectin, starch etc. into simple sugars. There was a considerable increase in reducing sugar with corresponding decline in non reducing sugar in papaya nectar. The increase in reducing sugars during storage might be due to hydrolysis of sugars by acid, which might have resulted in degradation of disaccharides to monosaccharides.

Singh (2005) found that the reducing sugar increased significantly and gradual decrease in non-reducing sugar was observed with the advancement of storage period in RTS and nectar from custard apple.

Hussain *et al*. (2010) reported that non-reducing sugars decreased from 2.56 to 1.88 percent in apple-apricot blended juice.

Byanna *et al.* (2012) observed an increase in reducing sugars in orange-pomegranate blended RTS during storage and was due to inversion of non-reducing sugars to reducing sugars by acids present in the products. Non-reducing sugars decreased during storage due to inversion of non-reducing sugars to reducing sugars.

Kausar *et al*. (2012) observed that reducing sugars increased from 1.9 to 2.48 percent while non-reducing sugars decreased from 9.36 to 8.70 percent during storage period of cucumber melon drinks.

Selvi *et al*. (2013) found a gradual increase in reducing sugar content of the RTS. The final reducing sugar content of Guava-Lime-Ginger RTS was increased from 5.98 to 8.28 and 5.98-7.98 g per 100 ml in R1 and R2, respectively. The final total sugar content of the RTS beverage decreased from 12.24 to 10.95 in R1and 12.24- 11.24g per 100 ml in R2 samples.

Bal *et al.* (2014) observed that reducing sugar increased significantly during storage. Increase in reducing sugars might be assigned to the partial acid hydrolysis of starch and disaccharide of guava nectar converted into invert sugar and also inversion of part of non-reducing sugars into glucose and fructose and gradual degradation of polysaccharides in pulp through acid hydrolysis.

Malav *et al*.(2014) observed increase in reducing sugars with the advancement of storage period in all the treatments could be attributed to

gradual inversion of non-reducing sugars into reducing sugars in acidic medium. The reducing sugars content increased gradually with the increasing period of storage.

Rani *et al*.(2015) observed a gradual increase in reducing sugar content of guava and aloe blends in storage might be due to hydrolysis of sugars by increased acidity, resulted in degradation of disaccharides to monosaccharides.

2.5.6 Total soluble solids

Godara and Pareek (1985) observed that total soluble solids of RTS date juice beverage increased slightly under both the storage condition i.e., room temperature (25±5°C) and low temperature (13.2°C).

Tripathi *et al*. (1992) found that the total soluble solids of pineapple and guava blended juice increased continuously during different storage period.

Baramanray (1995) reported that TSS of guava nectar increased with the increase in storage period. The reasons assigned for the increased TSS content in nectar during storage might be due to conversion of left over polysaccharides into soluble sugar. However, this trend did not persist in all the cultivars. This increase in TSS content was maximum in cv. Allahabad Safeda and Lucknow-49.

Bons and Dhawan (2003) evaluated the best TSS content in the preserved pulp of guava for preparing a quality RTS after storing the pulp for 3 months.

Sarvanan *et al.* (2004) reported increase in TSS of papaya during storage which might be due to solubilization of pulp constituents during storage hydrolysis of polysaccharides.

Mandal and Pathak (2005) studied that TSS of pineapple and phalsa blended nectar slightly increased after two months of storage.

Choudhary and Dikshit (2006) also found gradual increase in total soluble solids in guava nectar during storage period of 150 days at ambient conditions.

Nidhi *et al.* (2008) in bael and guava blended beverage found an increase in TSS during storage period.

Byanna *et al.*(2012) found an increase in TSS during storage which could be due to conversion of polysaccharides to simple sugars and increased acidity.

Jakhar *et al*.(2012) reported that total soluble solids and acidity did not change upto three month and then increased continuously upto the end of storage of guava and barbados cherry blended beverage.

Jan and Masih (2012) found an increasing trend in total soluble solids during storage at ambient and low temperature in lime - aonla and mango-pineapple spiced RTS beverages.

Kausar *et al*.(2012) observed that TSS mean values increased (15.49-16.09%) during storage of cucumber melon drinks. It might be due to hydrolysis of polysaccharides into monosaccharide and oligosaccharides.

Selvi *et al*.(2013) observed that freshly prepared guava-lime-ginger RTS beverages had TSS of 15^{o} brix and slight reduction was noticed during storage.

Bal *et al.* (2014) observed that TSS (°Brix) of guava nectar increased during 8 months of storage.The increase of TSS in the nectar was due to conversion of left over polysaccharides into soluble sugar and formation of water soluble pectin from protopectin.

Malav *et al*.(2014) found that the TSS content of orange- based blended RTS beverages increased apparently during storage, which is possibly due to hydrolysis of polysaccharides (starch) into monosaccharide (sugars) and concentration of orange based blended RTS beverage due to dehydration. The minimum rate of increase in TSS during storage period is desirable for good quality RTS.

Yadav *et al*.(2014) observed that TSS increased with storage periods irrespectively of level of sugar and storage temperatures in banana RTS.

Jumde *et al*.(2015) observed increase in TSS with gradual passage of storage time, which might be due to hydrolysis of polysaccharides into monosaccharide and oligosaccharides.

Rani *et al*.(2015) found an increase in TSS with advancement of storage, which may be attributed due to hydrolysis of polysaccharides like starch, cellulose and pectin substances into simpler substances. No change was noticed upto 30 days.

CHAPTER-III
MATERIALS AND METHODS

The present investigation entitled "Studies on effect of blending impact of guava (*Psidium guajava* L.) and papaya (*Carica papaya* L.) pulp on recipe standardization of blended nectar and RTS (ready to serve) beverages" was conducted in the Horticulture Processing Laboratory Department of Fruit science, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.) during the year 2015-16. The details regarding materials used and techniques applied during the course of investigation have been described in this chapter.

3.1 Geographical situation

3.2 Climate

3.3 Weather condition during storage period

3.4 Experimental details

3.5 Treatment details

3.6 Preparation of blended nectar and RTS of guava and papaya

3.7 Observations recorded

3.8 Organoleptic evaluation

3.9 Benefit: Cost ratio

3.10 Statistical analysis

3.1 Geographical situation

Raipur is situated in the central part of the Chhattisgarh and lies at 21.16^{o}N latitude and 81.36^{o}E longitudes at an altitude of 298 meters above the mean sea level under Chhattisgarh plains.

3.2 Climate

Raipur district comes under dry sub-humid agro-climatic region. It has annual rainfall of 1200-1400 mm, out of which about 85 per cent is received from third week of June to mid of September and very little during October to February. May is the hottest month and December the coolest. The maximum temperature goes as high as 46^{o}C during summer and minimum as low as 8^{o}C during winter months. The atmospheric humidity is low from December to April.

3.3 Weather condition during storage period

The weather data recorded during the period of investigation is given in Fig.3.1 and Appendix-A.

3.4 Experimental details

Crop	:	Guava (*Psidium guajava* L.) Papaya (*Carica papaya* L.)
Cultivar	:	Guava-Allahabad Safeda Papaya-F_1 Hybrid (Red Lady)
Processed Products	:	Two
Product name	:	(1) Nectar (2) Ready-to-Serve beverage (RTS)
Standard recipe used	:	(1) Nectar Juice - 20% TSS - 20% Acidity - 0.3% (2) RTS Juice - 10% TSS - 15% Acidity - 0.3%
Design used	:	Completely Randomized Design (CRD)
Number of Treatments	:	Nectar – 13, RTS – 13
Number of Replications	:	Three
Storage of products	:	For 90 days at ambient condition

3.5 Treatment details

The experiment consists of 13 treatments each in nectar and RTS. The treatments were replicated three times in Completely Randomized block design (CRD). The details of treatments are given below:

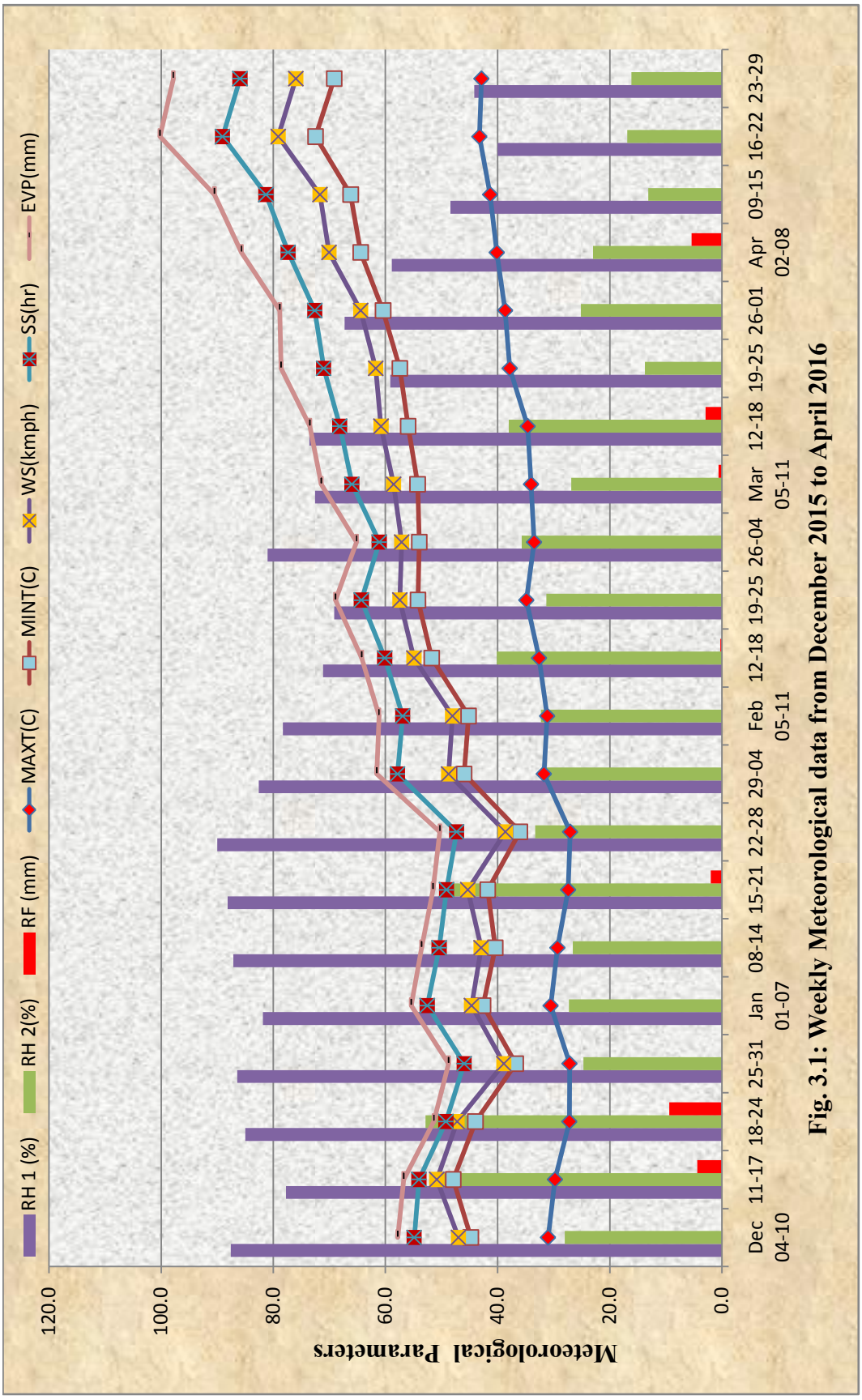


Fig. 3.1: Weekly Meteorological data from December 2015 to April 2016

1. Nectar

Treatment combination	Details
T_0 (R_0B_0)	(Standard recipe) 20% Juice: 20% TSS: 0.3% acidity + No Blending
T_1 (R_1B_1)	20% Juice: 19% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice
T_2 (R_1B_2)	20% Juice: 19% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice
T_3 (R_1B_3)	20% Juice: 19% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice
T_4 (R_2B_1)	20% Juice: 18% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice
T_5 (R_2B_2)	20% Juice: 18% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice
T_6 (R_2B_3)	20% Juice: 18% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice
T_7 (R_3B_1)	20% Juice: 17% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice
T_8 (R_3B_2)	20% Juice: 17% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice
T_9 (R_3B_3)	20% Juice: 17% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice
T_{10} (R_4B_1)	20% Juice: 16% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice
T_{11} (R_4B_2)	20% Juice: 16% TSS: 0.3% acidity +50% Guava juice: 50% Papaya juice
T_{12} (R_4B_3)	20% Juice: 16% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice

*R= Recipe,*B=Blending Ratio* 20% juice consist of four different blending ratio i.e., 100: 0, 25: 75, 50: 50 and 75:25 of guava and papaya, respectively.

2. RTS (Ready to Serve)

Treatment combination	Details
T_0 (R_0B_0)	(Standard recipe) 10% Juice: 15% TSS: 0.3% acidity + No Blending
T_1 (R_1B_1)	10% Juice: 14% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice
T_2 (R_1B_2)	10% Juice: 14% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice
T_3 (R_1B_3)	10% Juice: 14% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice
T_4 (R_2B_1)	10% Juice: 13% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice
T_5 (R_2B_2)	10% Juice: 13% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice
T_6 (R_2B_3)	10% Juice: 13% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice
T_7 (R_3B_1)	10% Juice: 12% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice
T_8 (R_3B_2)	10% Juice: 12% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice
T_9 (R_3B_3)	10% Juice: 12% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice
T_{10} (R_4B_1)	10% Juice: 11% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice
T_{11} (R_4B_2)	10% Juice: 11% TSS: 0.3% acidity +50% Guava juice: 50% Papaya juice
T_{12} (R_4B_3)	10% Juice: 11% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice

*R= Recipe,*B=Blending Ratio*10% juice consist of four different blending ratio i.e., 100: 0, 25:75, 50:50 and 75: 25 of guava and papaya, respectively.

3.6 Preparation of blended nectar and RTS of guava and papaya

3.6.1 Selection of fruits

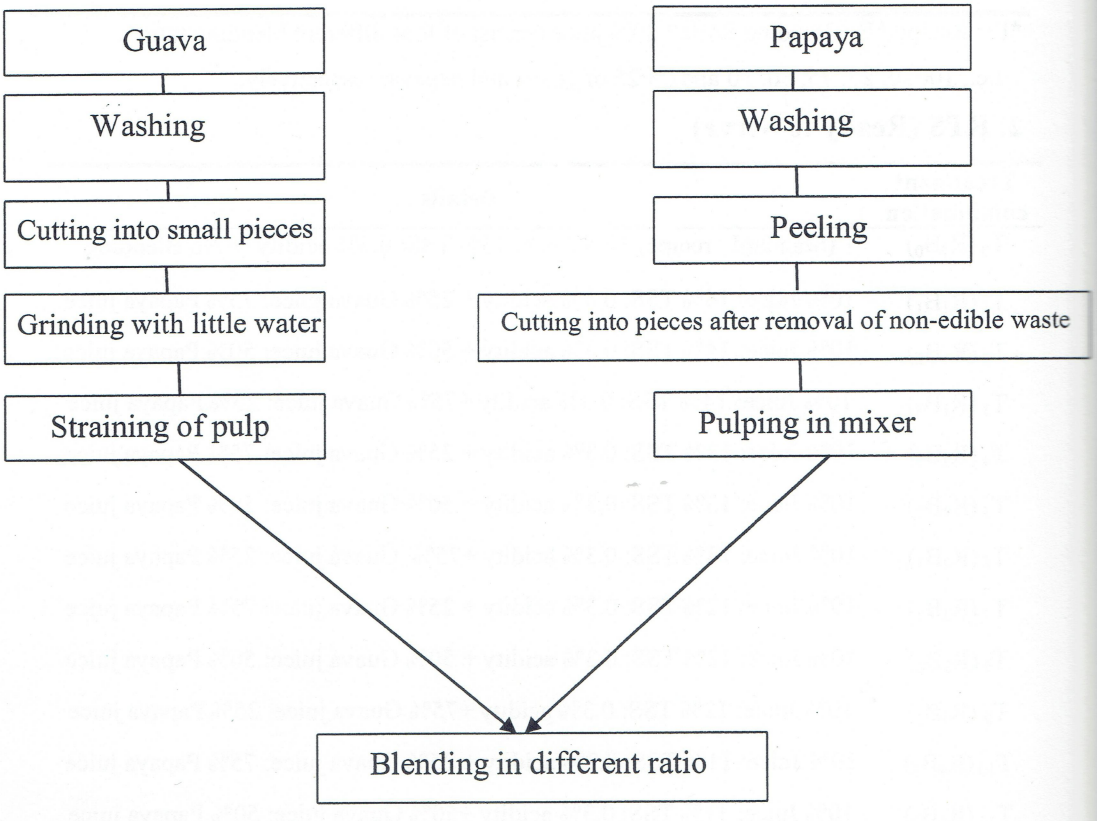
Firm ripe fruits were selected for the preparation of blended nectar and RTS from guava and papaya. The fruits were washed under running tap water to remove dirt and dust particles.

3.6.2 Extraction of Pulp from guava and papaya fruit

The Guava fruits were cut into small pieces with the help of stainless steel knife and a little amount of water was added and crushed it in mixer- grinder, while the mature and ripened papaya fruits were peeled using stainless steel knife or peeler and then cut into two equal halves and then seeds were removed. The papaya pulp was obtained by crushing it in mixer-grinder. Straining of pulp was done with the help of stainless steel sieve.

3.6.3 Preparation of blends of guava pulp and papaya pulp

Different ratios of guava and papaya pulp were made as per the recipe:



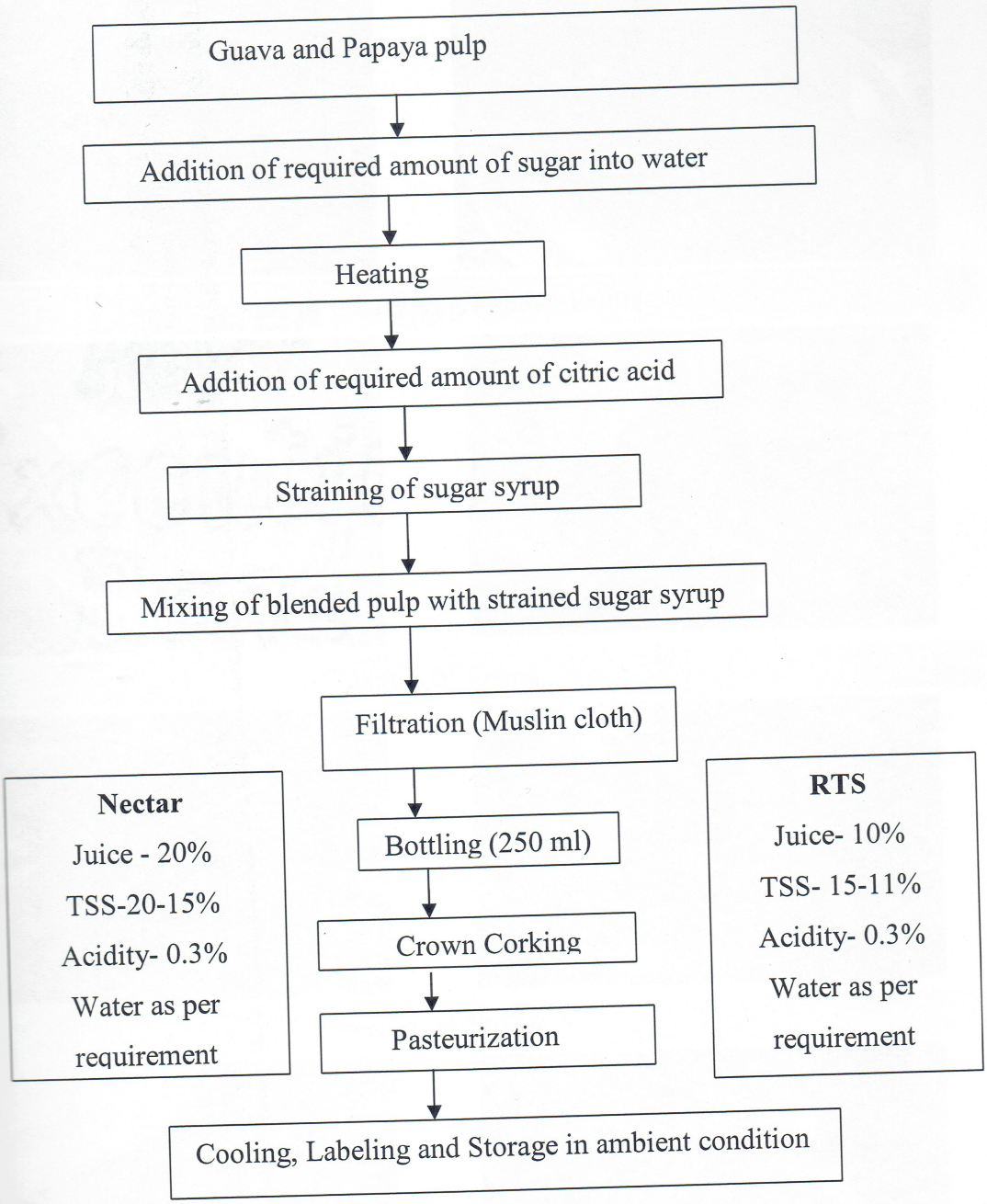


Fig.3.2: Preparation of blended nectar and RTS from guava and papaya

Grinding of Guava and Papaya

Straining of Guava and Papaya Pulp

Addition of Sugar

Heating of Sugar Syrup

Filling of Bottles

Crown Corking

Fig. 3.3. Preparation of Nectar and RTS by blending Guava and Papaya

Grinding of Guava and Papaya

Straining of Guava and Papaya Pulp

Addition of Sugar | Boiling of Sugar Syrup

Filling of Bottles | Crown Corking

Fig. 3.3. Preparation of Nectar and RTS by blending Guava and Papaya

3. 6.4 Calculation of quantity of sugar, citric acid and water

To find out quantity of sugar, TSS of pulp was measured. Then, the required quantity of sugar was calculated to obtain desired TSS (%) in nectar and RTS.

To find out quantity of citric acid, acidity of pulp was measured. Then, the required quantity of citric acid was calculated to obtain desired acidity (%) in nectar and RTS.

Quantity of water was calculated by following formula (Shrivastava and Kumar, 2002).

Quantity of water required (litre)

= Quantity of finished product — Quantity of ingredient used

(litre) [Juice (l) + Sugar (kg) + Acid (g)]

3.6.5 Mixing of ingredients

After extraction of pulp, 20 per cent pulp for nectar and 10 per cent pulp for RTS were taken as per required ratio for blending of guava and papaya. Sugar syrup was prepared by heating required amount of sugar and water to adjust the total soluble solids as per requirement in different recipe for nectar and RTS. The acidity was maintained to 0.3 per cent by the addition of required amount of citric acid in the sugar syrup. The blended guava and papaya pulp was mixed with sugar syrup to obtain final product.

3.6.6 Filtration

The prepared nectar and RTS beverages were again filtered by sieving through a muslin cloth to obtain a product of uniform consistency.

3.6.7 Bottling

The product was poured into hot, sterilized crown bottles of 250 ml capacity and corked air-tight.

3.6.8 Pasteurization

The filled bottles were pasteurized in boiling water till the temperature of product reaches 100°C. It took about 15 minutes to attain required temperature.

3.6.9 Storage

The bottles of nectar and RTS beverages were kept at ambient condition for further studies up to 90 days.

3.7 Observations recorded

3.7.1 Physical composition of fruits

Physical composition of five randomly selected mature fruits of guava and papaya was studied at harvest stage. Fruits were taken to record observations on the following characters.

3.7.1.1 Weight of fruit (g)

At the time of fruit picking, randomly selected individual fruits were under weighed separately on sensitive electronic balance and mean value of five fruits in each replication was recorded in gram.

3.7.1.2 Weight of non-edible waste (g)

The upper and basal non-edible portion of individual fruit was removed and weighed separately on sensitive electronic balance and mean value of five fruits in each replication was recorded.

3.7.1.3 Weight of seeds (g)

The pulp-free seeds of individual fruit were weighed separately and average seed weight of five fruits in each replication was recorded.

3.7.1.4 Weight of pulp (g)

The pulp weight of individual fruits were calculated by subtracting the weight of seeds, peel and non-edible waste from the weight of the whole fruit and mean value of five fruits under each replication was recorded.

3.7.1.5 Pulp: seed ratio

The pulp / seed ratio was calculated by dividing the weight of pulp by weight of seed.

3.7.2 Chemical composition of fruits, nectar and RTS

Chemical compositions of five mature fruits randomly selected under each replication were studied at harvest stage.

Chemical analysis of blended guava and papaya nectar and RTS beverages was done initially just after preparation and up to three months at 30 days interval during storage under ambient condition.

3.7.2.1 Ascorbic acid (mg/100 ml)

The ascorbic acid of pulp, nectar and RTS were determined by the procedure given by Ranganna (1997).

Estimation

Five ml L-ascorbic acid solution with same amount of HPO_3 was titrated against 2, 6-dichloro phenol indo-phenol. The end point was judged by light pink colour.

$$\text{Dye factor} = \frac{0.5}{\text{Titre}}$$

Standard ascorbic acid with HPO_3 solution was titrated against the dye solution till the pink colour appears. This method was repeated for fruit pulp, nectar and RTS beverage. The ascorbic acid was expressed as mg/ 100 ml.

$$\text{mg of ascorbic acid per 100 g or ml of sample} = \frac{\text{Titre} \times \text{Dye factor} \times \text{Volume made up} \times 100}{\text{Aliquot of extract taken for estimation} \times \text{Weight or volume of sample taken for estimation}}$$

3.7.2.2 Acidity (%)

The acidity of pulp, nectar and RTS was determined by the procedure given by Ranganna (1997). Total acid content was estimated by titrating 10 g of fruit pulp or 10 ml of nectar and RTS against standard solution of N/10 NaOH using phenolphthalein as an indicator. The end point appeared as light pink colour. The acidity was expressed in per cent.

$$\text{Acidity (\%)} = \frac{\text{Titre} \times \text{Normality of alkali} \times \text{volume made up} \times \text{equivalent wt. of acid} \times 100}{\text{Vol. of sample taken for estimation} \times \text{Weight or volume of sample taken} \times 1000}$$

3.7.2.3 pH

The pH value of fruit pulp, nectar and RTS were taken on digital pH meter.

3.7.2.4 Total soluble solids (%)

Total soluble solids (TSS) of pulp, nectar and RTS were determined by Hand Refractometer at 20^oC.

3.7.2.5 Sugars (%)

Sugars was determined by the method of Lane and Eynon as described by Ranganna (1997).The Standard invert sugar solution was prepared by dissolving 9.5 g sucrose and 5 ml conc. HCl then volume made upto 100 ml. This solution was allowed to stand for further three days at 20-250C for inversion to take place and used for several months during analysis.

Twenty five ml of invert sugar solution was taken in a flask and added 50 ml distilled water, then neutralized with 20% NaOH in the presence of phenolphthalein as an indicator until the solution turned into pink colour. Then acidified with 1 N HCl till pink colour disappears. The volume was made upto mark with distilled water (1 ml = 2.5 ml of invert sugar).

A. Reducing sugar (%)

A fixed quantity of filtered juice was transferred into volumetric flask and added same quantity of distilled water and neutralized with alkali solution. In this solution, a fixed quantity of lead acetate solution was added, shaked and let it stand for some time and necessary amount of potassium oxalate solution was added. This process was necessary to get clarified solution.

5ml fehling's solution A and fehling's solution B was taken in a conical flask. Burette was filled with sugar solution. Conical flask was heated in a open flame. Two to four ml sugar solution was poured and 1-2 drop of methylene blue indicator was added. Now, this solution was kept for heating and sugar solution was added to it. The end point appeared with brick-red colour. The reducing sugar was expressed in per cent.

$$\text{Reducing sugars (\%)} = \frac{\text{mg of invert sugar} \times \text{Dilution} \times 100}{\text{Titre} \times \text{Wt. or Volume of the sample} \times 100}$$

B. Non -reducing sugar (%)

Non-reducing sugar was determined by subtracting the value of reducing sugar from total sugar.

C. Total sugar (%)

Fifty ml clarified sugar solution was added to 5 g of citric acid with 50 ml distilled water. It was boiled slowly for 10 minutes, cooled and

transferred into a 250 ml volumetric flask and neutralized with NaOH with phenolphthalein indicator and made up the volume. Titre was expressed as per cent reducing sugars. The total sugar was expressed in per cent.

Total sugar (%) = % reducing sugar (in which the titre is obtained after inversion) + % Sucrose.

3.8 Organoleptic evaluation

The nectar and RTS beverages prepared from guava and papaya were subjected to sensory evaluation by a panel of judges following the Hedonic rating test as described by Ranganna (1997). The products were evaluated for appearance, flavour, and taste.

The characters with mean scores of 5 or more out of 9 marks were considered acceptable. The overall acceptability of products was based upon the mean scores obtained from all these characters studied under the test. The product with an overall mean score of 15 or above was considered acceptable. The mean scores obtained by different products were calculated.

3.9 Benefit: Cost (B: C) ratio

Treatment wise cost of production was worked out. The total expenditure on production and management of nectar and RTS was recorded in terms of Rs. as cost of nectar production. The gross monetary return for hundred bottles was worked out considering the average prevailing price for nectar and net return was calculated by subtracting the cost of production from gross returns then the B: C ratio was worked out by using following formula.

$$\text{B: C ratio} = \frac{\text{Net return}}{\text{Cost of production}}$$

Storage of Nectar and RTS in ambient condition

Organoleptic Evaluation

Chemical Analysis of Products

Fig. 3.4 Storage organoleptic evaluation and Chemical analysis of blended guava and papaya nectar and RTS

3.10 Statistical analysis

Data recorded on various aspects in the laboratory were subjected to statistical analysis of variance technique as given by Gomez and Gomez (1985).

ANOVA

Source of Variance	d.f.	Sum of Square	Mean sum of square	Fcal	Ftab
Treatment	$t-1$	TrSS	$\text{TrSS} = \frac{\text{TrSS}}{\text{df}}$	$\frac{\text{TrMS}}{\text{EMS}}$	
Error	$t(r-1)$	ESS	$\text{EMS} = \frac{\text{ESS}}{\text{df}}$		
Total	$rt-1$	TSS			

CHAPTER-IV

RESULTS AND DISCUSSION

Data recorded and results obtained on various aspects of blending impact of guava (*Psidium guajava* L.) and papaya (*Carica papaya* L.) pulp on recipe standardization of blended nectar and RTS (Ready to Serve) beverages during the course of investigation have been presented in appropriate tables and figures along with statistical interpretations. Some facts and discussions which are briefly elucidated under the following heads have also been focused:

4.1 Physico-chemical composition of guava and papaya fruits.

4.2 Biochemical changes in blended guava and papaya nectar during storage.

4.3 Organoleptic evaluation of blended guava and papaya nectar during storage.

4.4 Biochemical changes in blended guava and papaya RTS during storage.

4.5 Organoleptic evaluation of blended guava and papaya RTS during storage.

4.6 Benefit: Cost ratio

4.1 Physico-chemical composition of guava and papaya fruits

Data pertaining to physico-chemical composition of guava and papaya fruits are presented in Table 4.1and 4.2.

A. Physico- Chemical composition of guava

A critical analysis of data on physical composition of guava cv. Allahabad Safeda revealed that average fruit weight and pulp weight was recorded 161.77 g and 155.30 g, respectively, which was 96.36 per cent of the total fruit weight. As regards, seed weight and non- edible waste of guava fruit, these parameters were recorded 5.85 g and 6.83 g, respectively. The calculated values of these two parameters are 3.6 per cent and 4.22 per cent of total fruit weight, respectively. Whereas, pulp: seed ratio was calculated 26.54.

The Chemical compositions of five randomly selected mature fruits were studied and data are presented in Table 4.1.

Table 4.1: Physico-chemical composition of guava fruits

S.No.	Characters		cv. Allahabad Safeda
A.	**Physical composition**	**Values**	**% of total fruit**
1.	Fruit weight (g)	161.77	_
2.	Pulp weight (g)	155.30	96.36
3.	Seed weight (g)	5.85	3.6
4.	Weight of non-edible waste (g)	6.83	4.22
5.	Pulp: seed ratio	26.54	_
B.	**Chemical composition**		
1.	Total Soluble Solids (%)	13.31	
2.	Acidity (%)	0.49	
3.	Ascorbic acid (mg/100ml)	241.0	
4.	pH	3.62	
5.	Total sugar (%)	10.29	
a)	Reducing sugar (%)	4.78	
b)	Non-reducing sugar (%)	5.51	

Data with respect to chemical composition of fruits revealed that mean value of total soluble solids (TSS) was recorded 13.31%. The mean value of total sugar, reducing sugar and non - reducing sugar content was recorded 10.3 per cent, 4.78 per cent and 5.51 per cent, respectively in cv. Allahabad Safeda. The mean value of ascorbic acid content was recorded 241mg /100ml. The pH value was recorded as 3.62.Total titrable acidity was recorded 0.49 per cent in the fruit sample.

B. Physico- Chemical composition of papaya

A critical analysis of data on physical composition of papaya variety Red Lady revealed that average fruit weight and pulp weight was recorded 1620 g and 1420 g, respectively, which was 87.65 per cent of the total fruit weight. As regards, seed weight and non- edible waste of papaya fruit, these parameters were recorded 12.50 g and 89.00 g, respectively. The calculated values of these two parameters are 0.77 per cent and 5.49 per cent of total fruit weight, respectively. Whereas, pulp: seed ratio was calculated 113.60.

The Chemical compositions of five randomly selected mature fruits were studied and data are presented in Table 4.2.

Table 4.2: Physico-chemical composition of Papaya fruits

S. No.	Characters	F_1 Hybrid (Red Lady)	
A.	**Physical composition**	**Value**	**% of total fruit weight**
1.	Fruit weight (g)	1620.00	_
2.	Pulp weight (g)	1420.0	87.65
3.	Seed weight (g)	12.50	0.77
4.	Weight of non-edible waste (g)	89.00	5.49
5.	Pulp: seed ratio	113.60	_
B.	**Chemical composition**		
1.	Total Soluble Solids (%)	10.6	
2.	Acidity (%)	0.34	
3.	Ascorbic acid (mg/100ml)	66.62	
4.	pH	4.37	
5.	Total sugar (%)	9.39	
a)	Reducing sugar (%)	7.69	
b)	Non-reducing sugar (%)	1.70	

Data with respect to chemical composition of fruits revealed that mean value of total soluble solids (TSS) was recorded 10.6%. The mean value of total sugar, reducing sugar and non - reducing sugar content was recorded 9.39 per cent, 7.69 per cent and 1.70 per cent, respectively in variety Red Lady of papaya. The mean value of ascorbic acid content was recorded 66.62mg/100ml. The pH value was recorded as 4.37.Total titrable acidity was recorded 0.34 per cent in the fruit sample.

4.2 Biochemical changes in blended guava and papaya nectar during storage

4.2.1 Total soluble solids (%)

Data pertaining to effect of different recipe treatments on the total soluble solids of blended guava and papaya nectar stored under ambient condition are presented in Table 4.3 and illustrated in Fig.4.1.

It is clear from the data that total soluble solids content of nectar showed an increasing trend with increasing period of storage (0 to 90 days). A significant difference in total soluble solids was observed at the time of preparation (0 day). The total soluble solids content of nectar was found to be significant from 30 to 90 days of storage.

At the time of preparation, TSS was found significantly higher (20.00 %) with the treatment T_0(20%Juice: 20%TSS: 0.3% acidity +No Blending) followed by T_2(20% Juice: 19% TSS: 0.3% acidity+ 50% Guava juice: 50% Papaya juice) and T_1(20% Juice: 19% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice).While, minimum TSS content was recorded (15.40%) with the treatment T_{12}(20% Juice: 16% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice).

At 30 days of storage, the total soluble solids content was found to be maximum (20.1%) with the treatment T_0 (20% Juice: 20% TSS: 0.3% acidity + No Blending) followed by T_2 (20% Juice: 19% TSS: 0.3% acidity+ 50% Guava juice: 50% Papaya juice) and T_1 (20% Juice: 19% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice). While, minimum TSS content was recorded (15.4%) with the treatment T_{12} (20% Juice: 16% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice).

At 60 days of storage, maximum TSS was recorded(20.2%) with the treatment T_0(20% Juice: 20% TSS: 0.3% acidity + No Blending) followed by T_2(20% Juice: 19% TSS: 0.3% acidity+ 50% Guava juice: 50% Papaya juice) and T_1(20% Juice: 19% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice).While, minimum TSS content was recorded (15.5%) with the treatment

Table 4.3: Effect of different recipe treatments on TSS (%) of stored guava and papaya blended nectar

Treatments	Storage period (in days)			
	0	**30**	**60**	**90**
T_0(20% Juice: 20% TSS: 0.3% acidity + No Blending)	20.00	20.10	20.20	20.20
T_1(20% Juice: 19% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	18.40	18.50	18.60	18.62
T_2(20% Juice: 19% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	18.60	18.60	18.66	18.67
T_3(20% Juice: 19% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	18.20	18.35	18.41	18.50
T_4(20% Juice: 18% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	17.80	17.85	17.85	17.90
T_5(20% Juice: 18% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	18.00	18.16	18.18	18.20
T_6(20% Juice: 18% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	17.60	17.72	17.75	17.82
T_7(20% Juice: 17% TSS: 0.3% acidity 25% Guava juice: 75% Papaya juice)	16.60	16.65	16.70	16.70
T_8(20% Juice: 17% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	16.20	16.20	16.30	16.39
T_9(20% Juice: 17% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	16.40	16.54	16.54	16.58
T_{10}(20% Juice: 16% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	15.60	15.65	15.70	15.75
T_{11}(20% Juice: 16% TSS: 0.3% acidity +50% Guava juice: 50% Papaya juice)	15.80	15.82	15.86	15.90
T_{12}(20% Juice: 16% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	15.40	15.40	15.50	15.50
SEm±	0.045	0.021	0.019	0.015
CD at 5%	0.13	0.06	0.05	0.04
CV	0.46	0.21	0.19	0.15

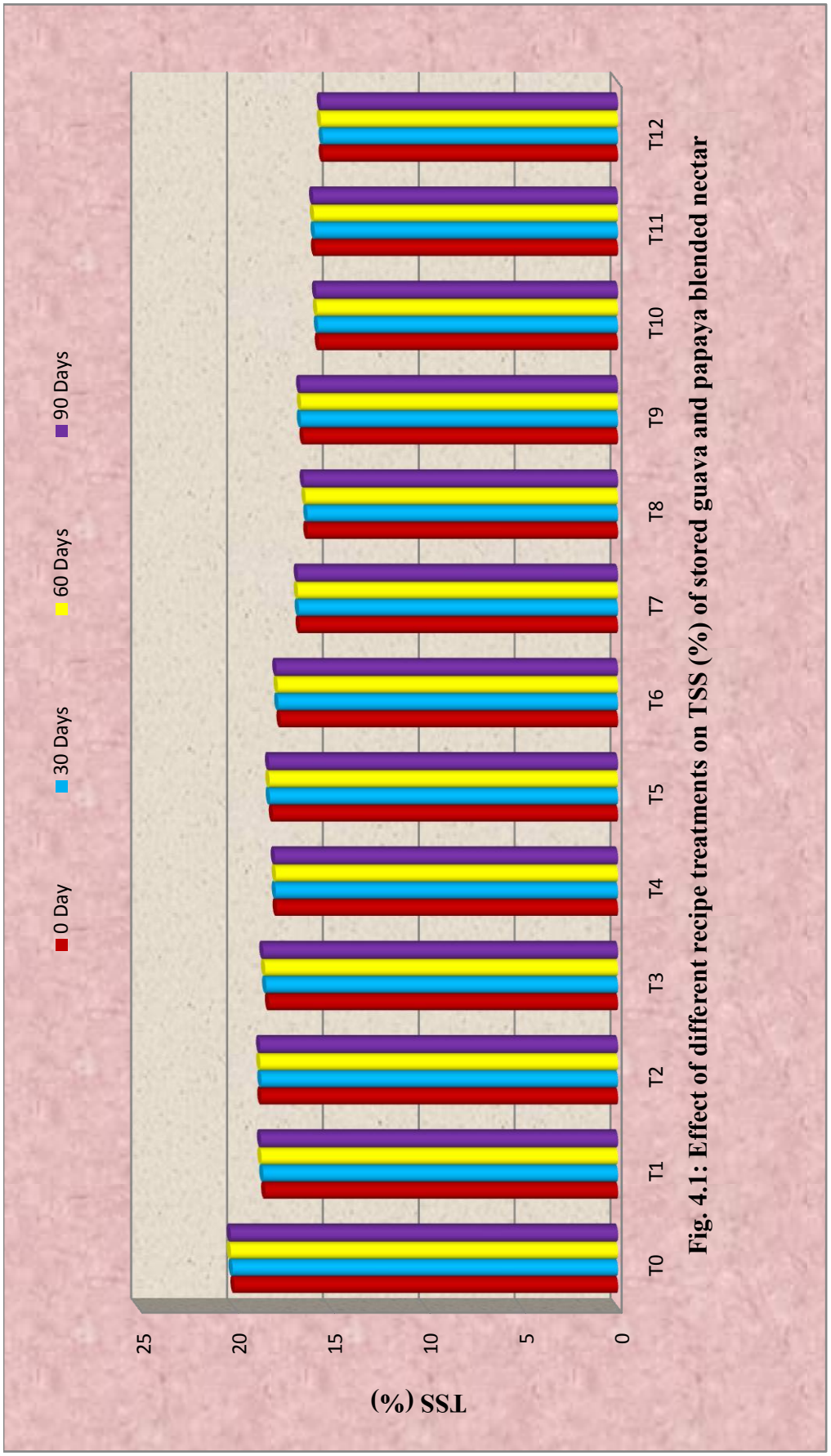


Fig. 4.1: Effect of different recipe treatments on TSS (%) of stored guava and papaya blended nectar

T_{12}(20% Juice: 16% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice).

At 90 days of storage, similar trend was observed in TSS.

The increased TSS in nectar during storage was probably due to conversion of left over polysaccharides into soluble sugars. The present findings are in close conformity with the report of Tripathi *et al*. (1992), who found that the total soluble solids of pineapple and guava blended juice increased continuously during storage period. Similar findings were also reported by Deka *et al*. (2004), who observed that total soluble solids showed an increasing trend throughout the storage period. These results are in good agreement with the findings of Sharma and Singh (2005), who reported that the TSS of lime juice increased with an increase in storage period upto 90 days .

4.2.2 Acidity (%)

Data pertaining to effect of different recipe treatments on the acidity of blended guava and papaya nectar under ambient condition of storage are presented in Table. 4.4 and illustrated in Fig.4.2.

It is evident from the data that acidity of blended guava and papaya nectar showed an increasing trend with increasing period of storage (0 to 90 days). At the time of preparation (0 day), though the differences was non- significant however, it was recorded maximum (0.37%) under the treatment T_{10}(20% Juice: 16% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice) and it was found minimum (0.28%) under the treatment T_6(20% Juice: 18 % TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice) .Similarly, during 0 to 30 days of storage, maximum acidity (0.41%) was recorded with the treatment T_{10}(20% Juice: 16% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice) and it was minimum (0.31%) under the treatment T_6(20% Juice: 18 % TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice).

The acidity of nectar was found to be significant at 60 and 90 days of storage. At 60 days of storage, significant higher acidity was recorded (0.56%) with the treatment T_{10} (20% Juice: 16% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice) followed by T_{11} (20% Juice: 16% TSS: 0.3%

Table 4.4: Effect of different recipe treatments on acidity (%) of stored guava and papaya blended nectar

Treatments	Storage period (in days)			
	0	**30**	**60**	**90**
T_0(20% Juice: 20% TSS: 0.3% acidity + No Blending)	0.32	0.35	0.36	0.45
T_1(20% Juice: 19% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	0.33	0.36	0.41	0.53
T_2(20% Juice: 19% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	0.32	0.35	0.38	0.50
T_3(20% Juice: 19% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	0.33	0.36	0.40	0.52
T_4(20% Juice: 18% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	0.33	0.36	0.44	0.54
T_5(20% Juice: 18% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	0.30	0.33	0.34	0.40
T_6(20% Juice: 18%TSS: 0.3% acidity + 75% Guava juice: 25% Papaya juice)	0.28	0.31	0.32	0.37
T_7(20% Juice: 17% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	0.34	0.37	0.46	0.57
T_8(20% Juice: 17% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	0.32	0.35	0.37	0.48
T_9(20% Juice: 17% TSS: 0.3% acidity + 75% Guava juice: 25% Papaya juice)	0.31	0.34	0.35	0.41
T_{10}(20% Juice: 16% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	0.37	0.41	0.56	0.63
T_{11}(20%Juice: 16%TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	0.36	0.39	0.51	0.60
T_{12}(20%Juice: 16%TSS: 0.3% acidity + 75% Guava juice: 25% Papaya juice)	0.35	0.38	0.47	0.59
SEm ±	0.017	0.018	0.007	0.08
CD at 5%	NS	NS	0.02	0.02
CV	NS	NS	3.15	2.74

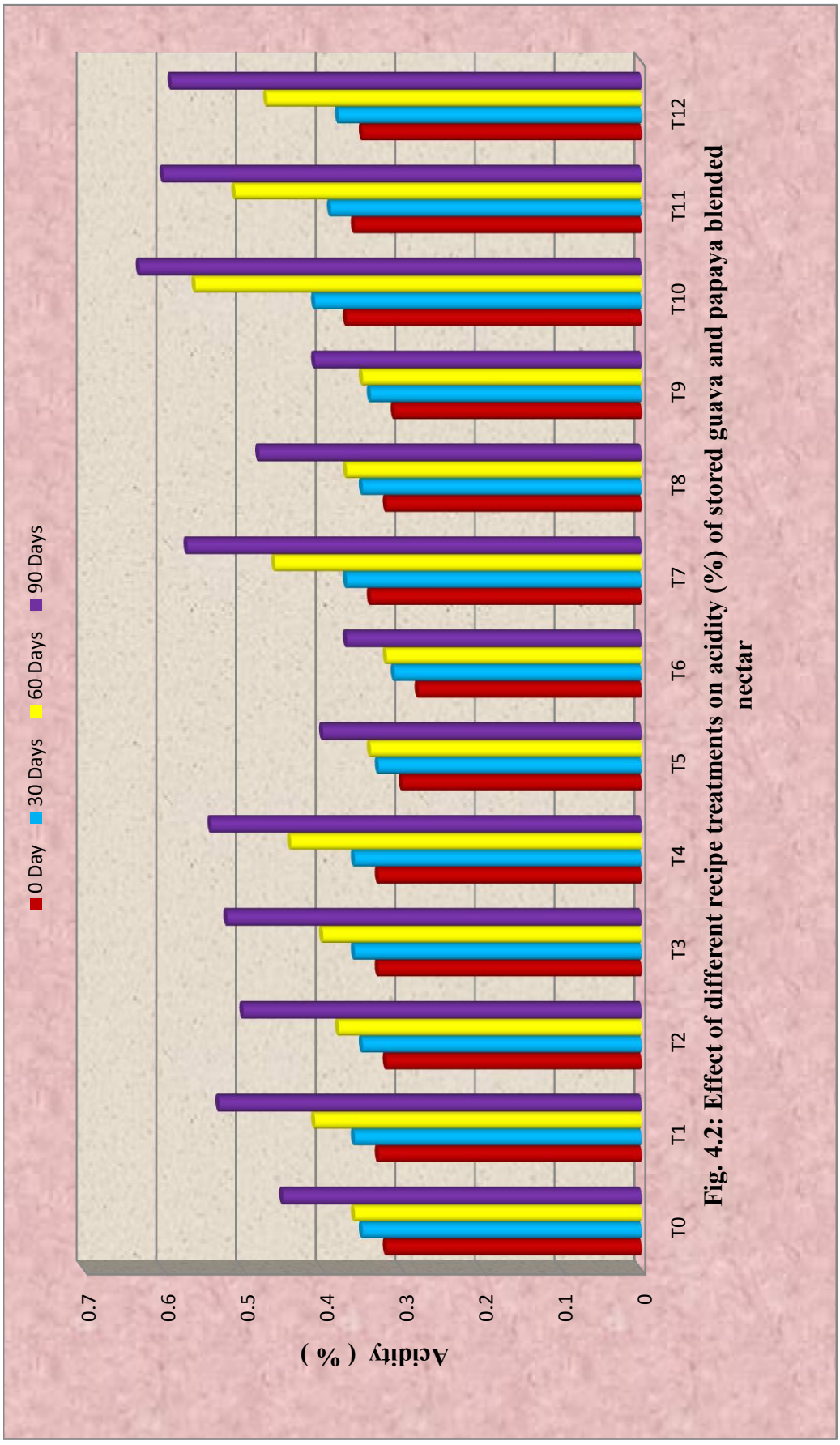


Fig. 4.2: Effect of different recipe treatments on acidity (%) of stored guava and papaya blended nectar

acidity +50% Guava juice: 50% Papaya juice) and T_{12} (20% Juice: 16% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice). While, minimum acidity was observed (0.32%) with T_6 (20% Juice: 18 % TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice).

After 90 days of storage, the significant highest titrable acidity (0.63%) was noticed under the treatment T_{10}(20% Juice: 16% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice) followed by T_{11} (20% Juice: 16% TSS: 0.3% acidity +50% Guava juice: 50% Papaya juice) and T_{12} (20% Juice: 16% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice).While, minimum (0.37%) acidity was observed with T_6 (20% Juice: 18 % TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice).

The increase in acidity of nectar during storage might be due to formation of organic acids by ascorbic acid degradation as well as progressive decrease in the pectin content. It is also due to formation of acids from sugar.

Similar findings were also reported by Baramanray *et al.* (1995), who observed that the titrable acidity in guava nectar increased significantly ($P < 0.01$) with the increase in storage period. The results are also in conformity with the findings of Bal *et al.* (2014), who reported a significant increase in acidity of guava nectar during storage. Similar finding have also been reported by Pandey and Singh (1999), Choudhary and Dikshit (2006), in guava beverages and Singh (1988), in litchi beverages.

4.2.3 Ascorbic acid (mg/100ml)

Data pertaining to effect of different recipe treatments on the ascorbic acid content of blended guava and papaya nectar under ambient storage condition are presented in Table 4.5 and illustrated in Fig. 4.3.

It is apparent from the data that ascorbic acid content in blended guava and papaya nectar of all the treatments showed a decreasing trend with increasing period of storage (0 to 90 days).

At the time of preparation (0 day), though the differences was non-significant however, it was recorded maximum (32.43 mg/100ml) under the treatment T_6 (20% Juice: 18% TSS: 0.3% acidity+75% Guava juice: 25% Papaya

Table 4.5: Effect of different recipe treatments on Ascorbic acid (mg/100 ml) of stored guava and papaya blended Nectar

Treatments	Storage period (in days)			
	0	**30**	**60**	**90**
T_0(20% Juice: 20% TSS: 0.3% acidity + No Blending)	32.30	32.28	31.96	30.37
T_1(20% Juice: 19% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	32.05	32.03	31.71	28.63
T_2(20% Juice: 19% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	32.16	32.16	31.8	29.86
T_3(20% Juice: 19% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	32.10	32.08	31.76	28.75
T_4(20% Juice: 18% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	32.01	31.97	31.65	27.05
T_5(20% Juice: 18% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	32.38	32.36	32.10	30.85
T_6(20% Juice: 18% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	32.43	32.40	32.12	30.90
T_7(20% Juice: 17% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	31.97	31.95	30.98	26.98
T_8(20% Juice: 17% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	32.20	32.15	31.90	30.23
T_9(20% Juice: 17% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	32.34	32.32	32.02	30.54
T_{10}(20% Juice: 16% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	31.85	31.81	30.65	25.35
T_{11}(20% Juice: 16% TSS: 0.3% acidity +50% Guava juice: 50% Papaya juice)	31.87	31.85	30.72	25.69
T_{12}(20% Juice: 16% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	31.91	31.89	30.76	25.80
SEm ±	0.184	0.162	0.013	0.013
CD at 5%	NS	NS	0.04	0.04
CV	NS	NS	0.07	0.08

Fig. 4.3: Effect of different recipe treatments on Ascorbic acid (mg/100 ml) of stored guava and papaya blended Nectar

juice) and it was minimum (31.85 mg/100ml) in treatment T_{10} (20% Juice: 16% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice).

Similarly, at 30 days of storage, maximum ascorbic acid was recorded (32.40 mg/100ml) with the treatment T_6 (20% Juice: 18% TSS: 0.3% acidity+75% Guava juice: 25% Papaya juice) and it was minimum (31.81 mg/100ml) in the treatment T_{10} (20% Juice: 16% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice).

The ascorbic acid of nectar was found to be significant at 60 and 90 days of storage. After 60 days of storage, significantly maximum (32.12 mg/100ml) ascorbic acid was observed with the treatment T_6 (20% Juice: 18% TSS: 0.3% acidity+75% Guava juice: 25% Papaya juice) followed by T_5 (20% Juice: 18% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice) and T_9 (20% Juice: 17% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice).The minimum ascorbic acid was recorded (30.65 mg/100ml) with the treatment T_{10}(20% Juice: 16% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice).The treatment T_{10} and T_{11},T_{11} and T_{12} and T_4 and T_1 were found statistically at par.

After 90 days of storage, significantly maximum ascorbic acid was recorded(30.90 mg/100ml) with the treatment T_6 (20% Juice: 18% TSS: 0.3% acidity+75% Guava juice: 25% Papaya juice) followed by T_5(20% Juice: 18% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)and T_9(20% Juice: 17% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice). The minimum ascorbic acid (25.35 mg/100ml) was recorded under treatment T_{10} (20% Juice: 16% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice).

The decreasing trend of ascorbic acid content with increase in the storage period was found in blended guava and papaya nectar and this decrease in ascorbic acid content might be due to oxidation of vitamin-C by trapped oxygen in glass bottles, which resulted in formation of dehydro-ascorbic acid and also due to the effect of processing, storage time and exposure to light. Similar results were also noted by Mall and Tondon (2007), in guava-aonla blended beverage, Sharma *et al*. (2008), in guava-papaya RTS beverage and Pebam (2010), in aonla products. The losses in ascorbic acid content of fruit

beverages have also been noticed by Kumar (1990), in papaya and Rabbani (1992), in mango beverages during storage at ambient conditions. The results are in conformity with the findings of Baramanray *et al*.(1995), who observed that ascorbic acid content in guava nectar decreased significantly with increasing storage period.

4.2.4 pH

Data pertaining to effect of different recipe treatments on the pH value of blended guava and papaya nectar under ambient condition of storage are presented in Table 4.6 and illustrated in Fig. 4.4.

It is evident from the data that the pH value in blended guava and papaya nectar showed a decreasing trend with increasing period of storage (0-90 days). However, a significant difference in the pH value was observed upto 90 days of storage. At the time of preparation, maximum pH value was observed (4.27) with the treatment T_6(20% Juice: 18% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice) followed by T_5(20% Juice: 18% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice) and T_9(20% Juice: 17% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice).While, minimum pH was observed (3.64) with the treatment T_{10} (20% Juice: 16% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice). The differences between treatments T_8 and T_0, T_0 and T_2, T_2 and T_4, T_3 and T_1, T_{12} and T_{11} were statistically at par.

At 30 days of storage, the recipe was found to influence significantly the pH of nectar and it was maximum(4.2) with the treatment T_6(20% Juice: 18 % TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice) followed by T_5(20% Juice: 18% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice) and T_9(20% Juice: 17% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice).While, minimum pH was observed (3.57) with the treatment T_{10} (20% Juice: 16% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice). The differences between treatments T_0 and T_2, T_3 and T_1 were statistically at par.

At 60 days of storage, maximum pH value was recorded (4.06) under the treatment T_6(20% Juice: 18% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice) followed by T_5(20% Juice: 18% TSS: 0.3% acidity + 50% Guava juice:

Table 4.6: Effect of different recipe treatments on pH of stored guava and papaya blended nectar

Treatments	Storage period (in days)			
	0	**30**	**60**	**90**
T_0(20% Juice: 20% TSS: 0.3% acidity + No Blending)	4.00	3.93	3.79	3.49
T_1(20% Juice: 19% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	3.88	3.81	3.67	3.37
T_2(20% Juice: 19% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	3.98	3.91	3.77	3.47
T_3(20% Juice: 19% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	3.90	3.83	3.69	3.39
T_4(20% Juice: 18% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	3.94	3.87	3.73	3.43
T_5(20% Juice: 18% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	4.21	4.14	4.00	3.70
T_6(20% Juice: 18% TSS: 0.3% acidity + 75% Guava juice: 25% Papaya juice)	4.27	4.20	4.06	3.76
T_7(20% Juice: 17% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	3.81	3.74	3.60	3.30
T_8(20% Juice: 17% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	4.04	3.97	3.83	3.53
T_9(20% Juice: 17% TSS: 0.3 %acidity +75% Guava juice: 25% Papaya juice)	4.13	4.06	3.92	3.62
T_{10}(20% Juice: 16% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	3.64	3.57	3.43	3.13
T_{11}(20% Juice: 16% TSS: 0.3% acidity +50% Guava juice: 50% Papaya juice)	3.71	3.64	3.50	3.2
T_{12}(20% Juice: 16% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	3.75	3.68	3.54	3.24
SEm±	0.014	0.011	0.010	0.008
CD at 5%	0.04	0.03	0.03	0.02
CV	0.08	0.49	0.47	0.40

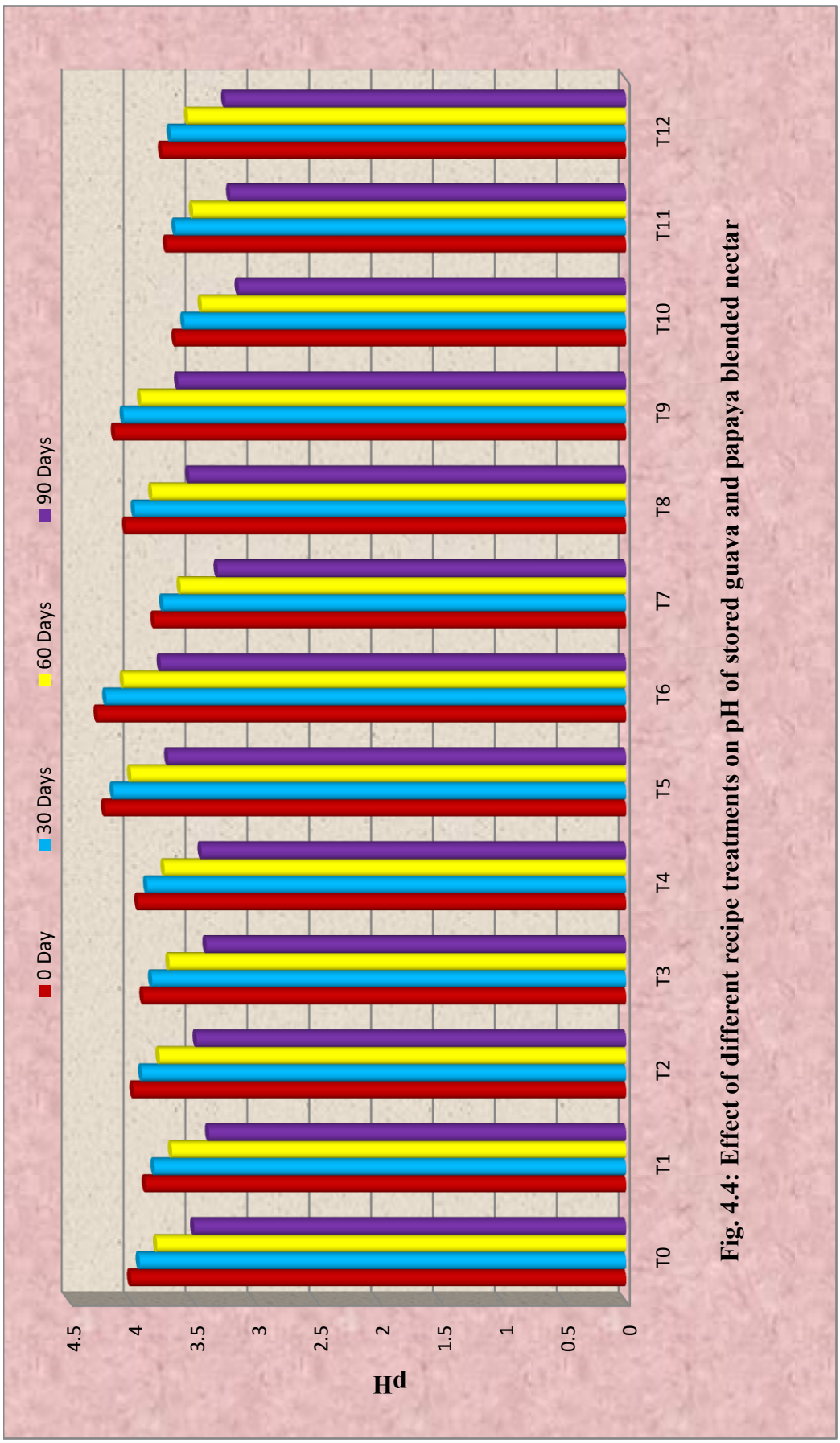


Fig. 4.4: Effect of different recipe treatments on pH of stored guava and papaya blended nectar

50% Papaya juice) and T_9(20% Juice: 17% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice).While, minimum pH was observed (3.43) with the treatment T_{10} (20% Juice: 16% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice). The differences between treatments T_0 and T_2, T_3 and T_1 were statistically at par.

After 90 days of storage, maximum pH value was observed (3.76) with the T_6(20% Juice: 18 % TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice) followed by T_5(20% Juice: 18% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice) and T_9(20% Juice: 17% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice). While, minimum pH was observed (3.13) with the treatment T_{10} (20% Juice: 16% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice). The differences between treatments T_0 and T_2, T_3 and T_1 were statistically at par.

The increased acidity and TSS under all the recipe treatments during storage had a corresponding decrease in pH. Hence, the reduction in pH could be attributed to simultaneous increase in acidity and TSS of nectar irrespective of their storage temperature. The present findings are in agreement with Sasikumar (2015), who observed significant decrease in pH during storage of functional beverages from Aloe-vera juice blended with bael fruit juice.

4.2.5 Reducing sugar (%)

Data pertaining to effect of different recipe treatments on reducing sugar of blended guava and papaya nectar under ambient condition storage are presented in Table 4.7 and illustrated in Fig.4.5.

It is evident from the data that the different recipes influenced the reducing sugar content of guava nectar and showed an increasing trend with increasing period of storage (0-90 days). The reducing sugar was recorded to be significant from 0 to 90 days of storage. At the time of preparation, the maximum (10.12%) reducing sugar was observed with the treatment T_{10} (20% Juice: 16% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice) followed by T_{11} (20% Juice: 16% TSS: 0.3% acidity +50% Guava juice: 50% Papaya juice) and T_7 (20% Juice: 17% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice). The minimum reducing sugar was recorded (9.31%) with the treatment T_6 (20% Juice: 18 % TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice).The

Table 4.7: Effect of different recipe treatments on reducing sugar (%) of stored guava and papaya blended nectar

Treatments	Storage period (in days)			
	0	**30**	**60**	**90**
T_0(20% Juice: 20% TSS: 0.3% acidity + No Blending)	9.50	9.60	9.68	9.75
T_1(20% Juice: 19% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	9.77	9.85	9.92	9.98
T_2(20% Juice: 19% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	9.63	9.70	9.81	9.87
T_3(20% Juice: 19% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	9.70	9.77	9.86	9.91
T_4(20% Juice: 18% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	9.83	9.91	9.98	10.02
T_5(20% Juice: 18% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	9.38	9.48	9.55	9.60
T_6(20% Juice: 18 % TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	9.31	9.41	9.49	9.56
T_7(20% Juice: 17% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	9.99	10.05	10.09	10.11
T_8(20% Juice: 17% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	9.56	9.65	9.74	9.80
T_9(20% Juice: 17% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	9.44	9.54	9.61	9.69
T_{10}(20% Juice: 16% TSS: 0.3%acidity + 25% Guava juice: 75% Papaya juice)	10.12	10.15	10.21	10.25
T_{11}(20% Juice: 16% TSS: 0.3%acidity +50% Guava juice: 50% Papaya juice)	10.05	10.07	10.13	10.15
T_{12}(20% Juice: 16% TSS: 0.3%acidity +75% Guava juice: 25% Papaya juice)	9.97	10.00	10.04	10.07
SEm±	0.01	0.01	0.009	0.007
CD at 5%	0.03	0.03	0.03	0.02
CV	0.20	0.19	0.16	0.12

Fig. 4.5: Effect of different recipe treatments on reducing sugar (%) of stored guava and papaya blended nectar

treatment T_7 and $T_{12,}$ T_{12} and T_4 were statistically at par.

At the time of 30 days storage, maximum reducing sugar was observed (10.15%) with the treatment T_{10} (20% Juice: 16% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice) followed by T_{11}(20% Juice: 16% TSS: 0.3% acidity +50% Guava juice: 50% Papaya juice) and T_7(20% Juice: 17% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice).The minimum reducing sugar was recorded (9.41%) with the treatment T_6 (20% Juice: 18 % TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice).The treatment T_{11} and T_7 were statistically at par.

After 60 days of storage, significant maximum reducing sugar was recorded (10.21%) with the treatment T_{10} (20% Juice: 16% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice) followed by T_{11}(20% Juice: 16% TSS: 0.3% acidity +50% Guava juice: 50% Papaya juice) and T_7(20% Juice: 17% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice).The minimum reducing sugar was recorded (9.49%) with the treatment T_6 (20% Juice: 18 % TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice).

After 90 days of storage, significant maximum reducing sugar was observed (10.25%) with the treatment T_{10} (20% Juice: 16% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice) followed by T_{11}(20% Juice: 16% TSS: 0.3% acidity +50% Guava juice: 50% Papaya juice) and T_7(20% Juice: 17% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice. The minimum reducing sugar was recorded (9.56%) with the treatment T_6 (20% Juice: 18 % TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice).

The increase in reducing sugar during storage may be attributed due to gradual inversion of non-reducing sugars to reducing sugar by the hydrolysis process. These results are in close conformity with the findings of Brekke *et al.* (1976), who studied that the decrease in sucrose content in papaya nectar was correlated with an increase in storage temperature and sulphur di-oxide preserved pulp and showed maximum increase in reducing sugar content, whereas, the non-reducing sugar followed a decreasing trend. Tiwari (2000) reported an increase in reducing sugar content during storage of the RTS beverages prepared from guava- papaya (70:30) blends. Baramanray *et al.* (1995) reported significant ($P< 0.01$) increase in total sugar as well as reducing sugar content in stored guava nectar with increasing storage period.

4.2.6 Non-reducing sugar (%)

Data pertaining to effect of different treatments on the non-reducing sugar of blended guava and papaya nectar under ambient condition storage are presented in Table 4.8 and illustrated in Fig.4.6.

It is evident from the data that the non-reducing sugar in blended guava and papaya nectar showed a decreasing trend with increasing period of storage (0-90 days). The non-reducing sugar was found to be significant from 0 to 90 days of storage. At the time of preparation, significant maximum non-reducing sugar was recorded (16.06%) with the treatment T_6(20% Juice: 18 % TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice) followed by T_5(20% Juice: 18% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice) and T_9(20% Juice: 17% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice).Whereas, the minimum (15.80%) non -reducing sugar was observed with the treatment T_{10} (20% Juice: 16% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice). The treatments T_5 and T_9, T_9 and T_0, T_8 and T_2, T_3 and T_1, $T_4$and T_7, T_7 and T_{12}, T_{12} and T_{11}, T_{11} and T_{10} were significantly at par.

After 30 days of storage, significantly maximum non-reducing sugar was observed (16.00%) with the treatment T_6(20% Juice: 18 % TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice) followed by T_5(20% Juice: 18% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice), T_9(20% Juice: 17% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice) and T_0(20% Juice: 20% TSS: 0.3% acidity+ No Blending).Whereas, the minimum (15.74%) non-reducing sugar was observed with the treatment T_{10} (20% Juice: 16% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice). The treatments T_5 and T_9, T_9 and T_0, T_8 and T_2, T_3 and T_1, $T_4$and T_7, T_7 and T_{12}, T_{12} and T_{11}, T_{11} and T_{10} were significantly at par.

After 60 days of storage significantly maximum non-reducing-sugar was recorded (15.88%) with the treatment T_6 (20% Juice: 18% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice) followed by T_5 (20% Juice: 18% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice) and T_9 (20% Juice: 17% TSS:

Table 4.8: Effect of different recipe treatments on Non- reducing sugar (%) of stored guava and papaya blended nectar

Treatments	Storage period (in days)			
	0	30	60	90
T_0(20% Juice: 20% TSS: 0.3% acidity + No Blending)	15.99	15.93	15.81	15.60
T_1(20% Juice: 19% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	15.90	15.84	15.72	15.51
T_2(20% Juice: 19% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	15.94	15.88	15.76	15.55
T_3(20% Juice: 19% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	15.91	15.85	15.73	15.52
T_4(20% Juice: 18% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	15.87	15.81	15.69	15.48
T_5(20% Juice: 18% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	16.02	15.96	15.84	15.63
T_6(20% Juice: 18 % TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	16.06	16.00	15.88	15.67
T_7(20% Juice: 17% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	15.86	15.80	15.68	15.47
T_8(20% Juice: 17% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	15.96	15.90	15.78	15.57
T_9(20% Juice: 17% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	16.01	15.95	15.83	15.62
T_{10}(20% Juice: 16% TSS: 0.3% acidity +25% Guava juice: 75% Papaya juice)	15.80	15.74	15.62	15.41
T_{11}(20% Juice: 16% TSS: 0.3% acidity +50% Guava juice: 50% Papaya juice)	15.82	15.76	15.64	15.43
T_{12}(20% Juice: 16% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	15.84	15.78	15.66	15.45
SEm±	0.008	0.009	0.005	0.005
CD at 5%	0.02	0.02	0.01	0.01
CV	0.09	0.10	0.06	0.06

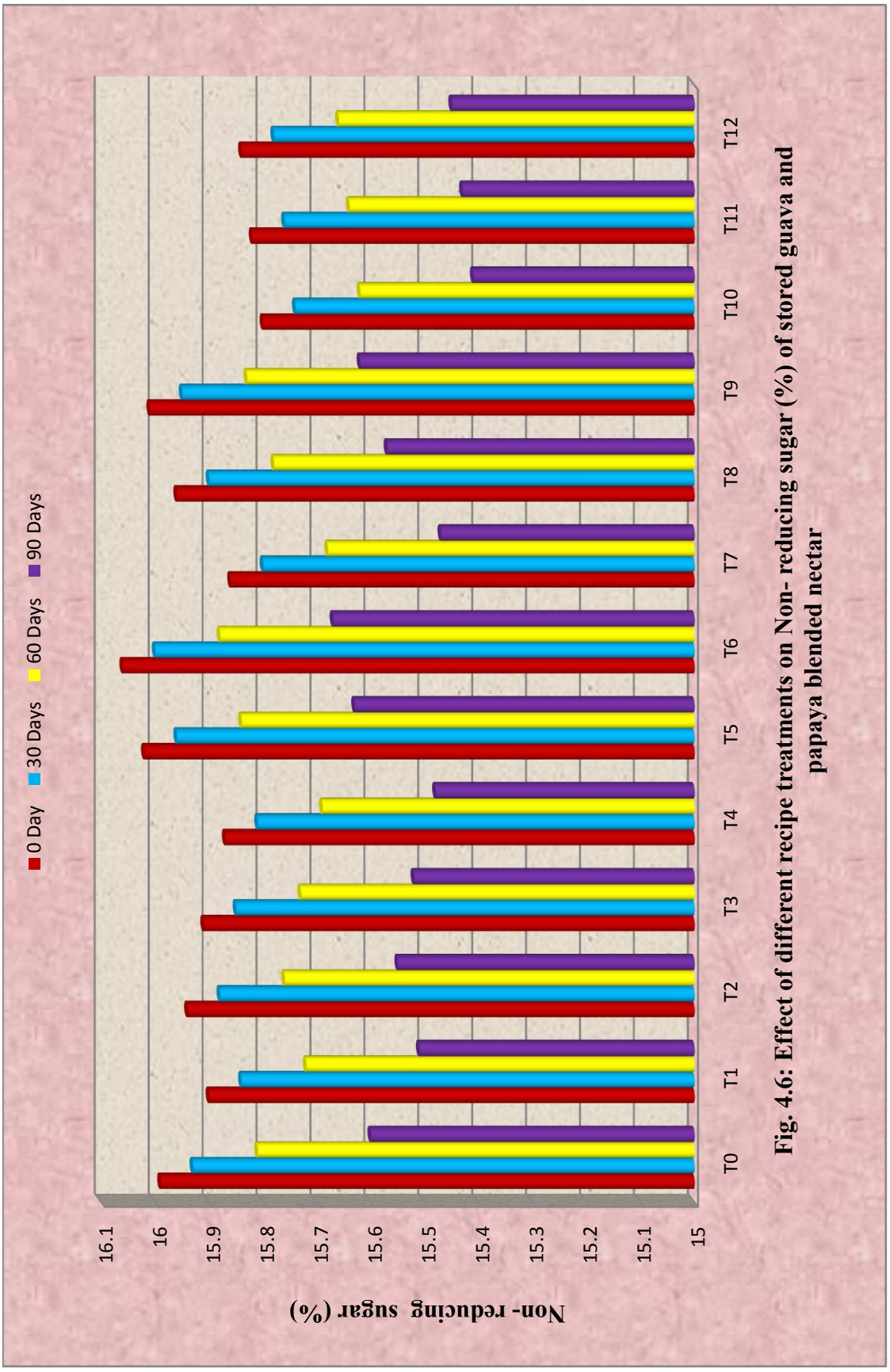


Fig. 4.6: Effect of different recipe treatments on Non- reducing sugar (%) of stored guava and papaya blended nectar

0.3% acidity +75% Guava juice: 25% Papaya juice). While, the minimum (15.62%) non-reducing sugar was observed with the treatment T_{10} (20% Juice: 16% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice). The treatments T_5 and T_9, T_3 and T_1, $T_4$and T_7 were significantly at par.

After 90 days of storage, maximum non-reducing sugar was recorded(15.67%) with the treatment T_6(20% Juice: 18 % TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice) followed by T_5(20% Juice: 18% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice) and T_9 (20% Juice: 17% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice). Whereas, the minimum (15.41%) non-reducing sugar was observed with the treatment T_{10} (20% Juice: 16% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice). The treatments T_5 and T_9, T_3 and T_1, $T_4$and T_7 were significantly at par.

These results are in close conformity with the report of Brekke *et al.* (1976), who studied that the decrease in sucrose content in papaya nectar was correlated with an increase in storage temperature which showed maximum increase in reducing sugar content, whereas, the non-reducing sugar followed a decreasing trend. Hussain *et al*. (2010), who reported that non-reducing sugar decreased from 2.56 to 1.88 per cent in apple-apricot blended juice during storage period.

4.2.7 Total sugar (%)

Data pertaining to effect of different recipe treatments on the total sugar of blended guava and papaya nectar under ambient condition storage are presented in Table 4.9 and illustrated in Fig.4.7.

It is clear from the data that total sugar content of nectar showed an increasing trend with increasing period of storage (0 to 90 days). The total sugar content of nectar was found to be significant from 0 to 90 days of storage. At the time of preparation, total sugar was found significantly higher (25.92%) with the treatment T_{10} (20% Juice: 16% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice) followed by T_{11}(20% Juice: 16% TSS: 0.3% acidity +50% Guava juice: 50% Papaya juice) and T_{12}(20% Juice: 16% TSS: 0.3% acidity + 75% Guava juice: 25% Papaya juice).The minimum reducing sugar was recorded

Table 4.9: Effect of different recipe treatments on Total sugar (%) of stored guava and papaya blended nectar

Treatments	Storage period (in days)			
	0	**30**	**60**	**90**
T_0(20% Juice: 20% TSS: 0.3% acidity + No Blending)	25.49	25.55	25.57	25.60
T_1(20% Juice: 19% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	25.67	25.72	25.75	25.77
T_2(20% Juice: 19% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	25.57	25.63	25.68	25.70
T_3(20% Juice: 19% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	25.61	25.67	25.71	25.74
T_4(20% Juice: 18% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	25.70	25.75	25.78	25.82
T_5(20% Juice: 18% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	25.40	25.46	25.50	25.53
T_6(20% Juice: 18% TSS: 0.3% acidity + 75% Guava juice: 25% Papaya juice)	25.37	25.42	25.44	25.47
T_7(20% Juice: 17% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	25.76	25.78	25.8	25.86
T_8(20% Juice: 17% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	25.52	25.59	25.61	25.65
T_9(20% Juice: 17% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	25.45	25.51	25.53	25.57
T_{10}(20% Juice: 16% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	25.92	25.97	26.02	26.07
T_{11}(20% Juice: 16% TSS: 0.3% acidity +50% Guava juice: 50% Papaya juice)	25.87	25.95	25.98	26.01
T_{12}(20% Juice: 16% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	25.81	25.89	25.93	25.97
SEm±	0.015	0.011	0.010	0.01
CD at 5%	0.04	0.03	0.03	0.03
CV	0.10	0.07	0.07	0.06

Fig 4.7: Effect of different recipe treatments on total sugar (%) of stored guava and papaya blended nectar

(25.37%) with the treatment T_6 (20% Juice: 18 % TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice). The treatments T_4 and T_1, T_1 and T_3, T_3 and T_2, T_8 and T_0, T_0 and T_9, T_5 and T_6 were significantly at par.

At 30 days of storage, the maximum total sugar content was observed (25.97%) %) with the treatment T_{10} (20% Juice: 16% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice) followed by T_{11} (20% Juice: 16% TSS: 0.3% acidity +50% Guava juice: 50% Papaya juice) and T_{12}(20% Juice: 16% TSS: 0.3% acidity + 75% Guava juice: 25% Papaya juice). The minimum reducing sugar was recorded (25.42 %) with the treatment T_6 (20% Juice: 18 % TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice). The treatments T_{10} and T_{11}, T_7 and T_4, T_4 and T_1 were significantly at par.

After 60 days of storage, maximum total sugar was found (26.02 %) with the treatment T_{10} (20% Juice: 16% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice) followed by T_{11} (20% Juice: 16% TSS: 0.3% acidity +50% Guava juice: 50% Papaya juice) and T_{12} (20% Juice: 16% TSS: 0.3% acidity + 75% Guava juice: 25% Papaya juice). The minimum reducing sugar was recorded (25.44 %) with the treatment T_6 (20% Juice: 18 % TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice). The treatments T_7 and T_4, T_4 and T_1, T_3 and T_2, T_9 and T_5 were significantly at par.

At the end (90 days) of storage, significant maximum total sugar content was observed (26.07%) with the treatment T_{10} (20% Juice: 16% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice) followed by T_{11}(20% Juice: 16% TSS: 0.3% acidity +50% Guava juice: 50% Papaya juice) and T_{12}(20% Juice: 16% TSS: 0.3% acidity + 75% Guava juice: 25% Papaya juice). The minimum total sugar was recorded (25.47 %) with the treatment T_6 (20% Juice: 18% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice). The treatments T_1 and T_3, T_0 and T_9 were significantly at par.

The increase in reducing sugar as well as total sugar corresponded to the increase in TSS (total soluble solids) and ultimate decrease in non reducing sugar in both the beverages during storage period .The variation in different fractions of sugar might be due to hydrolysis of polysaccharides like starch, pectin and inversion of non-reducing sugar into reducing sugar, as increase in

reducing sugar was co-related with the decrease in non-reducing sugar. The increased level of total sugar was probably due to conversion of starch and pectin into simple sugars.

The present findings are in close conformity with the report of Tripathi *et al.* (1992), who reported that there was a continuous increase in the level of total sugar (11.2% to 18.6%) in pineapple-guava blended RTS. Baramanray *et al.*(1995), also reported significant ($P< 0.01$) increase in total sugar as well as reducing sugar content in stored guava nectar with increasing storage period. The increase in total sugar content was also reported by Choudhary and Dikshit (2006), in guava nectar.

4.3 Organoleptic evaluation of blended guava and papaya nectar

Organoleptic evaluation of blended guava and papaya nectar for colour, aroma, taste and overall acceptability stored under ambient condition was conducted at 30 days interval by a panel of ten judges under Hedonic Rank Test.

4.3.1 Colour and appearances

Data pertaining to effect of different recipe treatments on the colour and appearance of blended guava and papaya nectar under ambient condition storage are presented in Table 4.10 and illustrated in Fig.4.8.

At the time of preparation (0 day), significantly maximum mean for colour and appearance score was recorded (8.10) with the treatment T_{10} (20% Juice: 16% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice) followed by T_7 (20% Juice: 17% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice) and T_4 (20% Juice: 18% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice). The minimum mean score was recorded (5.02) with the treatment T_{12} (20% Juice: 16% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice). The treatments T_0 and T_8 were statistically par.

After 30 days of storage, significantly maximum mean score for colour and appearance was recorded (8.00) with the treatment T_{10} (20% Juice: 16% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice) followed by T_7 (20% Juice: 17% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice) and

Table 4.10: Effect of different recipe treatments on Colour and appearance (Organoleptic score) of stored guava and papaya blended nectar

Treatments	Storage period (in days)			
	0	**30**	**60**	**90**
T_0(20% Juice: 20% TSS: 0.3% acidity + No Blending)	6.25	6.20	5.40	5.28
T_1(20% Juice: 19% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	7.05	7.00	6.20	6.08
T_2(20% Juice: 19% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	6.40	6.35	5.55	5.43
T_3(20% Juice: 19% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	6.31	6.27	5.47	5.35
T_4(20% Juice: 18% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	7.20	7.11	6.31	6.19
T_5(20% Juice: 18% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	7.00	6.96	6.16	6.04
T_6(20% Juice: 18 % TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	6.90	6.80	6.00	5.88
T_7(20% Juice: 17% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	7.40	7.25	6.45	6.33
T_8(20% Juice: 17% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	6.23	6.18	5.38	5.26
T_9(20% Juice: 17% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	6.38	6.31	5.51	5.38
T_{10}(20% Juice: 16% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	8.10	8.00	7.20	7.08
T_{11}(20% Juice: 16% TSS: 0.3% acidity +50% Guava juice: 50% Papaya juice)	5.12	5.06	4.15	4.03
T_{12}(20% Juice: 16% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	5.02	4.95	4.15	4.02
SEm±	0.013	0.01	0.008	0.008
CD at 5%	0.04	0.03	0.02	0.02
CV	0.37	0.27	0.24	0.23

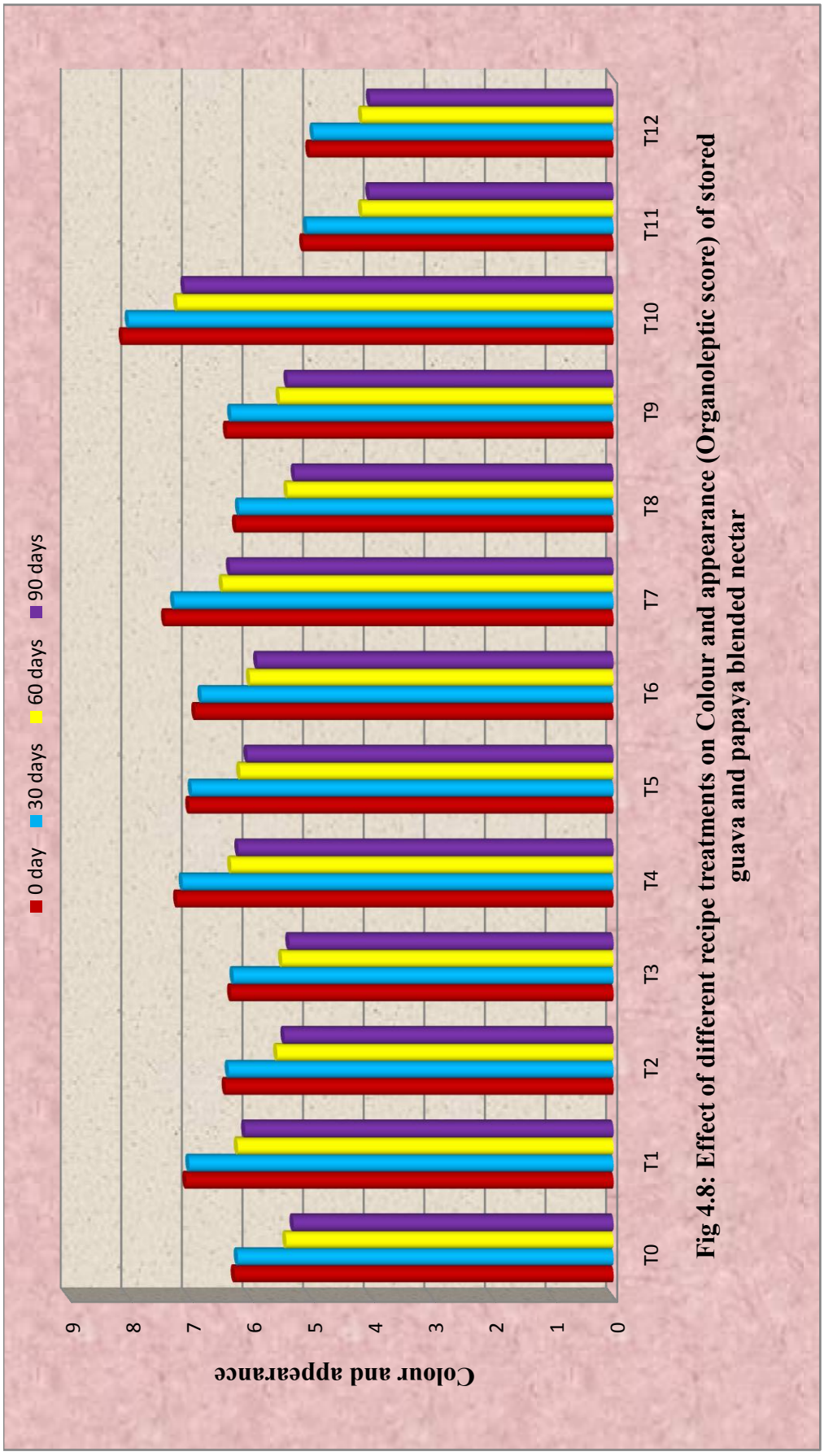


Fig 4.8: Effect of different recipe treatments on Colour and appearance (Organoleptic score) of stored guava and papaya blended nectar

T_4 (20% Juice: 18% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice). The minimum mean score was recorded (4.95) with the treatment T_{12} (20% Juice: 16% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice). The treatments T_0 and T_8 are statistically at par.

After 60 days of storage, maximum mean score for colour and appearance was recorded (7.20) with the treatment T_{10} (20% Juice: 16% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice) followed by T_7 (20% Juice: 17% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice) and T_4 (20% Juice: 18% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice). While on the other hand the minimum mean score was recorded (4.15) with the treatment T_{12} (20% Juice: 16% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice). The treatments T_0 and T_8 are statistically at par. The treatments T_{11} and T_{12} were statistically similar.

After 90 days of storage, similar trend was observed. , maximum mean score for colour and appearance was recorded (7.08) with the treatment T_{10} (20% Juice: 16% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice) followed by T_7 (20% Juice: 17% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice) and T_4 (20% Juice: 18% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)**.**The minimum mean score was recorded (4.02) with the treatment T_{12}(20% Juice: 16% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice). The treatments T_0 and T_8, T_{11} and T_{12} were statistically at par.

The colour and appearances showed decreasing trend during storage which might be due to the action of acidity which enhances the hydrolytic reaction causes browning and acid also enhances the maillard reaction and caramelization which causes more browning in product. Polyphenolic compound present in fruit pulp also reacts with enzymes to get discoloration. These findings are accordance with Kalra & Tandon(1991) for guava nectar, Mall and Tondon (2007) for guava- aonla blended beverage.

4.3.2 Aroma

Data pertaining to effect of different recipe treatments on the aroma of blended guava and papaya nectar under ambient condition storage are presented in Table 4.11 and illustrated in Fig.4.9.The mean score for aroma of different treatments were recorded at 0, 30, 60 and 90 days and observed that organoleptic score for aroma continuously decreased with all the treatments upto 90 days of storage.

At the time of preparation, the maximum mean for aroma score was recorded (8.90) with the treatment T_6 (20% Juice: 18 % TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice) followed by T_5 (20% Juice: 18% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice) and T_9 (20% Juice: 17% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice). The minimum mean score was recorded (4.5) with the treatment T_{10} (20% Juice: 16% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice). The treatments T_6 and T_5, T_5 and T_9, T_9 and T_0, T_1 and T_4 were found statistically at par.

After 30 days of storage, the maximum mean score for aroma was recorded (8.82) with the treatment T_6 (20% Juice: 18 % TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice) followed by T_9 (20% Juice: 17% TSS: 0.3% acidity + 75% Guava juice: 25% Papaya juice) and T_5 (20% Juice: 18% TSS: 0.3% acidity +50% Guava juice: 50% Papaya juice. The minimum mean score was recorded (4.42) with the treatment T_{10} (20% Juice: 16% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice). The treatments T_9 and T_5, T_8 and T_{11} were found statistically at par.

After 60 days of storage, the maximum mean score for aroma was recorded (8.7) with the treatment T_6 (20% Juice: 18 % TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice) followed by T_5 (20% Juice: 18% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice) and T_9 (20% Juice: 17% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice). While the minimum mean score was recorded (4.3) with the treatment T_{10} (20% Juice: 16% TSS: 0.3%

Table 4.11: Effect of different recipe treatments on Aroma (Organoleptic score) of stored guava and papaya blended nectar

Treatments	Storage period (in days)			
	0	30	60	90
T_0(20% Juice: 20% TSS: 0.3% acidity + No Blending)	8.75	8.65	8.53	8.31
T_1(20% Juice: 19% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	7.11	7.05	6.93	6.71
T_2(20% Juice: 19% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	7.90	7.85	7.73	7.51
T_3(20% Juice: 19% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	7.52	7.46	7.34	7.12
T_4(20% Juice: 18% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	7.06	7.00	6.88	6.66
T_5(20% Juice: 18% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	8.85	8.71	8.59	8.36
T_6(20% Juice: 18 % TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	8.90	8.82	8.70	8.48
T_7(20% Juice: 17% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	6.88	6.75	6.63	6.41
T_8(20% Juice: 17% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	8.20	8.13	8.01	7.79
T_9(20% Juice: 17% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	8.80	8.70	8.58	8.29
T_{10}(20% Juice: 16% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	4.50	4.42	4.30	4.08
T_{11}(20% Juice: 16% TSS: 0.3% acidity +50% Guava juice: 50% Papaya juice)	6.50	6.46	6.34	6.12
T_{12}(20% Juice: 16% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	6.60	6.50	6.38	6.16
SEm±	0.017	0.013	0.010	0.009
CD at 5%	0.05	0.04	0.03	0.03
CV	0.40	0.31	0.23	0.21

Fig. 4.9: Effect of different recipe treatments on Aroma (Organoleptic score) of stored guava and papaya blended nectar

acidity + 25% Guava juice: 75% Papaya juice). The treatments T_5 and T_9 were found statistically at par.

After 90 days of storage, the maximum mean score for aroma was recorded (8.48) with the treatment T_6 (20% Juice: 18 % TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice) followed by T_5 (20% Juice: 18% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice) and T_9 (20% Juice: 17% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice).The minimum mean score was recorded (4.08) with the treatment T_{10} (20% Juice: 16% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice). The treatments T_0 and T_9 were found statistically at par.

4.3.3 Taste

Data pertaining to effect of different recipe treatments on the taste score of blended guava and papaya nectar under ambient condition storage are presented in Table 4.12 and illustrated in Fig.4.10.The mean score for taste of different treatments were recorded at 0, 30, 60 and 90 days and observed that organoleptic score for taste continuously decreased with all the treatments upto 90 days of storage. At the time of preparation, maximum mean for taste score was recorded (9.00) with the treatment T_6 (20% Juice: 18 % TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice) followed by T_5 (20% Juice: 18% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice) and T_9 (20% Juice: 17% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice). The minimum mean score was recorded (5.00) with the treatment T_{10} (20% Juice: 16% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice). The treatments T_9 and T_0 were found statistically at par.

After 30 days of storage, maximum mean score for taste was recorded (8.9) with the treatment T_6 (20% Juice: 18 % TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice) followed by T_5 (20% Juice: 18% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice) and T_9 (20% Juice: 17% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice). While the minimum mean score was recorded (5.00) with the treatment T_{10} (20%Juice: 16% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice). The treatments T_9 and T_5, T_8 and T_{11} were found

Table 4.12: Effect of different recipe treatments on taste (Organoleptic score) of stored guava and papaya blended nectar

Treatments	Storage period(in days)			
	0	30	60	90
T_0(20% Juice: 20% TSS: 0.3% acidity + No Blending)	8.79	8.62	8.47	8.22
T_1(20% Juice: 19% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	7.12	7.02	6.87	6.62
T_2(20% Juice: 19% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	7.95	7.89	7.74	7.49
T_3(20% Juice: 19% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	7.50	7.43	7.28	7.03
T_4(20% Juice: 18% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	7.00	6.95	6.80	6.55
T_5(20% Juice: 18% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	8.90	8.76	8.61	8.36
T_6(20% Juice: 18 % TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	9.00	8.90	8.75	8.50
T_7(20% Juice: 17% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	6.90	6.84	6.69	6.44
T_8(20% Juice: 17% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	8.25	8.21	8.06	7.81
T_9(20% Juice: 17% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	8.84	8.70	8.55	8.30
T_{10}(20% Juice: 16% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	5.00	5.00	4.85	4.60
T_{11}(20% Juice: 16% TSS: 0.3% acidity +50% Guava juice: 50% Papaya juice)	6.42	6.40	6.25	6.00
T_{12}(20% Juice: 16% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	6.52	6.46	6.31	6.06
SEm±	0.016	0.019	0.014	0.009
CD at 5%	0.05	0.06	0.04	0.03
CV	0.37	0.45	0.34	0.22

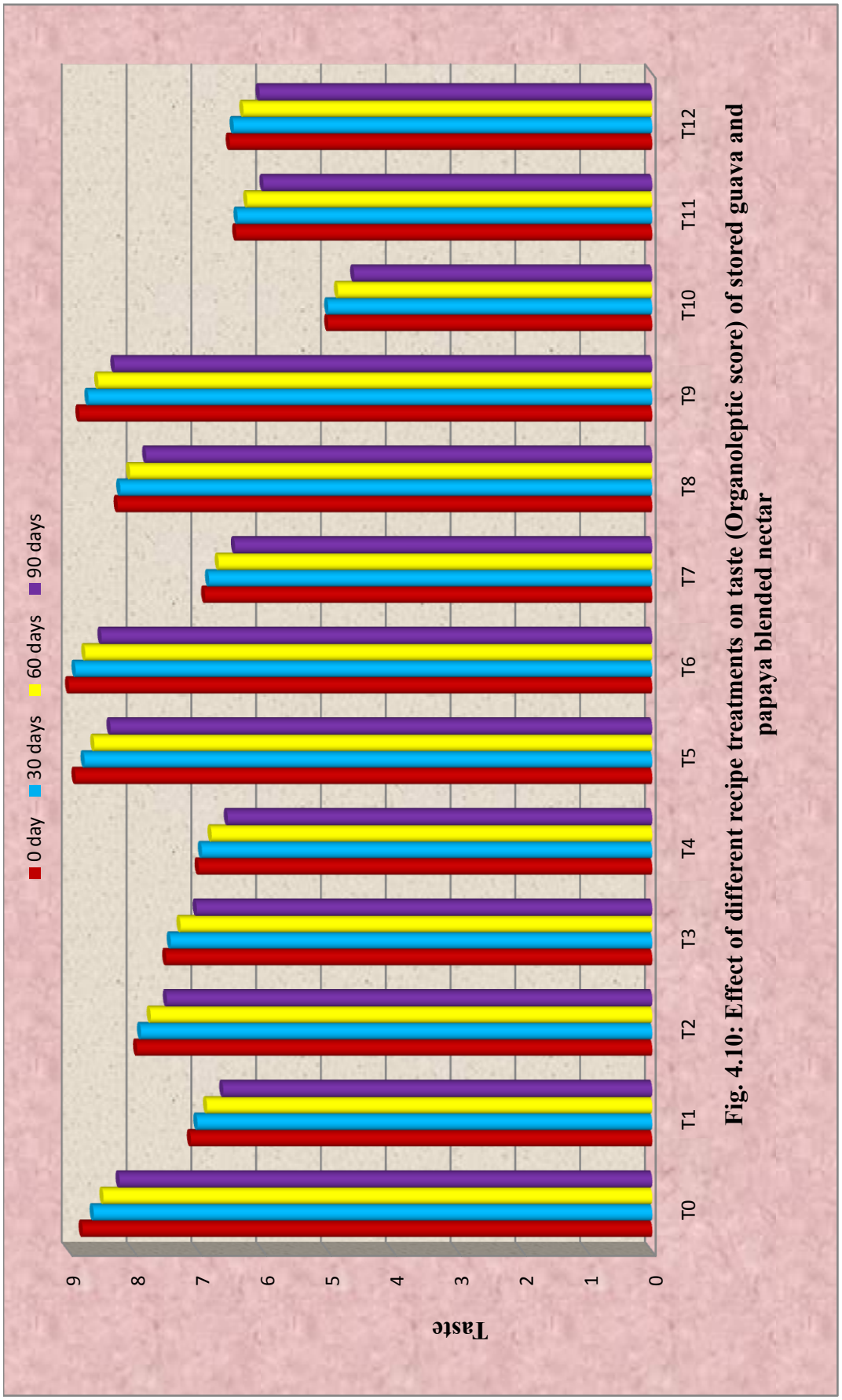


Fig. 4.10: Effect of different recipe treatments on taste (Organoleptic score) of stored guava and papaya blended nectar

statistically at par.

After 60 days of storage, maximum mean score for taste was recorded (8.75) with the treatment T_6 (20% Juice: 18 % TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice) followed by T_5 (20% Juice: 18% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice) and T_9 (20% Juice: 17% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice). The minimum mean score was recorded (4.85) with the treatment T_{10} (20% Juice: 16% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice).

After 90 days of storage, maximum mean score for taste was recorded (8.50) with the treatment T_6 (20% Juice: 18 % TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice) followed by T_5 (20% Juice: 18% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice) and T_9 (20% Juice: 17% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice). The minimum mean score was recorded (4.60) with the treatment T_{10} (20% Juice: 16% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice).

4.3.4 Overall acceptability

Data pertaining to change in overall acceptability of organoleptic score of nectar during storage under ambient condition are presented in Table 4.13 and illustrated in Fig. 4.11.The mean score for overall acceptability of different treatments were recorded at 0, 30, 60 and 90 days and observed that organoleptic score for taste continuously decreased with all the treatments upto 90 days of storage. At the time of preparation, the maximum mean score for overall acceptability was recorded (8.26) with the treatment T_6 (20% Juice: 18 % TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice) followed by T_5(20% Juice: 18% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice) and T_9 (20% Juice: 17% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice). The minimum mean score was recorded (5.86) with the treatment T_{10} (20% Juice: 16% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice). The treatments T_3 and T_1, T_1 and T_4, T_4 and T_7, T_{12} and T_{11} were statistically at par.

After 30 days of storage, maximum mean score for overall acceptability

Table 4.13: Effect of different recipe treatments on overall acceptability (Organoleptic score) of stored guava and papaya blended nectar

Treatments	Storage period (in days)			
	0	**30**	**60**	**90**
T_0(20% Juice: 20% TSS: 0.3% acidity + No Blending)	7.93	7.82	7.46	7.27
T_1(20% Juice: 19% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	7.09	7.02	6.66	6.47
T_2(20% Juice: 19% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	7.41	7.36	7.00	6.81
T_3(20% Juice: 19% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	7.11	7.05	6.69	6.50
T_4(20% Juice: 18% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	7.08	7.02	6.66	6.46
T_5(20% Juice: 18% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	8.25	8.14	7.78	7.58
T_6(20% Juice: 18 % TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	8.26	8.17	7.81	7.62
T_7(20% Juice: 17% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	7.06	6.94	6.59	6.39
T_8(20% Juice: 17% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	7.56	7.50	7.15	6.95
T_9(20% Juice: 17% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	8.00	7.90	7.55	7.32
T_{10}(20% Juice: 16% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	5.86	5.80	5.45	5.25
T_{11}(20% Juice: 16% TSS: 0.3% acidity +50% Guava juice: 50% Papaya juice)	6.01	5.97	5.58	5.38
T_{12}(20% Juice: 16% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	6.04	5.97	5.61	5.41
SEm±	0.01	0.01	0.009	0.008
CD at 5%	0.03	0.03	0.03	0.02
CV	0.25	0.24	0.23	0.21

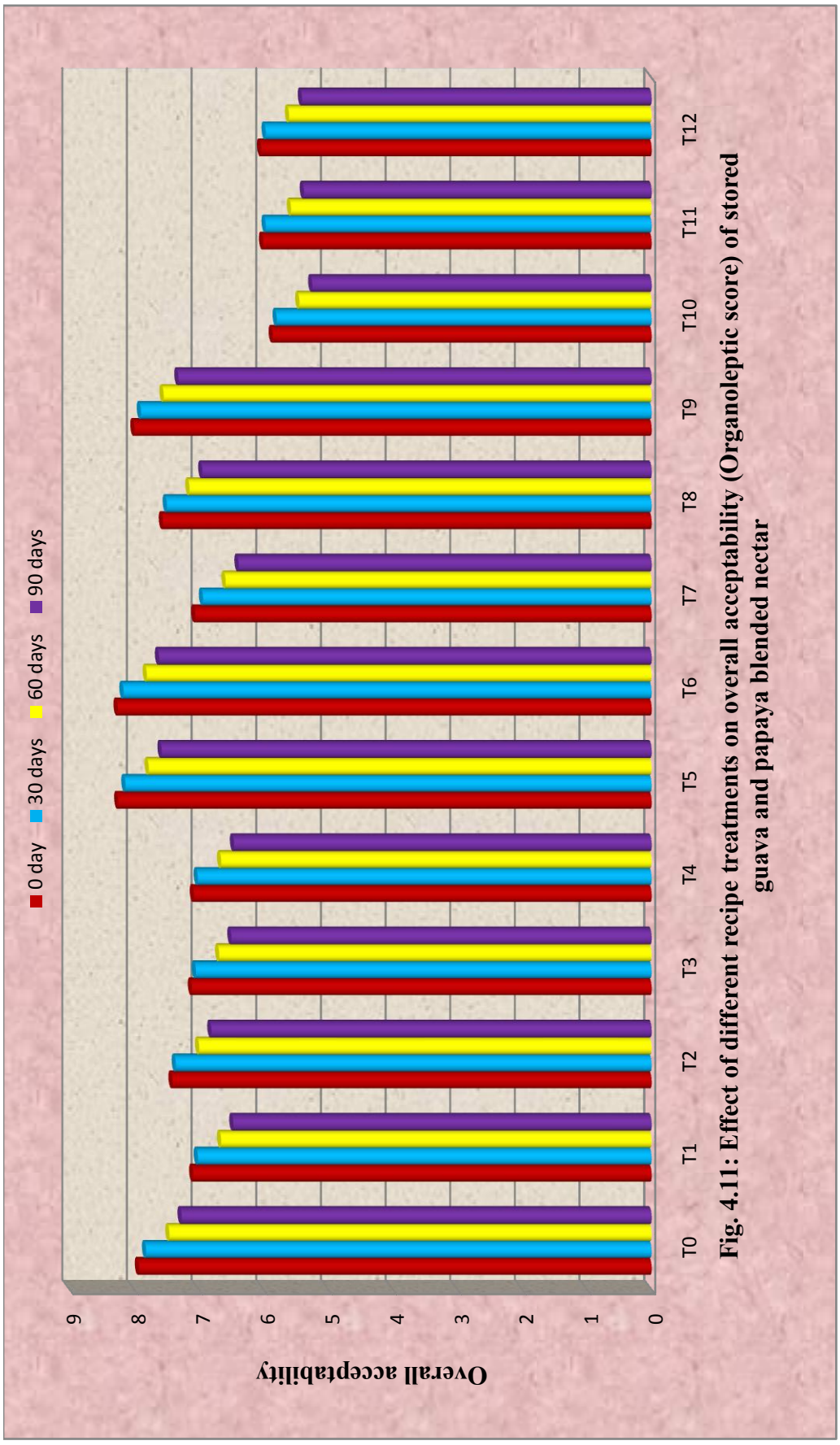


Fig. 4.11: Effect of different recipe treatments on overall acceptability (Organoleptic score) of stored guava and papaya blended nectar

was recorded (8.17), with the treatment T_6 (20% Juice: 18 % TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice) followed by T_5 (20% Juice: 18% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice) and T_9 (20% Juice: 17% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice). Whereas the minimum mean score was recorded (5.80) with the treatment T_{10} (20% Juice: 16% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice). The treatments T_5 and T_9, T_3 and T_1 were found statistically at par. The treatments T_1 and T_4, T_{12} and T_{11} were statistically similar.

After 60 days of Storage period, the maximum mean score for overall acceptability was recorded (7.81) with the treatment T_6 (20% Juice: 18 % TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice) followed by T_5 (20% Juice: 18% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice) and T_9 (20% Juice: 17% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice). The minimum mean score was recorded (5.45) with the treatment T_{10} (20% Juice: 16% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice). The treatments T_6 and T_5, T_3 and T_1, T_{12} and T_{11} were found statistically at par. The treatments T_1 and T_4 were statistically similar.

After 90 days of storage, maximum mean score for overall acceptability was recorded (7.62) with the treatment T_6 (20% Juice: 18 % TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice) followed by T_5 (20% Juice: 18% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice) and T_9 (20% Juice: 17% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice).The minimum mean score was recorded (5.25) with the treatment T_{10} (20% Juice: 16% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice). The treatments T_1 and T_4 were found statistically at par.

Overall acceptability is an expression of individual sensory parameters like appearance, colour, taste, flavor and consistency and overall acceptability. Therefore, a change in individual parameters is reflected on the change in overall acceptability of the products. The organoleptic scores were higher upto 30 days of storage after their decreased further by the end of the storage. This is in

conformation with the work of Mahadeviah (1996) that the acceptability rate decreased due to colour range and the product was slightly acceptable which might be due to conversion of vitamin C and polyphenol into di or poly carbonyl compounds. Similar findings were also observed by Tiwari (2000) in guava and papaya blends. Among all blends of nectar, 75% guava+25% papaya blend was found most acceptable over control rating (T_6- 8.26) and was at par with 50% guava+50% papaya blend rating (T_5-8.25) with 20% juice,18% TSS and 0.3% acidity was found as best recipe. All the organoleptic quality attributes are also affected by different fruit pulp/juice blending ratios.

There are many other extrinsic factors which determine the storage stability of products and temperature plays an important role among them. There are certain biochemical changes which occurs under low pH and high temperature that leads to the formation of brown pigments and produces off flavour in the beverages. The other possible reasons could be the loss of volatile aromatic substances responsible for flavour and taste which decreased acceptability in storage at ambient condition. The present findings are in accordance with the view of Jain and Asati (2004), who reported a decrease in overall acceptability of guava with storage period. Similar results were obtained by Harnanan *et al*. (1980) and Baramanray *et al*. (1995). The decrease in overall acceptability rating during storage is due to decrease in rating of colour, flavour, taste and texture of the fruit pulp. Similarly, Chan and Cavaletto (1982) have reported change in sensory quality of aseptically processed guava and papaya puree during storage.

4.4 Biochemical changes in blended guava and papaya RTS during storage

4.4.1 Total soluble solids (%)

Data pertaining to effect of different recipe treatments on the total soluble solids of blended guava and papaya RTS stored under ambient condition are presented in Table4.14 and illustrated in Fig.4.12.

It is clear from the data that total soluble solids content in RTS showed an increasing trend with increasing period of storage (0 to 90 days). The total soluble solids content of RTS was found to be significant from 0 to 90 days of storage. At the time of preparation, TSS was found significantly

Table 4.14: Effect of different recipe treatments on TSS (%) of stored guava and papaya blended RTS

Treatments	Storage period (in days)			
	0	**30**	**60**	**90**
T_0(10% Juice: 15% TSS: 0.3% acidity + No Blending)	15.13	15.17	15.17	15.20
T_1(10% Juice: 14% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	14.10	14.16	14.20	14.20
T_2(10% Juice: 14% TSS: 0.3% acidity+ 50% Guava juice: 50% Papaya juice)	14.17	14.20	14.28	14.32
T_3(10% Juice: 14% TSS: 0.3% acidity + 75% Guava juice: 25% Papaya juice)	14.00	14.06	14.10	14.10
T_4(10% Juice: 13% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	13.10	13.12	13.16	13.18
T_5(10% Juice: 13% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	13.01	13.07	13.10	13.16
T_6(10% Juice: 13% TSS: 0.3% acidity + 75% Guava juice: 25% Papaya juice)	13.05	13.10	13.13	13.17
T_7(10% Juice: 12% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	13.20	13.25	13.29	13.30
T_8(10% Juice: 12% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	12.12	12.17	12.23	12.23
T_9(10% Juice: 12% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	12.08	12.10	12.15	12.19
T_{10}(10% Juice: 11% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	11.15	11.15	11.21	11.21
T_{11}(10% Juice: 11% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	11.20	11.22	11.22	11.22
T_{12}(10% Juice: 11% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	11.04	11.04	11.09	11.10
SEm±	0.024	0.021	0.015	0.012
CD at 5%	0.07	0.06	0.04	0.03
CV	0.33	0.28	0.21	0.16

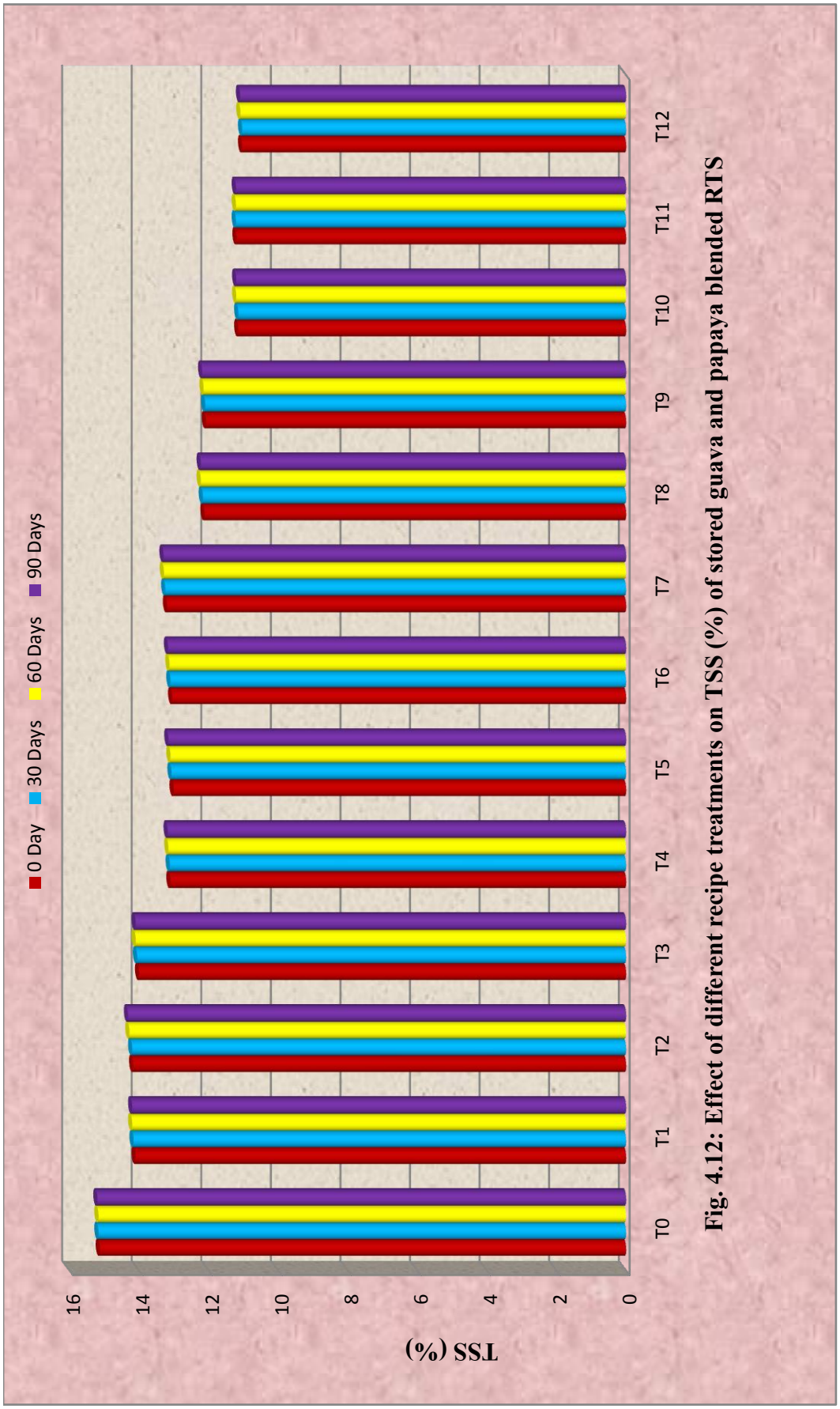


Fig. 4.12: Effect of different recipe treatments on TSS (%) of stored guava and papaya blended RTS

higher (15.13%) with the treatment T_0(10% Juice: 15% TSS: 0.3% acidity + No Blending) followed T_2(10% Juice: 14% TSS: 0.3% acidity+ 50% Guava juice: 50% Papaya juice) and T_1(10% Juice: 14% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice).While, minimum TSS content was recorded (11.04%) with the treatment T_{12}(10% Juice: 11% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice). The treatments T_2 and T_1, T_6 and T_5, T_8 and T_9, T_{11} and T_{10}, T_4 and T_6 were found statistically at par.

At 30 days of storage, the total soluble solids content was found to be maximum (15.17%) under the treatment T_0(10% Juice: 15% TSS: 0.3% acidity + No Blending) followed T_2(10% Juice: 14% TSS: 0.3% acidity+ 50% Guava juice: 50% Papaya juice) and T_1(10% Juice: 14% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice).While, minimum TSS content was recorded (11.04%) with the treatment T_{12}(10% Juice: 11% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice). The treatments T_2 and T_1, T_4 and T_6, $T_6$and T_5 were found statistically at par.

At 60 days of storage, maximum TSS was recorded (15.17%) with the treatment T_0(10% Juice: 15% TSS: 0.3% acidity + No Blending) followed T_2(10% Juice: 14% TSS: 0.3% acidity+ 50% Guava juice: 50% Papaya juice) and T_1(10% Juice: 14% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice).While, minimum TSS content was recorded (11.09%) with the treatment T_{12}(10% Juice: 11% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice). The treatments T_6 and T_5, T_4 and T_6, T_{11} and T_{10} were found statistically at par.

At 90 days of storage, maximum TSS was recorded (15.20%) with the treatment T_0(10% Juice: 15% TSS: 0.3% acidity + No Blending) followed T_2(10% Juice: 14% TSS: 0.3% acidity+ 50% Guava juice: 50% Papaya juice) and T_1(10% Juice: 14% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice).While, minimum TSS content was recorded (11.10%) with the treatment T_{12}(10% Juice: 11% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice). The treatments T_4 and T_6 were found statistically at par.

The increased TSS in RTS during storage was probably due to conversion of left over polysaccharides into soluble sugars. The present findings are in close conformity with the finding of Tripathi *et al*. (1992), who found that

the total soluble solids of pineapple and guava blended juice increased continuously during storage period. Deka *et al*. (2004) who evaluated lime-aonla ready-to-serve beverages and observed that total soluble solids showed increasing trend throughout the storage period. These results are in good agreement with the findings of Sharma and Singh (2005), reported that the TSS of lime juice increased with an increase in storage period up-to 90 days.

4.4.2 Acidity (%)

Data pertaining to effect of different recipe treatments on the acidity of blended guava and papaya RTS under ambient condition of storage are presented in Table 4.15 and illustrated in Fig.4.13.

It is evident from the data that acidity of RTS showed an increasing trend with increasing period of storage (0 to 90 days). At the time of preparation (0 day), though the differences was non- significant however, it was recorded (0.35%) maximum under the treatment T_{10} (10% Juice: 11% TSS: 0.3% acidity +25% Guava juice: 75% Papaya juice) and it was found minimum (0.28%) with the treatment T_3(10% Juice: 14% TSS: 0.3% acidity + 75% Guava juice: 25% Papaya juice).Similarly after 30 days of storage maximum(0.37%) acidity was recorded with the treatment T_{10} (10% Juice: 11% TSS: 0.3% acidity +25% Guava juice: 75% Papaya juice) and it was noted minimum (0.30%) with the treatment T_3(10% Juice: 14% TSS: 0.3% acidity + 75% Guava juice: 25% Papaya juice).The acidity of RTS was found to be significant at 60 and 90 days of storage.

At 60 days of storage, significant highest acidity was recorded (0.54%) with the treatment T_{10} (10% Juice: 11% TSS: 0.3% acidity +25% Guava juice: 75% Papaya juice) followed by T_{12}(10% Juice: 11% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice) and T_{11}(10% Juice: 11% TSS: 0.3% acidity +50% Guava juice: 50% Papaya juice).While, minimum acidity was observed (0.31%) with T_3(10% Juice: 14% TSS: 0.3% acidity + 75% Guava juice: 25% Papaya juice).

After 90 days of storage, significantly highest (0.60%) titrable acidity was recorded with the treatment T_{10} (10% Juice: 11% TSS: 0.3% acidity +25% Guava juice: 75% Papaya juice) followed by T_{12}(10% Juice: 11% TSS: 0.3%

Table 4.15: Effect of different recipe treatments on Acidity (%) of stored guava and papaya blended RTS

Treatments	Storage period (in days)			
	0	**30**	**60**	**90**
T_0(10% Juice: 15% TSS: 0.3% acidity + No Blending)	0.31	0.33	0.36	0.41
T_1(10% Juice: 14% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	0.31	0.33	0.37	0.44
T_2(10% Juice: 14% TSS: 0.3%acidity+ 50% Guava juice: 50% Papaya juice)	0.29	0.31	0.32	0.37
T_3(10% Juice: 14% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	0.28	0.30	0.31	0.33
T_4(10% Juice: 13% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	0.32	0.34	0.39	0.45
T_5(10% Juice: 13% TSS: 0.3%acidity + 50% Guava juice: 50% Papaya juice)	0.32	0.34	0.41	0.48
T_6(10% Juice: 13% TSS: 0.3% acidity+75% Guava juice: 25% Papaya juice)	0.30	0.32	0.34	0.40
T_7(10% Juice: 12% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	0.33	0.35	0.45	0.51
T_8(10% Juice: 12% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	0.32	0.34	0.42	0.50
T_9(10% Juice: 12% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	0.33	0.35	0.48	0.54
T_{10}(10% Juice: 11% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	0.35	0.37	0.54	0.60
T_{11}(10% Juice: 11% TSS: 0.3% acidity +50% Guava juice: 50% Papaya juice)	0.34	0.36	0.51	0.55
T_{12}(10% Juice: 11% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	0.34	0.36	0.53	0.58
SEm±	0.014	0.014	0.008	0.07
CD at 5%	NS	NS	0.02	0.02
CV	NS	NS	3.11	2.55

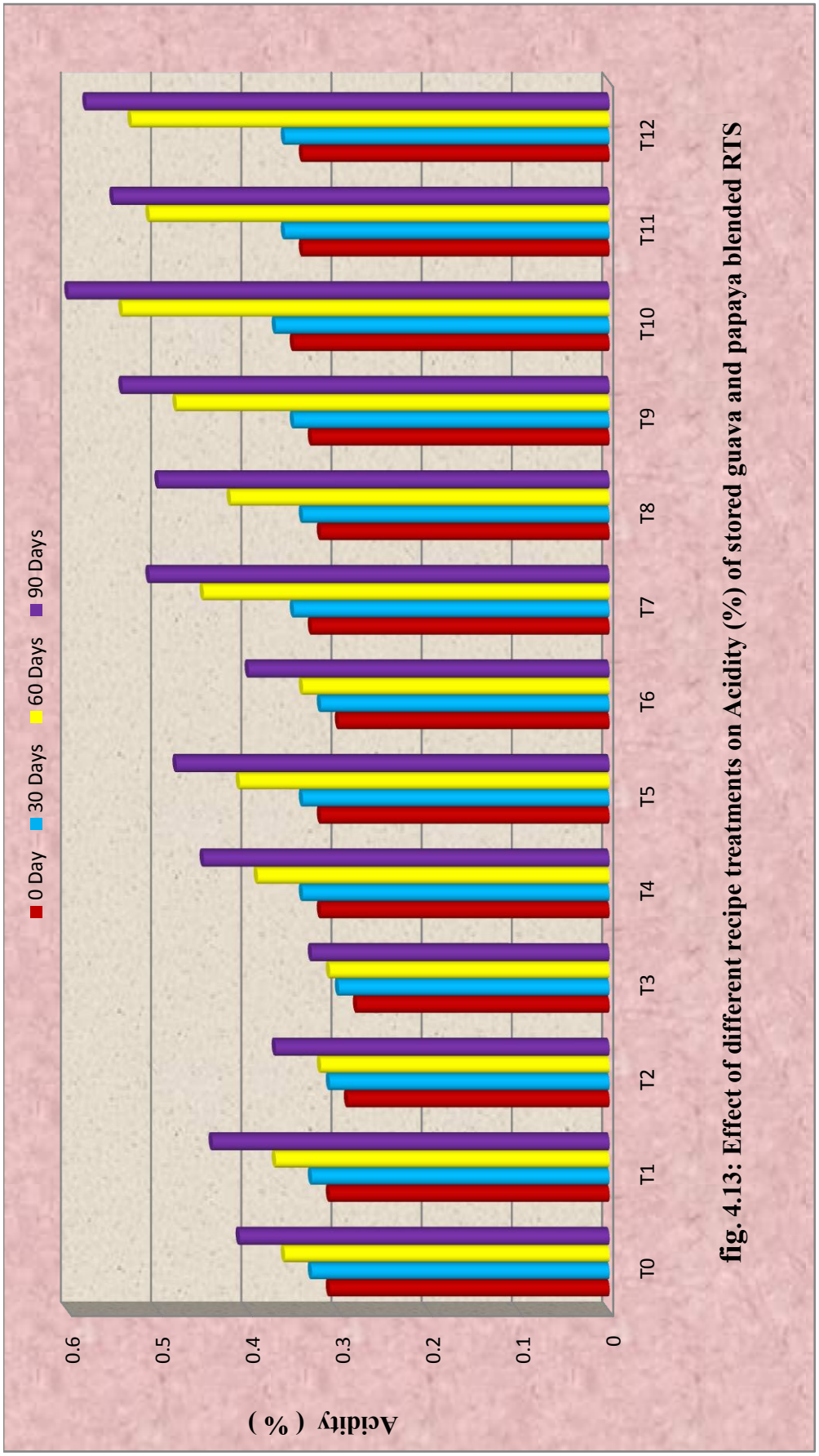


fig. 4.13: Effect of different recipe treatments on Acidity (%) of stored guava and papaya blended RTS

acidity +75% Guava juice: 25% Papaya juice) and T_{11}(10% Juice: 11% TSS: 0.3% acidity +50% Guava juice: 50% Papaya juice).While, minimum acidity was observed (0.33%) with T_3(10% Juice: 14% TSS: 0.3%acidity + 75% Guava juice: 25% Papaya juice).

The increase in acidity of RTS during 90 days of storage might be due to formation of organic acids by ascorbic acid degradation as well as progressive decrease in the pectin content. Similar findings were reported by Nidhi *et al.* (2007), who observed an increase in acidity in RTS blends of bael-guava beverages during storage. Sasikumar (2013), reported an increasing trend in acidity during the storage of beverages at room temperature over a period of 60 days. Similarly Malav *et al*.(2014), found a sudden decrease in acidity observed during storage of orange-based blended RTS beverages which could be attributed to the chemical interaction between the organic constituents of orange-based blended RTS beverage affected by the temperature and action of enzymes.

4.4.3 Ascorbic acid (mg/100ml)

Data pertaining to effect of different recipe treatments on the ascorbic acid content of blended guava and papaya RTS under ambient storage condition are presented in Table 4.16 and illustrated in Fig.4.14.

It is apparent from the data that ascorbic acid content in guava RTS of all the treatments showed a decreasing trend with increasing period of storage (0 to 90 days). A significant difference in ascorbic acid was observed at the time of preparation. It was found to be significant from 0 to 90 days of storage. At the time of preparation, ascorbic acid was significantly higher (30.78 mg/100 ml) with the treatment T_3(10% Juice: 14% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice) followed by T_2(10% Juice: 14% TSS: 0.3% acidity+ 50% Guava juice: 50% Papaya juice) and T_6 (10% Juice: 13% TSS: 0.3% acidity + 75% Guava juice: 25% Papaya juice).While, minimum ascorbic acid content was recorded (29.95 mg/100 ml) with the treatment T_{10} (10% Juice: 11% TSS: 0.3% acidity +25% Guava juice: 75% Papaya juice).The treatment T_5 and T_8 were statistically at par.

Thereafter, at 30 days of storage, the level of ascorbic acid decreased

Table 4.16: Effect of different recipe treatments on Ascorbic acid (mg/100 ml) of stored guava and papaya blended RTS

Treatments	Storage period (in days)			
	0	**30**	**60**	**90**
T_0(10% Juice: 15% TSS: 0.3% acidity + No Blending)	30.60	30.54	29.72	28.33
T_1(10% Juice: 14% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	30.55	30.49	29.64	28.12
T_2(10% Juice: 14% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	30.72	30.66	29.89	28.50
T_3(10% Juice: 14% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	30.78	30.70	29.95	28.56
T_4(10% Juice: 13% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	30.50	30.43	29.53	27.98
T_5(10% Juice: 13% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	30.45	30.40	29.45	27.85
T_6(10% Juice: 13% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	30.66	30.60	29.81	28.42
T_7(10% Juice: 12% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	30.33	30.30	29.21	27.68
T_8(10% Juice: 12% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	30.41	30.36	29.33	27.76
T_9(10% Juice: 12% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	30.18	30.12	29.12	27.51
T_{10}(10% Juice: 11% TSS: 0.3% acidity +25% Guava juice: 75% Papaya juice)	29.95	29.90	28.77	26.92
T_{11}(10% Juice: 11% TSS: 0.3% acidity +50% Guava juice: 50% Papaya juice)	30.10	30.06	28.98	27.45
T_{12}(10% Juice: 11% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	30.02	29.98	28.86	27.16
SEm±	0.012	0.011	0.01	0.009
CD at 5%	0.04	0.03	0.03	0.02
CV	0.07	0.06	0.06	0.05

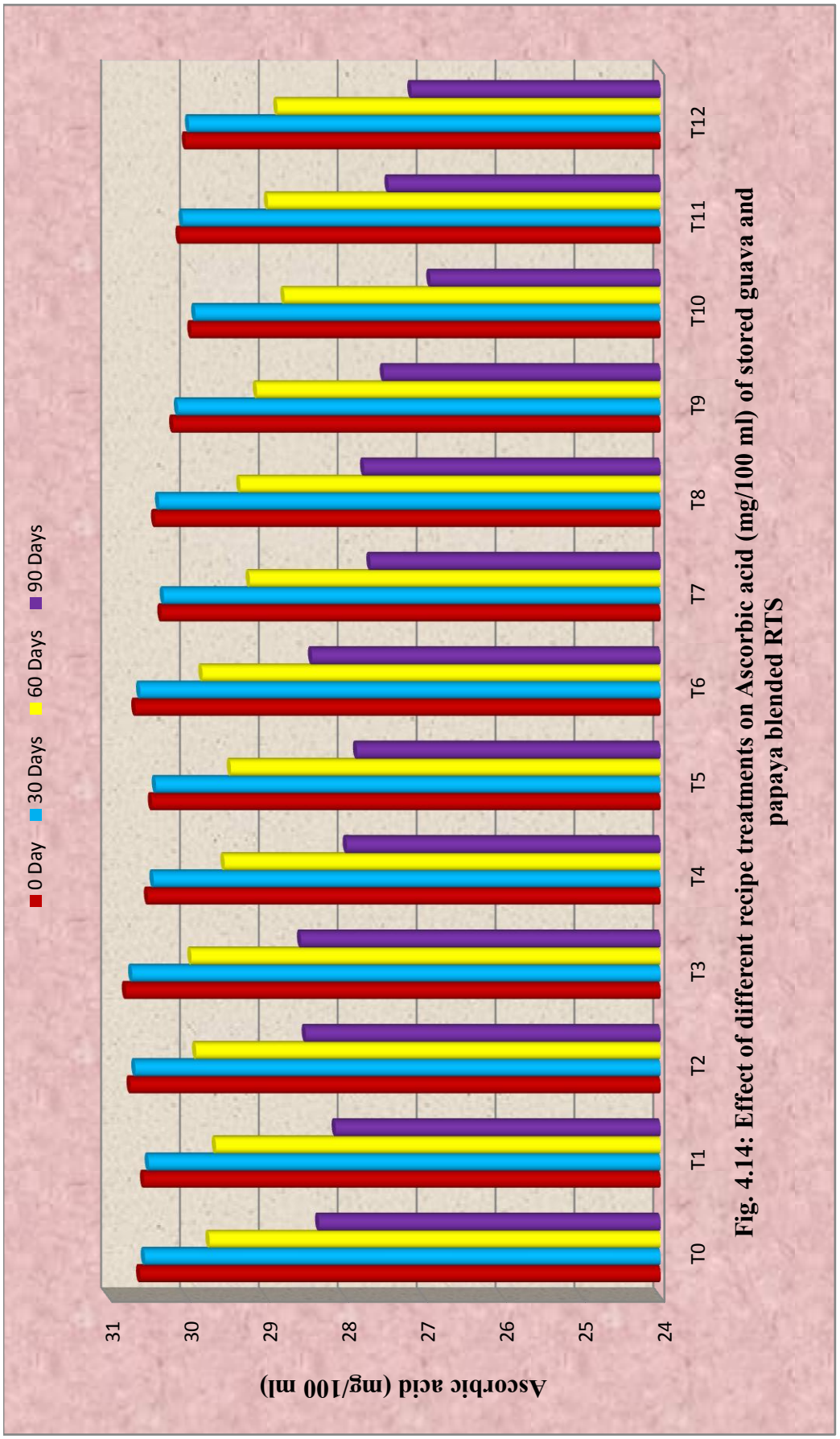


Fig. 4.14: Effect of different recipe treatments on Ascorbic acid (mg/100 ml) of stored guava and papaya blended RTS

and was recorded to be significant. Maximum ascorbic acid was observed (30.70 mg/100 ml) with the treatment T_3(10% Juice: 14% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice) followed by T_2 (10% Juice: 14% TSS: 0.3% acidity+ 50% Guava juice: 50% Papaya juice) and T_6 (10% Juice: 13% TSS: 0.3% acidity + 75% Guava juice: 25% Papaya juice).While minimum ascorbic acid content was recorded T_{12}(29.90 mg/100 ml) with the treatment T_{10} (10% Juice: 11% TSS: 0.3% acidity +25% Guava juice: 75% Papaya juice).The treatment T_4 and T_5 were statistically at par.

After 60 days of storage, maximum ascorbic acid was observed (29.95 mg/100ml) with the treatment T_3 (10% Juice: 14% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice) followed by T_2 (10% Juice: 14% TSS: 0.3% acidity+ 50% Guava juice: 50% Papaya juice) and T_6 (10% Juice: 13% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice). While minimum ascorbic acid content was recorded T_{12} (28.77 mg/100 ml) with the treatment T_{10} (10% Juice: 11% TSS: 0.3% acidity +25% Guava juice: 75% Papaya juice).

After 90 days of storage, maximum ascorbic acid was recorded (28.56 mg/100 ml) with the treatment T_3(10% Juice: 14% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice) followed by T_2 (10% Juice: 14% TSS: 0.3% acidity+ 50% Guava juice: 50% Papaya juice) and T_6 (10% Juice: 13% TSS: 0.3% acidity + 75% Guava juice: 25% Papaya juice.While minimum ascorbic acid content was recorded T_{12} (26.92 mg/100 ml) with the treatment T_{10}(10% Juice: 11% TSS: 0.3% acidity +25% Guava juice: 75% Papaya juice).

The decrease in ascorbic acid in RTS during storage might be due to oxidation or irreversible conversion of L- ascorbic acid into dehydro-ascorbic acid in the presence of enzyme ascorbic acid oxidase (ascorbinase) caused by trapped or residual oxygen in the glass bottles. Similar reduction in ascorbic acid content have also been reported by Baramanray (1995), in guava nectar and Saravanan *et al*. (2004), in papaya RTS.The present findings are in agreement with the report of Deka and Bidyut (2000), who observed that ascorbic acid content of mango and pineapple blended RTS beverage decreased continuously during storage at room temperature. Similar findings were also reported by Jakhar

et al.(2013), in guava and barbados cherry blended beverage and Byanna *et al*.(2012) in orange -pomegranate blended RTS.

4.2.4 pH

Data pertaining to effect of different recipe treatments on the pH value of blended guava and papaya RTS under ambient condition of storage are presented in Table 4.17 and illustrated in Fig. 4.15.

It is evident from the data that the pH value in blended guava and papaya RTS showed a decreasing trend with increasing period of storage (0-90 days). However, a significant difference in the pH value was observed upto 90 days of storage. At the time of preparation, maximum pH value was observed (4.18) with the treatment T_3(10% Juice: 14% TSS: 0.3% acidity + 75% Guava juice: 25% Papaya juice) followed by T_2(10% Juice: 14% TSS: 0.3% acidity+ 50% Guava juice: 50% Papaya juice) and T_6(10% Juice: 13% TSS: 0.3% acidity + 75% Guava juice: 25% Papaya juice).While, minimum pH was observed (3.50) with the treatment T_{10} (10% Juice: 11% TSS: 0.3% acidity +25% Guava juice: 75% Papaya juice)..The differences between treatments T_6 and T_0, $T_0$and T_1, T_1 and T_4, T_4 and T_5, T_5 and T_8 were statistically at par.

At 30 days of storage, the recipe was found to influence significantly the pH of RTS and it was maximum(4.10) with the treatment T_3(10% Juice: 14% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice) followed by T_2(10% Juice: 14% TSS: 0.3% acidity+ 50% Guava juice: 50% Papaya juice) and T_6(10% Juice: 13% TSS: 0.3% acidity + 75% Guava juice: 25% Papaya juice).While, minimum pH was observed (3.42) with the treatment T_{10} (10% Juice: 11% TSS: 0.3% acidity +25% Guava juice: 75% Papaya juice)..The differences between treatments T_6 and T_0, $T_0$and T_1, T_1 and T_4, T_4 and T_5, T_5 and T_8 were statistically at par.

At 60 days of storage, maximum pH value was recorded (3.9) under the treatment T_3 (10% Juice: 14% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice) followed by T_2 (10% Juice: 14% TSS: 0.3% acidity+ 50% Guava juice: 50% Papaya juice) and T_6(10% Juice: 13% TSS: 0.3% acidity+75% Guava juice: 25% Papaya juice). While, minimum pH was observed (3.22) with

Table 4.17: Effect of different recipe treatments on pH of stored guava and papaya blended RTS

Treatments	Storage period (in days)			
	0	**30**	**60**	**90**
T_0(10% Juice: 15% TSS: 0.3% acidity + No Blending)	3.95	3.87	3.67	3.29
T_1(10% Juice: 14% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	3.92	3.84	3.64	3.26
T_2(10% Juice: 14% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	4.12	4.04	3.84	3.46
T_3(10% Juice: 14% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	4.18	4.10	3.90	3.52
T_4(10% Juice: 13% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	3.89	3.81	3.61	3.23
T_5(10% Juice: 13% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	3.86	3.78	3.58	3.20
T_6(10% Juice: 13% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	4.05	3.97	3.77	3.39
T_7(10% Juice: 12% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	3.74	3.66	3.46	3.08
T_8(10% Juice: 12% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	3.83	3.75	3.55	3.17
T_9(10% Juice: 12% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	3.67	3.59	3.39	3.01
T_{10}(10% Juice: 11% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	3.50	3.42	3.22	2.84
T_{11}(10% Juice: 11% TSS: 0.3% acidity +50% Guava juice: 50% Papaya juice)	3.62	3.54	3.34	2.96
T_{12}(10% Juice: 11% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	3.56	3.48	3.28	2.90
SEm±	0.011	0.010	0.009	0.007
CD at 5%	0.03	0.03	0.03	0.02
CV	0.07	0.48	0.43	0.40

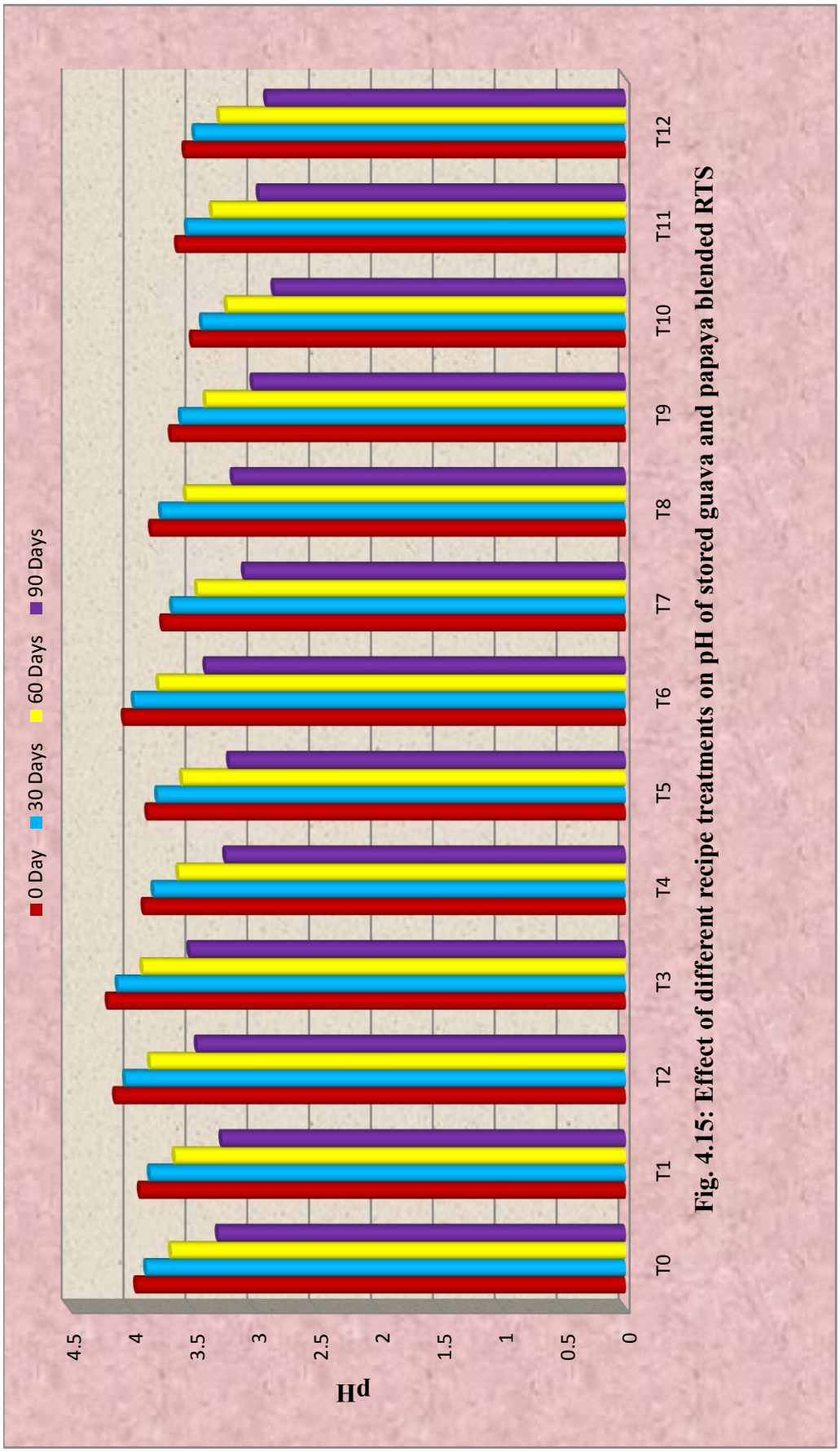


Fig. 4.15: Effect of different recipe treatments on pH of stored guava and papaya blended RTS

the treatment T_{10} (10% Juice: 11% TSS: 0.3% acidity +25% Guava juice: 75% Papaya juice). The differences between treatments T_6 and T_0, $T_0$and T_1, T_1 and T_4, T_4 and T_5, T_5 and T_8 were statistically at par.

After 90 days of storage, maximum pH value was recorded (3.52) under the treatment T_3 (10% Juice: 14% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice) followed by T_2 (10% Juice: 14% TSS: 0.3% acidity+ 50% Guava juice: 50% Papaya juice) and T_6(10% Juice: 13% TSS: 0.3% acidity+ 75% Guava juice: 25% Papaya juice). While, minimum pH was observed (2.84) with the treatment T_{10} (10% Juice: 11% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice). The differences between treatments T_6 and T_0 were statistically at par.

The increased acidity and TSS under all the cultivar and recipe treatments during storage had a corresponding decrease in pH. Hence, the reduction in pH could be attributed to simultaneous increase in acidity and TSS of RTS irrespective of their storage temperature. The present findings are in agreement with those of Malav *et al*. (2014), in orange -based blended RTS beverages and Sindumathi *et al*.(2013), in flavored papaya-pineapple blended RTS beverage, respectively.

4.4.5 Reducing sugar (%)

Data pertaining to effect of different recipe treatments on the reducing sugar of blended guava and papaya RTS under ambient condition storage are presented in Table 4.18 and illustrated in Fig. 4.16.

It is evident from the data that the different recipes influenced the reducing sugar content of blended guava and papaya RTS and showed an increasing trend with increasing period of storage (0-90 days). The reducing sugar was recorded to be significant from 0 to 90 days of storage. At the time of preparation, the maximum (6.98%) reducing sugar was observed with the treatment T_{10} (10% Juice: 11% TSS: 0.3% acidity +25% Guava juice: 75% Papaya juice) followed by T_{12} (10% Juice: 11% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice) and T_{11} (10% Juice: 11% TSS: 0.3% acidity +50% Guava juice: 50% Papaya juice). The minimum reducing sugar was recorded (6.08%)

Table 4.18: Effect of different recipe treatments on reducing sugar (%) of stored guava and papaya blended RTS

Treatments	Storage period (in days)			
	0	**30**	**60**	**90**
T_0(10% Juice: 15% TSS: 0.3% acidity + No Blending)	6.27	6.45	6.52	6.66
T_1(10% Juice: 14% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	6.32	6.50	6.61	6.72
T_2(10% Juice: 14% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	6.15	6.30	6.36	6.54
T_3(10% Juice: 14% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	6.08	6.25	6.29	6.48
T_4(10% Juice: 13% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	6.40	6.58	6.70	6.80
T_5(10% Juice: 13% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	6.45	6.65	6.76	6.88
T_6(10% Juice: 13% TSS: 0.3% acidity + 75% Guava juice: 75% Papaya juice)	6.22	6.38	6.45	6.60
T_7(10% Juice: 12% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	6.60	6.83	6.95	7.08
T_8(10% Juice: 12% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	6.50	6.71	6.84	6.98
T_9(10% Juice: 12% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	6.72	6.90	7.03	7.17
T_{10}(10% Juice: 11% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	6.98	7.10	7.25	7.39
T_{11}(10% Juice: 11% TSS: 0.3% acidity +50% Guava juice: 50% Papaya juice)	6.85	6.98	7.11	7.25
T_{12}(10% Juice: 11% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	6.91	7.03	7.20	7.31
SEm±	0.019	0.016	0.016	0.013
CD at 5%	0.06	0.05	0.05	0.04
CV	0.51	0.43	0.41	0.32

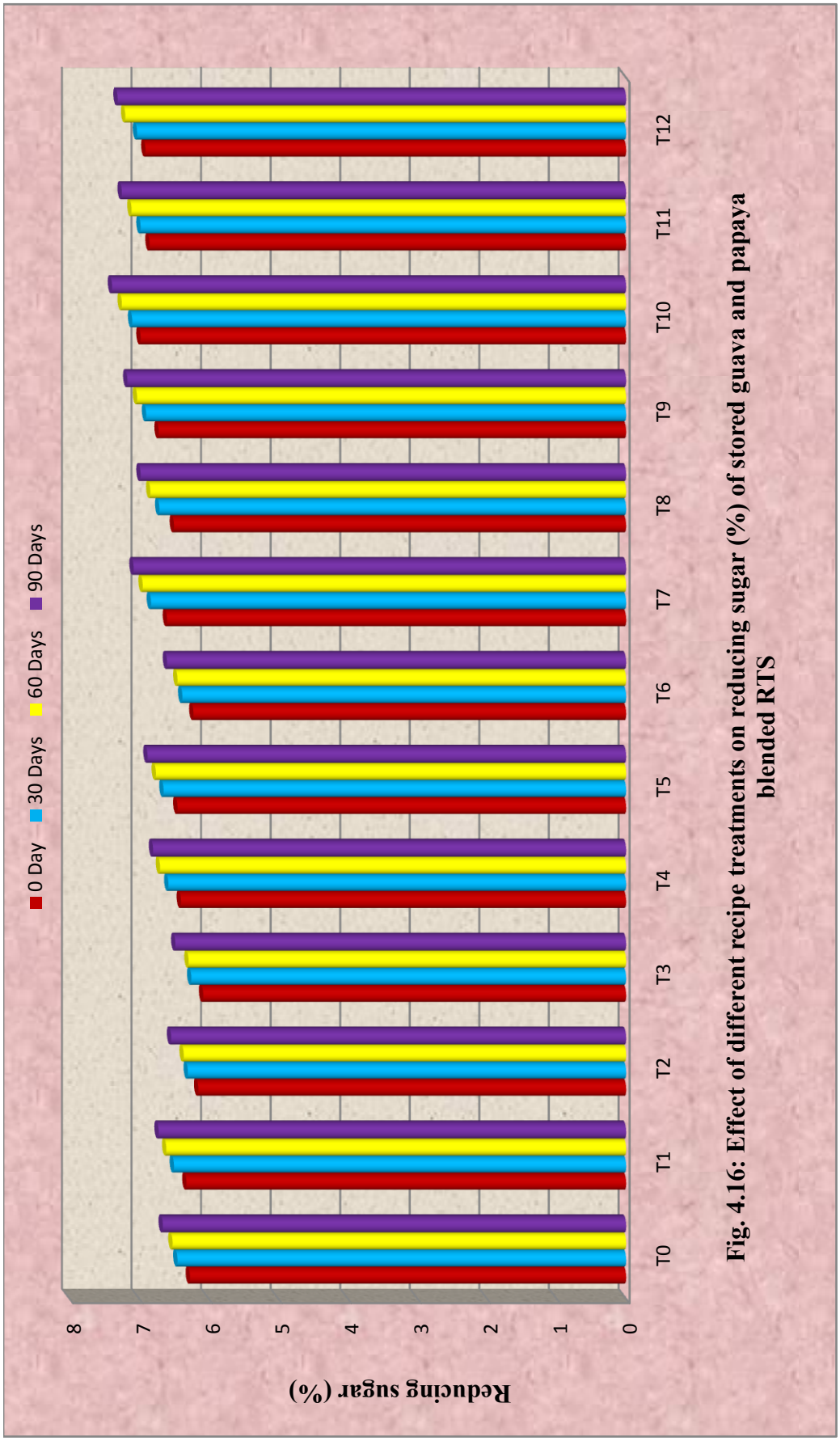


Fig. 4.16: Effect of different recipe treatments on reducing sugar (%) of stored guava and papaya blended RTS

with the treatment T_3 (10% Juice: 14% TSS: 0.3% acidity + 75% Guava juice: 25% Papaya juice). The treatments T_{12} and T_{11}, T_8 and T_5, T_5 and T_4, T_4 and T_1, T_1 and T_0, T_0 and T_6 were found statistically at par.

At the time of 30 days storage, maximum reducing sugar was observed (7.1%) with the treatment T_{10} (10% Juice: 11% TSS: 0.3% acidity +25% Guava juice: 75% Papaya juice) followed by T_{12} (10% Juice: 11% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice) and T_{11} (10% Juice: 11% TSS: 0.3% acidity +50% Guava juice: 50% Papaya juice). The minimum reducing sugar was recorded (6.25%) with the treatment T_3 (10% Juice: 14% TSS: 0.3% acidity + 75% Guava juice: 25% Papaya juice). The treatments T_{12} and $T_{11,}$ T_1 and T_0 and T_2 and T_3 were found statistically at par.

After 60 days of storage maximum reducing sugar was recorded (7.25%) with the treatment T_{10} (10% Juice: 11% TSS: 0.3% acidity +25% Guava juice: 75% Papaya juice) followed by T_{12} (10% Juice: 11% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice) and T_{11} (10% Juice: 11% TSS: 0.3% acidity +50% Guava juice: 50% Papaya juice). The minimum reducing sugar was recorded (6.29%) with the treatment T_3 (10% Juice: 14% TSS: 0.3% acidity + 75% Guava juice: 25% Papaya juice). The treatments T_{10} and T_{12} were found statistically at par.

After 90 days of storage, maximum reducing sugar was recorded (7.39%) with the treatment T_{10} (10% Juice: 11% TSS: 0.3% acidity +25% Guava juice: 75% Papaya juice) followed by T_{12} (10% Juice: 11% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice) and T_{11} (10% Juice: 11% TSS: 0.3% acidity +50% Guava juice: 50% Papaya juice). The minimum reducing sugar was recorded (6.48%) with the treatment T_3 (10% Juice: 14% TSS: 0.3% acidity + 75% Guava juice: 25% Papaya juice).

The increase in sugars during storage may be attributed due to gradual inversion of non reducing sugars to the reducing sugars by the hydrolysis process. These results are in close conformity with the findings of Tiwari (2000), who reported an increase in reducing sugar content during storage of the RTS beverages prepared from guava-papaya (70:30) blends. Nidhi *et al*. (2007) reported that total sugars and reducing sugars increased, while total phenols

decreased in both the beverages with the increase in storage duration.

4.4.6 Non-reducing sugar (%)

Data pertaining to effect of different treatments on non-reducing sugar of blended guava and papaya RTS under ambient condition storage are presented in Table4.19 and illustrated in Fig.4.17.

It is evident from the data that the non-reducing sugar in blended guava and papaya RTS showed a decreasing trend with increasing period of storage (0-90 days). The non-reducing sugar was found to be significant from 0 to 90 days of storage. At the time of preparation, significant maximum non-reducing sugar was recorded (14.06 %) with the treatment T_3(10% Juice: 14% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice) followed by T_2(10% Juice: 14% TSS: 0.3% acidity+ 50% Guava juice: 50% Papaya juice) and T_6(10% Juice: 13% TSS: 0.3% acidity + 75% Guava juice: 25% Papaya juice).While, minimum non-reducing sugar was observed (13.64%) with the treatment T_{10} (10% Juice: 11% TSS: 0.3% acidity +25% Guava juice: 75% Papaya juice).The treatments T_2 and T_6, T_6 and T_0, T_0 and T_1, T_4 and T_5, T_5 and T_8, T_{11} and T_{12} were significantly at par.

After 30 days of storage, significantly maximum non-reducing sugar was recorded (13.93 %) with the treatment T_3(10% Juice: 14% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice) followed by T_2(10% Juice: 14% TSS: 0.3% acidity+ 50% Guava juice: 50% Papaya juice) and T_6(10% Juice: 13% TSS: 0.3% acidity + 75% Guava juice: 25% Papaya juice).While, minimum non-reducing sugar was observed (13.56%) with the treatment T_{10} (10% Juice: 11% TSS: 0.3% acidity +25% Guava juice: 75% Papaya juice).The treatments T_0 and T_1,T_5 and T_8, T_8 and T_7 ,T_{11} and T_{12} were significantly at par.

After 60 days of storage maximum non reducing-sugar was recorded(13.91 %) with the treatment T_3(10% Juice: 14% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice) followed by T_2(10% Juice: 14% TSS: 0.3% acidity+ 50% Guava juice: 50% Papaya juice) and T_6(10% Juice: 13% TSS: 0.3% acidity + 75% Guava juice: 25% Papaya juice).While, minimum non-reducing sugar was observed (13.46%) with the treatment T_{10} (10% Juice: 11% TSS: 0.3%

Table 4.19: Effect of different recipe treatments on Non- reducing (%) sugar of stored guava and papaya blended RTS

Treatments	Storage period (in days)			
	0	**30**	**60**	**90**
T_0(10% Juice: 15% TSS: 0.3% acidity + No Blending)	13.98	13.82	13.78	13.68
T_1(10% Juice: 14% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	13.96	13.81	13.72	13.64
T_2(10% Juice: 14% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	14.02	13.9	13.88	13.73
T_3(10% Juice: 14% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	14.06	13.93	13.91	13.75
T_4(10% Juice: 13% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	13.92	13.77	13.68	13.60
T_5(10% Juice: 13% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	13.91	13.73	13.65	13.55
T_6(10% Juice: 13% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	13.99	13.85	13.81	13.69
T_7(10% Juice: 12% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	13.85	13.67	13.59	13.48
T_8(10% Juice: 12% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	13.89	13.71	13.61	13.52
T_9(10% Juice: 12% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	13.79	13.64	13.55	13.46
T_{10}(10% Juice: 11% TSS: 0.3% acidity +25% Guava juice: 75% Papaya juice)	13.64	13.56	13.46	13.36
T_{11}(10% Juice: 11% TSS: 0.3% acidity +50% Guava juice: 50% Papaya juice)	13.71	13.61	13.51	13.43
T_{12}(10% Juice: 11% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	13.69	13.59	13.47	13.40
SEm±	0.011	0.008	0.010	0.008
CD at 5%	0.03	0.02	0.03	0.02
CV	0.15	0.10	0.13	0.10

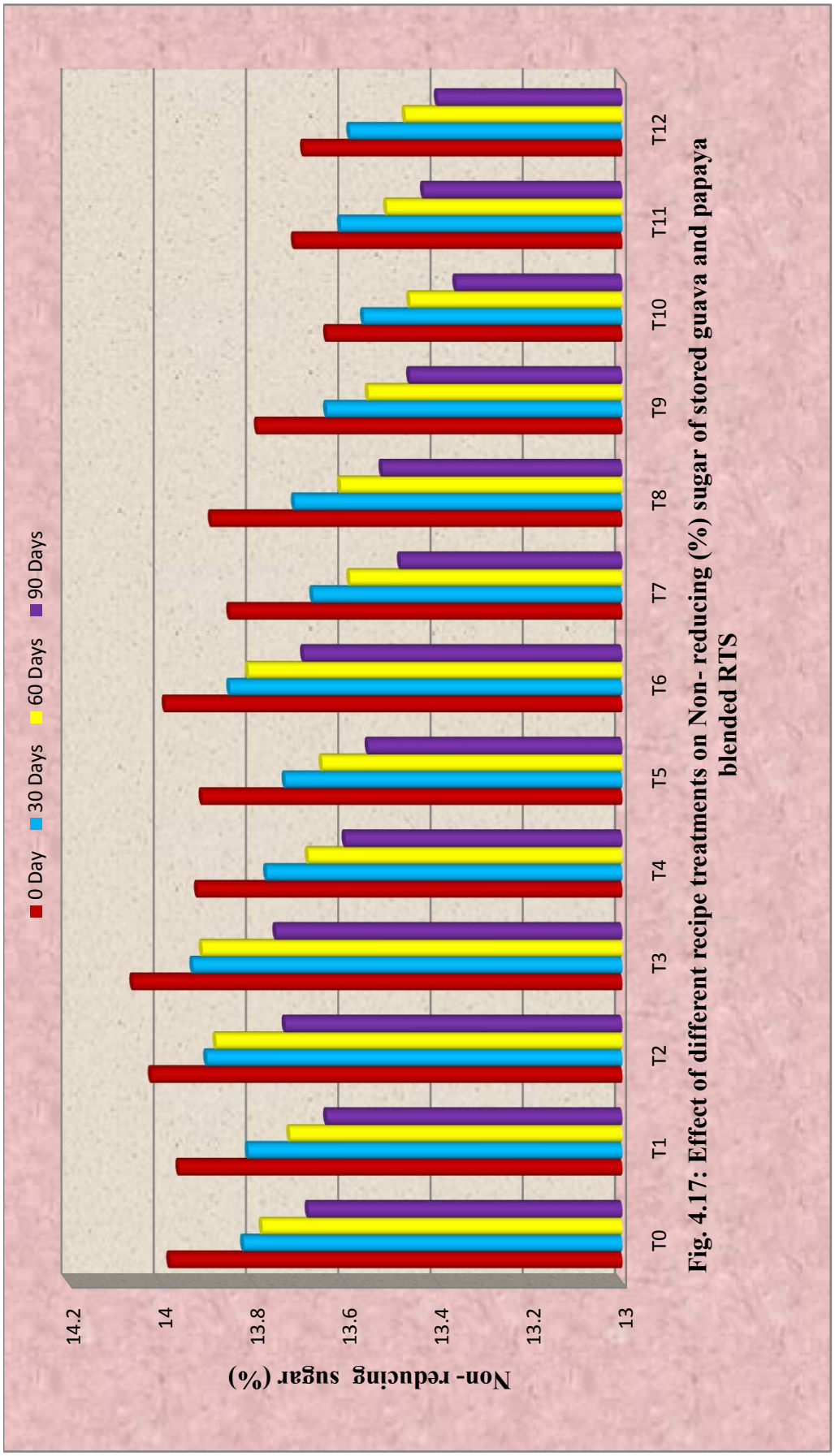


Fig. 4.17: Effect of different recipe treatments on Non- reducing (%) sugar of stored guava and papaya blended RTS

acidity +25% Guava juice: 75% Papaya juice).The treatments T_3 and T_2,T_6 and T_0, T_4 and T_5 ,T_8 and T_7, T_{12} and T_{10} were significantly at par.

After 90 days of storage, maximum non-reducing sugar was recorded(13.75%) with the treatment T_3(10% Juice: 14% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice) followed by T_2(10% Juice: 14% TSS: 0.3% acidity+ 50% Guava juice: 50% Papaya juice) and T_6(10% Juice: 13% TSS: 0.3% acidity + 75% Guava juice: 25% Papaya juice).While, minimum non-reducing sugar was observed (13.36%) with the treatment T_{10} (10% Juice: 11% TSS: 0.3% acidity +25% Guava juice: 75% Papaya juice).The treatments T_3 and T_2,T_6 and T_0, T_0 and T_1 ,T_7 and T_9 were significantly at par.

These results are in close conformity with the report of Brekke *et al.* (1976), who reported that the decrease in sucrose content in papaya nectar was correlated with an increase in storage temperature which showed maximum increase in reducing sugar content, whereas, the non-reducing sugar followed a decreasing trend. Singh (2005), also reported that the reducing sugar increased significantly and gradual decrease in non-reducing sugar was observed with the advancement of storage period in RTS and nectar of custard apple.

4.4.7. Total sugar (%)

Data pertaining to effect of different recipe treatments on the total sugar of blended guava and papaya RTS under ambient condition storage are presented in Table 4.20 and illustrated in Fig.4.18.

It is clear from the data that total sugar content of RTS showed an increasing trend with increasing period of storage (0 to 90 days). A significant difference in total sugar was observed at the time of storage. The total sugar content of RTS was found to be significant from 0 to 90 days of storage. At the time of preparation, total sugar was found significantly higher (20.62%) with the treatment T_{10} (10% Juice: 11% TSS: 0.3% acidity +25% Guava juice: 75% Papaya juice) followed by T_{12} (10% Juice: 11% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice) and T_{11} (10% Juice: 11% TSS: 0.3% acidity +50% Guava juice: 50% Papaya juice). The minimum total sugar was recorded (20.14%) with the treatment T_3 (10% Juice: 14% TSS: 0.3% acidity + 75% Guava

Table 4.20: Effect of different recipe treatments on Total sugar (%) of stored guava and papaya blended RTS

Treatments	Storage period (in days)			
	0	**30**	**60**	**90**
T_0(10% Juice: 15% TSS: 0.3% acidity + No Blending)	20.25	20.27	20.30	20.34
T_1(10% Juice: 14% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	20.28	20.31	20.33	20.36
T_2(10% Juice: 14% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	20.17	20.20	20.24	20.27
T_3(10% Juice: 14% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	20.14	20.18	20.20	20.23
T_4(10% Juice: 13% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	20.32	20.35	20.38	20.40
T_5(10% Juice: 13% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	20.36	20.38	20.41	20.43
T_6(10% Juice: 13% TSS: 0.3% acidity + 75% Guava juice: 25% Papaya juice)	20.21	20.23	20.26	20.29
T_7(10% Juice: 12% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	20.45	20.50	20.54	20.56
T_8(10% Juice: 12% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	20.39	20.42	20.45	20.50
T_9(10% Juice: 12% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	20.51	20.54	20.58	20.63
T_{10}(10% Juice: 11% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	20.62	20.66	20.71	20.75
T_{11}(10% Juice: 11% TSS: 0.3% acidity +50% Guava juice: 50% Papaya juice)	20.56	20.59	20.62	20.68
T_{12}(10% Juice: 11% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	20.60	20.62	20.67	20.71
SEm±	0.01	0.008	0.011	0.08
CD at 5%	0.03	0.02	0.03	0.02
CV	0.09	0.07	0.1	0.07

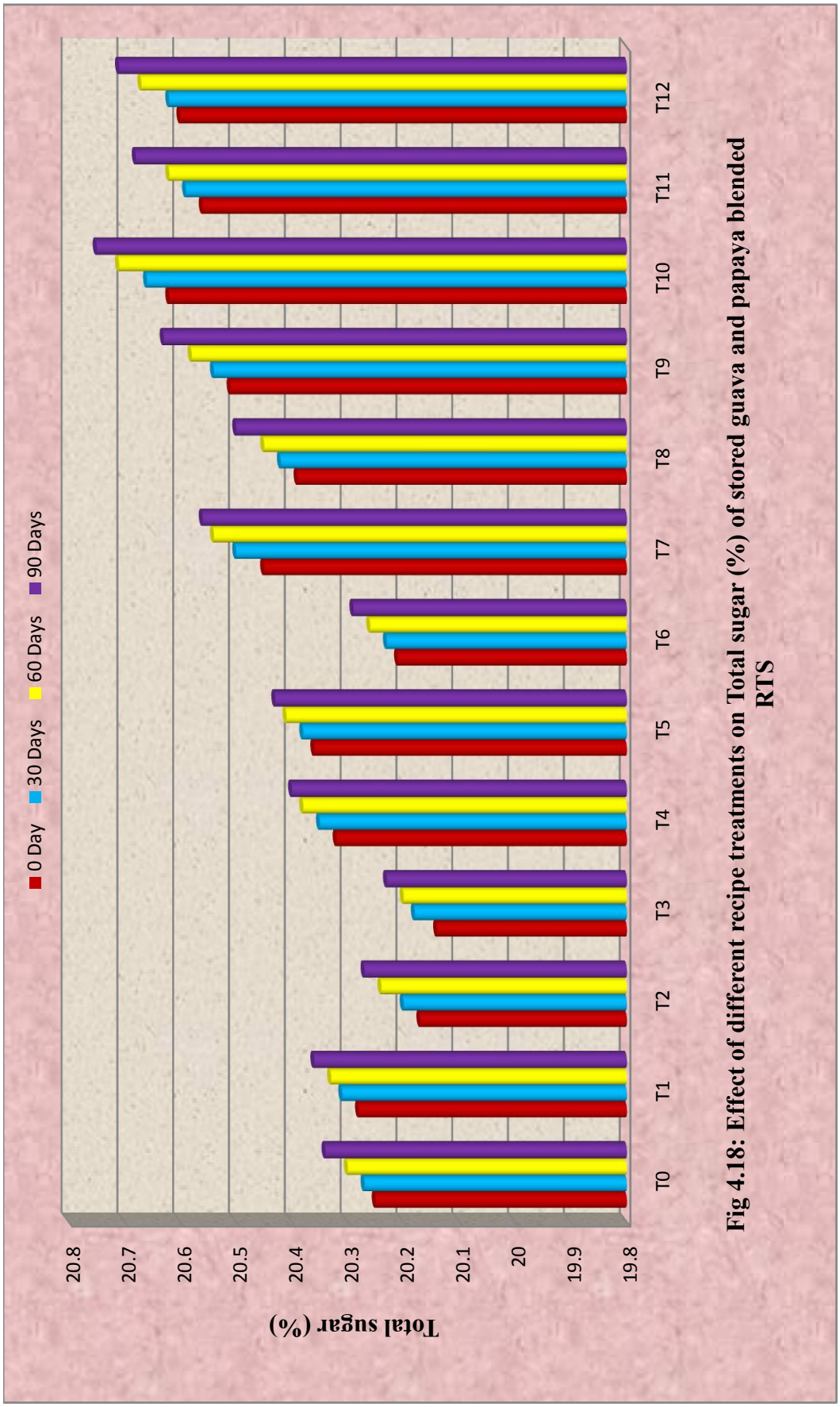


Fig 4.18: Effect of different recipe treatments on Total sugar (%) of stored guava and papaya blended RTS

juice: 25% Papaya juice). The treatments T_{10} and T_{12}, T_8 and $T_{5,}$ T_1 and $T_{0,}$ T_2 and T_3were found statistically at par.

At 30 days of storage, the maximum total sugar content was observed (20.66 %) with the treatment T_{10} (10% Juice: 11% TSS: 0.3% acidity +25% Guava juice: 75% Papaya juice) followed by T_{12} (10% Juice: 11% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice) and T_{11} (10% Juice: 11% TSS: 0.3% acidity +50% Guava juice: 50% Papaya juice). The minimum total sugar was recorded (20.18%) with the treatment T_3 (10% Juice: 14% TSS: 0.3% acidity + 75% Guava juice: 25% Papaya juice). The treatments T_2 and T_3were found statistically at par.

After 60 days of storage, maximum total sugar was found (20.71%) with the treatment T_{10} (10% Juice: 11% TSS: 0.3% acidity +25% Guava juice: 75% Papaya juice) followed by T_{12} (10% Juice: 11% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice) and T_{11} (10% Juice: 11% TSS: 0.3% acidity +50% Guava juice: 50% Papaya juice). The minimum total sugar was recorded (20.20%) with the treatment T_3 (10% Juice: 14% TSS: 0.3% acidity + 75% Guava juice: 25% Papaya juice). The treatments T_5 and T_4, T_1 and $T_{0,}$ T_6 and T_2 were found statistically at par.

At the end 90 days of storage, maximum total sugar content was observed (20.75%) with the treatment T_{10} (10% Juice: 11% TSS: 0.3% acidity +25% Guava juice: 75% Papaya juice) followed by T_{12} (10% Juice: 11% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice) and T_{11} (10% Juice: 11% TSS: 0.3% acidity +50% Guava juice: 50% Papaya juice). The minimum total sugar was recorded (20.23%) with the treatment T_3 (10% Juice: 14% TSS: 0.3% acidity + 75% Guava juice: 25% Papaya juice). The treatments T_1 and $T_{0,}$ T_6 and T_2 were found statistically at par.

The increase in reducing sugar as well as total sugar corresponded to the increase in TSS (total soluble solids) and ultimate decrease in non-reducing sugar in both the beverages during storage period .The variation in different fractions of sugar might be due to hydrolysis of polysaccharides like

starch, pectin and inversion of non-reducing sugar into reducing sugar, as increase in reducing sugar was co-related with the decrease in non-reducing sugar. The increased level of total sugar was probably due to conversion of starch and pectin into simple sugars.

The present findings are in close conformity with the report of Tripathi *et al.* (1992), who reported that there was a continuous increase in the level of total sugar (11.2% to 18.6%) in pineapple-guava blended RTS. Similar finding were also reported by Nidhi *et al.* (2007), who analyzed the bael-guava ready-to-serve beverage and squash. They reported that total sugars and reducing sugars increased, with the increase in storage period. Choudhary and Dikshit (2006) reported that there was an increasing trend of total and reducing sugar in guava nectar and RTS with increasing period of storage under ambient condition.

4.5 Organoleptic evaluation of guava and papaya RTS during storage

Organoleptic evaluation of guava and papaya RTS stored under ambient condition was done at 30 days interval by a panel of ten judges.

4.5.1 Colour and appearances

Data pertaining to change in colour and appearance score of RTS during storage under ambient condition are presented in Table 4.21 and illustrated in Fig. 4.19. The mean score for colour and appearance of different treatments were recorded at 0, 30, 60 and 90 days and observed that organoleptic score for colour and appearance continuously decreased with all the treatments upto 90 days of storage.

At the time of preparation, significantly maximum mean for colour and appearance score was recorded (7.5) with the treatment T_2 (10% Juice: 14% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice) followed by T_2 (10% Juice: 14% TSS: 0.3% acidity+ 50% Guava juice: 50% Papaya juice) and T_4 (10% Juice: 13% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice). The minimum mean score was recorded (6.5) with the treatment T_{12} (10% Juice: 11% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice). The treatments T_0 and T_3 were

Table 4.21: Effect of different recipe treatments on colour and appearance (Organoleptic score) of stored guava and papaya blended RTS

Treatments	Storage period			
	0 day	30 days	60 days	90 days
T_0(10% Juice: 15% TSS: 0.3% acidity + No Blending)	7.10	7.07	6.81	6.11
T_1(10% Juice: 14% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	7.46	7.45	7.19	6.49
T_2(10% Juice: 14% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	7.50	7.41	7.15	6.45
T_3(10% Juice: 14% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	7.12	7.05	6.79	6.09
T_4(10% Juice: 13% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	7.40	7.35	7.09	6.39
T_5(10% Juice: 13% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	7.00	6.95	6.69	5.99
T_6(10% Juice: 13 % TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	6.81	6.76	6.50	5.80
T_7(10% Juice: 12% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	7.20	7.15	6.89	6.19
T_8(10% Juice: 12% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	6.93	6.88	6.62	5.92
T_9(10% Juice: 12% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	6.66	6.61	6.35	5.65
T_{10}(10% Juice: 11% TSS: 0.3% acidity +25% Guava juice: 75% Papaya juice)	6.75	6.70	6.44	5.74
T_{11}(10% Juice: 11% TSS: 0.3% acidity +50% Guava juice: 50% Papaya juice)	6.70	6.65	6.39	5.69
T_{12}(10% Juice: 11% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	6.50	6.45	6.19	5.49
SEm±	0.01	0.009	0.008	0.008
CD at 5%	0.02	0.03	0.02	0.02
CV	0.25	0.22	0.22	0.23

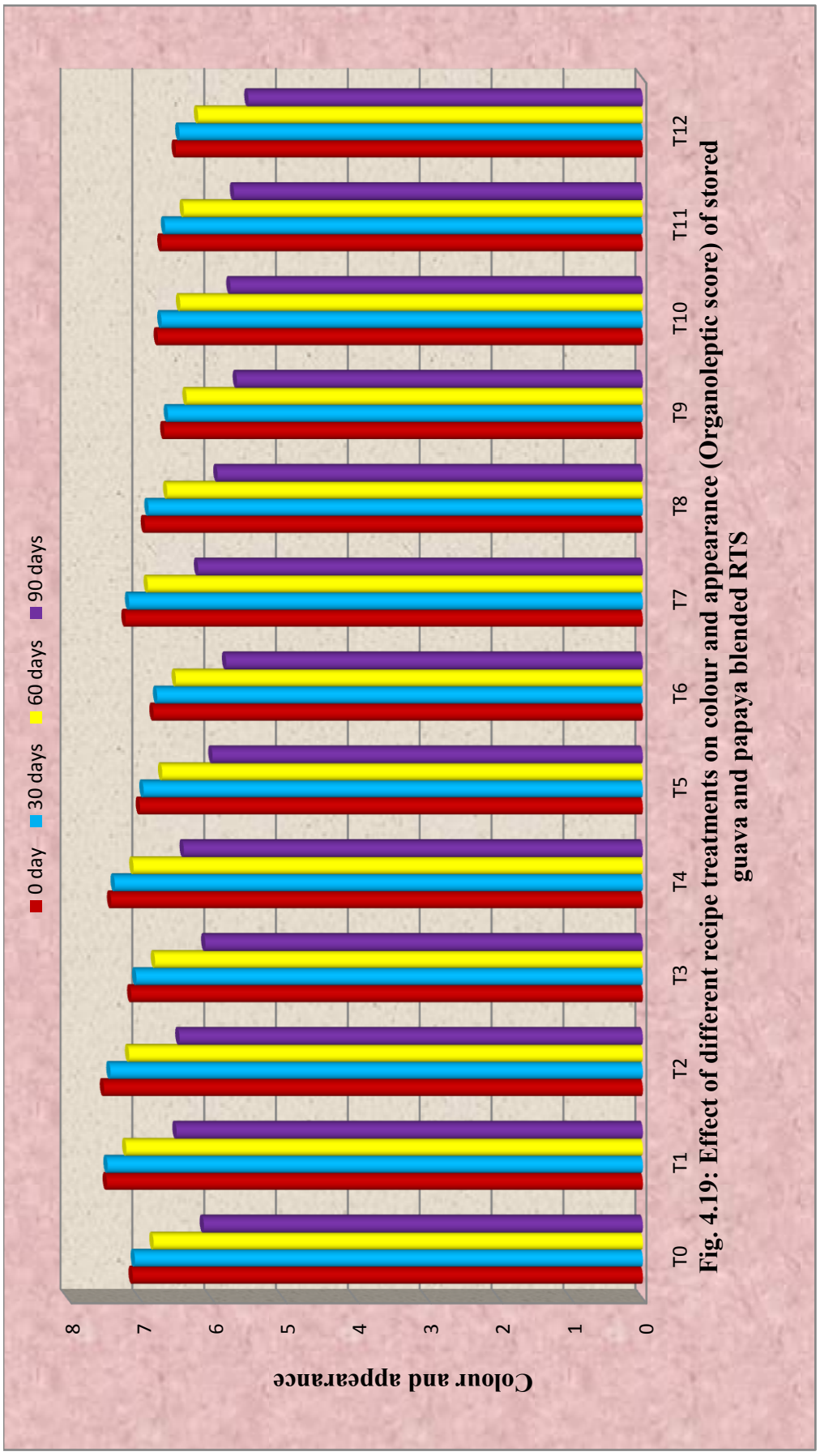


Fig. 4.19: Effect of different recipe treatments on colour and appearance (Organoleptic score) of stored guava and papaya blended RTS

found statistically at par.

After 30 days of storage, significantly maximum mean score for colour and appearance was recorded (7.45) with the treatment T_1 (10% Juice: 14% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice) followed by T_2 (10% Juice: 14% TSS: 0.3% acidity+ 50% Guava juice: 50% Papaya juice) and T_4 (10% Juice: 13% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice). The minimum mean score was recorded (6.45) with the treatment T_{12} (10% Juice: 11% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice). The treatments T_0 and T_3 were found statistically at par.

After 60 days of storage, maximum mean score for colour and appearance was recorded (7.19) with the treatment T_1 (10% Juice: 14% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice) followed by T_2 (10% Juice: 14% TSS: 0.3% acidity+ 50% Guava juice: 50% Papaya juice) and T_4 (10% Juice: 13% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice). The minimum mean score was recorded (6.19) with the treatment T_{12} (10% Juice: 11% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice). The treatments T_0 and T_3 were found statistically at par.

After 90 days of storage, maximum mean score for colour and appearance was recorded (6.49) with the treatment T_1 (10% Juice: 14% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice) followed by T_2 (10% Juice: 14% TSS: 0.3% acidity+ 50% Guava juice: 50% Papaya juice) and T_4 (10% Juice: 13% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice). The minimum mean score was recorded (5.49) with the treatment T_{12} (10% Juice: 11% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice).

4.5.2 Aroma

Data pertaining to change in aroma of organoleptic score of RTS during storage under ambient condition are presented in Table 4.22 and illustrated in Fig. 4.20. The mean score for aroma for different treatments were recorded at 0, 30, 60 and 90 days and observed that organoleptic score for aroma continuously decreased with all the treatments upto 90 days of storage.

At the time of preparation, the maximum mean for aroma score was

Table 4.22: Effect of different recipe treatments on Aroma (Organoleptic score) of stored guava and papaya blended RTS

Treatments	Storage period(in days)			
	0 day	30 days	60 days	90 days
T_0(10% Juice: 15% TSS: 0.3% acidity + No Blending)	7.75	7.52	7.40	7.16
T_1(10% Juice: 14% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	7.64	7.41	7.29	7.05
T_2(10% Juice: 14% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	7.97	7.74	7.62	7.38
T_3(10% Juice: 14% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	8.22	7.99	7.87	7.63
T_4(10% Juice: 13% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	7.58	7.35	7.23	6.99
T_5(10% Juice: 13% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	7.71	7.48	7.36	7.12
T_6(10% Juice: 13 % TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	7.89	7.66	7.54	7.30
T_7(110% Juice: 12% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	7.79	7.06	6.94	6.70
T_8(10% Juice: 12% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	7.40	7.17	7.05	6.81
T_9(10% Juice: 12% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	7.46	7.23	7.11	6.87
T_{10}(10% Juice: 11% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	6.95	6.72	6.60	6.36
T_{11}(10% Juice: 11% TSS: 0.3% acidity +50% Guava juice: 50% Papaya juice)	7.05	6.82	6.70	6.46
T_{12}(10% Juice: 11% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	7.12	6.89	6.77	6.53
SEm±	0.014	0.014	0.011	0.009
CD at 5%	0.04	0.04	0.03	0.03
CV	0.31	0.33	0.28	0.22

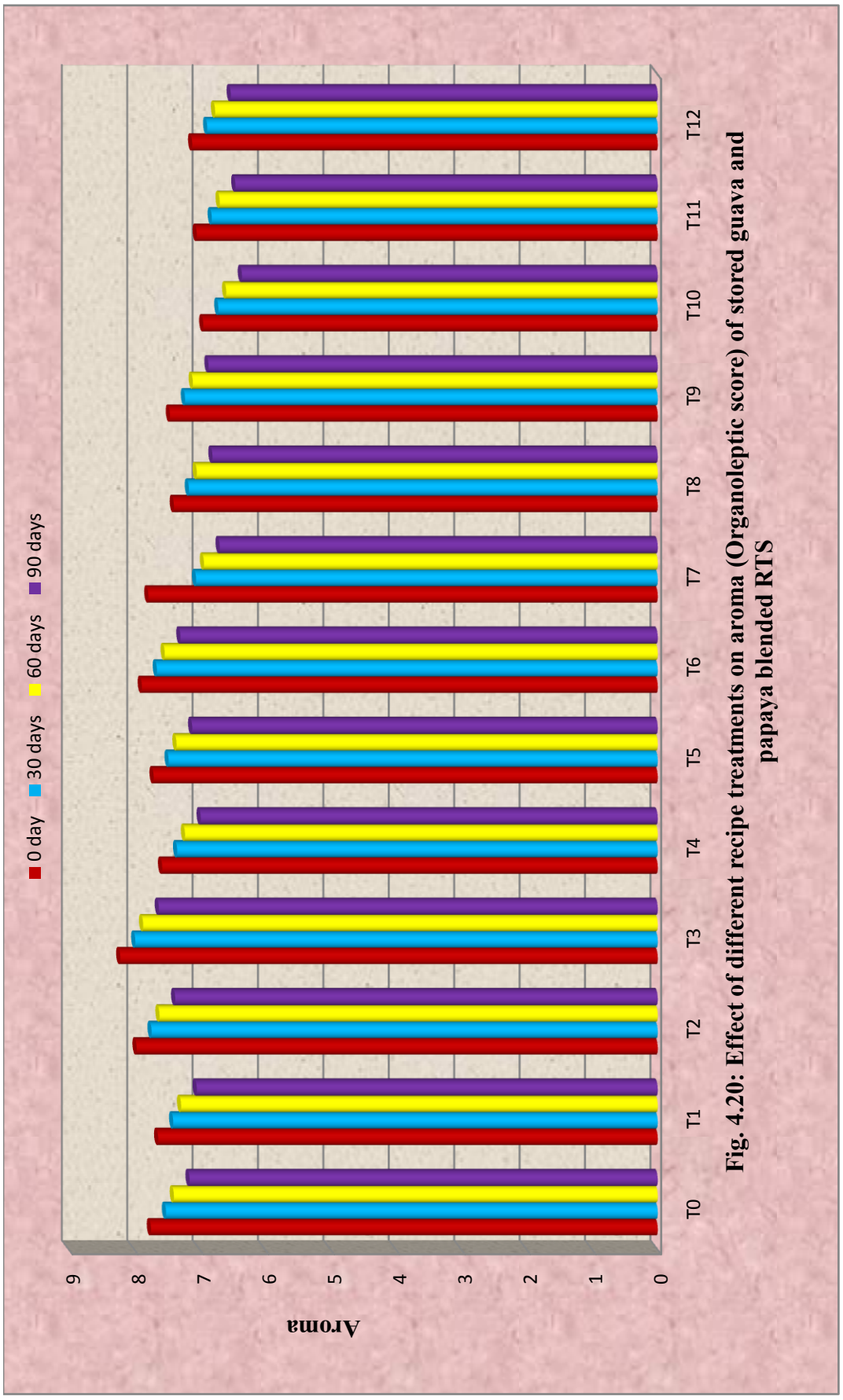


Fig. 4.20: Effect of different recipe treatments on aroma (Organoleptic score) of stored guava and papaya blended RTS

recorded (8.22) with the treatment T_3 **(**10% Juice: 14% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice) followed by T_2(10% Juice: 14% TSS: 0.3% acidity+ 50% Guava juice: 50% Papaya juice) and T_6 (10% Juice: 13% TSS: 0.3% acidity+75% Guava juice: 25% Papaya juice). The minimum mean score was recorded (6.95) with the treatment T_{10} (10% Juice: 11% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice) . The treatments T_0 and T_5, T_7 and T_0 were statistically at par.

After 30 days of storage period, the maximum mean score for aroma was recorded (7.99) with the treatment T_3 **(**10% Juice: 14% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice) followed by T_2 (10% Juice: 14% TSS: 0.3% acidity+ 50% Guava juice: 50% Papaya juice) and T_6 (10% Juice: 13% TSS: 0.3% acidity+75%Guava juice: 25% Papaya juice). The minimum mean score was recorded (6.72) with the treatment T_{10} (10% Juice: 11% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice). The treatments T_0 and T_5 were statistically at par.

After 60 days of storage, maximum mean score for aroma was recorded (7.87) with the treatment T_3**(**10% Juice: 14% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice) followed by T_2(10% Juice: 14% TSS: 0.3% acidity+ 50% Guava juice: 50% Papaya juice) and T_6 (10% Juice: 13% TSS: 0.3% acidity+75% Guava juice: 25% Papaya juice).The minimum mean score was recorded (6.6) with the treatment T_{10} (10% Juice: 11% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice).

After 90 days of storage period, similar trend was observed.

4.5.3 Taste

Data pertaining to change in taste of organoleptic score of RTS during storage under ambient condition are presented in Table 4.23 and illustrated in Fig. 4.21. The mean score for taste for different treatments were recorded at 0, 30, 60 and 90 days and observed that organoleptic score for taste continuously decreased with all the treatments upto 90 days of storage.

At the time of preparation, maximum mean for taste score was recorded

Table 4.23: Effect of different recipe treatments on taste (Organoleptic score) of stored guava and papaya blended RTS

Treatments	Storage period (in days)			
	0 day	30 days	60 days	90 days
T_0(10% Juice: 15% TSS: 0.3% acidity + No Blending)	8.45	8.24	8.09	7.99
T_1(10% Juice: 14% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	8.10	7.89	7.74	7.64
T_2(10% Juice: 14% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	8.60	8.39	8.24	8.14
T_3(10% Juice: 14% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	8.82	8.61	8.46	8.36
T_4(10% Juice: 13% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	8.03	8.00	7.85	7.75
T_5(10% Juice: 13% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	8.21	7.82	7.67	7.57
T_6(10% Juice: 13 % TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	8.65	8.44	8.29	8.19
T_7(10% Juice: 12% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	7.70	7.49	7.34	7.24
T_8(10% Juice: 12% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	7.89	7.68	7.53	7.43
T_9(10% Juice: 12% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	7.96	7.75	7.60	7.50
T_{10}(10% Juice: 11% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	7.4	7.19	7.04	6.94
T_{11}(10% Juice: 11% TSS: 0.3% acidity +50% Guava juice: 50% Papaya juice)	7.54	7.33	7.18	7.08
T_{12}(10% Juice: 11% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	7.62	7.41	7.26	7.16
SEm±	0.019	0.016	0.008	0.006
CD at 5%	0.06	0.05	0.02	0.02
CV	0.41	0.34	0.18	0.15

Fig. 4.21: Effect of different recipe treatments on taste (Organoleptic score) of stored guava and papaya blended RTS

(8.82) with the treatment T_3 **(**10% Juice: 14% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice) followed by T_6 (10% Juice: 13% TSS: 0.3% acidity+75% Guava juice: 25% Papaya juice) and T_2(10% Juice: 14% TSS: 0.3% acidity+ 50% Guava juice: 50% Papaya juice).The minimum mean score was recorded (7.4) with the treatment T_{10} (10% Juice: 11% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice). The treatments T_6 and T_2 were statistically par.

After 30 days of storage, maximum mean score for taste was recorded (8.61) with the treatment T_3 **(**10% Juice: 14% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice) followed by T_6 (10% Juice: 13% TSS: 0.3% acidity+75% Guava juice: 25% Papaya juice) and T_2 (10% Juice: 14% TSS: 0.3% acidity+ 50% Guava juice: 50% Papaya juice). The minimum mean score was recorded (7.19) with the treatment T_{10} (10% Juice: 11% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice). The treatments T_6 and T_2 were statistically at par.

After 60 days of storage, maximum mean score for taste was recorded (8.46) with the treatment T_3 **(**10% Juice: 14% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice) followed by T_6 (10% Juice: 13% TSS: 0.3% acidity+75% Guava juice: 25% Papaya juice) and T_2 (10% Juice: 14% TSS: 0.3% acidity+ 50% Guava juice: 50% Papaya juice). The minimum mean score was recorded (7.04) with the treatment T_{10} (10% Juice: 11% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice).

After 90 days of storage period, similar trend was observed.

4.5.4 Overall acceptability

Data pertaining to change in overall acceptability of organoleptic score of RTS during storage under ambient condition are presented in Table 4.24 and illustrated in Fig. 4.22. The mean score for overall acceptability of different treatments were recorded at 0, 30, 60 and 90 days and observed that organoleptic score for overall acceptability continuously decreased with all the treatments upto 90 days of storage.

At the time of preparation, the maximum mean for overall acceptability

Table 4.24: Effect of different recipe treatments on overall acceptablility (Organoleptic score) of stored guava and papaya blended RTS

Treatments	Storage period			
	0 day	30 days	60 days	90 days
T_0(10% Juice: 15 % TSS: 0.3% acidity + No Blending)	7.77	7.61	7.43	7.08
T_1(10% Juice: 14% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	7.74	7.58	7.40	7.06
T_2(10% Juice: 14% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	8.01	7.84	7.67	7.32
T_3(10% Juice: 14% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	8.04	7.88	7.70	7.36
T_4(10% Juice: 13% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	7.67	7.56	7.39	7.04
T_5(10% Juice: 13% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	7.64	7.41	7.24	6.89
T_6(10% Juice: 13 % TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	7.78	7.62	7.44	7.09
T_7(10% Juice: 12% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	7.39	7.23	7.05	6.71
T_8(10% Juice: 12% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	7.40	7.24	7.06	6.72
T_9(10% Juice: 12% TSS: 0.3%acidity +75% Guava juice: 25% Papaya juice)	7.36	7.19	7.02	6.67
T_{10}(10% Juice: 11% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	7.03	6.87	6.69	6.34
T_{11}(10% Juice: 11% TSS: 0.3% acidity +50% Guava juice: 50% Papaya juice)	7.09	6.93	6.75	6.41
T_{12}(10% Juice: 11% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	7.08	6.91	6.74	6.39
SEm±	0.009	0.008	0.008	0.006
CD at 5%	0.03	0.02	0.02	0.02
CV	0.21	0.2	0.19	0.15

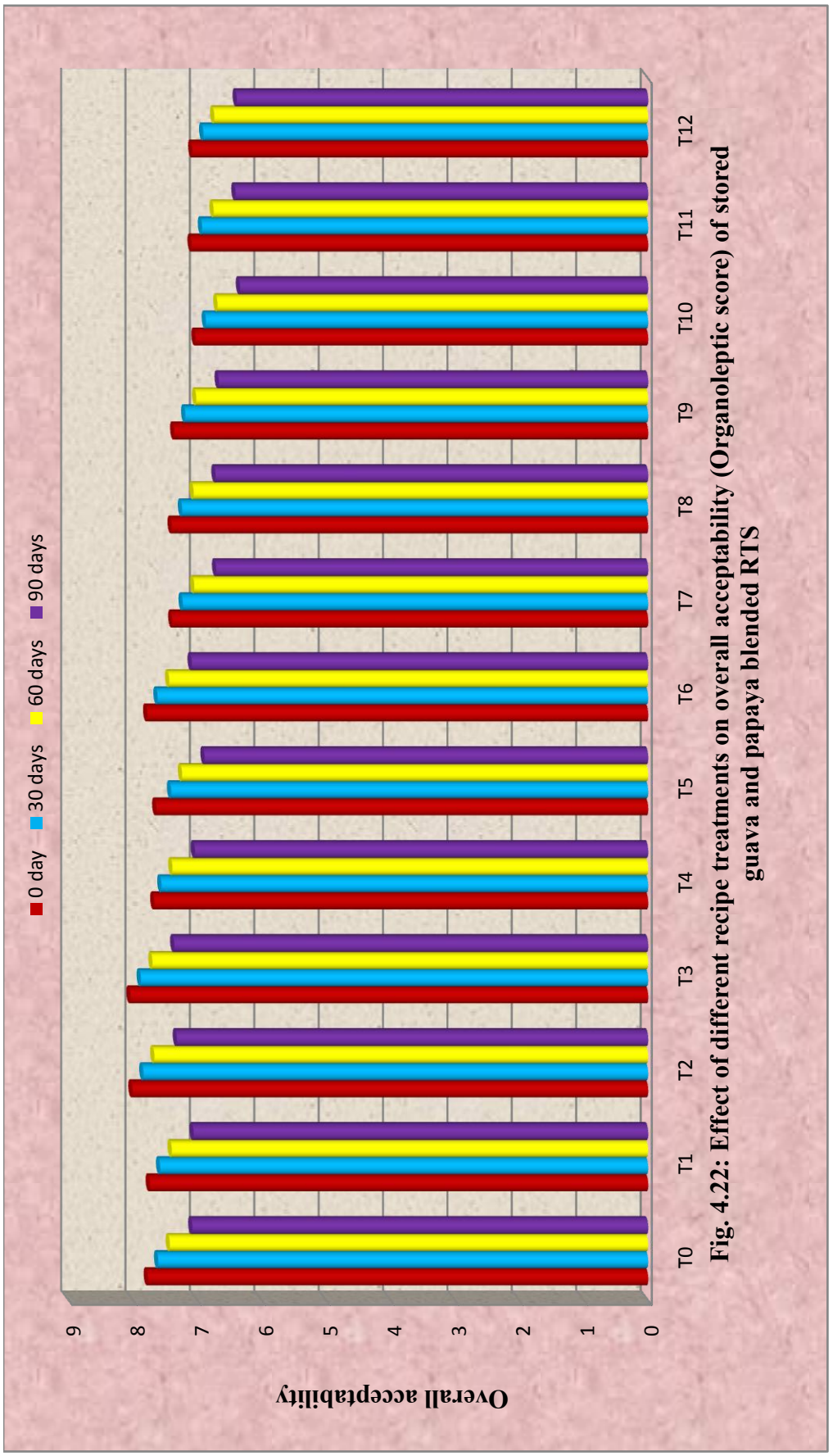


Fig. 4.22: Effect of different recipe treatments on overall acceptability (Organoleptic score) of stored guava and papaya blended RTS

score was recorded (8.04) with the treatment T_3 **(**10% Juice: 14% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice) followed by T_2(10% Juice: 14% TSS: 0.3% acidity+ 50% Guava juice: 50% Papaya juice) and T_6 (10% Juice: 13% TSS: 0.3% acidity+75% Guava juice: 25% Papaya juice). The minimum mean score was recorded (7.03) with the treatment T_{10} (10% Juice: 11% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice). The treatments T_3 and T_2, T_6 and T_0, T_0 and T_1, T_4 and T_5, T_8 and T_7, T_7 and T_9, T_{11} and T_{12} were statistically par.

After 30 days of storage, maximum mean score for overall acceptability was recorded (7.88) with the treatment T_3 **(**10% Juice: 14% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice) followed by T_2 (10% Juice: 14% TSS: 0.3% acidity+ 50% Guava juice: 50% Papaya juice) and T_6 (10% Juice: 13% TSS: 0.3% acidity+75% Guava juice: 25% Papaya juice). The minimum mean score was recorded (6.87) with the treatment T_{10} (10% Juice: 11% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice). The treatments T_6 and T_0, T_1 and T_4, T_8 and T_7, T_{11} and T_{12} were statistically at par.

After 60 days of storage, maximum mean score for overall acceptability was recorded (7.70) with the treatment T_3 **(**10% Juice: 14% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice) followed by T_2 (10% Juice: 14% TSS: 0.3% acidity+ 50% Guava juice: 50% Papaya juice) and T_6 (10% Juice: 13% TSS: 0.3% acidity+75% Guava juice: 25% Papaya juice). The minimum mean score was recorded (6.69) with the treatment T_{10} (10% Juice: 11% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice). The treatments T_6 and T_0, T_1 and T_4, T_8 and T_7, T_{11} and T_{12} were statistically par.

After 90 days of storage, similar trend was observed.

Overall acceptability is an expression of individual sensory parameters like appearance, colour, taste, flavor and consistency. Therefore, a change in individual parameters is reflected on the change in overall acceptability of the products. A considerable decrease in the organoleptic mean score was observed in both nectar and RTS at all the intervals of storage. The organoleptic scores were

higher upto 30 days of storage there after decreased further by the end of the storage. This is in conformation with the work of Mahadeviah (1996), that the acceptability rate decreased due to colour range and the product was slightly acceptable which might be due to conversion of vitamin C and polyphenol into di or poly carbonyl compounds. Similar findings were observed by Tiwari (2000), in guava and papaya blends. Among all blends of RTS, 75% guava:35% papaya blend was found most acceptable over control rating (T_3- 8.04) and was at par with 50% guava:50% papaya blend rating (T_2-8.01) with 10% juice:14%TSS:0.3% acidity found as best recipe. All the organoleptic quality attributes are also affected by different fruit pulp/juice blending ratios.

There are many other extrinsic factors which determine the storage stability of products and temperature plays an important role among them. There are certain biochemical changes which occurs under low pH and high temperature that leads to the formation of brown pigments and produces off flavour in the beverages. The other possible reasons could be the loss of volatile aromatic substances responsible for flavour and taste which decreased acceptability in storage at ambient condition. The present findings are in accordance with the view of Jain and Asati (2004), who reported a decrease in overall acceptability of guava with storage period. Similar results were obtained by Harnanan *et al*. (1980) and Baramanray *et al*. (1995). The decrease in overall acceptability rating during storage is due to decrease in rating of colour, flavour, taste and texture of the fruit pulp. Similarly, Chan and Cavaletto (1982), have reported change in sensory quality of aseptically processed guava and papaya puree during storage.

4.6 Benefit: Cost ratio

Data pertaining to effect of different recipe treatments on the Benefit: Cost ratio of blended guava and papaya nectar and RTS are presented in Table 4.25 and 4.26.

4.6.1 Benefit: Cost ratio of blended guava and papaya nectar

The results revealed that the highest cost of production (749.00) was recorded with the treatment T_0 (20% juice: 20% TSS: 0.3% acidity+ No Blending) while, it was lowest (646.96) under the treatment T_{10} (20% juice: 16% TSS: 0.3% acidity+25% Guava: 75% papaya). The highest net return (853.04) and benefit: cost ratio (1.32)

Table 4.25: Effect of recipe treatments on economics of blended guava and papaya nectar

Treatments	Cost of production(Rs)	Gross return 100 bottle(Rs)	Net return 100 bottle(Rs)	Benefit : Cost ratio
T_0(20% Juice: 20% TSS: 0.3% acidity + No Blending)	749.00	1500	751.00	1.00
T_1(20% Juice: 19% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	666.71	1500	833.29	1.25
T_2(20% Juice: 19% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	696.65	1500	803.35	1.15
T_3(20% Juice: 19% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	724.83	1500	775.17	1.07
T_4(20% Juice: 18% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	665.21	1500	834.79	1.25
T_5(20% Juice: 18% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	689.15	1500	810.85	1.18
T_6(20% Juice: 18% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	723.33	1500	776.67	1.07
T_7(20% Juice: 17% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	654.51	1500	845.49	1.29
T_8(20% Juice: 17% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	684.85	1500	815.15	1.19
T_9(20% Juice: 17% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	712.83	1500	787.17	1.10
T_{10}(20% Juice: 16% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	646.96	1500	853.04	1.32
T_{11}(20% Juice: 16% TSS: 0.3% acidity +50% Guava juice: 50% Papaya juice)	677.35	1500	822.65	1.21
T_{12}(20% Juice: 16% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	705.33	1500	794.67	1.13

was recorded in the treatment of T_{10} (20% juice: 16% TSS: 0.3% acidity+25% Guava: 75% papaya) while, both values were recorded lowest (751.00) and (1.00) under the treatment T_0 (20% juice: 20% TSS: 0.3% acidity+ No Blending), respectively. The highest benefit: cost ratio under the treatment of T_{10} could be attributed to good gross monetary returns and comparatively moderate cost of production that resulted in high benefit: cost ratio. The lowest benefit: cost ratio in treatment T_0 may be due to lowest gross monetary returns.

4.6.2 Benefit: Cost ratio of blended guava and papaya RTS

The results revealed that the highest cost of production (590.91) was recorded with the treatment T_3 **(**10% Juice: 14% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice) while, it was lowest (539.34) under the treatment T_{10}(10% Juice: 11% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice).The highest net return (960.66) and benefit: cost ratio (1.78) was recorded in the treatment T_{10}(10% Juice: 11% TSS: 0.3% acidity + 75% Guava juice: 25% Papaya juice) while, both was (909.09) and (1.54) recorded lowest under the treatment T_3 **(**10% Juice: 14% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice), respectively. The highest benefit: cost ratio under the treatment of T_{10} could be attributed to good gross monetary returns and comparatively moderate cost of production that resulted in high benefit: cost ratio. The lowest benefit: cost ratio (1.54) in treatment T_3 may be due to lowest gross monetary returns.

Table 4.26: Effect of recipe treatments on economics of blended guava and papaya RTS

Treatments	Cost of production (Rs)	Gross return 100 bottle(Rs)	Net return 100 bottle(Rs)	Benefit: Cost ratio
T_0(10% Juice: 15% TSS: 0.3% acidity + No Blending)	589.50	1500	910.50	1.55
T_1(10% Juice: 14% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	561.84	1500	938.16	1.67
T_2(10% Juice: 14% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	574.67	1500	925.33	1.61
T_3(10% Juice: 14% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	590.91	1500	909.09	1.54
T_4(10% Juice: 13% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	554.34	1500	945.66	1.71
T_5(10% Juice: 13% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	567.18	1500	932.82	1.64
T_6(10% Juice: 13% TSS: 0.3% acidity + 75% Guava juice: 25% Papaya juice)	583.41	1500	916.59	1.57
T_7(10% Juice: 12% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	546.84	1500	953.16	1.74
T_8(10% Juice: 12% TSS: 0.3% acidity + 50% Guava juice: 50% Papaya juice)	559.65	1500	940.35	1.68
T_9(10% Juice: 12% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	575.91	1500	924.09	1.60
T_{10}(10% Juice: 11% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice)	539.34	1500	960.66	1.78
T_{11}(10% Juice: 11% TSS: 0.3% acidity +50% Guava juice: 50% Papaya juice)	552.17	1500	947.83	1.72
T_{12}(10% Juice: 11% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)	568.41	1500	931.59	1.64

CHAPTER-V

SUMMARY AND CONCLUSIONS

The present investigation entitled "**Studies on effect of blending impact of guava (*Psidium guajava* L.) and papaya (*Carica papaya* L.) pulp on recipe standardization of blended nectar and RTS (ready to serve) beverages**" was conducted in the Horticulture Processing Laboratory Department of Fruit Science, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.) during the year 2015-16.The investigation was undertaken with a view to assess the physico-chemical composition of guava and papaya fruit, impact of blending on recipe standarization of nectar and RTS, organoleptic quality and shelf life of blended guava and papaya nectar and RTS beverages during storage upto 90 days under ambient condition.

The experimental material consisted of guava and papaya fruits and thirteen treatments with combination of four recipe including one standard recipe without blending and three blending ratio of guava and papaya i.e., 25:75, 50:50 and 75:25, respectively. The four different recipes were maintained with varying levels of TSS for nectar (20-16%) and RTS (15-11%). Thus, the treatment combinations were twenty six and replicated thrice under Completely Randomized Design.

The fresh and mature fruits of guava and papaya were procured from the Horticulture Farm, (IGKV) and analyzed for physico-chemical characters. Guava and Papaya pulp were blended in required ratio as per treatment combination for preparation of nectar and RTS. Prepared blended nectar and RTS were stored under ambient condition upto 90 days of storage for their various chemical studies. All the samples were analysed periodically at 30 days interval. The results of the experiment obtained during studies are summarized as under:

The amount of ascorbic acid is one of the important parameter of nectar and RTS to test their nutritive value. After processing, the ascorbic acid content in blended guava and papaya nectar and RTS decreased with increase in storage period upto 90 days at ambient condition. The maximum ascorbic acid was retained in the nectar having recipe T_6 (20% Juice: 18% TSS: 0.3% acidity + 75%

Guava juice: 25% Papaya juice) and in RTS with the recipe T_3 (10% Juice: 11% TSS: 0.3% acidity + 75% Guava juice: 25% Papaya juice). The level of ascorbic acid was found to be minimum in nectar T_{10} (20% Juice: 16% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice) and RTS under the recipe T_{10} (10% Juice: 11% TSS: 0.3% acidity +25% Guava juice: 75% Papaya juice), respectively.

The acidity in blended guava and papaya nectar and RTS increased with all the recipe treatments at increasing period of storage upto 90 days under ambient condition. The acidity was found to be highest having recipe T_{10}(20% Juice: 16% TSS: 0.3%acidity + 25% Guava juice: 75% Papaya juice) for nectar and T_{10} (10% Juice: 11% TSS: 0.3% acidity +25% Guava juice: 75% Papaya juice) for RTS.While, the recipe treatment T_6(20% Juice: 18 % TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice)for nectar and T_3(10% Juice: 14% TSS: 0.3% acidity + 75% Guava juice: 25% Papaya juice) for RTS had minimum acidity during storage.

The TSS increased gradually in the nectar and RTS during storage period upto 90 days at ambient condition. The maximum TSS content was recorded with the treatment T_0 (20% Juice: 20% TSS: 0.3% acidity + No Blending) for nectar and T_0 (10% Juice: 15% TSS: 0.3% acidity + No Blending) for RTS. While, the minimum TSS was recorded with the treatment T_{12} (20% Juice: 16% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice) for nectar and T_{12} (10% Juice: 11% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice) for RTS.

A gradual decline in the pH of nectar and RTS was recorded throughout the storage period upto 90 days. The maximum pH was found with the recipe T_6 (20% Juice: 18% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice) for nectar and T_3 (10% Juice: 14% TSS: 0.3% acidity + 75% Guava juice: 25% Papaya juice) for RTS during storage. Whereas, the minimum pH was noted with the recipe T_{10} (20% Juice: 16% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice) in nectar and T_{10} (10% Juice: 11% TSS: 0.3% acidity +25% Guava juice: 75% Papaya juice) in RTS during storage.

The total sugar content in nectar and RTS showed an increasing trend with all the recipe treatments at the increasing period of storage upto 90 days

under ambient condition. The treatment having recipe T_{10} (20% juice : 16% TSS +0.3% acidity + 25% guava juice: 75% papaya juice) had a higher content of total sugar in nectar and T_{10}(10% Juice: 11% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice) for RTS, while the recipe T_6 (20% Juice: 18 % TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice) in nectar and T_3 (10% Juice: 14% TSS: 0.3%acidity + 75% Guava juice: 25% Papaya juice) in RTS contained its minimum level during storage upto 90 days.

There was also an increasing trend of reducing sugar in nectar and RTS with all the recipe treatments at increasing period of storage under ambient condition. The treatment having recipe T_{10}(20% juice : 16% TSS +0.3% acidity + 25% guava juice: 75% papaya juice) had a higher content of reducing sugar in nectar and for RTS T_{10}(10% Juice: 11% TSS: 0.3%acidity +25% Guava juice: 75% Papaya juice), while the recipe T_6(20% juice :18% TSS :0.3% acidity +25%guava juice: 75% papaya juice) in nectar and T_3(10% Juice: 14% TSS: 0.3% acidity + 75% Guava juice: 25% Papaya juice) in RTS contained its minimum level during storage upto 90 days.

A progressive decrease in non-reducing sugar was noted throughout the storage period upto 90 days at ambient condition The maximum non-reducing sugar was retained in the nectar having recipe T_6 (20% Juice: 18% TSS: 0.3% acidity+75% Guava juice: 25% Papaya juice) and in RTS with the recipe T_3 (10% Juice: 14% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice). The level of non-reducing sugar was found to be minimum in nectar T_{10} (20% Juice: 16% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice) and RTS under the recipe T_{10} (10% Juice: 11% TSS: 0.3% acidity +25% Guava juice: 75% Papaya juice), respectively.

The organoleptic score reflects the acceptability of the produce to the consumer. The organoleptic score decreased with all the recipe treatments at increasing period of storage upto 90 days at ambient condition. The maximum overall acceptability was retained by treatment T_6 (20% Juice: 18% TSS: 0.3% acidity+75% Guava juice: 25% Papaya juice) in nectar and minimum acceptability was found in treatment T_{12} (10% Juice: 11% TSS: 0.3%acidity +75% Guava juice:

25% Papaya juice). The maximum overall acceptability was gained by treatment T_3 (10% Juice: 14% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice) in RTS and minimum overall acceptability gained by T_{10} (10% Juice: 11% TSS: 0.3% acidity + 25% Guava juice: 75% Papaya juice).

CONCLUSIONS

- The nectar prepared from the recipe T_6 (20% Juice: 18% TSS: 0.3% acidity+75% Guava juice: 25% Papaya juice) contained highest ascorbic acid, pH, non-reducing sugar and organoleptic score as compared to other recipes during storage. Therefore, the nectar may be prepared from the above standardized recipe and commercialized.
- The RTS prepared from the recipe T_3 (10% Juice: 14% TSS: 0.3% acidity +75% Guava juice: 25% Papaya juice) had highest ascorbic acid, pH, non-reducing sugar and organoleptic score than other recipe treatments during storage upto 90 days under ambient condition. Hence, the standardized recipe may be used for RTS preparation and adopted on commercial scale.
- The study concludes that 75:25 ratio for blending of guava and papaya was most acceptable for preparation of nectar and RTS with minimum changes in TSS, acidity, pH, reducing and non-reducing sugar followed by 50: 50 ratio of guava and papaya blending. Hence, upto 50% papaya pulp blending was found to be acceptable by the consumers.

SUGGESTIONS FOR FUTURE RESEARCH WORK

- The present experiment is based on the results of three month study. Hence, it may be repeated for three or more months to find out conformity of the results so that definite recommendations could be made for an ideal blended (guava+ papaya) nectar and RTS preparation.
- The recipes standardized for nectar and RTS can be exploited for commercial use after concrete recommendations.
- Research work should be intensified for the processing of beverages based on locally available raw material like guava and papaya.
- A little attention has been made so far in the field of fruit processing technology in Chhattisgarh region. Hence, there is an urgent need to

standardize the various recipes for different preserved products of guava and papaya.

- A variety of fruit product can be developed by blending less exploited fruits with other fruits to improve the utilization of less exploited fruits.

REFERENCES

Adrees, M., Younis, M., Farooq, U. and Hussain, K. 2010. Nutritional quality evaluation of different guava varieties. Pak. J. Agri. Sci., 47(1): 1-4.

Anonymous. 2012. Indian Horticulture Database. www.nhb.gov.in

Attri, B.L., Lal, B.B. and Joshi, V.K. 1998. Physico-chemical characteristics, sensory quality and storage behaviour of sand pear juice blended with temperate fruit juices/ pulps. Indian Fd. Pack., 52 (6): 36-42.

Aulakh, P.S. 2004. Effect of seasonal variation on yield and fruit quality of some promising guava under arid irrigated region of Punjab. Haryana J. Hort. Sci., 33 (3/4): 170-171.

Bal, L.M., Ahmad T., Senapati, A.K. and Pandit, P.S. 2014. Evaluation of Quality Attributes During Storage of Guava Nectar cv. Lalit from Different Pulp and TSS Ratio. J. Fd. Process. Technol., 5: 329.

Baramanray, A., Gupta, O.P. and Dhawan, S.S. 1995. Evaluation of guava (*Psidium guajava* L.) hybrids for making nectar. Haryana J. Hort. Sci., 24 (2): 102-109.

Bhardwaj, R.L. and Mukherjee, J. 2011. Effects of fruit juice blending ratios on Kinnow juice preservation at ambient storage condition. Afr. J. Food Sci. 5(5): 281 – 286.

Bhargawa, S., Kapoor, S., Singh, R.P. and Sharma, S. 2014. Studies on Aloe Juice Supplemented Kinnow Nectar Res. J. Agriculture and Forestry Sci. 2(8): 14-20.

Biswas, B., Sen, S.K. and Maiti, S.C. 1990. Physico-chemical characterstics of some Papaya Cultivars. Horticulture Journal, 3: 20-25.

Bohra, P. and Srinivas, K.N. 2015. 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., 19(1): 70-74.

Bons, H.K. and Dhawan, S.S. 2003. Evaluation of methods for preparation of guava juice concentrate. Crop. Sci., 25 (2): 364 -368.

Brekke, J.E., Cavaletto, C.G., Nakayama, T.O.M. and Suehisa, R.H. 1976. Effect of storage temperature and container lining on some quality attributes of papaya nectar. J. Agri. Fd. Chem., 24(2): 341-343.

Byanna, C.N. and Gowda, I.N.D. 2012. Standardization of recipe for preparation of nectar from sweet orange (*Citrus sinensis.* Osbeck) var. Sathgudi and its storage. Asian J. Hort., 7(2): 250-255.

Chan, H.T.Jr. and Cavaletto, C.G. 1982. Aseptically packaged papaya and guava puree: Changes in chemical and sensory quality during processing and storage. J. Food Sci., 47: 1164-1169.

Choudhary, Madan Lal, Dikshit, S.N. and Sharma, H.G. 2006. Studies on preparation and biochemical changes in guava RTS beverage during storage. Indian J. Arid Hort., 1 (1): 78-79.

Chundawat, B.S., Singh, H.K. and Gupta O.P. 1978. Effect of different method of ripening in guava (*Psidium guajava* L.) on quality of fruits. Haryana J. Hort. Sci., **7** (1-2): 28-30.

Chundawat, B.S., Singh, J.P., Kaisna, R.L. and Gupta, O.P. 1976. Post-harvest studies on guava fruit and effect of packaging and storage period on the quality of fruit. Haryana J. Hort. Sci., 5 (3&4): 130-136.

Das, Sukhen Chandra and Dinesh, M.R. 2014. Evaluation of certain papaya varieties and hybrids for physico-chemical characteristics. Asian J. Hort., 9(1): 237-239.

Deka, B.C. and Bidyut, C. 2000. Preparation and storage of mixed fruit juice spiced beverages. Ph.D. thesis, IARI, New Delhi.

Deka, B.C., Sethi, V., Suneja, P. and Srivastava, V.K. 2004. Physico – chemical changes of lime-aonla spiced beverage during storage. J. Fd. Sci. Technol., 41(31): 329-332.

Deka, B.S., Sethi, V., Prasad, R. and Batra, P.K. 2001. Application of mixtures methodology for beverages from mixed fruit juice / pulp. J. Food Sci. & Technol., 38(6): 615-618.

Dubey, S., Banafar, R.N.S. and Sahu, G.D. 2011. Effect of storage period on biochemical composition of guava nectar. Environment and Ecology, 29(4): 1911- 1917.

El-Mansy, H.A., Sharoba, A.M., Bahlol, H.EL.M. and El-Desouky. 2005. A. I. Rheological Properties of Mango & Papaya Nectar Blends.Annals of Agric. Sc., Moshtohor, 43(2): 665-686.

Godara, R.K. and Pareek, O.P. 1985. Effect of temperature on storage life of ready-to-serve date juice beverage. Indian J. Agricultural Sci., 53 (5): 347-349.

Gomez, K.A. and Gomez, A. 1985. Statistical procedure for agriculture research. wiley- International Science Publication John and Sons. Newyork. Indian Fd. Pack., 68-72.

Harnanan, S.W., Bains, G.C. and Singh, K.K. 1980. Studies on the processing of pink and white fleshed guava varieties for pulp. Punjab Hort. J., 20: 179-189.

Hussain, I., Zaib, A., and Ayub, M. 2010. Quality attributes of apple and apricot blend juice preserved with potassium sorbate during storage at low temperature. Intern. J. Food Sci., 12: 80-86.

Jain P.K., Priyanka, J. and Prabhat, K.N. 2011. Quality of guava and papaya Fruit pulp as Influenced by blending ratio and storage period. Am. J. Food Technol., 6: 507-512.

Jain, P.K. and Asati, V.K. 2004. Evaluation of guava cultivars for pulp preparation. J. Fd. Sci. Technol., 41(6): 684-686.

Jain,V. and Thakre, M. 2013. Storage study of blended nectar of papaya and banana under different storage conditions. Progressive Horticulture, 45(1): 100-103.

Jakhar, M.S. Vaish, P.K. and Pathak, S. 2012. Studies on the standardization and preservation of guava (*Psidium guajava* L.) and barbados cherry (*Malpighia glabra* L.) pulp blended ready-to-serve beverage. Internat. J. Proc. & Post Harvest Technol., 3 (2): 246-250.

Jan, A. and Masih, D. 2012. Development and quality evaluation of pineapple juice blend with carrot and orange juice. International Journal of Scientific and Research Publications, 2(8).

Jana, B.R., Munsi, P.S., Manna, D.C. and Das, B. 2010. Evaluation of Guava (*Psidium guajava* L.) Genotypes Based on Fruit Morphology, Physico-chemical Properties and Yield under Eastern Plateau Condition. Indian J. Plant Genetic Resources, 23(1): 25:29.

Jumde, A.D., Shukla, R.N. and Gousoddin. 2015. Development and Chemical Analysis of Watermelon Blends with Beetroot juice during Storage. International J. of Science, Engineering and Technology, 3(4): 960-964.

Kalra, S.K. and Revathi, G. 1981. Storage studies on guava pulp. Indian Food Packer., 37: 29-33.

Kalra, S.K., Tandon, D., Garg, N. and Singh, B.P. 1991. Quality evaluation of some market fruit drinks. Indian Fd. Pack., 45 (3): 48-53.

Kapoor, S. and Ranote, P.S. 2015. Antioxidant Potentials and Quality of Blended Pear-Jamun (*Syzygium cumini* L.) Juice. Int. Res. J. Biological Sci., 4(4): 30-37.

Kaur, N., Kumar, A., Monga, P.K. and Arora, P.K. 2011. Biochemical studies in fruits of guava cultivars. Asian J. Hort., 6 (1): 122- 123.

Kausar, H., Saeed, S., Ahmad, M.M. and Salam, A. 2012. Development and storage stability of cucumber-melon drink. J. Agric. Res., 50(2): 239-248.

Kerure, Y.E. and Kjedkar, D.M. 1982. Studies on ready-to-serve beverages. International Food Abstract of Technical Papers, 7: 1.

Khurdiya, D.S. 1980. A new beverage from dried ber (*Zizyphus mauritiana* Lamk.). J. Fd. Sci. Technol., 17: 158-159.

Kocher, G.S. and Pooja. 2011. Status of wine production from guava (*Psidium guajava* L.): A traditional fruit of India. African J. Fd. Sci., 5 (16): 851-860.

Kumar, S. 1990. Studies on post-harvest technology of papaya fruits. Ph.D. Thesis, NDUA & T, Kumarganj, Faizabad, (U.P.)

Kumar, S.R. and Manimegalai, G. 2001. Storage stability of mixed fruit juice, RTS beverages in different storage conditions. Beverage & Food World, 28 (2): 28-29.

Mahadeviah, M. 1996. Brown and pink discolouration in some processed fruit and vegetable products and their presentation. Indian Food Pack., 20(2) : 5-9.

Malav, M., Gupta, R. and Nagar, T. 2014. Studies on bio-chemical composition of orange based blended ready-to-serve (RTS) beverages. Biosci. Biotech. Res. Comm., 7(1): 78-83.

Mall, P. and Tondon, D.K. 2007. Develpoment of guava-aonla blended beverage. Acta Horticulturae, 735: 555-560.

Mandal, P. and Pathak, S. 2005. Studies on blending of pineapple juice with different ratios of phalsa juice for preparation of nectar beverages. Orissa J. Hort., 33 (1): 65-68.

Mehta, G.L. and Tomar, M.C. 1980. Studies on dehydration of tropical fruits in Uttar Pradesh. ll. Guava (*Psidium guajava* L.). Indian Fd. Pack., 34 (4): 8.

Murari, K. and Verma, R.A. 1989. Studies on the effect of varieties and pulp extraction methods on the quality of guava nectar. Indian Food Packer 43: 11-15.

Nidhi, Gehlot, R., Singh, R. and Rana, M.K. 2008. Changes in chemical composition of ready-to- serve bael- guava blended beverage during storage.J. Food Sci. Tecnol., 45(4): 378-380.

Nidhi, Gehlot, R., Singh, R., Siddiqui, S. and Rana, M.K. 2007. Changes in chemical composition of bael-guava blend ready-to-serve beverage and squash during storage. Haryana J. Hort. Sci., 36(1/2): 46-48.

Othman, O.C. 2009. Physical and chemical composition of storage-ripened papaya.Tanz. J. Sci., 35: 47-56.

Pal, D.K. and Subramanyam, M.D. 1980. Studies on physico-chemical composition of fruits of twelve Papaya varieties. J. Food Sci. Technol., 17(6): 254.

Pal, R. K. and Susanta, Roy, K.1989. Studies on extraction of pulp and development of beverages from green mangoes. Indian Food Packer,43(3): 27-34.

Pandey, A. K. and Singh, J. 1999. Studies on preparation and preservation of guava ready-to-serve beverage. Indian J. Hort., 56 (2): 130-132.

Pandey, A.K. and Singh, I.S. 1998. Studies on preparation and preservation of guava squash. Prog. Hort., 30(3-4): 190-193.

Patel, R.M., Pandey, A., Dwivedi, S.K. and Sharma, G. 2005 . Studies on physico-chemical properties of guava (*Psidium guajava* L.) cultivars grown in Rewa (M.P.). Plant Archives., 5(2): 597-600.

Patil, Ravishankar, M., Thippanna, K.S., Prashanth, S.J. and Chikkasubbanna, V. 2011. Physico-chemical character,sensory quality and storage behaviour of rose apple squash blended with Jamun, Internat. J. Proc. & Post Harvest Technol., 2 (2): 102-105.

Pebam, N. 2010. Studies on post harvest technology of aonla (*Emblica officinalis* Gaertn.) fruits. Ph.D. Thesis, Allahabad Agriculture Institute, Allahabad, U.P. (India).

Prasad, R.N. and Mali, P.C. 2000. Changes in physico-chemical characteristics of pomegranate squash during storage. Indian J. Hort., 57 (1): 18-20.

Rabbani, A. and Singh, I.S. 1988. Evaluation of local sucking mango varieties for beverage industry. Acta Hort., 231: 715-720.

Rajput, C.B.S., Singh, S.N. and Singh, N.P. 1977. Effect of certain plant growth substance in guava (*Psidium guajava* L.). Haryana J. Hort. Sci., 6 (3 & 4): 117.

Ranganna, S. 1997. Handbook of analysis and quality control for fruit and vegetable products. Tata McGraw Hill Publishing Co. Ltd., New Delhi.

Rani, T. B., and Babu, J. D. 2015. Acceptability and storage studies of guava-aloe nectar blends. Asian J. Hort., 10(1): 80-85.

Rao, M.V.N. 1974. Papaya farm information unit Bult. 9, Ministry of Agriculture, New Delhi.

Reddy, N.N., Gangopadhyay, R.M. and Kumar, R. 1999. Evaluation of guava cultivar under rainfed sub-humid region of Chhotanagpur plateau. Indian J. Hort., 56 (2): 135-140.

Sachan, B.P., Pandey, D. and Shankar, G. 1969. Influence of weather on the chemical composition of guava (*Psidium guajava* L.) fruits var. Allahabad Safeda. Punjab Hort. J., (3 &4): 119-123.

Sandhu, K.S. and Sindhu, J.S. 1992. Studies on the development of multi fruit ready-to-serve beverage. J. Plant Sci. Res., 8: 87-89.

Saravanan, K., Godara, R.K., Goyal, R.K. and Sharma, R.K. 2004. Standardization of recipe for papaya nectar and its storage. Haryana J. Hort. Sci., 33(3&4): 204-206.

Sasikumar, R. 2013. Effect of processing on physio-chemical and sensory parameters of low calorie therapeutic RTS beverage blend of Aloe-Vera and Aonla fruit using artificial sweeteners. Asian J. Food Agro-Industry. 6(06): 337-346.

Selvi, J., Banumathi, P., Kanchana, S. and Ilamaran, M. 2013. Formulation of therapeutic drink to boon human health (guava-lime-ginger RTS beverage). Food Sci. Res. J., 4(2): 141-146.

Shaheel, S.K., Swami, D.V., Kumar, B.P. and Krishna, K. Uma. 2015. Effect of storage period on chemical properties of rts prepared from karonda (*Carissa carandas* L.) Blended juices. Plant Archives., 15(1): 35-40.

Sharma , A. and Singh, K. 2005. Effect of different treatments on TSS, sugars, viscosity and suspended pulp of lime juice during storage. Haryana J. Hort. Sci., 33(1-2): 45-46.

Sharma, D.S., 2014. Quality Evaluation and Storage Stability of Jamun- Mango Blended Jam. International J. Life Sci., 9(3): 953-957.

Sharma, I., Kaul, R., and Anju, B. 2008. Effect of different treatment combinations of guava and papaya on quality and storability of ready-to-serve beverages. J. Res. Skuast J., 7(1): 1-8.

Sharma, M., Gehlot, R., Singh, R. and Siddiqui, S. 2009. Changes in chemical constituents of guava-jamun blends ready-to-serve drink and squash during storage. Haryana J. Hort. Sci., 38(3/4): 259-263.

Shukla, A. 2005. Studies on physico-chemical characteristics, sensory quality and storage behaviour of beverages (RTS and nectar) prepared from guava and pineapple. M.Sc. (Ag.) Thesis, IGKV, Raipur (CG).

Sindumathi, G., Premalatha, M.R.,2015. Development and storage studies of naturally flavored papaya-pineapple blended ready-to-serve (RTS) beverages. International Journal of Science and Research (IJSR). 4(2): 856-860.

Singh, A.K., Mishra, S.K. and Singh, A. 2008 . Studies on physico-chemical characters of different guava (*Psidium guajava* L.) cultivars. Plant Archives., 8(1): 453:455.

Singh, I.P. 2003. Performance of different guava (*Psidium guajava* L.) cultivars under Tripura climatic conditions. Prog. Hort., 35(1): 55-58.

Singh, I.S. and Dhawan,S.S. 1983. Potentiality of various fruits for processing industry. Indian Fd. Pack., 35(6): 29.

Singh, N.P. and Rajput, C.B.S. 1977. Chemical composition of guava fruit as Influenced by nitrogen applications. Prog. Hort., 9 (2): 65.

Singh, O., Pathak, S. and Singh R. 2013. Studies on Suitable Blending Ratio for the Preparation of Aonla based Quality Beverages. Annals of Horticulture., 6(2): 198-204.

Singh, P. 1988. Studies on ripening and processing of litchi (*Litchi chinensis* Sonn.) fruits. Ph.D. Thesis, NDUA&T, Faizabad (U.P.)

Singh, P. and Singh, I.S. 1994. Physico-chemical changes during storage of litchi (*Litchi chinensis*) beverages. Indian J. agri. Sci., 64 (3): 168-170.

Singh, P., Shukla, A., Singh, R., & Kumar Singh, A. 2005. Utilization of Guava Juice by Value Addition through Blended Beverages. *In International Guava Symposium*. 735: 639-645.

Singh, Prabhakar and Singh, I.S. 1995. Estimation of pulp and water ratio for juice extraction in litchi fruits. Environment and Ecology, 13(4): 988-989.

Singh, R. 2005. Studies on physico-chemical characteristics, sensory quality and storage behaviour of beverages (RTS and nectar) from custard apple. M.Sc. (Ag.) Thesis, IGKV, Raipur (CG).

Tiwari, R.B. 2000. Studies on blending of guava and papaya pulp for RTS beverage. Indian Fd. Pack., 54 (2): 68-72.

Tripathi, V.K., Lyndgoh, K. and Singh, S. 1992. Studies on blending of pineapple juice with different ratios of guava juice for preparation of RTS beverages. Prog. Hort., 24(1-2): 60-65.

Vaidya, R.N., Kotecha, P.M. and Kadam, S.S. (1998). Studies on mixed fruit juice beverages based on ber, pomegranate and guava. Beverage and Food World, 25 (2): 41-47.

Vyas, K.K., Sharma, P.C., Joshi, V.K. and Shrivastava, M.P. 1989. Standardization of a method for juice extraction and preparation of refreshing RTS, nectar from Rhodo petals (*Rhododendron abroreaum*). Indian Fd. Pack., 43(4): 8-12.

Yadav, A., Singh, S.J., Chandra, S., Kumar, V. and Goyal, S.K. 2012. Studies on development and various properties of banana RTS beverages. Annals of Hort., 5(2): 179-184.

APPENDIX-A: Weekly Meteorological data during the storage period (December 2015 to April-2016)

Week No.	Date	Temperature (^{o} C)		Rainfall (mm)	Relative Humidity (%)		Wind velocity(Km/hr)	Evaporation (mm)	Sunshine(hr)
		Max.	Min.		I	II			
49	Dec 04-10	31.0	13.8	0.0	87.6	28.0	2.2	2.9	7.9
50	11-17	29.7	18.1	4.4	77.7	50.0	3.0	2.7	3.2
51	18-24	27.2	16.8	9.4	85.0	52.9	3.3	2.1	2.0
52	25-31	27.1	9.6	0.0	86.4	24.7	2.1	2.8	7.1
1	Jan 01-07	30.5	12.1	0.0	81.9	27.3	2.0	2.9	7.9
2	08-14	29.3	11.1	0.0	87.1	26.6	2.5	3.1	7.5
3	15-21	27.4	14.3	2.0	88.1	49.3	3.6	2.4	3.8
4	22-28	27.0	9.0	0.0	90.0	33.3	2.6	3.0	8.7
5	29-04	31.7	14.2	0.0	82.6	31.3	2.8	3.7	9.1
6	Feb05-11	31.1	14.0	0.0	78.3	32.3	2.9	4.2	8.9
7	12-18	32.6	19.2	0.3	71.1	40.1	3.2	4.1	5.2
8	19-25	34.9	19.3	0.0	69.1	31.3	3.2	4.6	6.9
9	26-04	33.5	20.5	0.0	81.0	35.7	3.2	4.0	4.0
10	Mar 05-11	34.0	20.2	0.6	72.6	26.9	4.3	5.5	7.4
11	12-18	34.6	21.3	2.9	73.6	38.0	4.8	5.4	7.4
12	19-25	37.8	19.6	0.0	59.1	13.7	4.3	7.6	9.3
13	26-01	38.6	21.8	0.0	67.3	25.1	4.0	6.3	8.2
14	Apr 02-08	40.1	24.3	5.4	58.9	23.0	5.7	8.3	7.3
15	09-15	41.3	24.9	0.0	48.4	13.1	5.5	9.2	9.6
16	16-22	43.2	29.2	0.0	40.0	16.9	6.7	11.2	9.9
17	23-29	42.9	26.2	0.0	44.1	16.1	6.8	11.9	10.0

APPENDIX-B: Cost of nectar preparation and Benefit Cost ratio as influenced by various treatments

Treatment	Cost of guava for 100 bottles (Rs)	Cost of papaya for 100 bottles (Rs)	Cost of citric acid for 100 bottles (Rs)	Cost of sugar for 100 bottles (Rs)	Cost of fuel for 100 bottles (Rs)	Cost of cap for 100 bottles (Rs)	Labour cost		Total cost for 100 bottles (Rs)	Selling price per bottle (Rs)	Gross return for 100 bottles (Rs)	Net return for 100 bottles (Rs)	B:C ratio
							Input Mandays	Cost (Rs)					
T_0	250.0	-	27.5	136.5	35	100	1	200	749.00	15	1500	751.00	1.00
T_1	62.5	99.36	41.6	128.25	35	100	1	200	666.71	15	1500	833.29	1.25
T_2	125.0	66.25	38.4	132.00	35	100	1	200	696.65	15	1500	803.35	1.15
T_3	187.5	33.13	38.4	130.8	35	100	1	200	724.83	15	1500	775.17	1.07
T_4	62.5	99.36	41.6	126.75	35	100	1	200	665.21	15	1500	834.79	1.25
T_5	125.0	66.25	38.4	124.5	35	100	1	200	689.15	15	1500	810.85	1.18
T_6	187.5	33.13	38.4	129.3	35	100	1	200	723.33	15	1500	776.67	1.07
T_7	62.5	99.36	41.6	119.25	35	100	1	200	654.51	15	1500	845.49	1.29
T_8	125.0	66.25	38.4	117.00	35	100	1	200	684.85	15	1500	815.15	1.19
T_9	187.5	33.13	38.4	118.8	35	100	1	200	712.83	15	1500	787.17	1.10
T_{10}	62.5	99.36	38.4	111.7	35	100	1	200	646.96	15	1500	853.04	1.32
T_{11}	125.0	66.25	41.6	109.5	35	100	1	200	677.35	15	1500	822.65	1.21
T_{12}	187.5	33.13	38.4	111.3	35	100	1	200	705.33	15	1500	794.67	1.13

*Guava Rs/Kg-40 /- * Papaya Rs/Kg-25/- * Sugar Rs/Kg 30/- *Citric acid 25g-16/-

The costs of bottles are excluded from cost of production as the bottles used for nectar are recycled.

APPENDIX-C: Cost of RTS preparation and Benefit Cost ratio as influenced by various treatments

Treatment	Cost of guava for 100 bottles (Rs)	Cost of papaya for 100 bottles (Rs)	Cost of citric acid for 100 bottles (Rs)	Cost of sugar for 100 bottles (Rs)	Cost of fuel for 100 bottles (Rs)	Cost of cap for 100 bottles (Rs)	Labour cost		Total cost for 100 bottles (Rs)	Selling price per bottle (Rs)	Gross return for 100 bottles (Rs)	Net return for 100 bottles (Rs)	B:C ratio
							Input Mandays	Cost (Rs)					
T_0	125.0	-	27.5	102	35	100	1	200	589.50	15	1500	910.5	1.55
T_1	31.25	49.69	44.8	101.1	35	100	1	200	561.84	15	1500	938.16	1.67
T_2	62.5	33.10	43.2	100.87	35	100	1	200	574.67	15	1500	925.33	1.61
T_3	93.75	16.56	44.8	100.8	35	100	1	200	590.91	15	1500	909.09	1.54
T_4	80.94	49.69	44.8	93.6	35	100	1	200	554.67	15	1500	945.66	1.71
T_5	95.6	33.10	43.3	93.38	35	100	1	200	567.18	15	1500	932.82	1.64
T_6	110.31	16.56	44.8	93.30	35	100	1	200	583.41	15	1500	916.59	1.57
T_7	80.94	49.69	44.8	86.10	35	100	1	200	546.84	15	1500	953.16	1.74
T_8	95.6	33.10	43.3	85.85	35	100	1	200	559.65	15	1500	940.35	1.68
T_9	110.31	16.56	44.8	85.8	35	100	1	200	575.91	15	1500	924.09	1.6
T_{10}	80.94	49.69	44.8	78.6	35	100	1	200	539.34	15	1500	960.66	1.78
T_{11}	95.6	33.10	43.3	78.37	35	100	1	200	552.17	15	1500	947.83	1.72
T_{12}	110.31	16.56	44.8	78.30	35	100	1	200	568.41	15	1500	931.59	1.64

*Guava Rs/Kg-40 /- * Papaya Rs/Kg-25/- * Sugar Rs/Kg 30/- *Citric acid 25g-16/-

The costs of bottles are excluded from cost of production as the bottles used for nectar are recycled.

APPENDIX D: Hedonic rating test of blended guava and papaya nectar for judges

Name:
Date:

Product: Blended Guava and Papaya Nectar

Taste the sample and check how much you like or dislike. Use the appropriate scale to show your attitude by checking at the point that best describes your feeling about the sample. Remember you are the only who can tell what you like. An honest expression of your personal feeling will help in evaluation.

Treatments	Colour and appearance	Aroma	Taste	Overall acceptability
T_0				
T_1				
T_2				
T_3				
T_4				
T_5				
T_6				
T_7				
T_8				
T_9				
T_{10}				
T_{11}				
T_{12}				

Scale: 9- Like extremely
8- Like very much
7- Like moderately
6- Like slightly
5- Neither like nor dislike
4- Dislike slightly
3- Dislike moderately
2- Dislike very much
1- Dislike extremely

APPENDIX E: Hedonic rating test of blended guava and papaya RTS for judges

Name:
Date:

Product: Blended Guava and Papaya RTS

Taste the sample and check how much you like or dislike. Use the appropriate scale to show your attitude by checking at the point that best describes your feeling about the sample. Remember you are the only who can tell what you like. An honest expression of your personal feeling will help in evaluation.

Treatments	Colour and appearance	Aroma	Taste	Overall acceptability
T_0				
T_1				
T_2				
T_3				
T_4				
T_5				
T_6				
T_7				
T_8				
T_9				
T_{10}				
T_{11}				
T_{12}				

Scale: 9- Like extremely
8- Like very much
7- Like moderately
6- Like slightly
5- Neither like nor dislike
4- Dislike slightly
3- Dislike moderately
2- Dislike very much
1- Dislike extremely

RESUME

Name : Yuthika Kumari

Date of Birth : 17-03-1991

Present Address : Room No. 20, Kadambari girl's hostel,
College of Agriculture, IGKV, Krishak Nagar,
Jora, Raipur (C.G.), PIN- 492012

Phone : 9685267450(M)

E. mail : yuthikakumari5@gmail.com

Permanent address : C/o Late Narsing Pandit,Shiv Sadan,
Bilasi town, Deoghar, Jharkhand
PIN - 814112

Academic Qualifications :

Degree	Year	University/Institute
10th	2007	CBSE, D.A.V. Public School, Etwa, Begusarai, Bihar
12th	2009	CBSE,B.R.D.A.V. Public School, RTS, Begusarai, Bihar
B.Sc.(Ag)	2014	AAU, Jorhat, Assam
M.Sc.(Hort) Fruit Science	2016 (contd.)	IGKV, Raipur, C.G.

Professional Experience : Rural Agricultural Work Experience Programme (RAWEP)

Membership of Professional Societies : NIL

Awards *I* Recognitions : NIL

Publication : NIL

Yuthika Kumari

Signature

JOURNAL OF AGRICULTURAL ISSUES
INDIRA GANDHI KRISHI VISHWAVIDYALAYA
RAIPUR - 492 012 (C.G.), INDIA

Dr. S.S. Kolhe
Professor, Agronomy & Editor In Chief

No./JAI/2016/115

Date : 08/07/2016

Dear

Miss Yuthika Kumari
Department of Fruit Science
CoA, IGKV, Raipur

Your research article entitled "**Effect of blending of Guava and Papaya pulp on recipe standardization of RTS (Ready to Serve) beverage"** authored by **Yuthika Kumari, S.N. Dikshit and H.G. Sharma** has been received for publication in the Journal of Agricultural Issues (JAI) and has assigned the reference No. MS JAI **805** dated **08.07.2016**.

In all future correspondence, please quote the reference number of your research article.

Thanks for the interest shown in the research article publication in the JAI.

8/7/16
Editor In Chief