

**STUDIES ON STANDARDIZATION OF  
OSMODEHYDRATED SLICES AND PRESERVE  
MAKING TECHNOLOGY IN SNAPMELON  
(*Cucumis melo var. momordica*)**

by

**CHOGALE SUCHITA BHANUDAS**  
B.Sc. (Horti.)

**COLLEGE OF HORTICULTURE,  
DR. BALASAHEB SAWANT KONKAN KRISHI VIDYAPEETH,  
DAPOLI- 415 712, DIST. RATNAGIRI (M.S.)**

*September, 2020*

**STUDIES ON STANDARDIZATION OF  
OSMODEHYDRATED SLICES AND PRESERVE  
MAKING TECHNOLOGY IN SNAPMELON  
(*Cucumis melo var. momordica*)**

A thesis submitted to the

**DR. BALASAHEB SAWANT KONKAN KRISHI VIDYAPEETH, DAPOLI**

(Agricultural University)

Dist. Ratnagiri

(Maharashtra State)

*in partial fulfilment of the requirements for the degree of*

*Master of Science (Horticulture)*

in

*VEGETABLE SCIENCE*

by

**Miss. CHOGALE SUCHITA BHANUDAS**

B. Sc. (Horti.)

**COLLEGE OF HORTICULTURE,  
DR. BALASAHEB SAWANT KONKAN KRISHI VIDYAPEETH,  
DAPOLI - 415 712, DIST. RATNAGIRI (M.S.)**

*September, 2020*

**STUDIES ON STANDARDIZATION OF  
OSMODEHYDRATED SLICES AND PRESERVE MAKING  
TECHNOLOGY IN SNAPMELON (*Cucumis melo* var.  
*momordica*)**

A thesis submitted to the

**DR. BALASAHEB SAWANT KONKAN KRISHI VIDYAPEETH, DAPOLI**

(Agricultural University)

Dist. Ratnagiri (Maharashtra State)

*in partial fulfillment of the requirements for the degree of*

*Master of Science (HORTICULTURE)*

in

*VEGETABLE SCIENCE*

by

**Miss. CHOGALE SUCHITA BHANUDAS**

**B. Sc. (Horti.)**

**Approved by the Advisory Committee**

**Chairman and Research Guide:**

**(C. D. Pawar )**

Professor,

College of Horticulture, Dapoli

**Members**

**(P. B. Sanap)**

Vegetable Specialist,  
Vegetable Improvement  
Scheme,  
Central Experiment  
Station, Wakavali, Dapoli

**(V. G. Salavi )**

Professor,  
Department of Soil Science  
and Agril. Chemistry,  
College of Agriculture,  
Dapoli

**(J. S. Dhekale)**

Associate Professor  
Department of Agriculture  
Economics and Statistics,  
College of Agriculture,  
Dapoli

**Dr. C.D. Pawar**

M.Sc. (Agri,) Ph.D. (Hort.)  
Professor,  
College of Horticulture, Dapoli  
Dr. B.S.K.K.V., Dapoli



**CERTIFICATE**

This is to certify that, the thesis entitled “**STUDIES ON STANDARDIZATION OF OSMODEHYDRATED SLICES AND PRESERVE MAKING TECHNOLOGY IN SNAPMELON (*Cucumis melo var. momordica*)**” submitted to College of Horticulture, Dapoli, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Dist. Ratnagiri (Maharashtra State), in the partial fulfillment of the requirements for the degree of **MASTER OF SCIENCE (HORTICULTURE)** in **VEGETABLE SCIENCE**, embodies the results of a piece of *bona-fide* research carried out by **MISS. CHOGALE SUCHITA BHANUDAS (Regd. No. 0173)** under my guidance and supervision and that no part of this thesis has been submitted for any other degree or diploma or published in other form. All the assistance and help received during this course of investigation and the sources of literature has been duly acknowledged by her.

Place: Dapoli  
Date: / /2020

**(C. D. Pawar)**  
Chairman,  
Advisory Committee  
and Research Guide

## **ACKNOWLEDGMENT**

*Gratitude takes three forms "A feeling from heart, an expression in words and a giving in returns", I sincerely thanks all those who directly made this thesis possible...As I devotionally dedicate this piece of work to my parents whose blessing is the pillar of my success.*

*Success is not possible lonely and any creativity is possible only after the involvement of many minds and hands to beautiful it. Emotions cannot be expressed adequately in words it is nearly the formalities. Traditional formal words of acknowledgment will not project the picture of volcano of feeling while expressing a deep sense of gratitude to my known and unknown hands which pushed and put me on right path and enlightened me with their experience, knowledge and wisdom and shall ever remain grateful to them.*

*Heartily, I feel grand pleasure in getting this privilege of offering reverential feeling about Hon. Chairman and Research guide **Dr. C. D. Pawar**, Professor, College of Horticulture, Dapoli, who has the substance of a genius: he convincingly guided and encouraged me to be professional and do the right thing even when the road got tough. Without his persistent help, the goal of this project would not have been realized.*

*I wish to express my deepest gratitude to my advisory committee members **Dr. P. B. Sanap**, Vegetable Specialist, Vegetable Improvement Scheme Central Experiment Station, Wakavali, Dapoli, **Dr. V. G. Salvi**, Head of Department, Department of Soil Science and Agril. Chemistry, and **Dr. J. S. Dhekale**, Associate Professor, Department of Agriculture Economics and Statistics, College of Agriculture Dapoli, for their unique mastery, guidance and support.*

*I wish to show my gratitude to **Dr. B. R. Salvi**, Head and Associate Dean College of Horticulture, for their friendly nature, moral lessons, scholar guidance and trust.*

*I would like to pay my special regards to **Dr. R. G. Khandekar**, Professor, **Dr. P. C. Mali**, Associate Professor, **Prof. Y. R. Parulekar**, Assistant Professor, **Prof. M. M. Kulkarni**, Assistant Professor, **Prof. S. B. Thorat**, Assistant Professor, **Mr. A. V. Agre**, Agril. Assistant, College of Horticulture, **Dr. M. S. Joshi**, Head of Department, Department of Plant Pathology, College of Agriculture, Dapoli.*

*I convey my thanks to all the non-teaching staff, especially Mr. M. B. Sawant, (Agricultural assistant), Shri. Gorivale kaka, Jitu dada, Omkar dada College of Horticulture, Dapoli for their generous help and co-operation during the course of my work and study period.*

*I must express my very profound gratitude to Dr. Sanjay Sawant Sir, Honorable Vice Chancellor, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Dr. P. M. Haldankar Sir, Director of Research for their valuable guidance and provision of necessary facilities for conducting this study.*

*I wish to acknowledge the support and great love of my family, my father Shri. Bhanudas Hasha Chogale, my mother Sau. Hira B. Chogale, and my brothers Vikas and Dattaram. They kept me going on and this work would not have been possible without their input.*

*Friends are wonderful gifts of CREATOR and I will thanks to first my Dept. friends Mukund, Tejesh, Prasad, Aishwarya, Bhagyashree, Ujwala, Neha, Snehal, Sylvia, Prathmesh, Chaitralee, Jyoti, Vishal Yadav, Yogesh, Umesh and Towid my jr. friends Bhakti, Aishwarya, Renuka.*

*I would like to thanks my hostelite friends Aishwarya, Pooja, Madhuri, Shweta for their lovely cooperation.*

*I would like to thanks to my seniors and Ph.D. scholar's Ashish dada, Omkar Dada, Shivaji Dada and Nagma Didi for being a beautiful part of journey of my life.*

*At the end of this note last but not least I wish to thank all those who directly or indirectly played pivotal role in successful completion of my post-graduation and this manuscript.*

*Place: Dapoli*

*Date: / /2020*

*(Suchita Bhanudas Chogale)*

## **CONTENTS**

<b>CHAPTERS</b>	<b>TITLE</b>	<b>PAGE NO.</b>
<b>I</b>	<b>INTRODUCTION</b>	<b>1-5</b>
<b>II</b>	<b>REVIEW OF LITERATURE</b>	<b>6-42</b>
<b>III</b>	<b>MATERIALS AND METHODS</b>	<b>43-55</b>
<b>IV</b>	<b>RESULTS AND DISCUSSION</b>	<b>56-135</b>
<b>V</b>	<b>SUMMARY AND CONCLUSION</b>	<b>136-143</b>
	<b>LITERATURE CITED</b>	<b>i-xvi</b>
	<b>APPENDICES</b>	<b>I</b>

## LIST OF TABLES

<b>TABLE No.</b>	<b>TITLE</b>	<b>PAGE No.</b>
1	Changes in T.S.S. (°B) of snapmelon osmodehydrated slices during storage at ambient temperature (27-29°C)	59
2	Changes in reducing sugars (%) of snapmelon osmodehydrated slices during storage at ambient temperature (27-29°C)	63
3	Changes in total sugars (%) of snapmelon osmodehydrated slices during storage at ambient temperature (27-29°C)	66
4	Changes in titratable acidity (%) of snapmelon osmodehydrated slices during storage at ambient temperature (27-29°C)	69
5	Changes in moisture (%) of snapmelon osmodehydrated slices during storage at ambient temperature (27-29°C)	73
6	Changes in colour score of osmodehydrated slices of snapmelon during storage at ambient temperature (27-29°C)	77
7	Changes in flavour score of osmodehydrated slices of snapmelon during storage at ambient temperature (27-29°C)	80
8	Changes in texture score of osmodehydrated slices of snapmelon during storage at ambient temperature (27-29°C)	83
9	Changes in overall acceptability score of osmodehydrated slices of snapmelon during storage at ambient temperature (27-29°C)	86
10	Changes in fungal count(colony count x 10 <sup>-3</sup> /ml) of osmodehydrated slices of snapmelon during storage at ambient temperature (27-29°C)	89
11	Changes in bacteria count (colony count x 10 <sup>-3</sup> /ml) of osmodehydrated slices of snapmelon during storage at ambient temperature (27-29°C)	91

12	Cost of production of 100 kg snapmelon osmodehydrated slices	93-95
13	Changes in T.S.S (°B) of snapmelon preserve during storage at ambient temperature (27-29°C)	99
14	Changes in reducing sugars (%) of snapmelon preserve during storage at ambient temperature (27-29°C)	102
15	Changes in total sugars (%) of snapmelon preserve during storage at ambient temperature (27-29°C)	106
16	Changes in titratable acidity (%) of snapmelon preserve during storage at ambient temperature (27-29°C)	109
17	Changes in moisture (%) of snapmelon preserve during storage at ambient temperature (27-29°C)	112
18	Changes in colour score of snapmelon preserve during storage at ambient temperature (27-29°C)	116
19	Changes in flavour score of snapmelon preserve during storage at ambient temperature (27-29°C)	119
20	Changes in texture score of snapmelon preserve during storage at ambient temperature (27-29°C)	122
21	Changes in overall acceptability score of snapmelon preserve during storage at ambient temperature (27-29°C)	124
22	Changes in fungal count(colony count x 10 <sup>-3</sup> /ml) of snapmelon preserve during storage at ambient temperature (27-29°C)	128
23	Changes in bacteria count (colony count x 10 <sup>-3</sup> /ml) of snapmelon preserve during storage at ambient temperature (27-29°C)	131
24	Cost of production of 100 kg snapmelon preserve	133-135

## LIST OF FIGURS

<b>Fig. No.</b>	<b>Title</b>	<b>Between pages</b>
1	Flow chart for snapmelon osmodehydrated slices	46-47
2	Flow chart for snapmelon preserve	48-49
3	Percentage decrease in T.S.S. of snapmelon osmodehydrated slices during storage at ambient temperature (27-29°C)	59-60
4	Percentage increase in reducing sugars of snapmelon osmodehydrated slices during storage at ambient temperature (27-29°C)	63-64
5	Percentage increase in total sugars of snapmelon osmodehydrated slices during storage at ambient temperature (27-29°C)	66-67
6	Percentage decrease in titratable acidity of snapmelon osmodehydrated slices during storage at ambient temperature (27-29°C)	69-70
7	Percentage increase in moisture of snapmelon osmodehydrated slices during storage at ambient temperature (27-29°C)	73-74
8	Percentage decrease in colour score of snapmelon osmodehydrated slices during storage at ambient temperature (27-29°C)	77-78
9	Percentage decrease in flavour score of snapmelon osmodehydrated slices during storage at ambient temperature (27-29°C)	80-81
10	Percentage decrease in texture score of snapmelon osmodehydrated slices during storage at ambient temperature (27-29°C)	83-84
11	Percentage decrease in overall acceptability score of snapmelon osmodehydrated slices during storage at ambient temperature (27-29°C)	86-87
12	Percentage increase in fungal count of snapmelon osmodehydrated slices during storage at ambient temperature (27-29°C)	89-90
13	Percentage increase in bacterial count of snapmelon osmodehydrated slices during storage at ambient temperature (27-29°C)	91-92

14	Percentage decrease in T.S.S. of snapmelon preserve during storage at ambient temperature (27-29°C)	99-100
15	Percentage increase in reducing sugars of snapmelon preserve during storage at ambient temperature (27-29°C)	102-103
16	Percentage decrease in total sugars of snapmelon preserve during storage at ambient temperature (27-29°C)	106-107
17	Percentage decrease in titratable acidity of snapmelon preserve during storage at ambient temperature (27-29°C)	109-110
18	Percentage increase/decrease in moisture of snapmelon preserve during storage at ambient temperature (27-29°C)	112-113
19	Percentage decrease in colour score of snapmelon preserve during storage at ambient temperature (27-29°C)	116-117
20	Percentage decrease in flavour score of snapmelon preserve during storage at ambient temperature (27-29°C)	119-120
21	Percentage decrease in texture score of snapmelon preserve during storage at ambient temperature (27-29°C)	122-123
22	Percentage decrease in overall acceptability score of snapmelon preserve during storage at ambient temperature (27-29°C)	124-125
23	Percentage increase in fungal count of snapmelon preserve during storage at ambient temperature (27-29°C)	128-129
24	Percentage increase in bacterial count of snapmelon preserve during storage at ambient temperature (27-29°C)	131-132

## LIST OF PLATES

Plate No.	Caption	Between pages
I.	Fruits of different maturity stages of snapmelon	44-45
II.	Snapmelon osmodehydrated slices stored at ambient temperature ('0' month)	84-85
III.	Snapmelon osmodehydrated slices stored at ambient temperature (3 months)	84-85
IV.	Snapmelon osmodehydrated slices stored at ambient temperature (6 months)	84-85
V.	Fungal count of snapmelon osmodehydrated slices at ambient temperature (27-29°C) ('0' and 3 months)	87-88
VI.	Fungal count of snapmelon osmodehydrated slices at ambient temperature (27-29°C) (6 months)	87-88
VII.	Bacterial count of snapmelon osmodehydrated slices at ambient temperature (27-29°C) ('0' and 3 months)	90-91
VIII.	Bacterial count of snapmelon osmodehydrated slices at ambient temperature (27-29°C) (6 months)	90-91
IX.	Snapmelon preserve stored at ambient temperature ('0' month)	125-126
X.	Snapmelon preserve stored at ambient temperature (3 months)	125-126
XI.	Snapmelon preserve stored at ambient temperature (6 months)	125-126
XII.	Fungal count of snapmelon preserve at ambient temperature (27-29°C) ('0' and 3 months)	126-127
XIII.	Fungal count of snapmelon preserve at ambient temperature (27-29°C) (6 months)	126-127
XIV.	Bacterial count of snapmelon preserve at ambient temperature (27-29°C) ('0' and 3 months)	129-130
XV.	Bacterial count of snapmelon preserve at ambient temperature (27-29°C) (6 months)	129-130



**COLLEGE OF HORTICULTURE, DAPOLI**  
**Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli**

**Thesis title** : Standardization of osmodehydrated slices and preserve making technology in snapmelon (*Cucumis melo var. momordica* L.)

**Name of the student** : Miss. Suchita Bhanudas Chogale

**Registration number** : HDPM/18/0166

**Name of the Research Guide** : Dr. C. D. Pawar  
Professor,  
College of Horticulture , Dapoli

**Year of submission** : September, 2020

**ABSTRACT**

---

The investigation entitled “Standardization of osmodehydrated slices and preserve making technology in snapmelon (*Cucumis melo var. momordica* L.)” was undertaken at Olericulture Laboratory and Fruit and Vegetable Processing Unit of College of Horticulture, Dapoli, Dist. Ratnagiri during 2019-2020. Both the experiments under study were carried out in factorial completely randomized design (FCRD) with four treatments of different maturity stages, M<sub>1</sub> (Mature green stage), M<sub>2</sub> (Turning stage), M<sub>3</sub> (Ripe stage) and M<sub>4</sub> (Over ripe stage) and three sugar syrup concentrations i.e. 40<sup>0</sup>B, 50<sup>0</sup>B and 60<sup>0</sup>B for osmodehydrated slices and 60<sup>0</sup>B, 70<sup>0</sup>B and 80<sup>0</sup>B for snapmelon preserve.

In experiment no.1, snapmelon osmodehydrated slices were prepared and stored for six months at ambient temperature for further study. In case of maturity stages, treatment M<sub>2</sub> (turning stage) was found best, in sugar syrup concentrations treatment S<sub>3</sub> (60<sup>0</sup>B) and in the interactions, M<sub>2</sub>S<sub>3</sub> (turning stage

and 60 °B) was found best at the end of 6 months storage with respect to changes in chemical parameters during storage. In case of sensory quality, treatment M<sub>1</sub> (mature green stage) was found best with respect to maturity stages and in sugar syrup concentrations treatment S<sub>2</sub> (50 °B). Interaction M<sub>1</sub>S<sub>1</sub> (mature green stage and 40 °B) was found best at the end of 6 months storage with respect to sensory quality. In case of microbial study as far as maturity stages are concerned, treatment M<sub>1</sub> (mature green stage) and M<sub>2</sub> (turning stage) were found to be best and in sugar syrup concentrations treatment S<sub>3</sub> (60 °B). In case of interactions, M<sub>1</sub>S<sub>1</sub>, M<sub>1</sub>S<sub>2</sub>, M<sub>1</sub>S<sub>3</sub>, M<sub>2</sub>S<sub>1</sub>, M<sub>2</sub>S<sub>2</sub>, M<sub>2</sub>S<sub>3</sub>, M<sub>3</sub>S<sub>2</sub> and M<sub>3</sub>S<sub>3</sub> were found to be the best with respect to fungal count. In bacterial count, interactions M<sub>1</sub>S<sub>1</sub>, M<sub>1</sub>S<sub>2</sub>, M<sub>1</sub>S<sub>3</sub>, M<sub>2</sub>S<sub>1</sub>, M<sub>2</sub>S<sub>2</sub>, M<sub>2</sub>S<sub>3</sub>, M<sub>3</sub>S<sub>1</sub>, M<sub>3</sub>S<sub>2</sub>, M<sub>3</sub>S<sub>3</sub> and M<sub>4</sub>S<sub>3</sub> were found to be best. The highest B:C ratio was recorded by interaction M<sub>1</sub>S<sub>1</sub> (2.30), followed by M<sub>1</sub>S<sub>2</sub> (2.10), M<sub>1</sub>S<sub>3</sub> (2.04) and M<sub>2</sub>S<sub>1</sub> (1.98).

In experiment no.2, snapmelon preserve were prepared and stored for six months at ambient temperature for further study. In case of maturity stages, treatment M<sub>2</sub> (turning stage) was found to be the best, in sugar syrup concentrations treatment S<sub>3</sub> (80°B) and in interactions, M<sub>2</sub>S<sub>3</sub> (turning stage and 80 °B) was found to be the best at the end of 6 months storage with respect to changes in chemical parameters during storage. As far as sensory quality is concerned, in case of maturity stages, treatment M<sub>1</sub> (mature green stage), in sugar syrup concentrations treatment S<sub>2</sub> (70 °B) and in interactions M<sub>1</sub>S<sub>2</sub> (mature green stage and 70 °B) was found to be best with respect to sensory quality at the end of 6 months storage. In microbial study, in case of maturity stages treatment M<sub>2</sub> (turning stage) was found to be best and in sugar syrup concentrations

treatment S<sub>3</sub> (80<sup>0</sup>B) was best. In case of interactions, M<sub>1</sub>S<sub>2</sub>, M<sub>1</sub>S<sub>3</sub>, M<sub>2</sub>S<sub>2</sub>, M<sub>2</sub>S<sub>3</sub>, M<sub>3</sub>S<sub>3</sub> and M<sub>4</sub>S<sub>3</sub> were found to be the best in fungal count and in case of bacterial count, interactions M<sub>1</sub>S<sub>3</sub>, M<sub>2</sub>S<sub>2</sub> and M<sub>2</sub>S<sub>3</sub> were found to be best. The highest B:C ratio was recorded by interaction M<sub>1</sub>S<sub>2</sub> (1.95), followed by M<sub>1</sub>S<sub>1</sub> (1.92).

From the above finding it is concluded that interaction M<sub>1</sub>S<sub>1</sub> (mature green stage and 40 <sup>0</sup>B) was found to be best followed by M<sub>2</sub>S<sub>1</sub> (turning stage and 40 <sup>0</sup>B) for preparation of osmodehydrated slices and interaction M<sub>1</sub>S<sub>2</sub> (mature green stage and 70 <sup>0</sup>B) was found to be best for preparation of snapmelon preserve.

## **CHAPTER I**

### **INTRODUCTION**

"Vegetables are the friends of doctor and glory of the cook" as described by Alcucin thousand years ago (Deshi and Padda, 1962). Vegetables play a very important role in the human diet as they supply number of vitamins, mineral elements, salts, acids and also they are the source of carbohydrates for energy (Barve, 2001).

In India, different kinds of vegetables are grown and it is regarded as the second largest vegetable producing country in the world. The area under vegetable is estimated to be 10.26 million ha with an annual production of 184.40 million tonnes (Anonymous, 2018). However, the daily per capita vegetable consumption in India is only 230 gm, which is far below the recommended dietary standards of 300 gm (Anonymous, 2013). Obviously, there is immediate need to increase the production of vegetables so as to fulfil the requirement.

Cucurbits form an important and big group of vegetable crops cultivated extensively in this country. The family cucurbitaceae is a moderately large one, comprising about 117 genera and 825 species distributed in warmer regions of both the hemispheres (Jeffrey, 1983). In India, Chakravarty (1982) estimated that 36 genera and around 100 species have been described. This group consists of wide range of vegetables, either used as salad (cucumber) or for cooking (all the gourds) or for pickling (cucumber), candy and preserve making (ash gourd) or as dessert fruits (muskmelon, watermelon, snapmelon).

Among the genera of cucurbitaceae, the genus *cucumis* is of great economic importance, which is widely grown for their

delicious, sweet edible fruits and as vegetable. The genus *Cucumis* comprises of 30 species. The well-known and commercially exploited vegetables among this group are muskmelon, cucumber and cantaloupe. The neglected and least attended vegetables include snapmelon (*Cucumis melo var momordica*). It is cultivated all over North India, West Bengal, Goa, Karnataka, Tamil Nadu, Maharashtra and is recognised by various names such as phut, phoot, phunt, kacharia, peddakai, chibud etc. The fruits of snapmelon burst spontaneously on ripening; hence the name phoot is given to it.

Though, origin of snapmelon is vague, Whitaker and Davis (1962) opine that melon was introduced into Asia at a comparatively recent date. Cultivation in congenial environment under the guidance of man resulted in a larger number of subspecies and cultivars being evolved in a relatively short span of time.

It is grown all over India and its cultivation on large scale is confined to Rajasthan, Tamil Nadu, West Bengal and Maharashtra. In Konkan region, snapmelon is particularly grown in Raigad, Ratnagiri and Sindhudurg districts, not merely in kitchen garden but also for trade in exceptional cases. Snapmelon is mainly grown in Konkan as a sole crop or intercrop in hill millets during rainy season. It can be good substitute for muskmelon in Konkan where muskmelon cannot be grown due to high rainfall and high humidity.

Snapmelon (*Cucumis melo var. momordica* L.) is one of the most popular vegetables in arid region. It is a member of the cucurbit family along with cucumber, squash, watermelon and muskmelon. It is originated from Africa and Asia. It is an annual

plant, able to climb with the help of tendrils, but more commonly it sprawl along the ground.

Snapmelon has variety with short, smooth, oval or cylindrical fruits, about 20 to 40 cm in length and about 7.5 to 15.0 cm in diameter. The fruits resemble cucumber rather than melon and are dark green when immature and lemon yellow when ripe. Some of the cultivars bear fruits with light green to green strips and become yellow colour at slip stage. The flesh is mealy but somewhat insipid or slightly sour. It is eaten raw or cooked as vegetable when tender and consumed as a dessert fruit after ripening. The ripe fruits are taken with the addition of a little sugar. The cultivar is hardier than muskmelon but has poor keeping quality. The seeds are smaller than those of muskmelon but the nutritive value of seeds is high due to their high oil and protein content, along with unsaturated fatty acids (Oleic and linoleic). The seeds are also used as a cooling medicine (Barve, 2001).

The ripe snap melon fruits are used to prepare rayta and also dessert or as salad. Seed kernels are extracted and are extensively used in sweets and bakery products (More, 1999).

The fruits can be used as a cooling light cleanser or moisturiser for the skin. They are also used as a first aid treatment for burns and abrasions. The flowers are expectorant and emetic. The fruit is stomachic. The seed is antitussive, digestive, febrifuge and vermifuge. The root is diuretic and emetic. It has been found to have high level of tolerance to downy mildew (Sambandam *et al.*, 1979).

Fruits of snapmelon are rich in nutrient components. It contains 79.93 g moisture, 0.369 g crude protein, 1.12 g fat,

15.6 g carbohydrate, 1.34 g crude fibre, 1.64 g total ash, 0.76 mg calcium, 0.088 mg phosphorus, 0.843 mg iron and 0.2023 mg zinc per 100 g of fruit sample (Samadia, 2003).

Processing of fruit and vegetables has always served one or all purposes like preventing post-harvest losses arising due to various reason, availability during off season, generating additional income, facilitating distant transport of fruits and vegetables which are highly perishable in nature, assurance of market to producers, utilization of surplus produce when it is cheap and available in plenty and generating rural employment.

The snap melon fruits are highly perishable in nature and they have poor storage life. To prolong its utilization, the snapmelon can be processed into value added product (Korgaonkar *et al.*, 2015). However, the research work on processing of snap melon is limited. Hence, it is necessary to explore the possibility of utilizing the snapmelon for the preparation of processed product such as osmodehydrated slices and preserve.

Traditional methods of drying food improve their stability during storage, but often with the loss of colour, flavour and essential nutrients. Consequently, the sensorial quality of the products decreases (Taiwo *et al.*, 2001). Several methods have been developed to stabilize food without changing its sensorial characteristics. One of these processes is osmotic dehydration (Moreira and Sereno, 2003, Sablani and Rahman, 2003). Osmotic dehydration decreases the moisture content of fruits with little changes in their sensorial characteristics (Escriche *et al.*, 2002).

Osmotic dehydration is a complementary treatment in the processing of dehydrated foods, since it presents some advantages such as minimizing heat damage to the colour and flavour, inhibiting enzymatic browning and reducing energy costs (Martinez *et al.*, 2011). This is one alternative to reduce postharvest losses of fruits, and a common process for producing dried fruits, which can be directly consumed or used as an ingredient in cakes, pastries and many others. The quality of osmotically dehydrated products is better and shrinkage is considerably lower as compared to products from conventional drying processes. The use of osmotic dehydration in food processing, particularly prior to drying and freezing operations, reduces energy requirements of these processes (Koprivica *et al.*, 2013).

However, till today no research has been carried out to explore the possibility of development of osmodehydrated slices and preserve from different maturity stages of snapmelon fruit. Hence, looking to the importance of processing and preservation of snapmelon, the present investigation entitled “Studies on standardization of osmodehydrated slices and preserve making technology in snapmelon (*Cucumis melo* var. *momordica*)” has been undertaken with the following objectives.

1. To standardized technology for preparation of osmodehydrated slices from different maturity stages of snapmelon.
2. To standardized technology for preparation of preserve from different maturity stages of snapmelon.

## CHAPTER II

### REVIEW OF LITERATURE

The research entitled “**Studies on standardization of osmodehydrated slices and preserve making technology in snapmelon (*Cucumis melo* var. *momordica*)**” is reviewed in the current chapter under the following headings. Since very limited work has been reported on snapmelon, the literature in this regard on other important fruit crops is also reviewed in this chapter under following headings.

- 2.1 Changes in chemical composition of snapmelon osmodehydrated slices during storage
- 2.2 Changes in sensory quality of snapmelon osmodehydrated slices during storage
- 2.3 Microbial studies of snapmelon osmodehydrated slices during storage
- 2.4 Cost of production of snapmelon osmodehydrated slices
- 2.5 Changes in chemical composition of snapmelon preserve during storage
- 2.6 Changes in sensory quality of snapmelon preserve during storage
- 2.7 Microbial count of snapmelon preserve during storage
- 2.8 Cost of production of snapmelon preserve

#### **2.1 Changes in chemical composition of snapmelon osmodehydrated slices during storage**

##### **2.1.1 Total soluble solids (°B)**

Kshirsagar (2004) reported that the TSS of mango frits ranged from 7.10 °B (Totapuri) to 10.32 °B (Totapuri red small) at mature stage and from 15.28 °B (Totapuri) to 21.48 °B (Ratna) at ripe stage.

Senesi *et al.* (2005) reported that the T.S.S. changed from 10 °B in unripe samples to about 15 °B in ripe and over ripe samples in two varieties (Calypso and Pamir) of muskmelon.

Chavan *et al.* (2010) observed the significant increase in TSS content in all the osmodried banana slices during storage. There was a gradual increase in TSS content in all the samples and this might be due to reduction in moisture content during storage. The TSS content increased from 66.5 per cent to 68.7 per cent at the end of 6 months.

Nayak *et al.* (2012) reported that the TSS gradually increases with increase in storage period. This might be due to conversion of polysaccharides into sugars during hydrolysis process in aonla candy.

Ghadge (2013) reported that the TSS of osmotically dehydrated ripe banana showed an increasing trend with increase in the sugar syrup level. The highest TSS level observed was 76.57°B, whereas the lowest was 61.22°B.

Jangle (2013) observed that there was a decreasing trend in TSS content up to 90 days of storage in osmotically dehydrated papaya. The TSS was in the range of 12.45 to 29.30 °B.

Nazaneen *et al.* (2015) reported that the TSS of osmotic dehydration of pineapple cubes showed an increasing trend with increase in the sugar syrup level. The highest TSS (73.60 °B) recorded in T<sub>6</sub> (70 °B sugar syrup conc. + 70 °C drying temperature) and lowest (54.40°B) in T<sub>1</sub> (50°B sugar syrup conc. + 60°C drying temperature).

Wanve *et al.* (2015) recorded the TSS in the range of 82.40 to 89.32°B in osmotically dehydrated ripe jackfruit slices.

Kenghe (2016) recorded that the TSS of aonla candy was increased from 79.33 to 83.00 °B during 6 months storage under ambient condition.

Kore *et al.* (2017) reported that, ber candies treated with 80 per cent sugar solution + 1 per cent citric acid showed maximum TSS (80.79 °Brix).

Gurumeenakshi and Varadharaju (2019) observed that in various treatments the highest TSS (63 °B) was found in T<sub>2</sub> (ascorbic acid solution) and lowest (60.80 °B) in T<sub>0</sub> (control), irrespective of the variety. After 180 days of storage negligible loss of TSS occurred in the osmo dried mango slices.

### **2.1.2 Reducing sugars (%)**

Sagar *et al.* (1998) estimated the reducing sugar content of dehydrated mango slices which was in the range of 25.35 to 29.79 per cent.

Sharma *et al.* (1998) observed that the reducing sugars showed increasing trend during storage of candid apples.

Mali (1999) reported that reducing sugar content increased steadily throughout the course of maturation of papaya fruits.

Kshirsagar (2004) reported that reducing sugars at mature stage was maximum in Totapuri red small (3.15 %) and minimum in Ratna (2.30 %). It was highest in Ratna (4.48 %) and lowest in Suvarnrekha (3.72 %) at ripe stage.

Rashmi *et al.* (2005) studied the reducing sugar content of osmo-air dehydration of pineapple. It was 41.86, 38.34 and 37.34 per cent at 50, 60 and 70 °Brix sugar concentrations, respectively.

Rodrigues *et al.* (2006) investigated that the reducing sugar content of osmodehydrated papaya slices was 12.96 per cent.

Kumar *et al.* (2008) observed that the reducing sugar content of osmotically dehydrated guava slices varied from 22 to 28 per cent.

Selvakumar (2011) observed that the maximum content of reducing sugar (62.07 %) was recorded in T<sub>4</sub> (50<sup>o</sup>B sugar syrup with 40 hours duration) followed by T<sub>5</sub> (60<sup>o</sup>B sugar syrup with 20 hours duration) 61.44 per cent in osmotic dehydration of carrot.

Phisut *et al.* (2013) reported that the reducing sugar content in FOD (Fast osmotic dehydration) muskmelon was  $14.03 \pm 0.52$  per cent whereas it was  $14.11 \pm 0.53$  per cent in SOD (Slow osmotic dehydration), muskmelon.

Nazaneen *et al.* (2015) reported that the reducing sugars of osmotic dehydration of pineapple cubes showed decreasing trend with increase in the sugar syrup level. The highest reducing sugar (40.79%) was recorded in T<sub>1</sub> (50<sup>o</sup>B sugar syrup conc. + 60<sup>o</sup>C drying temperature) and lowest (38.48%) in T<sub>6</sub> (70<sup>o</sup>B sugar syrup conc. + 70<sup>o</sup>C drying temperature).

Dhakar and Pradhananga (2017) observed that the sample S<sub>1</sub> (sucrose), sample S<sub>2</sub> (sucrose + honey, 75:25) and sample S<sub>3</sub> (sucrose + honey 50:50) of watermelon rind candy had higher rate of increase in reducing sugars at the initial stages. But on the subsequent days, the level of reducing sugar tends to level up and the increasing percentage of reducing sugar decreased slowly. This might be due to the higher viscosity of syrup, decrease in boiling time as well as saturation of rind fibers by syrup.

Dwivedi and Pandey (2017) observed that the reducing sugar content was decreased from 27.32 to 24.24 per cent during the entire storage period of aonla candy.

Mondal *et al.* (2017) observed that the sugar treatment had significant effect on reducing sugars of aonla candy. Sample-2 showed maximum reducing sugars (38.41%) and minimum in sample-1 (22.39%) on the processing day while at the end of 120 days of storage, maximum reducing sugars (40.77%) was in sample-2 and minimum in sample-1 (24.16%).

### **2.1.3 Total sugars (%)**

Sharma *et al.* (1998) observed that the candied apples gave increasing trend in total sugars during storage.

Mali (1999) reported that total sugar content increased steadily throughout the course of maturation of papaya fruits.

Rashmi *et al.* (2005) studied the total sugar content in pineapple slices and it was 61.54, 65.64 and 67.17 per cent when treated in 50<sup>o</sup>B, 60<sup>o</sup>B and 70<sup>o</sup>B sugar concentrations, respectively.

Ghadge (2013) observed that the total sugar content exhibited an increasing trend with increase in the sugar syrup level used for osmotic drying. The highest total sugar content reported was 18.67 per cent and the lowest was 10.85 per cent in ripe banana osmotic dehydration.

Jangle (2013) reported a decreasing trend in total sugar content of osmo-dehydro frozen papaya cubes which was noticed up to 90 days of storage. The total sugar content ranged from 9.74 to 22.49 per cent.

Babariya (2014) reported that the total sugar content was found to be significantly increased with increasing advancement of storage period. At end of storage period treatment T<sub>3</sub> (20 % NaCl and added direct sugar) recorded highest total sugars (74.79%). It might be due to reduction in moisture, conversion of polysaccharides and non-reducing sugars into reducing sugar and another probable reason was conversion of organic acids into sugars during metabolism in papaya candy.

Nazaneen *et al.* (2015) reported that the total sugars of osmotic dehydration of pineapple cubes showed an increasing trend with increase in the sugar syrup level. The highest (67.56%) total sugars was recorded in T<sub>3</sub> (70<sup>o</sup>B sugar syrup conc. + 60<sup>o</sup>C drying temperature) and lowest (46.57%) recorded in T<sub>4</sub> (50<sup>o</sup>B sugar syrup conc. + 70<sup>o</sup>C drying temperature).

Wanve *et al.* (2015) observed the highest total sugar content of 52.48 per cent and the lowest 43.33 per cent in osmotically dehydrated ripe jackfruit slices.

Kenghe (2016) observed that the total sugars of candies were found to increase significantly with an increase in storage period. The total sugars were found to be increased from 65.47 to 68.97 per cent during storage under ambient condition in aonla candy.

Shinde (2016) observed the highest total sugar content of 82.13 per cent and the lowest 43.33 per cent in osmotically dehydrated ripe jackfruit slices.

Kore *et al.* (2017a) observed that maximum total sugars (79.69%) were found in R<sub>3</sub>D<sub>1</sub> (80% sugar solution and sun drying), at 90<sup>th</sup> day during storage while, significantly minimum

(58.63%) total sugars were found in R<sub>1</sub>D<sub>3</sub> (60 % sugar solution and sun drying) in aonla candy.

Tyagi and Dhawan (2017) observed that the total sugar content was maximum (43.9<sup>0</sup>B) in treatment T<sub>5</sub> (blanching + osmosis in sugar 16 hrs) and minimum (22.3<sup>0</sup>B) in treatment T<sub>1</sub> (blanching). No significant effect on total sugar content was observed in different treatments. Total sugar content was maximum at the time of drying (46.6<sup>0</sup>B) and then significantly decreased during storage (43.9<sup>0</sup>B) in osmotic dehydrated aonla.

Kiranmai *et al.* (2018) observed initially highest (57.97%) total sugar content in T<sub>4</sub> (70% tamarind + 30% mango pulp) and least was in T<sub>1</sub> (100% tamarind pulp) 53.23 per cent. During the storage, there was no significant increase in the mean total sugar content of candy from '0' day (55.56%) to 90 days (57.71%) of storage period. The interaction effects of treatments and days of storage were also found to be non-significant during different storage periods.

#### **2.1.4 Titratable acidity (%)**

Corey and Schlimme (1988) reported titratable acidity to be 0.21, 0.12 and 0.14 per cent in under ripe, optimum and over ripe fruits, respectively, in Charleston gray cultivar of watermelon.

Chachad (1995) reported that the acidity was found to be decreased from marble size to full grown stage in watermelon fruit.

Gosavi (1998) noticed 2.64 and 0.73 per cent titratable acidity in mature and ripe karonda fruits, respectively.

Sagar *et al.* (1998) investigated different quality parameters of dehydrated ripe mango slices in which acidity percentage decreased from 0.32 to 0.28 per cent after six months of storage.

Amitabh *et al.* (2000) reported that the osmo-dehydrated mango slices had acidity ranging from 1.37 to 1.42 per cent.

Rashmi *et al.* (2005) observed the increase in the acidity of osmo-dehydrated pineapple slices which was 1.50, 1.52 and 1.34 per cent for 50, 60, and 70 °Brix, respectively, as compared to fresh sample in which it was 0.66 per cent during storage of 6 months at ambient conditions.

Rodrigues *et al.* (2006) mentioned that the osmo-dehydrated papaya showed a slight decrease in acidity which varied from 0.06 to 0.04 per cent after third day of storage and there was no significant change until the fifteenth day of storage.

Kumar *et al.* (2008) reported that there was an increase in the acidity of osmo-dehydrated guava slices from 0.4 to 1.8 per cent during storage period of 3 months at ambient condition.

Kumar *et al.* (2008a) observed that the osmo-vac dried mango slices showed a decreasing trend in acidity irrespective of packing and storage condition. Decrease in acidity was non-significant when samples were packed in 250 g COEX films with nitrogen flushed and stored at low temperature. Acidity was slightly higher at room temperature, attributed to hydrolysis of polysaccharides and non-reducing sugars through utilization of acids for converting them to hexose sugars.

Phisut *et al.* (2013) reported that total acidity in FOD (fast osmotic dehydration) was  $0.12 \pm 0.03$  per cent whereas in SOD

(slow osmotic dehydration), it was  $0.07 \pm 0.00$  per cent in muskmelon.

Nazaneen *et al.* (2015) reported that the titratable acidity of osmotic dehydration of pineapple cubes showed decreasing trend with increase in the sugar syrup level. The highest titratable acidity (1.47%) was recorded in T<sub>1</sub> (50<sup>0</sup>B sugar syrup conc. + 60<sup>0</sup>C drying temperature) and lowest (1.24%) recorded in T<sub>6</sub> (70<sup>0</sup>B sugar syrup conc. + 70<sup>0</sup>C drying temperature).

Bisen *et al.* (2017) observed the acidity in leather, it was found that the higher value was recorded in Treatment T<sub>4</sub> (60% aonla pulp + 40% guava pulp) with 125g sugar. Further, it was observed that acidity of the leather decreased significantly with increase in sugar content.

Ghanwat *et al.* (2019) observed that combination of sugar syrup concentration, dipping time and drying methods had significant effect on titratable acidity in aonla candy. The mean values were ranged from 0.17 to 0.34 per cent. Treatment combination S<sub>1</sub>T<sub>1</sub>M<sub>2</sub> (60 % sugar conc. + dipping for 36 hrs + solar drying) on 120 days of storage showed minimum value (0.08%) followed by S<sub>1</sub>T<sub>1</sub>M<sub>1</sub> (60 % sugar conc. + dipping for 36 hrs + sun drying) 0.09 per cent, while at initially S<sub>2</sub>T<sub>3</sub>M<sub>3</sub> (70 % sugar conc. + dipping for 48 hrs + cabinet drying) showed maximum value (0.44%).

### **2.1.5 Moisture (%)**

Garande (1992) observed that moisture content of jamun fruit continuously increased from 71.5 per cent at fruit set to 83.5 per cent at full ripe stage.

Sharma *et al.* (1998) observed that the candied apples, moisture content tended to decrease during storage.

Mali (1999) reported that the moisture content of papaya increased slowly upto the half grown stage i.e. upto 60 days after fruit set and later on decreased continuously and slowly upto the maturity of fruit.

Lauren and Badrie (2005) observed that after osmosis and convection drying of carambola slices, the moisture content of carambola OD slices varied between 18.8 per cent and 20.8 per cent. The water activity of intermediate moisture foods (15–40 % moisture) is depressed and the stability of the product is supplemented by the combination treatments (low pH and preservatives).

Rashmi *et al.* (2005) found that after osmo-air dehydration of pineapple, the moisture content was 13.82, 12.72 and 12.75 per cent in 50, 60 and 70 °B sugar syrup, respectively. The maximum moisture percentage was found at 50 °Brix while minimum at 60 °Brix

Nayak *et al.* (2012) observed that the moisture content decreased with an increase in storage period in aonla candy. After 270 days of storage, the moisture content decreased from an initial range of 16.5 to 17.2 per cent to a final of 14.7 to 15.4 per cent.

Rahman *et al.* (2012) observed that the higher moisture content was observed in the osmotic dehydrated jackfruit prepared from 50° Brix sugar syrup i.e. T<sub>4</sub> (14.06 %) followed by osmotic dehydrated jackfruit prepared from 45 ° Brix sugar syrup i.e. T<sub>3</sub> (13.36%) after a period of 8 months storage.

Chaudhari *et al.* (2015) reported that the moisture content was found to be decreased when concentration of syrup

increased. 60 °B (7.9 %) sample showed the maximum reduction in moisture content in osmotic dehydration of pineapple.

Nazaneen *et al.* (2015) reported that the titratable acidity of osmotic dehydration of pineapple cubes showed decreasing trend with increase in the sugar syrup level. The highest titratable acidity (15.31%) was recorded in T<sub>1</sub> (50°B sugar syrup conc. + 60°C drying temperature) and lowest titratable acidity (13.77%) recorded in T<sub>5</sub> (60°B sugar syrup conc. + 70°C drying temperature).

Sharma *et al.* (2016) observed the moisture content from the sample of 2 mm slices when immersed in syrup concentration of 30 °B and 40 °B for 0, 15, 30, and 45 days of storage period respectively. The highest moisture content 16.32 per cent was found for the untreated sample for 45 days of storage period and lowest moisture content 10.08 per cent was found for 40 °B syrup concentration before storage. While for the samples having 4 mm slices it was observed that the highest moisture content of 17.27 per cent was found for the untreated held at 60 °C for 45 days of storage period and lowest moisture content 11.01 per cent was found for 40 °B syrup concentration before storage, in osmo-dehydrated sweet potato slices.

Shinde (2016) observed that the moisture content was found to be increased (13.91 %) during storage of 90 days under ambient temperature in osmodehydrated muskmelon.

Tripura *et al.* (2017) observed that during the 4 months of storage period with increase in duration of storage period, the mean moisture content slightly increased significantly from the initial (8.00 %) to 120<sup>th</sup> day (10.17 %). The highest mean moisture content (10.17 %) was observed in dehydrated slices on

120 days of storage period closely followed by 105 days storage period (10.07 %) and was on par with 90 days storage period (10.03 %), whereas, lowest mean moisture (8.37 %) pickup was observed on 15<sup>th</sup> day of storage period followed by 30<sup>th</sup> day storage period (8.94 %) in osmotic dehydrated ripe sapota slices.

## **2.2 Changes in sensory quality of snapmelon osmodehydrated slices during storage**

### **2.2.1 Colour**

Mali (1999) found that colour of papaya changes from dark green to yellowish at ripe stage.

Barve (2001) reported that the colour changed from green to yellow colour at marble stage to over ripe stage in snapmelon fruits.

Sawant *et al.* (2011) recommended that the osmotically dehydrated pineapple slices in sucrose solution of 40<sup>o</sup>Brix for 24 hour soaking duration at 60<sup>o</sup>C temperature were most preferred for colour of pineapple slices.

Hiremath and Rokhade (2012) reported that the treatment T<sub>6</sub> (steeping in 60<sup>o</sup>B syrup + 1% citric acid and increasing daily by 10<sup>o</sup>B upto 70<sup>o</sup>B) recorded significantly highest (4.69) colour score, whereas lowest score (3.69) was observed in T<sub>3</sub> (steeping in 60<sup>o</sup>B syrup and increasing daily by 10<sup>o</sup>B upto 70<sup>o</sup>B). The mean scores for colour and appearance at different storage periods, irrespective of treatments showed a significant linear decrease from 4.31 at initial stage to 4.11 at three MAS in sapota candy.

Shamrez *et al.* (2013) observed that the mean score of judges for colour were significantly ( $p < 0.05$ ) decreased from 8.83

to 4.84 during storage. For treatments maximum mean score (7.86) was observed in sample T<sub>2</sub> (sliced citron peel + 40% sugar + potassium metabisulphite), while minimum mean score (2.19) was recorded in sample T<sub>0</sub> (control). Colour of treatment T<sub>2</sub> was comparatively attractive during storage period at ambient temperature in candies prepared from citron peel.

Babariya (2014) reported that the decline in colour acceptability of papaya candy product during storage has been due to increase in browning of cubes.

Chaudhari *et al.* (2015) found that the sample dipped in 60 °B solution and dried is significantly superior to other samples in terms of colour in osmotic dehydration of pineapple.

Khanom *et al.* (2015) reported that the sample S<sub>5</sub> (thickness of slice 0.5 cm and osmosed in 50 °B sugar solution) was the most preferable. But S<sub>5</sub> and S<sub>7</sub> (thickness of slice 0.5 cm and osmosed in 60 °B sugar solution) were equally acceptable at 5 per cent level of significance. It can be noted that sample S<sub>5</sub> secured the highest score of 8.7 out of 9, and S<sub>7</sub> secured the score of 8.4 points for colour and can be ranked as “like very much” in pineapple candy.

Nazaneen *et al.* (2015) reported that the highest colour score (8.50) was observed in T<sub>3</sub> (60°B sugar syrup conc. + 60°C drying temperature) and lowest colour score (7.01) recorded in T<sub>6</sub> (70°B sugar syrup conc. + 70°C drying temperature) in osmotic dehydration of pineapple cubes.

### **2.2.2 Flavour**

Barve (2001) reported that the highest flavour score (7.43) of snapmelon pickle was found in unripe fruits.

Rashmi *et al.* (2005) stated that the osmodehydrated pineapple slices steeped in 60 °Brix sugar syrup concentration were most acceptable with respect to flavour after 6 months of storage as compared to other steeping concentrations.

Chavan *et al.* (2010) reported that the reduction in flavour score of osmo-dried banana slices during storage could be due to hardening of slices because of water loss as well as oxidation of ascorbic acid.

Babariya (2014) reported that the variation and decline trend in flavour acceptability was due to loss of moisture and added preservative in papaya candy during storage.

Nazaneen *et al.* (2015) reported that the highest flavour score of 8.01 was showed in T<sub>3</sub> (60°B sugar syrup conc. + 60°C drying temperature) and lowest flavour score (6.96) recorded in T<sub>6</sub> (70°B sugar syrup conc. + 70°C drying temperature) in osmotic dehydration of pineapple cubes.

Bisen *et al.* (2017) revealed highest score of leather in treatment T<sub>10</sub> (40 % aonla pulp + 60 % guava pulp + 375g sugar). Similar results were found by in guava leather. However, least flavour was found with treatment T<sub>1</sub> (60 per cent aonla pulp + 40 per cent guava pulp + 500g sugar). Decreasing patterns of flavour rating value were observed during storage of mixed fruit leather for 100 days.

Aparna *et al.* (2018) observed that the mean score for flavour decreased from 8.27 to 7.97 for A<sub>3</sub> (fruit osmosed in 80 °B for 180 min.), 8.00 to 7.70 for A<sub>2</sub> (fruit osmosed in 80 °B for 120 min.) and 7.97 to 7.67 for A<sub>1</sub> (fruit osmosed in 60 °B for 180 min.) from the time of storage till the end of 4<sup>th</sup> month in osmo dehydrated bilimbi (*Averroha bilimbi*).

Solanke *et al.* (2018) reported that maximum score (7.4) for flavour was obtained by T<sub>1</sub> (sugar solution) and minimum score (3.8) in T<sub>4</sub> (stevia solution) in osmodehydrated sweet orange slices.

Gurumeenakshi and Varadharaju (2019) reported that highest scores for flavour and taste was obtained by T<sub>2</sub> (ascorbic acid), T<sub>1</sub> (citric acid) and T<sub>0</sub> (control) in both the varieties of Bangalora and Pairi, which was maintained throughout the storage period. The samples of T<sub>2</sub> had highly acceptable mango flavour and sweet taste in osmodried mango slices.

### **2.2.3 Texture**

Barve (2001) reported that the highest texture score (6.44) of snapmelon pickle was found in unripe fruits.

Panda *et al.* (2005) investigated that the osmotic tray dried samples of grapes at 55 °C temperature, 60 °Brix sugar concentration and syrup to sample ratio of 4:1 were the best with respect to texture during storage.

Hiremath and Rokhade (2012) reported that the mean scores for texture of sapota candy treatments irrespective of storage periods ranged between 3.56 and 4.39. The treatments T<sub>4</sub> (steeping in 40°B syrup + 1% citric acid and increasing daily by 10°B upto 70°B) and T<sub>7</sub> (blanching in 0.2% KMS solution + steeping in 40°B syrup + 1% citric acid and increasing daily by 10°B upto 70°B) recorded maximum scores of 4.39, whereas least (3.56) was recorded in T<sub>3</sub> (steeping in 60°B syrup and increasing daily by 10°B upto 70°B) and T<sub>9</sub> (blanching in 0.2% KMS solution + steeping in 60°B syrup + 1% citric acid and increasing daily by 10°B upto 70°B). Scores for texture at different storage periods irrespective of treatments showed

significant decrease from 4.11 at initial stage to 3.88 at three MAS.

Rahman *et al.* (2012) reported that the osmotic dehydrated jackfruit was organoleptically evaluated after every 2 months of storage period. But for the discussion, the 6 months and 8 months storage data have been taken. After 6 and 8 months of storage the highest texture score (7.6 and 6.9) was obtained for treatment T<sub>4</sub> (50 °B sugar syrup) followed by treatment T<sub>3</sub> (45°B sugar syrup) i.e. 7.4 and 7.8, respectively. It is noticed that nobody disliked the products even after 8 months of storage at ambient temperature.

Phisut *et al.* (2013) observed higher mean score of appearance and texture in sample produced by SOD (Slow osmotic dehydration) compared to FOD (Fast osmotic dehydration). This may be attributed due to the use of SOD which could maintain the shape and reduce shrinkage at the surface of osmodried cantaloupe. The result of sensory evaluation was in agreement with the result of hardness. However, no difference in mean score of overall acceptability was observed between samples produced by FOD and SOD in osmodried cantaloupe.

Shamrez *et al.* (2013) observed that the mean score of judges for texture significantly ( $p < 0.05$ ) decreased from 9.00 to 5.25 during storage. For treatments maximum mean score (8.14) was observed in T<sub>2</sub> (sliced citron peel + 40% sugar + potassium metabisulphite), while minimum 2.29 was recorded in T<sub>0</sub> (control) in candies prepared from citron peel.

Babariya (2014) reported that the variation and decline trend in texture acceptability has been due to fluctuations in

moisture levels and increasing sugar content in papaya candy during storage.

Nazaneen *et al.* (2015) reported that the highest texture score (8.24) showed in T<sub>3</sub> (60<sup>o</sup>B sugar syrup conc. + 60<sup>o</sup>C drying temperature) and lowest texture score (7.24) recorded in T<sub>6</sub> (70<sup>o</sup>B sugar syrup conc. + 70<sup>o</sup>C drying temperature) in osmotic dehydration of pineapple cubes.

Lingala *et al.* (2015) reported that the osmotically dehydrated karonda samples score for texture varied from 17.45 to 24.50. The highest score (24.50) was observed in T<sub>6</sub> (dipping in 70<sup>o</sup>B sugar syrup for 24 hrs.) and minimum score (10.58) was observed in case of control slices T<sub>7</sub>.

Tripura *et al.* (2017) reported significant decline in mean texture score from the initial (6.67) to 120<sup>th</sup> day (4.66) of storage period. It was observed that with increase in storage period, there was a decrease in texture score irrespective of the treatments in osmotic dehydrated ripe sapota slices.

#### **2.2.4 Overall acceptability**

Barve (2001) reported that the highest overall acceptability score (7.10) of snapmelon pickle was found in unripe fruits.

Singh (2001) reported that the product of osmo-dried ginger slices stored in 300 gauge HDPE was highly acceptable and unchanged in organoleptic quality.

Chavan *et al.* (2010) reported that the decrease in overall acceptability of osmo-dried banana slices during storage was evident and significant ( $p < 0.05$ ) and could be because of reduction in the score of all sensory parameters of banana slices.

Nayak *et al.* (2012) reported that the overall acceptability score of aonla candy prepared from cv. Krishna flavored with cardamom scored highest (8.2), while aonla candy prepared from cv. NA-10 scored lowest (6.2).

Bhattacharjee *et al.* (2013) reported that the highest organoleptic score (7.9) was found in candy prepared from fresh fruits followed by candy prepared from fruits after 7 days of storage (7.8), while minimum score (4.9) was recorded when candy was prepared from 21 days stored fruits in aonla candy.

Chaudhari *et al.* (2015) observed that overall acceptability of sample dipped in 60 °B sugar solution is significant over sample dipped in 40 °B and 50 °B sugar solutions. The sample dipped in 60 °B sugar solution has got maximum score for overall acceptability i.e. 8.34 in osmotic dehydration of pineapple.

Nazaneen *et al.* (2015) reported that the highest overall acceptability score (8.23) showed in T<sub>3</sub> (60°B sugar syrup conc. + 60°C drying temperature) and lowest overall acceptability score (7.08) recorded in T<sub>6</sub> (70°B sugar syrup conc. + 70°C drying temperature) in osmotic dehydration of pineapple cubes.

Mondal *et al.* (2017) reported that the sample-2 (70 % sucrose) had the highest (8.35) overall acceptability score while sample-1 (80 % sucrose) had lowest (7.65) score for aonla candy.

Tyagi and Dhawan (2017) observed that the aonla fruit treated with treatment T<sub>4</sub> (blanching + sulphured + osmosis 8 hours) were found to be best organoleptically and it had more nutrient retention with low tannins and less browning with improved taste and flavour in osmotic dehydrated aonla.

Kiranmai *et al.* (2018) observed that in the treatments of tamarind candy, the overall acceptability score was significantly highest for T<sub>1</sub> (100% tamarind) which was 4.97 followed by T<sub>2</sub> (90% tamarind + 10% mango pulp) 4.80, T<sub>3</sub> (80% tamarind + 20% mango pulp) 4.80 and T<sub>4</sub> (70% tamarind + 30% mango pulp) 4.60.

### **2.3 Microbial studies of snapmelon osmodehydrated slices during storage**

Rahman *et al.* (2012) reported that the osmotic dehydrated jackfruit prepared by 50° brix sugar solution and 45° brix sugar solution showed minimum of microbial counts than that prepared by 35° and 40° brix sugar solution during storage in high density polyethylene packet at ambient condition. Osmotic dehydrated jackfruit slices prepared by 35° brix sugar solution exhibited slightly higher microbial population than the rest of the slices.

Azeredo *et al.* (2006) studied the effect of drying conditions and storage period on physicochemical properties of mango leather. They concluded that mango leather remained microbiologically stable at 25°C for 6 months, without chemical preservatives.

Chavan *et al.* (2010) reported that the osmo-dried banana slices on storage for 6 months were microbiologically found safe, which could probably be because of addition of KMS, citrate, low moisture and high concentration of sugar. The higher TSS and acidity of the product might have also played a role in preservation of the product.

Akhtar *et al.* (2014) reported that the storage period did not exhibit any significant effect on the microbial count of apple-date fruit bar.

Gawale (2014) reported that the treatment as well as storage period did not exhibit any significant effect on the microbial count of the pineapple: papaya blended leather.

Lingala *et al.* (2015) reported that among treatments, significantly highest microbial colonies (5.00) were observed in T<sub>1</sub> (dipping in 60 °B sugar syrup for 6 hrs). In contrast, samples subjected to 5 per cent NaCl for 3 hours (T<sub>6</sub>) showed lowest colonies (2.00), while maximum colonies observed in control T<sub>7</sub> (7.66).

Dwivedi and Pandey (2017) reported that the storage period did not exhibit any significant effect on the microbial count of aonla candy.

Tripura *et al.* (2017) reported that, as storage period increased, the bacterial contamination increased irrespective of the treatments. No bacterial contamination was noticed on the 15<sup>th</sup> day of storage in all the treatments. On 30<sup>th</sup> and 45<sup>th</sup> day of storage, no contamination was observed in packed dehydrated slices except in C<sub>1</sub>S<sub>1</sub> (control without package + storage at ambient temperature) 4.37 and 9.62 and C<sub>1</sub>S<sub>2</sub> (control without package + storage at refrigerated temperature 8-10°C) 2.50 and 6.12 respectively. However treatments T<sub>1</sub>S<sub>2</sub> (aluminium foil covers + storage at refrigerated temperature 8-10°C) and T<sub>2</sub>S<sub>2</sub> (150 gauge polypropylene bags + storage at refrigerated temperature 8-10°C) showed no contamination till the 90<sup>th</sup> and 75<sup>th</sup> day of storage respectively. On 120<sup>th</sup> day of storage, both control treatments (C<sub>1</sub>S<sub>1</sub> and C<sub>1</sub>S<sub>2</sub>) exhibited maximum bacterial

contamination, the highest contamination was observed in control C<sub>1</sub>S<sub>1</sub> (57.75) followed by control C<sub>1</sub>S<sub>2</sub> (45.50). The minimum bacterial contamination was observed in aluminium foil covers stored at refrigerated temperature (15.37) followed by 150-gauge polypropylene bags stored at refrigerated temperature (22.50).

Aparna *et al.* (2018) reported that the lowest fungal load was maintained from 1.27 to 2.42 log CFU g<sup>-1</sup> from the first month of storage to the end of storage by the sample 80 °B for 180 minutes. The bacterial loads for 60 °B for 180 min recorded the highest values which varied from 2.30 to 4.35 log CFU g<sup>-1</sup>. Osmo dehydrated bilimbi A<sub>3</sub> (fruit osmosed in 80 °B for 180 min.) recorded lowest bacterial loads ranging from 1.85 to 3.41 log CFU g<sup>-1</sup> during storage. The osmo dehydrated bilimbi fruits were microbiologically safe for a period of 4 months of storage.

Kiranmai *et al.* (2018) observed that the bacterial growth was not observed in the tamarind candy samples at 60 days of storage period. The bacterial growth was observed at 90 days only. T<sub>2</sub> (90 % tamarind + 10 % mango pulp) recorded higher bacterial count ( $3 \times 10^1$ ), followed by T<sub>3</sub>, T<sub>4</sub>, and T<sub>1</sub> ( $2 \times 10^1$ ) at the end of 90 days storage. The interaction effect between days of storage and treatments were not significant.

Gurumeenakshi and Varadharaju (2019) reported the bacterial, fungal and yeast load of the osmo dried slices during storage. Initially there was no microbial load in all the treatments and varieties including the control. After 180 days of storage there was a slight increase in the bacterial load in all the samples, while no fungal and yeast colonies was found in T<sub>1</sub> (citric acid 0.5 %) and T<sub>2</sub> (ascorbic acid solution 0.5 %) in both the varieties.

## **2.4 Cost of production of snapmelon osmodehydrated slices**

Dhumal (2016) reported that the cost of production for the preparation of aonla syrup from 10 kg fruit/treatment. It could be observed that the total expenditure for production of aonla syrup was highest (Rs.2170.52) in T<sub>7</sub> i.e. juice extraction by shredding the fruits, heating (80°C for 5 minutes) with water (1:0.50) and pressing in basket press, then addition of 20 per cent water in pulp residue and heating 80°C for 5 minutes and pressing in basket press and lowest (Rs.1243.36) in T<sub>1</sub> i.e. juice extraction by shredding the fruits and pressing in basket press.

Shinde (2016) reported the cost of production for the preparation of 100 kg osmodehydrated muskmelon slices. It could be observed that the total expenditure for production of osmodehydrated muskmelon slices was highest i.e. Rs.110064 in T<sub>5</sub> (control) and lowest Rs. 74432.7 in the treatment T<sub>4</sub> (1:1.25).

Shinde (2016a) reported the cost of production for the preparation of 100 kg karonda leather. It could be observed that the total expenditure for production of karonda leather was highest i.e. Rs.15321.56 in T<sub>1</sub> (0% sugar) and lowest Rs.12236.55 in the treatment T<sub>5</sub> (20% sugar).

Jadhav (2017) reported the cost of production of kokum syrup prepared from 12.5 kg fruits/treatment. It could be observed that the total expenditure for production of kokum syrup was highest (Rs.1337.07) in the treatment T<sub>7</sub> i.e. juice extraction by pressing the rind pulp after adding 20 per cent water in rind pulp + juice extraction from remaining residue by adding 10 per cent water and lowest in the treatment T<sub>1</sub> (Rs.890.06) i.e. juice extraction by pressing rind pulp (control).

Kolambe (2018) reported that the cost of production for the preparation of 10 kg soft flesh jackfruit wine. It could be observed that the total expenditure for production of soft flesh jackfruit wine was highest Rs.1041.54 in J<sub>6</sub>M<sub>1</sub> i.e. 1:1.5 dilution 0.15 per cent pectinase and juice extraction by mixer and lowest Rs.529.67 in J<sub>1</sub>M<sub>2</sub> i.e. 1:1 dilution 0.05 per cent pectinase and juice extraction by sieve.

## **2.5 Changes in chemical composition of snapmelon preserve during storage**

### **2.5.1 Total soluble solids (°B)**

Jain *et al.* (1983) observed that the TSS content of amla preserve continued to increase from 75 °Brix to 78 °Brix after six months storage at room temperature.

Barve (2001) reported that the TSS of snapmelon fruit gradually increased from 2.4 °B at marble size stage to 4.5 °B at harvest.

Ranote *et al.* (2002) reported slight increase in the TSS of amla preserve (2.39%) during storage, which is attributable to the absorption of sugar from syrup till the final equilibrium, was established.

Durrani and verma (2011) observed that the TSS of murabba (52.2%) in fresh condition increased initially and decreased to 48 and 44 per cent in case of packaging in glass and PET jars on 180 days of storage at ambient temperature. The packaging material significantly affected the TSS during 90 to 180 days of storage at ambient temperature of honey aonla preserve.

Nayak *et al.* (2011) observed that the TSS in segments and syrup of the product were statistically non-significant as the TSS was maintained at 72 °B in aonla preserve.

Priya and Khatkar (2013) observed that the soluble solids of aonla preserve increased gradually during the storage period. The average total soluble solid content was increased from 60.85 °B to 75.50 °B during storage period of 90 days.

Ahmad and Kumaran (2015) observed the results for TSS of aonla preserve samples during storage period of 90 days. The TSS which was observed in the range of 49.83–77.17 °B was highest for the sample without the honey incorporation and lowest for the sample with 15 per cent of honey incorporation. The low moisture content in the preserve sample without honey incorporation may be the reason for higher TSS value.

Dhiman *et al.* (2018) reported that the higher TSS (72.95 °B) in preserve than fresh wild pear fruit was due to sugar penetration in fruits during processing.

Thakur *et al.* (2018) reported that the TSS of preserve increased slightly during storage and this increase in TSS during storage might be due to hydrolysis of polysaccharides into monosaccharide and soluble disaccharides. The highest TSS (59.05 °B) of preserve was recorded in T<sub>3</sub> (blanching with alum 2 %) and the lowest (49.02 °B) in T<sub>1</sub> (blanching with plain water) aonla preserve.

Singh *et al.* (2019) observed that the TSS (°Brix) in aonla murabba increased gradually during ambient storage conditions and maximum TSS was recorded in treatment T<sub>8</sub>- (Cardamom 1.5% + Sugar 70%) i.e. 56.2, 56.9, 58.3 58.0 at initial, 30,60 and 90 days of storage.

### 2.5.2 Reducing sugars

Jain *et al.* (1983) observed that the reducing sugars showed increasing trend during storage of amla preserve.

Ahire (1989) observed that the reducing sugars showed increasing trend during storage of gauva preserve.

Barve (2001) reported that the reducing sugars of snapmelon fruit increased gradually from 0.057 per cent at marble stage to 1.04 per cent at full grown stage.

Ranote *et al.* (2002) reported that the reducing sugars increased considerably during storage of amla preserve.

Durrani and verma (2011) observed that the effect of storage was significant in case of reducing sugars, though the effect of packaging material was insignificant. The reducing sugars increased from 27.3 per cent in fresh condition to 33-34.1 per cent in preserved condition in aonla murabba.

Nayak *et al.* (2011) observed that the maximum reducing sugar content of 19.9 per cent was found in the product of aonla prepared from fresh fruits, while product of aonla prepared from 9 days stored fruits recorded minimum reducing sugar content (17.8%).

Priya and Khatkar (2013) reported that the gradual increase in reducing sugars were noticed during storage period of 90 days in aonla preserve. The mean reducing sugar values for treatments showed that maximum reducing sugars of 45.45 per cent was noticed in the sample of “no-cooking method” at sugar syrup of 70 °B and minimum 38.41 per cent was observed in samples of “brine method” at sugar syrup of 60 °B.

Dhiman *et al.* (2018) observed that the reducing sugars were found to be 4.22 and 25.22 per cent in fresh fruit and preserve of wild pear respectively.

Thakur *et al.* (2018) reported that the reducing sugars of wild aonla preserve showed a significant increase during storage which was comparatively more in ambient storage conditions than in refrigerated. This higher increase might be due to the faster rate of reactions because of high temperature in ambient conditions.

### **2.5.3 Total sugars**

Jain *et al.* (1983) observed that the total sugars of amla preserve increased from 69.9 to 73.3 per cent during storage for six months.

Ahire (1989) observed that the guava preserve showed increasing trend in total sugars when stored for-3 months at room temperature.

Barve (2001) reported that the total sugars of snapmelon fruit increased gradually from 2.185 per cent at marble size stage to 4.4 per cent at full grown stage.

Ranote *et al.* (2002) reported that the total sugars remained almost the same in Chakaiya and Kanchan preserves, however it decreased to a limited extent in Francis cultivar exhibiting a different behaviour.

Durrani and verma (2011) observed that the effect of storage was significant in case of total sugars, though the effect of packaging material was insignificant. The total sugars increased from 50.4 per cent in fresh condition to 62-63.1 per cent in 180 days of storage in aonla murabba.

Nayak *et al.* (2011) observed that the total sugar content in segments was maximum (48.7%) in the aonla preserve prepared from 9 days stored fruits. The minimum content of total sugars (47.3%) were recorded in aonla preserve prepared from fresh fruits.

Patel *et al.* (2013) reported that total sugar content of aonla murabba increased slightly with increase in storage period. The interaction effect of varieties and pre-treatments on total sugar content was found to be significant on 180 days of storage. The maximum total sugars content was observed in V<sub>1</sub>T<sub>4</sub> (cultivar kanchan + salt and alum 2%) i.e. 56.17 per cent on 180 days of storage, however it was minimum in V<sub>3</sub>T<sub>1</sub> (cultivar NA-7 + water) 52.14 per cent.

Priya and Khatkar (2013) observed significant increase in the total sugars with increase in storage period. The mean total sugars value showed that maximum total sugars of 69.10 per cent were found in samples of aonla preserves.

Dhiman *et al.* (2018) observed that the total sugars were found to be 9.21 and 53.62 per cent in fresh fruit and preserve of wild pear respectively.

Thakur *et al.* (2018) reported that the total sugars of wild aonla preserve showed a significant increase during storage which was comparatively more in ambient storage conditions than in refrigerated. This higher increase might be due to the faster rate of reactions because of high temperature in ambient conditions.

#### 2.5.4 Titratable acidity

Jain *et al.* (1983) observed that the pH of amla preserve tended to increase while acidity showed a continuous fall during storage.

Gosh *et al.* (1985) reported that titratable acidity contents increased during the early growth stages but declined on attaining maturity in cultivar Himsagar and Fazli.

Dhavan (1990) reported the loss in acidity of ber preserve during storage.

Barve (2001) reported that the titratable acidity of snapmelon fruit was found to be decreased from marble size stage (0.115 %) to the full grown stage (0.053 %).

Ranote *et al.* (2002) reported that the pH of preserve increased slightly (2.57%) while the acidity declined considerably (23.1 to 30.81 %) in amla preserve.

Durrani and verma, (2011) observed that there was significant and remarkable reduction in acidity of aonla murabba during 180 days storage. The acidity reduced from 6.05 per cent in fresh condition to 0.65 per cent and 0.64 per cent in glass and pet jars respectively after 180 days storage.

Nayak *et al.* (2011) observed very little difference in titratable acidity in both segments and syrup of the aonla preserve.

Patel *et al.* (2013) reported minimum titratable acidity of 0.616 per cent in V<sub>1</sub>T<sub>4</sub> (cultivar kanchan + salt and alum 2%) and maximum (0.659%) in V<sub>3</sub>T<sub>1</sub> (cultivar NA-7 + water) after 180 days of storage. The titratable acidity content of aonla murabba decreased with the increase in storage period.

Priya and Khatkar (2013) observed that the titratable acidity of aonla preserves decreased significantly during storage period of 90 days. The mean titratable acidity was 0.841 per cent on first day of storage which decreased significantly to 0.522 per cent during 90 days of storage.

Khan *et al.* (2016) reported that in the different treatments maximum mean values of acidity were recorded in sample T<sub>5</sub> (mango slices + 60 °brix sucrose solution) which was 1.313 per cent followed by T<sub>0</sub> (mango slices + mango juice (control) 1.290 per cent, while minimum mean value was observed in sample T<sub>3</sub> (mango slices + 40 °brix sucrose solution) i.e. 1.197 per cent followed by T<sub>2</sub> (mango slices + 30 °brix sucrose solution) 1.253 per cent. During storage maximum increase was observed in sample T<sub>4</sub> (mango slices + 50 °brix sucrose solution) i.e. 15.96 per cent followed by T<sub>5</sub> (13.82%), while minimum increase was observed in sample T<sub>3</sub> (4.8%) followed by T<sub>2</sub> (5.30%) in mango preserve.

Basnet (2017) observed that the acidity of blanched and un-blanched samples were found to be 0.841 per cent and 0.890 per cent, respectively. The blanched sample has minimum acidity compared to un-blanched which is probably due to more leaching losses of acid in sugar in amla preserve.

Dhiman *et al.* (2018) observed that the titratable acidity of wild pear preserve slightly increased from value of 1.23 to 1.27 per cent after processing which could be due to additional citric acid treatment during processing.

Thakur *et al.* (2018) reported that the wild aonla preserve showed a slight decrease in titratable acidity during storage.

Decrease in titratable acidity during storage might be due to copolymerization of organic acids with sugars and amino acids.

### **2.5.5 Moisture**

Ahire (1989) observed that the intermediate moisture food of guava preserve stored in glass bottles showed continuous decline in moisture content at room temperature.

Barve (2001) reported that the moisture percentage of snapmelon fruit steadily increased till maturity.

Daisy and Gehlot (2006) reported decrease of moisture content in the aonla preserves during storage.

Durrani and verma (2011) observed that the fresh murabba had 48.3 per cent moisture content which initially decreased and after 30 days of storage the moisture content of this aonla preserve product started increasing with enhancement of storage period. Maximum moisture content of 52.2 per cent in glass jar and 56.5 per cent in PET jar was noted on 180 day of storage showing overall increase respectively by 3.87 and 8.2 per cent during entire period of storage.

Priya and Khatkar, (2013) observed significant decrease in moisture content during the storage period of 90 days in aonla preserve.

Ahmad and Kumaran (2015) observed that the moisture content of aonla preserve was found to decreased a little with honey incorporation. However, during ambient storage of 90 days the trend was found to reverse and the honey incorporated samples of aonla preserve had higher moisture content. The control, 7.5 and 15 per cent honey incorporated samples had, respectively, 44, 50.32 and 53 per cent moisture.

## **2.6 Changes in sensory quality of snapmelon preserve during storage**

### **2.6.1 Colour**

Chachad (1995) found that colour of watermelon changes from dull green at marble stage to dark blackish green at full grown stage.

Barve (2001) reported that the highest colour score of snapmelon preserve was found in unripe fruits.

Chandra (2010) reported that in karonda preserve the highest score (8.4) for colour was observed on 15 days (D<sub>1</sub>) and the lowest score (7.1) was obtained on 240 days (D<sub>17</sub>) of storage.

Khan *et al.* (2016) observed that the overall mean score of judges for colour of mango slices was significantly ( $P < 0.05$ ) decreased from 9 to 6.517 during storage. For treatments maximum mean value was observed in sample T<sub>3</sub> (mango slices + 40°brix sucrose solution) 8.2 followed by T<sub>2</sub> (mango slices + 30°brix sucrose solution) 8.171, while minimum mean value was observed in sample T<sub>1</sub> (mango slices + 20°brix sucrose solution) 6.214 followed by T<sub>5</sub> (7.143).

Thakur *et al.* (2018) reported that the colour score of wild aonla preserve changed slightly during six months of storage under ambient storage conditions. Slight change in colour shade has been observed in the product under ambient storage conditions (in both glass and PET jars) as initial colour of preserve was Yellow Green 152 A, after 3 months storage colour shade changes to Yellow Green 153 A and after 6 months storage colour shade changes to Yellow Green 154 A.

### 2.6.2 Flavour

Barve (2001) reported that the highest flavour score of snapmelon preserve was found in unripe fruits.

Durrani and verma (2011) reported that in case of flavour the average score (7.75) for T<sub>1</sub> (750 gm honey + 1000 gm amla) differed significantly to that of T<sub>2</sub> (1000 gm honey + 1000 gm amla) 8.05 and T<sub>3</sub> (1250 gm honey + 1000 gm amla) 8 while there was non-significant difference in flavour score of samples T<sub>2</sub> and T<sub>3</sub>. However, the highest flavour score was awarded to T<sub>2</sub> sample in aonla murabba.

Hussain *et al.* (2019) observed that the maximum score in flavour (6.53) was recorded in the olive murabba of semi-ripened fruit. It was followed by lemon green stage having a score of 4.77. The flavour of fully ripened fruit after processing scored 3.99 points and differed significantly from semi-ripened stage of maturity.

Singh *et al.* (2019) observed that the sensory score for flavour was highest in treatment T<sub>8</sub>- (Cardamom 1.5% + Sugar 70%) and it scored 8.9, 8.3, 7.4 and 7.3 in initial, 30, 60, 90 days in aonla murabba.

### 2.6.3 Texture

Barve (2001) reported that the highest texture score of snapmelon preserve found in unripe fruits.

Patel (2012) observed that the maximum texture (7.40) was found in T<sub>3</sub> and minimum texture (6.96) was in T<sub>1</sub> variety at 30 days. At 90 days of storage texture score increased and maximum texture score (8.22) was found in T<sub>3</sub> and minimum texture (7.90) was in T<sub>1</sub> variety in aonla preserve.

Basnet (2017) observed that the texture score of blanched sample had highest mean score compared to un-blanched. Statistical test showed that blanching treatment has significant effect ( $p < 0.05$ ) on texture property of amla preserve. The better texture of blanched sample might be due to higher total solids which maintain the body of the preserve.

Dhiman *et al.* (2018) reported that the highest score for texture found in treatment CA<sub>11</sub> (1 % citric acid dip for 30 minutes) was 8.50 in wild pear preserve.

Thakur *et al.* (2018) observed that the maximum texture score as 8.22 was obtained in T<sub>3</sub> (blanching with alum 2 %) treatment which was statistically at par with T<sub>5</sub> (blanching with plain water and dipping in lime water 3 %) and minimum (6.82) was found in T<sub>1</sub> (blanching with plain water) closely followed by T<sub>2</sub> (blanching with sodium sulphite 0.5 %) in wild aonla preserve.

Gaikwad *et al.* (2019) reported that the sweetener-based carrot preserve with 99:1 sugar to stevia received highest sensory score (8.6) in case of all sensory attributes followed by sweetener-based carrot preserve having 99.5:0.5 and scored 8.1 compared to rest of the samples in carrot preserve.

#### **2.6.4 Overall acceptability**

Barve (2001) reported that the preserve prepared from unripe snapmelon fruits showed highest overall acceptability score. The maximum score was observed at initial stage of evaluation (8.19) followed by 3 months of storage (8.16) and minimum at 6 months of storage (8.15).

Ranote *et al.* (2002) reported that the storage behaviour of the amla preserve showed that there was only slight decline in the overall acceptability of the product.

Nayak *et al.* (2011) observed that the organoleptic acceptability of the aonla preserve was found to decreased with the increase in storage period of fruits. The maximum (8.0) organoleptic score was found in preserve prepared from fresh fruits followed by the preserve prepared from 3 days stored fruits (7.6), while minimum score (4.7) in the preserve was noted when it was prepared from 9 days stored fruits. The preserve prepared from 6 and 9 days stored fruits were low in quality.

Bhattacharjee *et al.* (2013) observed that the maximum score (8.2) was noted in the aonla preserve prepared from 7 days stored fruits followed by those prepared from fresh fruits (8.0), while minimum (5.4) in the product prepared from fruits stored up to 21 days in segment-in-syrup.

Priya and Khatkar (2013) observed that the decrease in the scores for the overall acceptability was observed during the storage period of 90 days. The maximum scores (7.993) for overall acceptability was noticed in the samples of “no-cooking method” at sugar syrup 70°B. The minimum scores (7.474) for overall acceptability was observed in the aonla preserve samples “brine method” at sugar syrup of 70°B.

Khan *et al.* (2016) observed that initially the mean score of judges for overall acceptability of mango slices samples T<sub>0</sub> (control) to T<sub>5</sub> (mango slices + 60°Brix sucrose solution) was 8.1, 8.2, 8.9, 8.8, 8.6, and 8.5, respectively, which were decreased to 4.3, 6.0, 7.5, 7.2, 4.7, and 3.4, respectively during storage. Treatments maximum mean value (8.1) was observed in sample T<sub>2</sub> (mango slices + 30°Brix sucrose solution) followed by T<sub>3</sub> (mango slices + 40°Brix sucrose solution) 8.08, while minimum mean value was observed in sample T<sub>0</sub> (5.68) followed by T<sub>5</sub> (5.72).

Dhiman *et al.* (2018) reported that the highest score (8.55) for overall acceptability was found in treatment of CA<sub>11</sub> (1 % citric acid dip for 30 minutes) in wild pear preserve.

Thakur *et al.* (2018) observed that the highest score (8.12) of overall acceptability was observed in T<sub>3</sub> (blanching with alum 2 %) and lowest (7.11) in T<sub>5</sub> (blanching with plain water and dipping in lime water 3 %) which was statistically at par with T<sub>2</sub> (blanching with sodium sulphite 0.5 %) in wild aonla preserve.

## **2.7 Microbial count of snapmelon preserve during storage**

Emamifar (2010) studied the effect of nanocomposite packaging containing Ag and ZnO on shelf life of fresh orange juice and reported that bacterial population increased with increased in storage time to 56 days from  $4.84 \pm 0.07$  to  $6.35 \pm 0.06$  log cfu/ ml and also increased yeast population from  $4.94 \pm 0.05$  to  $6.47 \pm 0.08$  log cfu/ml in orange juice.

Durrani and verma (2011) reported that the no micro-organism were detected in fresh samples. During first 90 days storage of samples packed in glass and PET jars and stored at ambient temperature also the microorganism were either not detected or were too few to count. After 120 days storage only the presence of microorganism were noted. The TPC on 120 day of storage was 2.76 and 30.71 log cfu/g in glass and PET jars. These counts increased significantly up to maximum 4.71 log cfu/g in glass jar and up to 4.90 log cfu/g in PET jar on storage of samples for 180 days at ambient temperature in aonla murabba.

Priya and Khatkar (2013) reported increase in bacterial count with increase in storage period. Maximum counts  $2.7 \times 10^3$  cfu/g was seen in the samples of “brine method” at sugar syrup

of 60°B. In the samples of “traditional method” no growth was noticed on the day 1 of storage but after that a tremendous increase was noticed in the microbial growth that lead to fermentation of aonla preserves.

Ahmad and Kumaran (2015) studied the microbiological characteristics of the preserve samples which were evaluated based on the yeast and mould count. The aonla preserve samples were found to be stable throughout the 90 days period of study. The yeast and mould detected were too few to be counted in the sample without honey incorporation. The high TSS maintained during the study period, acidic pH, environmental conditions and the hygienic packaging practice may be the reason for this. All the above reasons together with the antimicrobial property of honey, may be the reason for non-detection of yeast and mould in honey incorporated samples.

## **2.8 Cost of production of snapmelon preserve**

Gharoskar (2014) reported the cost of production for the preparation of 100 kg sapota spicy nectar. It could be observed that the total expenditure for production of sapota spicy nectar was highest i.e. Rs.6404.1 in T<sub>2</sub>S<sub>2</sub> (2% lime juice + 0.4% ginger juice) and lowest (Rs.5919.9) in T<sub>1</sub>S<sub>3</sub> (0% lime juice + 0.8% ginger juice).

Gade (2017) reported the cost of production for the preparation of 100 kg ber *tuti fruiti*. It could be observed that the total expenditure for production of ber *tuti fruiti* was highest (Rs.23882) in T<sub>2</sub> (pre-treatment of 1% CaCO<sub>3</sub>) followed by Rs.22791 in T<sub>4</sub> (pre-treatment of 1% KAl (SO<sub>4</sub>)<sub>2</sub>), Rs.23662 in T<sub>3</sub> (pre-treatment of 1% CaCl<sub>2</sub>) and lowest (Rs.22361) in T<sub>1</sub> (control).

Thakur *et al.* (2018) reported that the cost of production of 500 gm wild aonla preserve was Rs. 24.49 in glass jar, whereas, it was observed slightly higher as Rs. 29.49 in PET jar.

Singh *et al.* (2019) from their studies concluded that treatment T<sub>8</sub> (cardamom 1.5% + sugar 70%) was found most suitable treatment in terms of physico- chemical properties, organoleptic test and treatment T<sub>7</sub> (cardamom 1.5% + sugar 65%) recorded highest cost benefit ratio (1:1.42) for preparation of aonla murabba.

## **CHAPTER III**

### **MATERIAL AND METHODS**

The experiment entitled “**Studies on standardization of osmodehydrated slices and preserve making technology in snapmelon (*Cucumis melo var. momordica L.*)**” was undertaken during the period September, 2019 to April, 2020 at Post Harvest Technology Laboratory, College of Horticulture, Dapoli, District- Ratnagiri (M.S.) The research study include two experiments:

1. Standardization of osmodehydrated slices making technology from different maturity stages of snapmelon.
2. Standardization of preserve making technology from different maturity stages of snapmelon.

#### **Experiment No.1: Standardization of osmodehydrated slices making technology from different maturity stages of snapmelon fruit**

In this experiment, snapmelon osmodehydrated slices were prepared by using the fruits of various maturity stages and also by using different concentrations of sugar syrup and stored at ambient storage condition for 6 months. Product was analyzed for different chemical and sensory attributes and also microbial count was taken at 3 months interval during storage.

#### **Experiment No.2: Standardization of preserve making technology from different maturity stages of snapmelon fruit**

In this experiment, the snapmelon preserve was prepared by using the fruits of various maturity stages and also by using different concentrations of sugar syrup and stored at ambient condition for 6 months. Product was analyzed for different

chemical and sensory attributes and also microbial count was taken at 3 months interval during storage.

The details of material used and methods adopted during the course of investigation are presented in this chapter under the following appropriate headings.

### **3.1 Material used:**

#### **3.1.1 Fruits:**

Fruit of different maturity stages of snapmelon as per the requirement of experiments were procured from the farm of College of Agriculture Engineering, Dapoli. Fruits were washed with water, cleaned and used for conducting the research.

#### **3.1.2 Chemicals:**

All the chemicals used in both the experiments were procured from Shree Chemicals, MIDC, Ratnagiri. All the chemicals used in this investigation were of analytical grade.

#### **3.1.3 Food additives:**

Food additives like sugar, KMS and citric acid were purchased from local market.

### **3.2 Methods:**

#### **3.2.1 Experiment no.1: Standardization of osmodehydrated slices making technology from different maturity stages of snapmelon fruit**

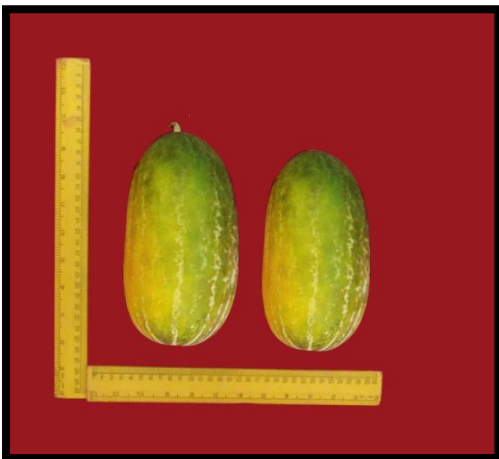
The experiment comprised of 12 treatment combinations consisting of Factor A and Factor B. The experimental and treatment details are given below.



**Mature green**



**Turning**



**Ripe**



**Over ripe stage**

**Plate I: Fruits of different maturity stages of snapmelon**

**Experimental details:**

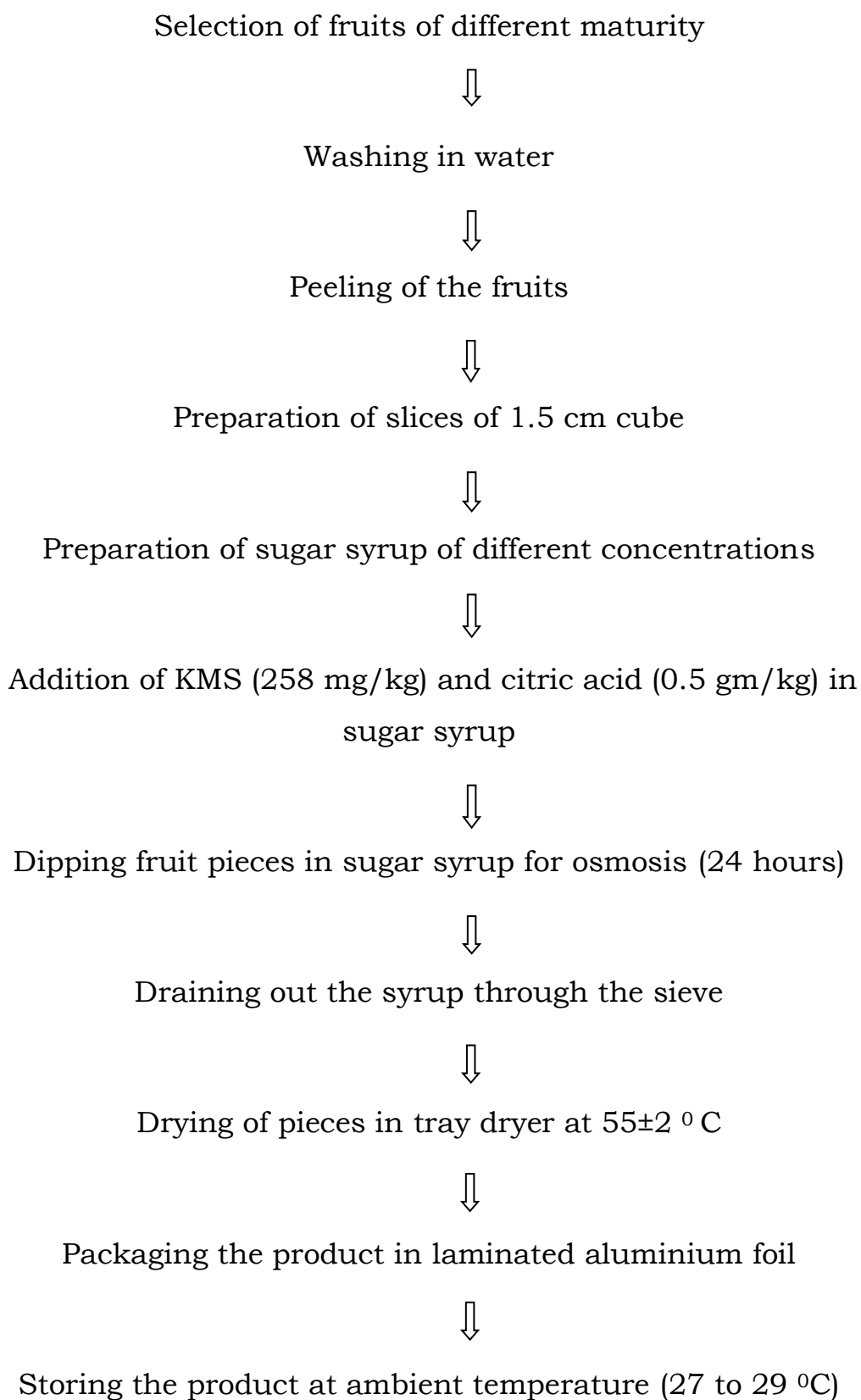
1.	Crop	Snapmelon
2.	Variety	Local
3.	Design	F.C.R.D.
4.	No. of treatment combinations	12
5.	Replications	3
6.	No. of packets required per treatment per replication	6
7.	Total packets required	216

**Treatment details:****Factor A:****Maturity stages :****M<sub>1</sub>** :Mature green stage**M<sub>2</sub>** :Turning stage**M<sub>3</sub>** :Ripe stage**M<sub>4</sub>** :Over ripe stage**Factor B:****Sugar syrup concentrations :****S<sub>1</sub>** :40 °B**S<sub>2</sub>** :50 °B**S<sub>3</sub>** :60 °B**3.2.1.1 Osmodehydrated slices preparation:**

The fruits of different maturity stages of snapmelon were selected for the experiment. The selected fruits were washed with cold water, peeled with the help of peeler and cut into the cubes of the size 1.5 cm. Sugar syrup was prepared of different concentrations (40, 50, 60 °B) by dissolving sugar in distilled water. The KMS and citric acid were added at the rate of 258 mg and 0.5 gm/kg sugar syrup, respectively. Then fruit pieces were dipped in the sugar solution of different concentration for osmosis for 24 hours. Then the syrup was drained with the help of sieve. The pieces removed from different concentration of sugar syrup were dried in the cabinet dryer at the temperature of  $55 \pm 2$  °C till they showed constant weight. The packaging of

product was done in the laminated aluminium foil and product was stored at ambient temperature (27 to 29 °C).

**Fig.1 Flow chart for osmodehydrated slices:**



### 3.2.2 Experimental No.2: Standardization of preserve making technology from different maturity stages of snapmelon fruit

The experiment comprised of 12 treatment combinations consisting of Factor A and Factor B. The experimental and treatment details and observations to be recorded are given below.

#### Experimental details:

1.	Crop	Snapmelon
2.	Variety	Local
3.	Design	F.C.R.D.
4.	No. of treatment combinations	12
5.	Replications	3
6.	No. of plastic jars/treatment/replication	6
7.	Total plastic jars required	216

#### Treatment details:

##### Factor A:

##### Maturity stages :

**M<sub>1</sub>** :Mature green stage

**M<sub>2</sub>** :Turning stage

**M<sub>3</sub>** :Ripe stage

**M<sub>4</sub>** :Over ripe stage

##### Factor B:

##### Sugar syrup concentrations:

**S<sub>1</sub>** :60 °B

**S<sub>2</sub>** :70 °B

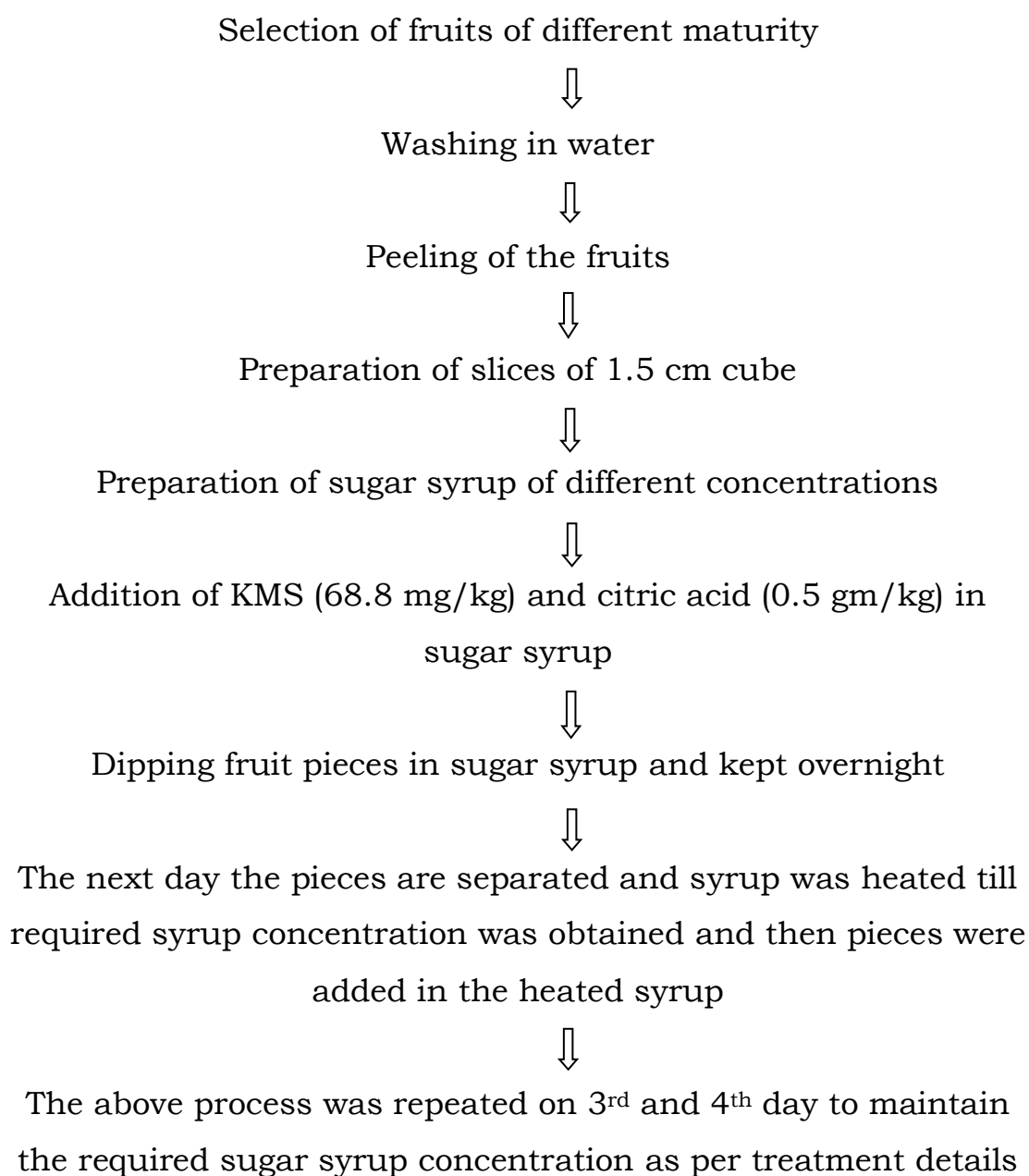
**S<sub>3</sub>** :80 °B

#### 3.2.2.1 Preserve preparation:

The fruits of snapmelon of different maturity stages were selected for the experiment. Fruits were washed with cold water. Then the fruits were peeled with help of peeler and cut into 1.5 cm cubes with the help of stainless steel knife. Sugar syrup of different concentrations was prepared and KMS and citric acid was added at the rate of 68.8 mg and 0.5 gm/kg sugar syrup,

respectively. The cut fruit pieces were dipped in the sugar syrup and kept overnight. Then next day pieces were separated and syrup was heated till required sugar concentrations as per treatment details is obtained and then pieces were added in the heated syrup. On third and fourth day same process was repeated till the required syrup concentration as per treatment details was maintained. Packaging of the product was done in plastic jars and stored at ambient temperature (27 to 29 °C).

**Fig.2 Flow chart for preserve:**





Packing the product in plastic jars



Storing the product at ambient temperature (27 to 29 °C)

### **3.3 Observations recorded**

#### **A) Changes in chemical composition of snapmelon osmodehydrated slices and preserve during storage**

1. T.S.S. (°Brix)
2. Reducing sugars (%)
3. Total sugars (%)
4. Titratable acidity (%)
5. Moisture content (%)

#### **B) Changes in sensory quality of snapmelon osmodehydrated slices and preserve during storage**

1. Colour
2. Flavour
3. Texture

#### **C) Microbial studies of snapmelon osmodehydrated slices and preserve during storage**

1. Fungal count
2. Bacterial count

The above observations were recorded at 3 months interval during 6 months storage for both the experiments.

### **3.4. METHODS OF ANALYSIS -**

#### **3.4.1 Changes in chemical composition of snapmelon osmodehydrated slices and preserve during storage.**

##### **3.4.1.1 Total soluble solids (°Brix):**

Total soluble solids (T.S.S.) were determined with the help of hand refractometer (Erma Japan, 0 to 32°Brix) as per the

method of A.O.A.C., 1975. The sample of osmodehydrated slices was prepared by grinding the pieces in mixer and in case of preserve only the pieces of preserve were pulped in mortar and from the 2 gm pulped sample was taken in 250 ml volumetric flask. To this 18ml of distilled water was added and the solution was boiled for half an hour by replacing water lost by evaporation. The drop of representative sample was placed on the dry refractometer and observed reading was multiplied by 10 and expressed in °Brix.

#### **3.4.1.2 Reducing sugars (%):**

The reducing sugars were estimated by using Lane and Eynon (1923) method with modifications suggested by Ranganna (1986). The sample of osmodehydrated slices was prepared by grinding the pieces in mixer and in case of preserve only the pieces of preserve were pulped with pestle and mortar and from 25 gm pulped sample was taken in 250 ml volumetric flask. To this, 100 ml of distilled water was added and the contents were neutralized by 1 N sodium hydroxide by using phenolphthalein indicator. After neutralizing, the solution was boiled gently for half hour by replacing water lost by evaporation. Then after cooling, 2 ml of 45 per cent lead acetate was added to it. The contents were mixed well and kept for 10 minutes. Then exact quantity of 2.5 ml of 22 per cent potassium oxalate was added to precipitate the excess of lead acetate. The volume was made to 250 ml with distilled water and solution was filtered through whatman No.4 filter paper. This filtrate was used for determination of reducing sugars by titrating it against the boiling mixture of Fehling 'A' and Fehling 'B' (5 ml each). Methylene blue was used as an indicator. The results were expressed on per cent basis by using following formula.

$$\text{Reducing sugars (\%)} = \frac{100}{\text{B.R}} \times \frac{250}{\text{Wt. of sample}} \times 0.05$$

#### **3.4.1.3 Total sugars (%):**

The total sugars were estimated by using method of Lane and Eynon (1923) as described by Ranganna (1986). For inversion at room temperature, a 50 ml aliquot of clarified dealeded solution prepared for reducing sugars estimation was transferred to 250 ml flask, to which, 5 gm of citric acid was added and then boiled for 10 min on mental heater. It was then neutralized with 1N NaOH solution. The volume of neutralized aliquot was made to 250 ml with distilled water. This aliquot was used for determination of total sugars by titrating it against the boiling mixture of Fehling 'A' and Fehling 'B' (5 ml each). Methylene blue was used as indicator. The results were expressed on per cent basis by using following formula.

$$\text{Total sugars (\%)} = \frac{100}{\text{B.R}} \times \frac{250}{\text{Wt. of sample}} \times \frac{250}{50} \times 0.05$$

#### **3.4.1.4 Titratable acidity (%):**

The method described by Ranganna (1986) was adopted for estimation of titratable acidity from snapmelon osmodehydrated slices and preserve. The sample of osmodehydrated slices was prepared by grinding the pieces in mixer and in case of preserve only the pieces of preserve were pulped with pestle and mortar and from the 2 gm was taken in 250 ml volumetric flask. To this 18ml of distilled water was added and the solution was boiled for half an hour by replacing water lost by evaporation. After cooling the whole quantity of sample was titrated against standard 0.1N sodium hydroxide solution, using phenolphthalein as an indicator. The appearance of light pink colour considered as the

end point. The per cent titrable acidity was expressed in terms of anhydrous citric acid.

$$\text{Titratable acidity (\%)} = \frac{\text{Burette reading} \times \text{Normality of NaOH} \times 0.064 \times 100}{\text{Wt. of sample taken}}$$

#### **3.4.1.5 Moisture (%)**

Moisture content of osmodehydrated slices and preserve samples were determined on percentage basis. The sample of osmodehydrated slices was prepared by grinding the pieces in mixer and in case of preserve only the pieces of preserve were pulped with pestle and mortar. The 10 gm sample was taken in petri dish and dried in cabinet dryer at 60 °C till constant weight was observed. Then dried weight was recorded and moisture content was estimated by following formula.

$$\text{Moisture content (\%)} = \frac{\text{Initial weight} - \text{Final weight}}{\text{Initial weight}} \times 100$$

#### **3.4.2 Changes in sensory quality of snapmelon osmodehydrated slices and preserve during storage.**

In sensory evaluation; colour, flavour and texture of snapmelon osmodehydrated slices and preserve was observed at 0, 3 and 6 months during storage. The sensory qualities in terms of colour, flavour and texture were assessed by panel of 10 judges with 9 point Hedonic scale score (Amerine *et al.*, 1965) as given below. The overall quality score was obtained by averaging the score of colour, flavour and texture. The score of 5.5 and above indicate acceptability within the score range of 1 to 9.

**Sensory Score Rating:**

- 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

**3.4.3 Microbial studies of snapmelon osmodehydrated slices and preserve during storage****3.4.3.1 Fungal count:**

For estimation of fungal growth in snapmelon osmodehydrated slices and preserve, serial dilution and plate technique was followed using potato dextrose agar medium (200 g potato, 20 g Dextrose, 20 g of Agar-agar and 1000 ml of distilled water). First 200 g of potato were peeled and kept for boiling in 500 ml of distilled water and then after boiling potato were squeezed by using muslin cloth, then in 500 ml of distilled water 20 g of dextrose, 20 g of agar-agar and potato extract was added to prepare the medium. For this technique water blanks were prepared by taking 9 ml of distilled water in sterilized test tube. 1g of pulped sample of osmodehydrated slices and preserve pieces was transferred to first water blank to obtained  $10^1$  dilution. The content was homogenized by shaking. After 1 minute 1ml of aliquot from  $10^1$  dilution was transferred to second water blank to obtained  $10^2$ . Likewise the dilution was made to  $10^3$  dilution and then from last ( $10^3$ ) dilution 1 ml of

aliquot was transferred on solid potato dextrose agar medium in sterilized petri plates and spread evenly with sterilized 'L' spreader. Such inoculated plates were then incubated at  $27\pm 2^{\circ}\text{C}$  for 2 days and observed for colony development. Each treatment was replicated three times. After 48 hours fungal colonies from  $1\text{cm}^2$  were counted using colony counter. Five random observations per plate were recorded and averaged to obtain number of colonies per  $\text{cm}^2$  and then the number of colonies per plate was calculated.

#### **3.4.3.2 Bacterial count**

To estimate the bacterial growth in snapmelon osmodehydrated slices and preserve serial dilution and plate technique was followed using nutrient agar medium (3g-Beef extract, 5g-Peptone, 20g Agar-agar and 1000 ml distilled water). For this technique water blanks were prepared by taking 9 ml of distilled water in sterilized test tube. 1gm of pulped sample of osmodehydrated slices and preserve pieces was transferred to first water blank to obtained  $10^1$  dilution. The content was homogenized by shaking. After 1 minute 1ml of aliquot from  $10^1$  dilution was transferred to second water blank to obtained  $10^2$ . Likewise the dilution was made to  $10^3$  dilution and then from last ( $10^3$ ) dilution 1ml of aliquot was transferred on solid nutrient agar medium in sterilized petri plates and spread evenly with sterilized 'L' spreader. Such inoculated plates were then incubated at  $27\pm 2^{\circ}\text{C}$  for 2 days and observed for colony development. Each treatment was replicated three times. After 48 hours colonies from  $1\text{cm}^2$  were counted using colony counter. Five random observations per plate were recorded and averaged to obtain number of colonies per  $\text{cm}^2$  and then number of colonies per plate was calculated.

### **3.4.1 Cost of production:**

The cost of production for preparation of snapmelon osmodehydrated slices and preserve was worked out by considering existing rates of various inputs such as cost of raw material, labour, electricity charge supervision charges, depreciation and interest on the fixed capital. Cost of production was calculated for 100 kg finished product.

The gross returns as per treatments were worked out by considering prevailing market price. The net profit as well as benefit:cost was calculated for different treatments.

### **3.4.2 Statistical analysis:**

The data obtained in the present study were subjected to Factorial Completely Randomized Design (FCRD) with three replications for statistical analysis as suggested by Panse and Sukhatme (1985). The critical difference (C.D.) at 1 per cent level of probability was used for comparing between treatments.

## **CHAPTER IV**

### **RESULTS AND DISCUSSION**

The present investigation was undertaken on “Standardization of osmodehydrated slices and preserve making technology in snapmelon (*Cucumis melo var. momordica* L.)” and it was conducted at Olericulture Laboratory and Fruit Processing Unit of College of Horticulture, Dapoli, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Dist. Ratnagiri.

The research study include two experiments:

1. Standardization of osmodehydrated slices making technology from different maturity stages of snapmelon fruit.
2. Standardization of preserve making technology from different maturity stages of snapmelon fruit.

The experimental results obtained are presented and discussed in this chapter under following headings:

- 4.1 Changes in chemical composition of snapmelon osmodehydrated slices during storage under ambient temperature (27-29°C) condition.
- 4.2 Changes in sensory quality of snapmelon osmodehydrated slices during storage under ambient temperature (27-29°C) condition.
- 4.3 Microbial count of snapmelon osmodehydrated slices during storage under ambient temperature (27-29°C) condition.
- 4.4 Cost of production of snapmelon osmodehydrated slices.
- 4.5 Changes in chemical composition of snapmelon preserve during storage under ambient temperature (27-29°C) condition.

- 4.6 Changes in sensory quality of snapmelon preserve during storage under ambient temperature (27-29°C) condition.
  - 4.7 Microbial count of snapmelon preserve during storage under ambient temperature (27-29°C) condition.
  - 4.8 Cost of production of snapmelon preserve.
- 4.1 Changes in chemical composition of snapmelon osmodehydrated slices during storage under ambient temperature (27-29°C) condition.**

In this study snapmmelon osmodehydrated slices were prepared by using the fruits of various maturity stages and also by using different sugar syrup concentrations and stored for 6 months at ambient storage condition for further study.

#### **4.1.1 Total soluble solids (°B)**

The data presented in Table 1 and depicted in Fig.3 indicates the T.S.S. content of snapmelon osmodehydrated slices during storage. From the table it was observed that T.S.S. of osmodehydrated slices decreased from '0' month (87.67 °B) to 6 months (75.38 °B) of storage, irrespective of maturity stages and sugar syrup concentrations.

The decrease in T.S.S. of osmodehydrated slices during storage may be due to dilution of native T.S.S. of slices because of absorbtion of moisture from surrounding atmosphere in package due to hygroscopic nature of slices. The moisture content of osmodehydrated slices was found to be increased with increase in storage period (Table 5) and hence decrease in T.S.S. was observed. Present findings are in line with the findings reported by Rai *et al.* (2007) in osmotically dehydrated pineapple slices.

The T.S.S. of osmodehydrated slices differs significantly with respect to different treatments of maturity stages during entire storage period. During storage, at '0' month treatment M<sub>3</sub> (19.47 °B) recorded maximum T.S.S. and M<sub>2</sub> (89.07 °B) was at par with it. At 3 months storage treatment M<sub>3</sub> (79.00 °B) and at 6 months storage treatment M<sub>2</sub> (83.00 °B) recorded significantly maximum T.S.S. Minimum T.S.S. was recorded by M<sub>4</sub> at '0' (82.47 °B), M<sub>1</sub> (74.23 °B) at 3 months and M<sub>4</sub> (64.67 °B) at 6 months storage, irrespective of sugar syrup concentrations.

The T.S.S. of osmodehydrated slices at '0' and 3 months storage was found to be increased from M<sub>1</sub> (87.68 and 74.23 °B) to M<sub>3</sub> (91.47 and 79.00 °B) and then decreased from M<sub>3</sub> to M<sub>4</sub> (82.47 and 77.20 °B). At 6 months it increased from M<sub>1</sub> (81.50 °B) to M<sub>2</sub> (83.00 °B) and then decreased from M<sub>2</sub> to M<sub>4</sub> (64.67 °B).

The fruit pectin and starch impart good texture to the fruit. However, with the advancement of ripening, fruit softening takes place due to hydrolysis of insoluble pectins to soluble form and starch into sugars.

In the present study increase in T.S.S. with increase in maturity stage may be due to increase in native sugars with the advancement in maturity stage. It may also be mainly due to better absorption of sugar syrup during 24 hours osmosis which increases with increase in softening of fruit. However, decrease in T.S.S. observed at over ripe stage may be due to decrease in native sugars and destruction of texture of fruit pieces which are unable to hold the absorbed sugar before drying. At six months storage decrease in T.S.S. from turning stage (M<sub>2</sub>) may be the effect of absorption of moisture by fruit pieces due to destruction of texture, which might have diluted native sugar.

**Table 1: Changes in T.S.S. (°B) of snapmelon osmodehydrated slices during storage at ambient temperature (27-29°C)**

Treatments (Maturity stages)	'0' month				3 months				6 months			
	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean
<b>M<sub>1</sub></b>	81.90	89.55	91.60	<b>87.68</b>	71.00	72.90	78.80	<b>74.23</b>	79.00	81.50	84.00	<b>81.50</b>
<b>M<sub>2</sub></b>	85.60	89.80	91.80	<b>89.07</b>	72.50	76.60	79.50	<b>76.20</b>	81.00	83.00	85.00	<b>83.00</b>
<b>M<sub>3</sub></b>	90.30	91.50	92.60	<b>91.47</b>	76.20	80.60	80.20	<b>79.00</b>	68.50	71.50	77.00	<b>72.33</b>
<b>M<sub>4</sub></b>	80.60	82.80	84.00	<b>82.47</b>	75.00	77.00	79.60	<b>77.20</b>	63.00	65.00	66.00	<b>64.67</b>
<b>Mean</b>	<b>84.60</b>	<b>88.41</b>	<b>90.00</b>	<b>87.67</b>	<b>73.68</b>	<b>76.78</b>	<b>79.53</b>	<b>76.66</b>	<b>72.88</b>	<b>75.25</b>	<b>78.00</b>	<b>75.38</b>
	<b>S.Em.±</b>		<b>C.D. at 1%</b>		<b>S.Em.±</b>		<b>C.D. at 1%</b>		<b>S.Em.±</b>		<b>C.D. at 1%</b>	
<b>Maturity stage (M)</b>	0.654		2.586		0.373		1.474		0.333		1.318	
<b>Sugar syrup (S)</b>	0.566		2.239		0.323		1.277		0.289		1.142	
<b>Interaction (MxS)</b>	1.132		4.478		0.645		2.553		0.577		2.284	

**M<sub>1</sub>**- Mature green,

**M<sub>2</sub>**- Turning stage,

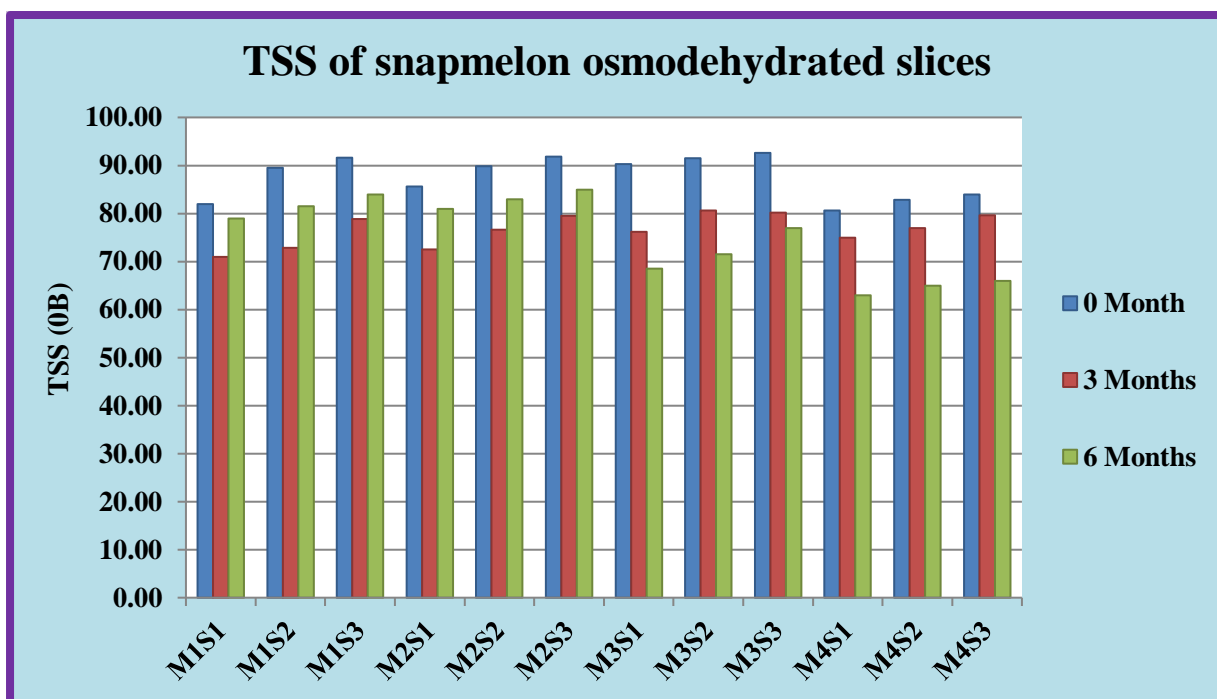
**M<sub>3</sub>**- Ripe stage,

**M<sub>4</sub>**- Over ripe stage

**S<sub>1</sub>**- 40 °B sugar syrup,

**S<sub>2</sub>**- 50 °B sugar syrup,

**S<sub>3</sub>**- 60 °B sugar syrup



**Fig.3 Percentage decrease in T.S.S. of snapmelon osmodehydrated slices during storage at ambient temperature (27-29°C)**

**Treatments details –**

**M<sub>1</sub>S<sub>1</sub> – Mature green stage + 40<sup>0</sup>B sugar syrup concentration**

**M<sub>1</sub>S<sub>2</sub> – Mature green stage + 50<sup>0</sup>B sugar syrup concentration**

**M<sub>1</sub>S<sub>3</sub> – Mature green stage + 60<sup>0</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>1</sub> – Turning stage + 40<sup>0</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>2</sub> – Turning stage + 50<sup>0</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>3</sub> – Turning stage + 60<sup>0</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>1</sub> – Ripe stage + 40<sup>0</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>2</sub> – Ripe stage + 50<sup>0</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>3</sub> – Ripe stage + 60<sup>0</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>1</sub> – Over ripe stage + 40<sup>0</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>2</sub> – Over ripe stage + 50<sup>0</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>3</sub> – Over ripe stage + 60<sup>0</sup>B sugar syrup concentration**

In case of sugar syrup concentrations the T.S.S. differ significantly at '0', 3 and 6 months storage. Treatment S<sub>3</sub> (60 °B) recorded significantly maximum T.S.S. at '0' (90.00 °B), 3 (79.53 °B) and 6 months (78.00 °B) storage, irrespective of maturity stages of fruit. However, treatment S<sub>2</sub> was at par with S<sub>3</sub> at '0' month storage. Minimum T.S.S. was recorded by S<sub>1</sub> (40 °B) at '0' (84.60 °B), 3 (73.68 °B) and 6 months (72.88 °B) storage.

The T.S.S. of osmodehydrated slices was found to be increased with increase in sugar syrup concentration from S<sub>1</sub> (40 °B) to S<sub>3</sub> (60 °B) during entire storage period. At '0', 3 and 6 months storage it increased from 84.60 to 90.00 °B, 73.68 to 79.53 °B and 72.88 to 88.00 °B respectively, irrespective of maturity stages. The increase in T.S.S. of osmodehydrated slices may be the effect of increase in sugar syrup concentration from 40 °B (S<sub>1</sub>) to 60 °B (S<sub>3</sub>), which was absorb by fruit pieces due to osmosis. Results analogous to present findings are reported by Ghanwat *et al.* (2019) in aonla candy.

In interactions of maturity stage of fruit and sugar syrup concentration, results were found to be significant throughout the storage. At '0' month, interaction M<sub>3</sub>S<sub>3</sub> (92.60 °B) recorded maximum T.S.S. and M<sub>3</sub>S<sub>1</sub> (90.30 °B), M<sub>1</sub>S<sub>2</sub> (89.55 °B), M<sub>2</sub>S<sub>2</sub> (89.80 °B), M<sub>3</sub>S<sub>2</sub> (91.50 °B), M<sub>1</sub>S<sub>3</sub> (91.60 °B) and M<sub>2</sub>S<sub>3</sub> (91.80 °B) were at par with it. At 3 months storage interaction M<sub>3</sub>S<sub>2</sub> (80.60 °B) recorded maximum T.S.S. and M<sub>1</sub>S<sub>3</sub> (78.80 °B), M<sub>2</sub>S<sub>3</sub> (79.50 °B), M<sub>3</sub>S<sub>3</sub> (80.20 °B) and M<sub>4</sub>S<sub>3</sub> (79.60 °B) was at par with it. At six months storage interaction M<sub>2</sub>S<sub>3</sub> (85.00 °B) recorded maximum T.S.S. and M<sub>2</sub>S<sub>2</sub> (83.00 °B), M<sub>1</sub>S<sub>3</sub> (84.00 °B) were at par with it. Minimum T.S.S. was recorded by interaction M<sub>4</sub>S<sub>1</sub> at '0' month (80.60 °B) and at 6 months (63.00 °B) and interaction M<sub>1</sub>S<sub>1</sub> at 3 months (71.00 °B). Maximum T.S.S. recorded by M<sub>3</sub>S<sub>3</sub>, M<sub>3</sub>S<sub>2</sub> and

M<sub>2</sub>S<sub>3</sub> may be due to semi-soft texture of fruit at M<sub>3</sub> (ripe stage) and M<sub>2</sub> (turning stage) and higher sugar syrup concentration at S<sub>3</sub> (60 °B) and S<sub>2</sub> (50 °B). The semi-soft texture of fruit might have helped in holding high concentration of sugar syrup.

#### **4.1.2 Reducing sugars (%)**

The data regarding reducing sugars of snapmelon osmodehydrated slices during storage is presented in Table 2 and depicted in Fig. 4. From the table it was observed that reducing sugar content of osmodehydrated slices increased from '0' month (28.01 %) to 6 months (36.88 %) of storage, irrespective of maturity stages and sugar syrup concentrations.

The increase in reducing sugars of osmodehydrated slices during storage may be due to conversion of non-reducing sugars into reducing sugars and hydrolysis of polysaccharides into monosaccharide during storage. Present findings are in accordance with the findings reported by Sharma *et al.* (1998) in candid apples.

The reducing sugars of osmodehydrated slices differ significantly with respect to different treatments of maturity stages during entire storage period. During storage, at '0' month treatment M<sub>4</sub> (29.75 %), at 3 months treatment M<sub>3</sub> (34.62 %) and at 6 months treatment M<sub>2</sub> (44.73 %) recorded significantly maximum reducing sugars. Minimum reducing sugar content was recorded by M<sub>1</sub> (25.97 %) at '0', M<sub>4</sub> (30.09 %) at 3 months and M<sub>1</sub> (32.29 %) at 6 months storage, irrespective of sugar syrup concentrations.

The reducing sugars of osmodehydrated slices at '0' month storage was found to be increased from M<sub>1</sub> (25.97 %) to M<sub>4</sub> (29.75 %). At 3 months it increased from M<sub>1</sub> (30.90 %) to M<sub>3</sub> (34.62) and then decreased from M<sub>3</sub> to M<sub>4</sub> (30.09 %). At 6

months it increased from M<sub>1</sub> (32.29 %) to M<sub>2</sub> (44.73 %) and then decreased from M<sub>2</sub> to M<sub>4</sub> (33.56 %) during entire storage period.

The increase in reducing sugars with advancement in maturity stage may be due to increase in conversion of native non-reducing sugars into reducing sugars. It also may be due to better absorption of non-reducing sugars due to increase in softening of fruit with advancement in maturity stage, which is converted into reducing sugars. Decrease in reducing sugars at later stages of maturity observed at 3 and 6 months storage may be the effect of destruction of fruit texture as explained earlier under 4.1.1 (T.S.S.). Similar observations were reported by Pandey *et al.* (1974), Tondon and Kalra (1983), Aree (1987) and Parekh *et al.* (2015) in different mango cultivars which are in support of present results.

In case of sugar syrup concentrations the reducing sugars differ significantly at '0', 3 and 6 months storage. Treatment S<sub>3</sub> (60 °B) recorded significantly maximum reducing sugar at '0' (29.94 %), 3 (33.86 %) and 6 months (41.88 %) storage, irrespective of maturity stages of fruit. Minimum reducing sugar content was recorded by S<sub>1</sub> (40 °B) at '0' (26.42 %), 3 (29.82 %) and 6 months (32.20 %) storage.

The reducing sugars of osmodehydrated slices were found to be increased with increase in sugar syrup concentration from S<sub>1</sub> (40 °B) to S<sub>3</sub> (60 °B) during entire storage period. At '0', 3 and 6 months storage it increased from 26.42 to 29.94 per cent, 29.82 to 33.86 per cent and 32.20 to 41.88 per cent respectively, irrespective of maturity stages. The increase in reducing sugars of osmodehydrated slices may be the effect of increase in sugar syrup concentration from 40 °B (S<sub>1</sub>) to 60 °B (S<sub>3</sub>), which was absorbed by fruit pieces due to osmosis. Hence, with increase in

**Table 2: Changes in reducing sugars (%) of snapmelon osmodehydrated slices during storage at ambient temperature (27-29°C)**

Treatments (Maturity stages)	'0' month				3 months				6 months			
	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean
<b>M<sub>1</sub></b>	24.40	25.66	27.86	<b>25.97</b>	27.86	31.37	33.48	<b>30.90</b>	28.10	32.80	35.97	<b>32.29</b>
<b>M<sub>2</sub></b>	25.66	27.77	30.33	<b>27.92</b>	30.33	32.33	33.48	<b>32.05</b>	36.24	42.38	55.57	<b>44.73</b>
<b>M<sub>3</sub></b>	27.04	27.77	30.33	<b>28.38</b>	32.25	34.52	37.09	<b>34.62</b>	33.80	37.31	39.76	<b>36.96</b>
<b>M<sub>4</sub></b>	28.59	29.41	31.25	<b>29.75</b>	28.85	30.05	31.37	<b>30.09</b>	30.64	33.80	36.23	<b>33.56</b>
<b>Mean</b>	<b>26.42</b>	<b>27.65</b>	<b>29.94</b>	<b>28.01</b>	<b>29.82</b>	<b>32.07</b>	<b>33.86</b>	<b>31.92</b>	<b>32.20</b>	<b>36.57</b>	<b>41.88</b>	<b>36.88</b>
	<b>S.Em.±</b>		<b>C.D. at 1%</b>		<b>S.Em.±</b>		<b>C.D. at 1%</b>		<b>S.Em.±</b>		<b>C.D. at 1%</b>	
<b>Maturity stage (M)</b>	0.035		0.139		0.033		0.132		0.037		0.146	
<b>Sugar syrup (S)</b>	0.030		0.120		0.029		0.114		0.032		0.127	
<b>Interaction (MxS)</b>	0.061		0.240		0.058		0.228		0.064		0.254	

**M<sub>1</sub>**- Mature green,

**M<sub>2</sub>**- Turning stage,

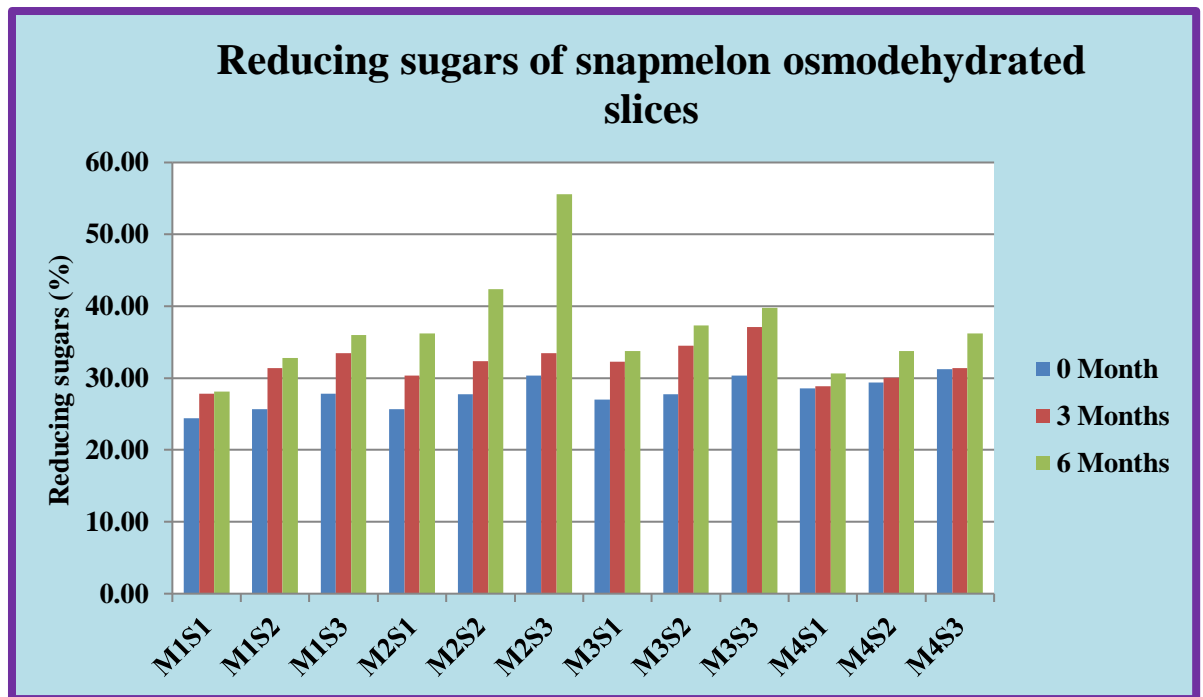
**M<sub>3</sub>**- Ripe stage,

**M<sub>4</sub>**- Over ripe stage

**S<sub>1</sub>**- 40 °B sugar syrup,

**S<sub>2</sub>**- 50 °B sugar syrup,

**S<sub>3</sub>**- 60 °B sugar syrup



**Fig.4 Percentage increase in reducing sugar of snapmelon osmodehydrated slices during storage at ambient temperature (27-29°C)**

**Treatments details –**

**M<sub>1</sub>S<sub>1</sub> – Mature green stage + 40<sup>o</sup>B sugar syrup concentration**

**M<sub>1</sub>S<sub>2</sub> – Mature green stage + 50<sup>o</sup>B sugar syrup concentration**

**M<sub>1</sub>S<sub>3</sub> – Mature green stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>1</sub> – Turning stage + 40<sup>o</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>2</sub> – Turning stage + 50<sup>o</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>3</sub> – Turning stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>1</sub> – Ripe stage + 40<sup>o</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>2</sub> – Ripe stage + 50<sup>o</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>3</sub> – Ripe stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>1</sub> – Over ripe stage + 40<sup>o</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>2</sub> – Over ripe stage + 50<sup>o</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>3</sub> – Over ripe stage + 60<sup>o</sup>B sugar syrup concentration**

sugar percentage of fruit pieces better conversion of non-reducing sugars to reducing sugars might have taken place. Results analogous to present findings are also reported by Rahman *et al.* (2012) in osmotic dehydration of jackfruit.

In case of interactions of maturity stage of fruit and sugar syrup concentration, results were found to be significant throughout the storage. At '0' month, M<sub>4</sub>S<sub>3</sub> (31.25 %), at 3 months M<sub>3</sub>S<sub>3</sub> (37.09 %) and at 6 months M<sub>2</sub>S<sub>3</sub> (55.57 %) recorded significantly maximum reducing sugars. Minimum reducing sugars were recorded by M<sub>1</sub>S<sub>1</sub> at '0' (24.40 %), 3 (27.86 %) and 6 months storage (28.10 %).

Maximum reducing sugars recorded by M<sub>4</sub>S<sub>3</sub>, M<sub>3</sub>S<sub>3</sub> and M<sub>2</sub>S<sub>3</sub> may be due to semi-soft texture of fruit at M<sub>4</sub>, M<sub>3</sub> and M<sub>2</sub> and higher sugar syrup concentration at S<sub>3</sub> (60 °B). The semi-soft texture of fruit might have helped in holding high concentration of sugar syrup. Hence, more conversion of non-reducing sugars to reducing sugars at M<sub>4</sub>S<sub>3</sub>, M<sub>3</sub>S<sub>3</sub> and M<sub>2</sub>S<sub>3</sub>. Minimum reducing sugars recorded by M<sub>1</sub>S<sub>1</sub> during storage may be the effect of hard texture of fruit and lower sugar syrup concentration.

#### **4.1.3 Total sugars (%)**

The data presented in Table 3 and depicted in Fig.5 indicates the total sugar content of snapmelon osmodehydrated slices during storage. From the table it was observed that total sugars of osmodehydrated slices increased from '0' month (40.77 %) to 6 months (60.51 %) of storage, irrespective of maturity stages and sugar syrup concentrations.

The increase in total sugars of osmodehydrated slices during storage may be due to hydrolysis of starch into sugars or conversion of acids into sugars during storage. The conversion of

acids into sugars can also be confirmed from Table 4, where titratable acidity was found to be decreased with increase in storage period. Present findings are in line with the findings reported by Sharma *et al.* (1998) in candid apples.

The total sugars of osmodehydrated slices differ significantly with respect to different treatments of maturity stages during entire storage period. During storage, treatments M<sub>2</sub> recorded significantly maximum total sugars at '0' (47.56 %) and 3 months (51.18 %) storage. At 6 months M<sub>2</sub> (75.07 %) recorded significantly maximum total sugars. Minimum total sugars were recorded by M<sub>1</sub> at '0' (35.43 %), 3 months (42.71 %) and treatment M<sub>4</sub> at 6 months (48.88 %) storage, irrespective of sugar syrup concentration ns.

The total sugar of osmodehydrated slices at '0' and 3 months storage was found to be increased from M<sub>1</sub> (35.43 and 42.71 %) to M<sub>3</sub> (47.56 and 51.18 %) and then decreased from M<sub>3</sub> to M<sub>4</sub> (39.72 and 43.41 %). At 6 months storage it increased from M<sub>1</sub> (61.44 %) to M<sub>2</sub> (75.07 %) and then decreased from M<sub>2</sub> to M<sub>4</sub> (48.88 %).

The reasons behind increase in total sugars with increase in maturity stage and decrease in total sugars at later stage of maturity are same as explained under 4.1.1 (T.S.S.).

In case of sugar syrup concentrations the total sugars differ significantly at '0', 3 and 6 months storage. Treatment S<sub>3</sub> (60 °B) recorded significantly maximum total sugars at '0' (42.63 %), 3 (47.64 %) and 6 months (65.35 %) storage, irrespective of maturity stages of fruit. Minimum total sugar content was recorded by S<sub>1</sub> (40 °B) at '0' (38.56 %), 3 (42.69 %) and 6 months (55.10 %) storage.

**Table 3: Changes in total sugars (%) of snapmelon osmodehydrated slices during storage at ambient temperature (27-29°C)**

Treatments (Maturity stages)	'0' month				3 months				6 months			
	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean
<b>M<sub>1</sub></b>	33.28	36.24	36.77	<b>35.43</b>	40.36	43.11	44.65	<b>42.71</b>	52.78	63.22	68.32	<b>61.44</b>
<b>M<sub>2</sub></b>	37.75	40.65	42.74	<b>40.38</b>	40.99	44.65	45.90	<b>43.85</b>	70.30	75.30	79.61	<b>75.07</b>
<b>M<sub>3</sub></b>	45.05	47.62	50.02	<b>47.56</b>	48.09	50.51	54.95	<b>51.18</b>	51.69	58.41	59.80	<b>56.63</b>
<b>M<sub>4</sub></b>	38.16	40.00	40.99	<b>39.72</b>	41.32	43.87	45.05	<b>43.41</b>	45.64	47.35	53.65	<b>48.88</b>
<b>Mean</b>	<b>38.56</b>	<b>41.13</b>	<b>42.63</b>	<b>40.77</b>	<b>42.69</b>	<b>45.54</b>	<b>47.64</b>	<b>45.29</b>	<b>55.10</b>	<b>61.07</b>	<b>65.35</b>	<b>60.51</b>
	<b>S.Em.±</b>		<b>C.D. at 1%</b>		<b>S.Em.±</b>		<b>C.D. at 1%</b>		<b>S.Em.±</b>		<b>C.D. at 1%</b>	
<b>Maturity stage (M)</b>	0.167		0.659		0.167		0.659		0.204		0.807	
<b>Sugar syrup (S)</b>	0.144		0.571		0.144		0.571		0.177		0.699	
<b>Interaction (MxS)</b>	0.289		1.142		0.289		1.142		0.354		1.398	

**M<sub>1</sub>**- Mature green,

**M<sub>2</sub>**- Turning stage,

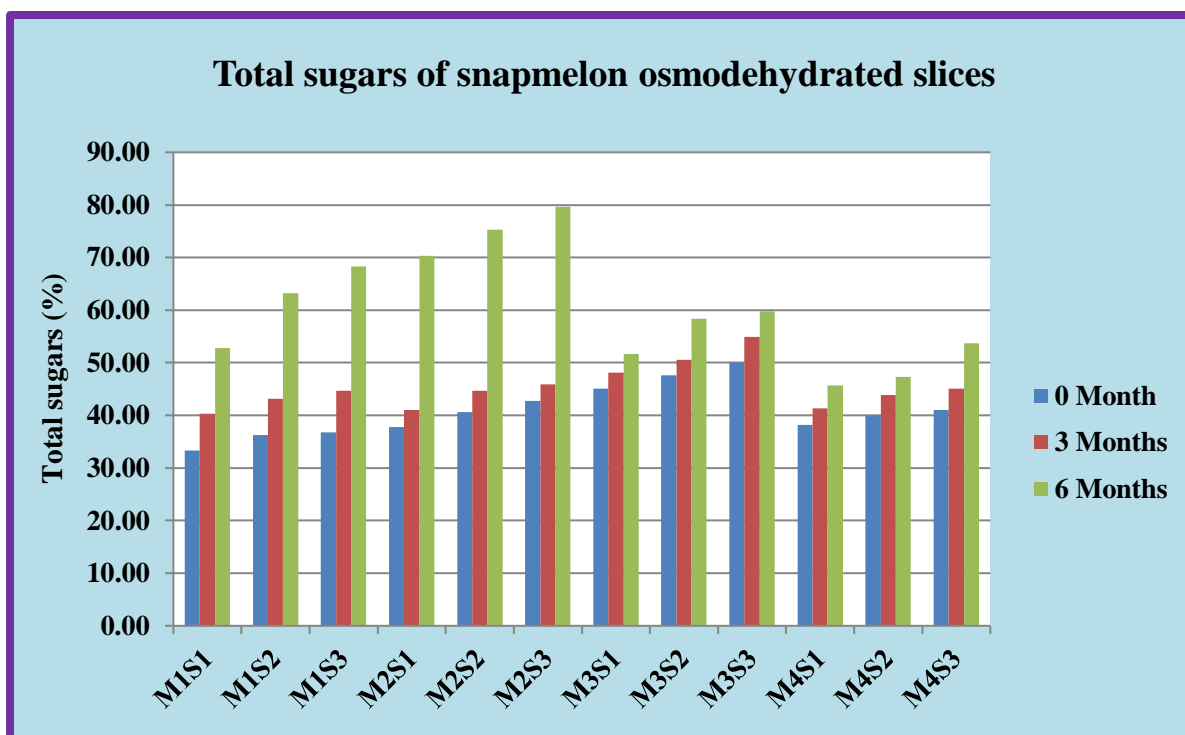
**M<sub>3</sub>**- Ripe stage,

**M<sub>4</sub>**- Over ripe stage

**S<sub>1</sub>**- 40 °B sugar syrup,

**S<sub>2</sub>**- 50 °B sugar syrup,

**S<sub>3</sub>**- 60 °B sugar syrup



**Fig.5 Percentage increase in total sugar of snapmelon osmodehydrated slices during storage at ambient temperature (27-29°C)**

**Treatments details –**

**M<sub>1</sub>S<sub>1</sub> – Mature green stage + 40<sup>o</sup>B sugar syrup concentration**

**M<sub>1</sub>S<sub>2</sub> – Mature green stage + 50<sup>o</sup>B sugar syrup concentration**

**M<sub>1</sub>S<sub>3</sub> – Mature green stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>1</sub> – Turning stage + 40<sup>o</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>2</sub> – Turning stage + 50<sup>o</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>3</sub> – Turning stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>1</sub> – Ripe stage + 40<sup>o</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>2</sub> – Ripe stage + 50<sup>o</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>3</sub> – Ripe stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>1</sub> – Over ripe stage + 40<sup>o</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>2</sub> – Over ripe stage + 50<sup>o</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>3</sub> – Over ripe stage + 60<sup>o</sup>B sugar syrup concentration**

The total sugars of osmodehydrated slices was found to be increased with increase in sugar syrup concentration from S<sub>1</sub> (40 °B) to S<sub>3</sub> (60 °B) during entire storage period. At '0', 3 and 6 months storage it increased from 38.56 to 42.63 per cent, 42.69 to 47.64 per cent and 55.10 to 65.35 per cent respectively, irrespective of maturity stages. The increase in total sugars of osmodehydrated slices from S<sub>1</sub> to S<sub>3</sub> may be the effect of increase in sugar syrup concentration. Results analogous to present findings are also reported by Singh *et al.* (2019) in aonla murabba.

In interactions of maturity stage of fruit and sugar syrup concentration, results were found to be significant throughout the storage. At '0' and 3 months storage interaction M<sub>3</sub>S<sub>3</sub> recorded significantly maximum total sugars of 50.02 and 54.95 per cent respectively. At 6 months storage M<sub>2</sub>S<sub>3</sub> (79.61 %) reported significantly maximum total sugars. Minimum total sugars were recorded by M<sub>1</sub>S<sub>1</sub> at '0' (33.28 %), 3 (40.36 %) and M<sub>4</sub>S<sub>1</sub> at 6 months storage (45.64 %). Maximum total sugars recorded by M<sub>3</sub>S<sub>3</sub> and M<sub>2</sub>S<sub>3</sub> may be due to semi-soft texture of fruit at M<sub>2</sub> and M<sub>3</sub> and higher sugar syrup concentration at S<sub>3</sub> (60 °B). The semi-soft texture of fruit might have helped in holding high concentration of sugar syrup.

#### **4.1.4 Titratable acidity (%)**

The data pertaining to titratable acidity of osmodehydrated slices as influenced by treatments of maturity stages of fruit and sugar syrup concentrations is given in Table 4 and illustrated in Fig. 6. From the table it was observed that titratable acidity of osmodehydrated slices decreased from '0' month (0.35 %) to 6 months (0.09 %) of storage, irrespective of maturity stages and sugar syrup concentrations.

The decrease in titratable acidity of osmodehydrated slices during storage may be due to conversion of organic acids into sugar and their derivatives. Present findings are in line with the findings reported by Thakur *et al.* (2018) in wild aonla preserve.

The titratable acidity of osmodehydrated slices differs significantly with respect to different treatments of maturity stages during entire storage period. During storage, treatment M<sub>1</sub> recorded significantly maximum titratable acidity at '0' (0.48 %) and 3 months (0.43 %) storage. At 6 months storage M<sub>4</sub> (0.17 %) recorded significantly maximum titratable acidity. Minimum titratable acidity was recorded by M<sub>4</sub> at '0' (0.19 %), 3 months (0.14 %) and M<sub>1</sub> at 6 months (0.04 %) storage, irrespective of sugar syrup concentrations.

The titratable acidity of osmodehydrated slices at '0' and 3 months storage was found to be decreased from M<sub>1</sub> (0.48 and 0.43 %) to M<sub>4</sub> (0.19 and 0.14 %) and at 6 months storage it showed reverse trend i.e. it increased from M<sub>1</sub> (0.04 %) to M<sub>4</sub> (0.17 %).

The decrease in acidity with increase in maturity stages may be the impact of initial native acids present in the fruit, which decreases with increase in maturity stages due to conversion of acids into sugars. It may also be due to utilization of acids from fruit for respiration process. Results of the present findings receive support from Krishnamorthy *et al.* (1960) that titratable acidity decreases during ripening in mango fruit and Mandal *et al.* (1993) noticed that acidity showed the decreasing trend throughout the different stages of growth and development of mango fruits.

However, increase in acidity with increase in maturity stages observed at 6 months storage may be due to formation of

**Table 4: Changes in titratable acidity (%) of snapmelon osmodehydrated slices during storage at ambient temperature (27-29°C)**

Treatments (Maturity stages)	'0' month				3 months				6 months			
	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean
<b>M<sub>1</sub></b>	0.58	0.46	0.39	<b>0.48</b>	0.50	0.43	0.35	<b>0.43</b>	0.06	0.04	0.03	<b>0.04</b>
<b>M<sub>2</sub></b>	0.53	0.43	0.35	<b>0.44</b>	0.37	0.29	0.24	<b>0.30</b>	0.06	0.06	0.03	<b>0.05</b>
<b>M<sub>3</sub></b>	0.37	0.27	0.21	<b>0.28</b>	0.27	0.21	0.18	<b>0.22</b>	0.10	0.09	0.06	<b>0.08</b>
<b>M<sub>4</sub></b>	0.24	0.19	0.14	<b>0.19</b>	0.18	0.16	0.09	<b>0.14</b>	0.20	0.18	0.12	<b>0.17</b>
<b>Mean</b>	<b>0.43</b>	<b>0.34</b>	<b>0.27</b>	<b>0.35</b>	<b>0.33</b>	<b>0.27</b>	<b>0.22</b>	<b>0.27</b>	<b>0.11</b>	<b>0.09</b>	<b>0.06</b>	<b>0.09</b>
	<b>S.Em.±</b>		<b>C.D. at 1%</b>		<b>S.Em.±</b>		<b>C.D. at 1%</b>		<b>S.Em.±</b>		<b>C.D. at 1%</b>	
<b>Maturity stage (M)</b>	0.003		0.013		0.004		0.015		0.004		0.015	
<b>Sugar syrup (S)</b>	0.003		0.011		0.003		0.013		0.003		0.013	
<b>Interaction (MxS)</b>	0.006		0.023		0.006		0.026		0.007		0.027	

**M<sub>1</sub>**- Mature green,

**M<sub>2</sub>**- Turning stage,

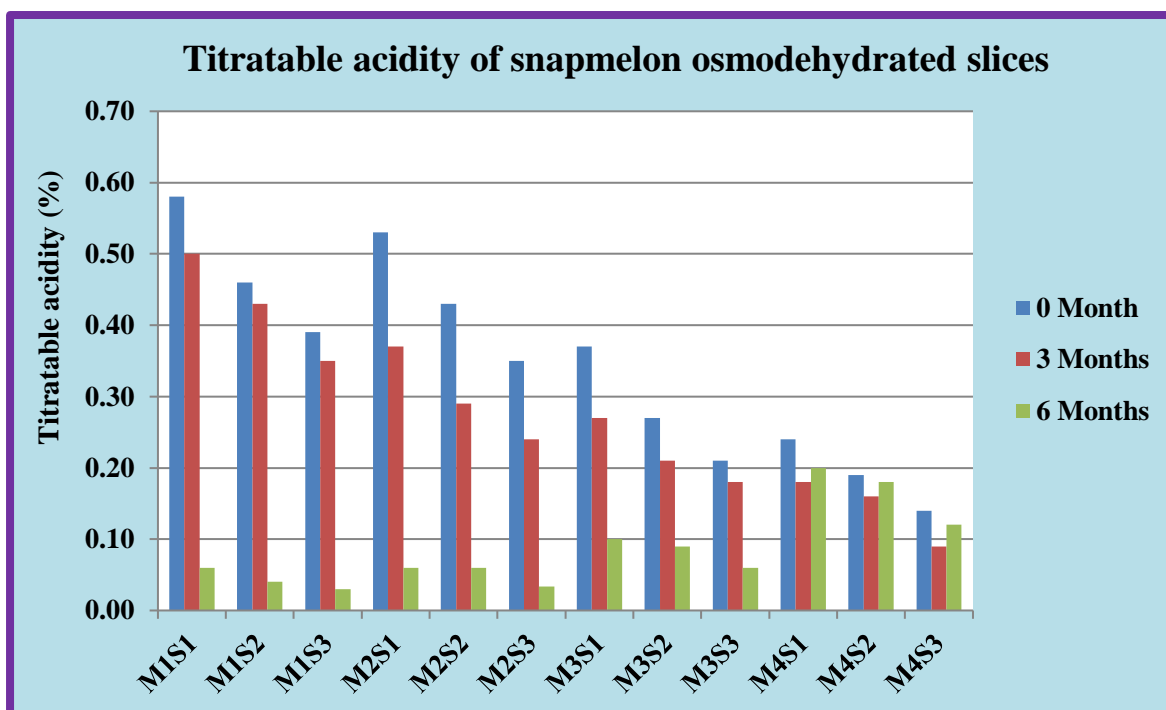
**M<sub>3</sub>**- Ripe stage,

**M<sub>4</sub>**- Over ripe stage

**S<sub>1</sub>**- 40 °B sugar syrup,

**S<sub>2</sub>**- 50 °B sugar syrup,

**S<sub>3</sub>**- 60 °B sugar syrup



**Fig.6 Percentage decrease in titratable acidity of snapmelon osmodehydrated slices during storage at ambient temperature (27-29°C)**

**Treatments details –**

**M<sub>1</sub>S<sub>1</sub> – Mature green stage + 40<sup>o</sup>B sugar syrup concentration**

**M<sub>1</sub>S<sub>2</sub> – Mature green stage + 50<sup>o</sup>B sugar syrup concentration**

**M<sub>1</sub>S<sub>3</sub> – Mature green stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>1</sub> – Turning stage + 40<sup>o</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>2</sub> – Turning stage + 50<sup>o</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>3</sub> – Turning stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>1</sub> – Ripe stage + 40<sup>o</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>2</sub> – Ripe stage + 50<sup>o</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>3</sub> – Ripe stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>1</sub> – Over ripe stage + 40<sup>o</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>2</sub> – Over ripe stage + 50<sup>o</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>3</sub> – Over ripe stage + 60<sup>o</sup>B sugar syrup concentration**

acids due to destruction and fermentation of slices at later maturity stages.

In case of sugar syrup concentrations the titratable acidity differs significantly at '0', 3 and 6 months storage. Treatment S<sub>1</sub> (40 °B) recorded significantly maximum titratable acidity at '0' (0.43 %), 3 (0.33 %) and 6 months (0.11 %) storage, irrespective of maturity stages of fruit. Minimum titratable acidity was recorded by S<sub>3</sub> (60 °B) at '0' (0.27 %), 3 (0.22 %) and 6 months (0.06 %) storage.

The titratable acidity of osmodehydrated slices was found to be decreased with increase in sugar syrup concentration from S<sub>1</sub> (40 °B) to S<sub>3</sub> (60 °B) during entire storage period. At '0', 3 and 6 months storage it increased from 0.43 to 0.27 per cent, 0.33 to 0.22 per cent and 0.11 to 0.06 per cent respectively, irrespective of maturity stages. The decrease in titratable acidity of osmodehydrated slices may be the effect of increase in sugar syrup concentration from 40 °B (S<sub>1</sub>) to 60 °B (S<sub>3</sub>). With increase in sugar syrup concentration more amount of water along with acids might have released from osmodehydrated slices due to osmosis. Results of the present study are supported by Ghanwat *et al.* (2019) in aonla candy.

In interactions of maturity stage of fruit and sugar syrup concentration, results were found to be significant throughout the storage. At '0' and 3 months storage interaction M<sub>1</sub>S<sub>1</sub> recorded significantly maximum titratable acidity of 0.58 and 0.50 per cent respectively. However, at 6 months storage interaction M<sub>4</sub>S<sub>1</sub> (0.20 %) recorded significantly maximum titratable acidity. Minimum titratable acidity was recorded by M<sub>4</sub>S<sub>3</sub> at '0' (0.14 %), 3 (0.09 %) and by M<sub>1</sub>S<sub>3</sub>, M<sub>2</sub>S<sub>3</sub> at 6 months storage (0.03 %). Minimum titratable acidity recorded by M<sub>4</sub>S<sub>3</sub> at

'0' and 3 months storage may be due to the impact of over ripe stage of fruit and higher sugar syrup concentration as explained above.

#### **4.1.5 Moisture (%)**

The data presented in Table 5 and depicted in Fig.7 indicates the moisture content of snapmelon osmodehydrated slices during storage. From the table it was observed that moisture of osmodehydrated slices increased from '0' month (6.53 %) to 6 months (8.07 %) of storage, irrespective of maturity stages and sugar syrup concentrations.

The increase in moisture of osmodehydrated slices during storage may be due absorption of atmospheric moisture in package due to hygroscopic nature of slices. Present findings are in line with the findings reported by Tripura *et al.* (2017) in osmotic dehydrated ripe sapota slices.

The moisture of osmodehydrated slices differs significantly with respect to different treatments of maturity stages during entire storage period. During storage, treatment M<sub>1</sub> recorded significantly maximum moisture at '0' (7.10 %) and M<sub>4</sub> was at par with it. At 3 months M<sub>4</sub> (8.19 %) and 6 months again M<sub>4</sub> (9.04 %) recorded maximum moisture. Minimum moisture was recorded by M<sub>3</sub> at '0' (5.83 %), 3 months (6.40 %) and 6 months (6.97 %) storage, irrespective of sugar syrup concentrations.

At '0' month storage moisture of osmodehydrated slices decreased from M<sub>1</sub> (7.10 %) to M<sub>3</sub> (5.83 %) and then increased at M<sub>4</sub> (7.07 %). At 3 months storage it decreased from M<sub>1</sub> (7.02 %) to M<sub>3</sub> (6.40 %) and then increased at M<sub>4</sub> (8.19 %). At the end of storage (6 months) it again decreased from M<sub>1</sub> (8.44 %) to M<sub>3</sub> (6.97 %) and then increased at M<sub>4</sub> (9.04 %).

Decrease in moisture of osmodehydrated slices with increase in fruit maturity may be due to increase in fruit softening with advancement in fruit maturity which might have helped in better removal of moisture from fruit pieces during drying. However, increase in moisture observed at M<sub>4</sub> (over ripe stage) may be due to more destruction of texture of osmodehydrated slices which might have absorbed more moisture from surrounding atmosphere due to its highly hygroscopic nature. Similar findings were reported by Mali (1999) in papaya.

In case of sugar syrup concentrations the moisture differs significantly at '0', 3 and 6 months storage. Treatment S<sub>1</sub> recorded significantly maximum moisture at '0' (7.83 %), S<sub>3</sub> at 3 months (7.23 %) and S<sub>1</sub> at 6 months (8.37 %) storage, irrespective of maturity stages of fruit. Treatment S<sub>2</sub> was at par with S<sub>3</sub> at 3 months storage. Minimum moisture was recorded by S<sub>3</sub> at '0' (5.63 %), S<sub>1</sub> at 3 (7.04 %) and S<sub>2</sub> at 6 months (7.90 %) storage.

The moisture of osmodehydrated slices at '0' month storage was found to be decreased with increase in sugar syrup concentration from S<sub>1</sub> (7.83 %) to S<sub>3</sub> (5.63 %). However, at 3 months storage it increased from S<sub>1</sub> (7.04 %) to S<sub>3</sub> (7.23 %) and at 6 months storage it decreased with increase in sugar syrup concentration from S<sub>1</sub> (8.37 %) to S<sub>2</sub> (7.90 %) then increased at S<sub>3</sub> (7.95 %), irrespective of maturity stages. The decrease in moisture of osmodehydrated slices with increase in sugar syrup concentration may be the effect of increase in sugar syrup concentration from 40 °B (S<sub>1</sub>) to 60 °B (S<sub>3</sub>), which might have removed water by osmosis. Results analogous to present findings

**Table 5: Changes in moisture (%) of snapmelon osmodehydrated slices during storage at ambient temperature (27-29°C)**

Treatments (maturity stages)	'0' month				3 months				6 months			
	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean
<b>M<sub>1</sub></b>	8.85	6.21	6.24	<b>7.10</b>	7.18	6.55	7.34	<b>7.02</b>	9.02	7.40	8.90	<b>8.44</b>
<b>M<sub>2</sub></b>	7.80	5.40	5.15	<b>6.12</b>	8.31	6.30	6.22	<b>6.94</b>	9.53	7.10	6.93	<b>7.85</b>
<b>M<sub>3</sub></b>	6.48	6.00	5.00	<b>5.83</b>	5.62	7.61	5.97	<b>6.40</b>	6.40	8.00	6.50	<b>6.97</b>
<b>M<sub>4</sub></b>	8.19	6.89	6.14	<b>7.07</b>	7.05	8.14	9.39	<b>8.19</b>	8.53	9.10	9.48	<b>9.04</b>
<b>Mean</b>	<b>7.83</b>	<b>6.13</b>	<b>5.63</b>	<b>6.53</b>	<b>7.04</b>	<b>7.15</b>	<b>7.23</b>	<b>7.14</b>	<b>8.37</b>	<b>7.90</b>	<b>7.95</b>	<b>8.07</b>
	<b>S.Em.±</b>		<b>C.D. at 1%</b>		<b>S.Em.±</b>		<b>C.D. at 1%</b>		<b>S.Em.±</b>		<b>C.D. at 1%</b>	
<b>Maturity stage (M)</b>	0.067		0.264		0.033		0.132		0.070		0.277	
<b>Sugar syrup (S)</b>	0.058		0.228		0.029		0.114		0.061		0.240	
<b>Interaction (MxS)</b>	0.115		0.457		0.058		0.228		0.121		0.480	

**M<sub>1</sub>**- Mature green,

**M<sub>2</sub>**- Turning stage,

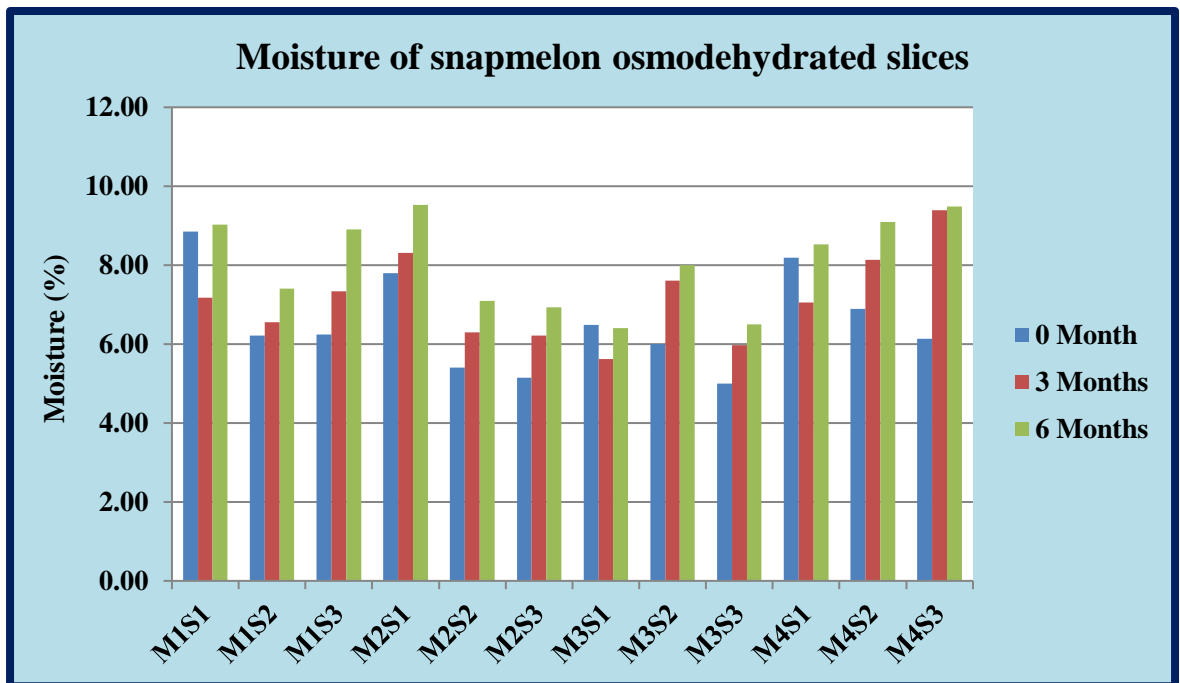
**M<sub>3</sub>**- Ripe stage,

**M<sub>4</sub>**- Over ripe stage

**S<sub>1</sub>**- 40 °B sugar syrup,

**S<sub>2</sub>**- 50 °B sugar syrup,

**S<sub>3</sub>**- 60 °B sugar syrup



**Fig.7 Percentage increase in moisture of snapmelon osmodehydrated slices during storage at ambient temperature (27-29°C)**

**Treatments details –**

**M<sub>1</sub>S<sub>1</sub> – Mature green stage + 40<sup>o</sup>B sugar syrup concentration**

**M<sub>1</sub>S<sub>2</sub> – Mature green stage + 50<sup>o</sup>B sugar syrup concentration**

**M<sub>1</sub>S<sub>3</sub> – Mature green stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>1</sub> – Turning stage + 40<sup>o</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>2</sub> – Turning stage + 50<sup>o</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>3</sub> – Turning stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>1</sub> – Ripe stage + 40<sup>o</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>2</sub> – Ripe stage + 50<sup>o</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>3</sub> – Ripe stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>1</sub> – Over ripe stage + 40<sup>o</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>2</sub> – Over ripe stage + 50<sup>o</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>3</sub> – Over ripe stage + 60<sup>o</sup>B sugar syrup concentration**

are also reported by Sharma *et al.* (2016) in osmo-dehydrated sweet potato slices.

In interactions of maturity stage of fruit and sugar syrup concentration, results were found to be significant throughout the storage. At '0', 3 and 6 months storage, interaction M<sub>1</sub>S<sub>1</sub>, M<sub>4</sub>S<sub>3</sub> and M<sub>2</sub>S<sub>1</sub> recorded significantly maximum moisture of 8.85, 9.39 and 9.53 per cent, respectively. At 6 months storage interaction M<sub>2</sub>S<sub>1</sub> was at par with M<sub>4</sub>S<sub>2</sub> (9.10%) and M<sub>4</sub>S<sub>3</sub> (9.48 %). Minimum moisture was recorded by M<sub>3</sub>S<sub>3</sub> at '0' (5.00 %), M<sub>3</sub>S<sub>1</sub> at 3 (5.62 %) and 6 months (6.40 %) storage. In case of interaction of maturity stages and sugar syrup concentrations no specific trend of moisture percentage was observed due to absorption of moisture during storage in varying degree.

#### **4.2 Changes in sensory quality of snapmelon osmodehydrated slices during storage under ambient temperature (27-29°C) condition.**

The snapmelon osmodehydrated slices were examined for its sensory qualities. The evaluation of sensory qualities in terms of colour, flavour and texture was done at every 3 months interval by a panel of 10 judges with 9 point Hedonic scale. Data regarding the effect of maturity stages, sugar syrup concentrations and their interactions on sensory quality are presented below.

##### **4.2.1 Colour**

The data presented in Table 6 and depicted in Fig. 8 indicates the changes in colour score of snapmelon osmodehydrated slices during storage. From the table it was observed that colour score of osmodehydrated slices decreased

from '0' month (7.78) to 6 months (5.83) of storage, irrespective of maturity stages and sugar syrup concentrations.

The decrease in colour score of osmodehydrated slices during storage may be due to oxidation of osmodehydrated slices and less retention of added antioxidant i.e. sulphur dioxide during storage. Similar findings have been reported by Babariya (2014) in papaya candy

The colour score of osmodehydrated slices differs significantly with respect to different treatments of maturity stages during entire storage period. During storage, treatment M<sub>3</sub> recorded significantly maximum colour score at '0' (8.07), 3 (7.60) and M<sub>2</sub> at 6 months (7.03) storage. Minimum colour score was recorded by M<sub>4</sub> at '0' (7.50) and 6 months (3.17) storage and M<sub>1</sub> at 3 months (7.07) storage, irrespective of sugar syrup concentrations.

At '0' months storage the colour score of osmodehydrated slices was found to be increased from M<sub>1</sub> (7.70) to M<sub>3</sub> (8.07) and then decreased at M<sub>4</sub> (7.50). At 3 months storage it increased from M<sub>1</sub> (7.07) to M<sub>3</sub> (7.60) and then decreased at M<sub>4</sub> (7.10). At the end of storage (6 months) it increased from M<sub>1</sub> (6.97) to M<sub>2</sub> (7.03) and then decreased till M<sub>4</sub> (3.17).

The increase in colour score with increase in maturity stage may be due to increase in carotenoid pigment with advancement of maturity stages. Decrease in colour score at M<sub>4</sub> (over ripe stage) may be due to destruction of texture of slices which might have increased oxidation of slices. Results in accordance to present findings are reported by Aina and Oladunjoye (1993) in mango fruit.

In case of sugar syrup concentrations the colour score differs significantly at '0', 3 and 6 months storage. Treatment S<sub>2</sub> (50 °B) recorded significantly maximum colour score at '0' (7.95), 3 (7.41) and 6 months (6.43) storage, irrespective of maturity stages of fruit. Minimum colour score was recorded by S<sub>1</sub> (40 °B) and S<sub>3</sub> (60 °B) at 3 (7.20) and 6 months (5.53) storage and at '0' month (7.65) storage.

The colour score of osmodehydrated slices at '0' month storage was found to be increased from S<sub>1</sub> (7.75) to S<sub>2</sub> (7.95) and then decreased at S<sub>3</sub> (7.65), irrespective of maturity stages. At 3 months storage it increased from S<sub>1</sub> (7.20) to S<sub>2</sub> (7.41) and then decreased at S<sub>3</sub> (7.20), irrespective of maturity stages. At 6 months storage it increased from S<sub>1</sub> (5.53) to S<sub>2</sub> (6.43) and then decreased at S<sub>3</sub> (5.53), irrespective of maturity stages. The decrease in colour score of osmodehydrated slices at S<sub>3</sub> may be the effect of higher sugar syrup concentration at S<sub>3</sub> (60 °B). This might have accelerated osmosis reaction and hence more removal of colour pigments from fruit pieces along with water might have taken place. Results analogous to present findings are also reported by Lingala *et al.* (2015) in osmo-dried karonda.

In interactions of maturity stage of fruit and sugar syrup concentration, results were found to be significant throughout the storage. At '0' month storage interaction M<sub>3</sub>S<sub>1</sub>, M<sub>3</sub>S<sub>2</sub> and M<sub>4</sub>S<sub>2</sub> recorded significantly maximum colour score 8.10. At 3 months storage interaction M<sub>3</sub>S<sub>2</sub> recorded significantly maximum colour score 7.80. At 6 months storage interaction M<sub>2</sub>S<sub>2</sub> recorded significantly maximum colour score 7.20. At '0' month storage interaction M<sub>4</sub>S<sub>1</sub> and M<sub>4</sub>S<sub>3</sub> recorded significantly minimum colour score of 7.20. At 3 months storage interaction M<sub>1</sub>S<sub>1</sub>, M<sub>1</sub>S<sub>3</sub> and M<sub>4</sub>S<sub>1</sub> recorded significantly minimum colour score (7.00). At

**Table 6: Changes in colour score of snapmelon osmodehydrated slices during storage at ambient temperature (27-29°C)**

Treatments (Maturity stages)	'0' month				3 months				6 months			
	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean
<b>M<sub>1</sub></b>	7.70	7.80	7.60	<b>7.70</b>	7.00	7.20	7.00	<b>7.07</b>	7.00	7.10	6.80	<b>6.97</b>
<b>M<sub>2</sub></b>	8.00	7.80	7.80	<b>7.87</b>	7.30	7.40	7.25	<b>7.32</b>	7.10	7.20	6.80	<b>7.03</b>
<b>M<sub>3</sub></b>	8.10	8.10	8.00	<b>8.07</b>	7.50	7.80	7.50	<b>7.60</b>	6.00	6.40	6.00	<b>6.13</b>
<b>M<sub>4</sub></b>	7.20	8.10	7.20	<b>7.50</b>	7.00	7.25	7.05	<b>7.10</b>	2.00	5.00	2.50	<b>3.17</b>
<b>Mean</b>	<b>7.75</b>	<b>7.95</b>	<b>7.65</b>	<b>7.78</b>	<b>7.20</b>	<b>7.41</b>	<b>7.20</b>	<b>7.27</b>	<b>5.53</b>	<b>6.43</b>	<b>5.53</b>	<b>5.83</b>
	<b>S.Em.±</b>		<b>C.D. at 1%</b>		<b>S.Em.±</b>		<b>C.D. at 1%</b>		<b>S.Em.±</b>		<b>C.D. at 1%</b>	
<b>Maturity stage (M)</b>	0.003		0.013		0.004		0.015		0.004		0.016	
<b>Sugar syrup (S)</b>	0.003		0.011		0.003		0.013		0.004		0.014	
<b>Interaction (MxS)</b>	0.006		0.023		0.006		0.026		0.007		0.028	

**M<sub>1</sub>**- Mature green,

**M<sub>2</sub>**- Turning stage,

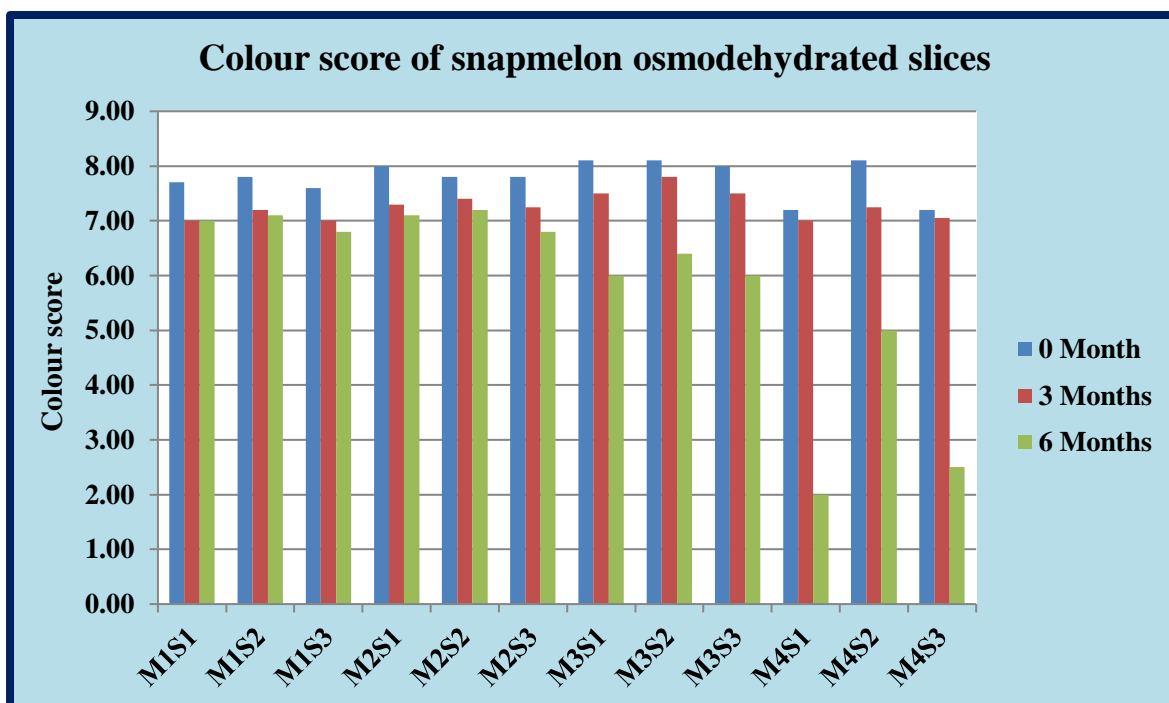
**M<sub>3</sub>**- Ripe stage,

**M<sub>4</sub>**- Over ripe stage

**S<sub>1</sub>**- 40 °B sugar syrup,

**S<sub>2</sub>**- 50 °B sugar syrup,

**S<sub>3</sub>**- 60 °B sugar syrup



**Fig.8 Percentage decrease in colour score of snapmelon osmodehydrated slices during storage at ambient temperature (27-29°C)**

**Treatments details –**

**M<sub>1</sub>S<sub>1</sub> – Mature green stage + 40<sup>o</sup>B sugar syrup concentration**

**M<sub>1</sub>S<sub>2</sub> – Mature green stage + 50<sup>o</sup>B sugar syrup concentration**

**M<sub>1</sub>S<sub>3</sub> – Mature green stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>1</sub> – Turning stage + 40<sup>o</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>2</sub> – Turning stage + 50<sup>o</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>3</sub> – Turning stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>1</sub> – Ripe stage + 40<sup>o</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>2</sub> – Ripe stage + 50<sup>o</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>3</sub> – Ripe stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>1</sub> – Over ripe stage + 40<sup>o</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>2</sub> – Over ripe stage + 50<sup>o</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>3</sub> – Over ripe stage + 60<sup>o</sup>B sugar syrup concentration**

6 months storage interaction M<sub>4</sub>S<sub>1</sub> recorded significantly minimum colour score (2.00). In general maximum colour score recorded by interactions of M<sub>3</sub> (ripe stage) stage of maturity and lower sugar concentrations (S<sub>1</sub> and S<sub>2</sub>) may be due to high amount of carotenoid pigment present in ripe stage of fruit (M<sub>3</sub>) and lower concentration of sugar syrup which might have removed less amount colour pigment from fruit pieces during 24 hours osmosis.

#### **4.2.2 Flavour**

The data presented in Table 7 and depicted in Fig.9 indicates the flavour score of snapmelon osmodehydrated slices during storage. From the table it was observed that flavour score of osmodehydrated slices decreased from '0' month (8.38) to 6 months (6.58) of storage, irrespective of maturity stages and sugar syrup concentrations.

The decrease in flavour score of osmodehydrated slices during storage may be due to loss of flavour compounds during ambient temperature storage, since they are highly volatile in nature. Similar findings have been reported by Chavan *et al.* (2010) in osmo-dried banana slices.

The flavour score of osmodehydrated slices differs significantly with respect to different treatments of maturity stages during entire storage period. During storage, treatment M<sub>3</sub> recorded significantly maximum flavour score at '0' (8.50), 3 (7.93) and at 6 months M<sub>2</sub> (7.57) recorded significantly maximum flavour score during storage. Minimum flavour was recorded by M<sub>1</sub> at '0' (8.27) and M<sub>4</sub> at 3 months (7.63) and 6 months (4.07) storage, irrespective of sugar syrup concentrations.

At '0' months storage flavour score of osmodehydrated slices was found to be increased from M<sub>1</sub> (8.27) to M<sub>3</sub> (8.50) and then decreased at M<sub>4</sub> (8.37). At 3 months storage it increased from M<sub>1</sub> (7.70) to M<sub>3</sub> (7.93) and then decreased at M<sub>4</sub> (7.63). At the end of storage (6 months) it increased from M<sub>1</sub> (7.33) to M<sub>2</sub> (7.57) and then decreased till M<sub>4</sub> (4.07).

Increase in flavour score of osmodehydrated slices with increase in maturity stages of fruit may be due to increase in synthesis of various flavour compounds with the advancement of fruit maturity stages. Identical results were also reported by Ragone and Catherine (2006) in breadfruit.

In case of sugar syrup concentrations the flavour score differ significantly at '0', 3 and 6 months storage. Treatment S<sub>1</sub> (40 °B) recorded significantly maximum flavour score at '0' (8.60), 3 (7.93) and 6 months (7.00) storage, irrespective of maturity stages of fruit. Minimum flavour score was recorded by S<sub>3</sub> (60 °B) at '0' (8.15), 3 (7.55) and 6 months (6.10) storage.

The flavour score of osmodehydrated slices was found to be decreased with increase in sugar syrup concentration from S<sub>1</sub> (40 °B) to S<sub>3</sub> (60 °B) during entire storage period. At '0', 3 and 6 months storage it decreased from 8.60 to 8.15, 7.93 to 7.55 and 7.00 to 6.10 respectively, irrespective of maturity stages. The decrease in flavour score of osmodehydrated slices may be due to of increase in sugar syrup concentration from 40 °B (S<sub>1</sub>) to 60 °B (S<sub>3</sub>), which might have released flavour compounds along with water from fruit pieces during osmosis in increasing trend with increase in sugar syrup concentration. Results analogous to present findings are also reported by Lingala *et al.* (2015) in osmo-dried karonda.

**Table 7: Changes in flavour score of snapmelon osmodehydrated slices during storage at ambient temperature (27-29°C)**

Treatments (Maturity stages)	'0' month				3 months				6 months			
	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean
<b>M<sub>1</sub></b>	8.40	8.30	8.10	<b>8.27</b>	7.90	7.80	7.40	<b>7.70</b>	7.60	7.40	7.00	<b>7.33</b>
<b>M<sub>2</sub></b>	8.60	8.40	8.10	<b>8.37</b>	8.00	7.90	7.50	<b>7.80</b>	7.80	7.70	7.20	<b>7.57</b>
<b>M<sub>3</sub></b>	8.70	8.40	8.40	<b>8.50</b>	8.10	7.90	7.80	<b>7.93</b>	7.60	7.50	7.00	<b>7.37</b>
<b>M<sub>4</sub></b>	8.70	8.40	8.00	<b>8.37</b>	7.70	7.70	7.50	<b>7.63</b>	5.00	4.00	3.20	<b>4.07</b>
<b>Mean</b>	<b>8.60</b>	<b>8.38</b>	<b>8.15</b>	<b>8.38</b>	<b>7.93</b>	<b>7.83</b>	<b>7.55</b>	<b>7.77</b>	<b>7.00</b>	<b>6.65</b>	<b>6.10</b>	<b>6.58</b>
	<b>S.Em.±</b>		<b>C.D. at 1%</b>		<b>S.Em.±</b>		<b>C.D. at 1%</b>		<b>S.Em.±</b>		<b>C.D. at 1%</b>	
<b>Maturity stage (M)</b>	0.003		0.013		0.004		0.015		0.004		0.016	
<b>Sugar syrup (S)</b>	0.003		0.011		0.003		0.013		0.004		0.014	
<b>Interaction (MxS)</b>	0.006		0.023		0.006		0.026		0.007		0.028	

**M<sub>1</sub>**- Mature green,

**M<sub>2</sub>**- Turning stage,

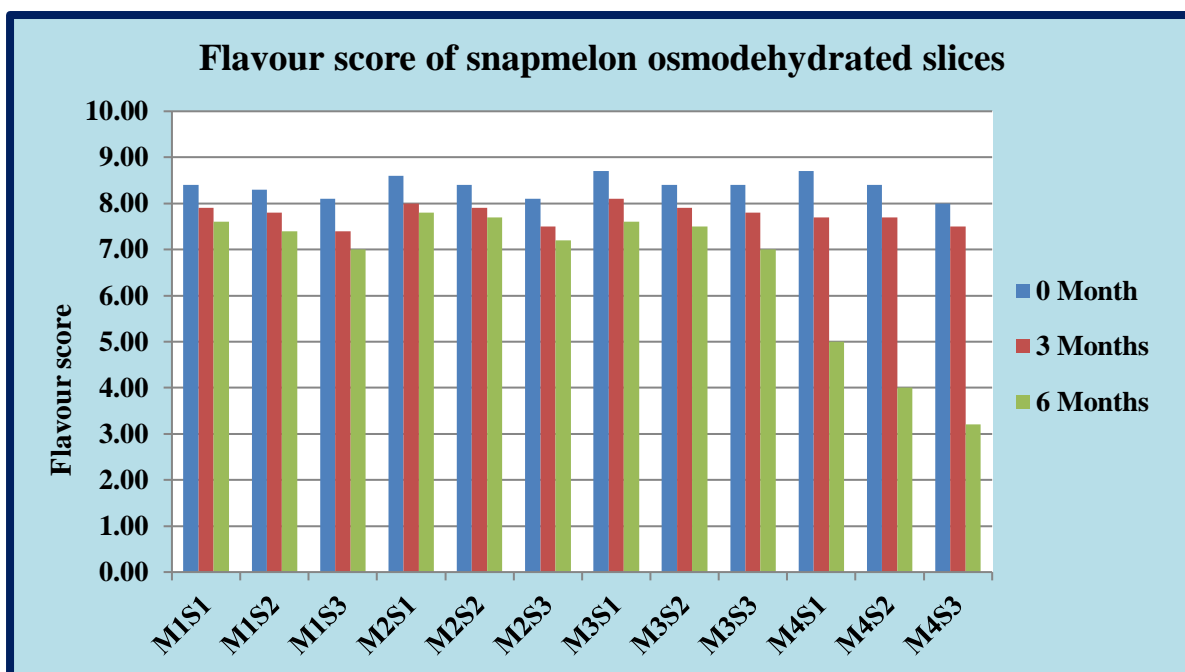
**M<sub>3</sub>**- Ripe stage,

**M<sub>4</sub>**- Over ripe stage

**S<sub>1</sub>**- 40 °B sugar syrup,

**S<sub>2</sub>**- 50 °B sugar syrup,

**S<sub>3</sub>**- 60 °B sugar syrup



**Fig.9 Percentage decrease in flavour score of snapmelon osmodehydrated slices during storage at ambient temperature (27-29°C)**

**Treatments details –**

**M<sub>1</sub>S<sub>1</sub> – Mature green stage + 40<sup>o</sup>B sugar syrup concentration**

**M<sub>1</sub>S<sub>2</sub> – Mature green stage + 50<sup>o</sup>B sugar syrup concentration**

**M<sub>1</sub>S<sub>3</sub> – Mature green stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>1</sub> – Turning stage + 40<sup>o</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>2</sub> – Turning stage + 50<sup>o</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>3</sub> – Turning stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>1</sub> – Ripe stage + 40<sup>o</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>2</sub> – Ripe stage + 50<sup>o</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>3</sub> – Ripe stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>1</sub> – Over ripe stage + 40<sup>o</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>2</sub> – Over ripe stage + 50<sup>o</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>3</sub> – Over ripe stage + 60<sup>o</sup>B sugar syrup concentration**

In interactions of maturity stage of fruit and sugar syrup concentration, results were found to be significant throughout the storage. At '0' month storage interactions M<sub>3</sub>S<sub>1</sub> and M<sub>4</sub>S<sub>1</sub> recorded significantly maximum flavour score of 8.70. At 3 months storage interaction M<sub>3</sub>S<sub>1</sub> (8.10) and at 6 months storage interaction M<sub>2</sub>S<sub>1</sub> (7.80) recorded significantly maximum flavour score. Minimum flavour score was recorded by M<sub>4</sub>S<sub>3</sub> and M<sub>1</sub>S<sub>3</sub> at '0' (8.00), 3 (7.40) months and at 6 months storage M<sub>4</sub>S<sub>3</sub> (3.20). Maximum flavour score recorded by M<sub>3</sub>S<sub>1</sub>, M<sub>4</sub>S<sub>1</sub> at '0' month, M<sub>3</sub>S<sub>1</sub> at 3 months and M<sub>2</sub>S<sub>1</sub> at 6 months storage may be the effect of native flavour compound retained in M<sub>2</sub>, M<sub>3</sub> and M<sub>4</sub> maturity stages due to low sugar syrup concentration which might have removed less amount of flavour compounds along with water during osmosis.

#### **4.2.3 Texture**

The data presented in Table 8 and depicted in Fig.10 indicates the changes in texture score of snapmelon osmodehydrated slices during storage. From the table it was observed that texture score of osmodehydrated slices decreased from '0' month (7.35) to 6 months (5.78) of storage, irrespective of maturity stages and sugar syrup concentrations.

The decrease in texture score of osmodehydrated slices during storage may be due to absorption of moisture from surrounding atmosphere which increases with increase in storage duration. Similar findings have been reported by Babariya (2014) in papaya candy during storage.

The texture score of osmodehydrated slices differs significantly with respect to different treatments of maturity stages during entire storage period. During storage, treatment M<sub>1</sub> recorded significantly maximum texture score at '0' (7.97), 3

(7.83) and 6 months (7.53) storage. Minimum texture score was recorded by M<sub>4</sub> at '0' (6.47), 3 months (6.03) and 6 months (3.27) storage, irrespective of sugar syrup concentrations.

The texture score of osmodehydrated slices was found to be decreased with increase in maturity stages. At '0' months storage it decreased from M<sub>1</sub> (7.97) to M<sub>4</sub> (6.47). At 3 months storage it decreased from M<sub>1</sub> (7.83) to M<sub>4</sub> (6.03). At the end of storage (6 months) it decreased from M<sub>1</sub> (7.53) to M<sub>4</sub> (3.27).

The fruit pectin and starch impart good texture to the fruit. However, with the advancement of ripening fruit softening takes place due to hydrolysis of insoluble pectins to soluble form and starch into sugars and hence decrease in texture with increase in maturity stages was observed.

In case of sugar syrup concentrations texture score differ significantly at '0', 3 and 6 months storage. Treatment S<sub>1</sub> (40 °B) recorded significantly maximum texture score at '0' (7.63), 3 (7.33) and 6 months (6.30) storage, irrespective of maturity stages of fruit. Minimum texture score was recorded by S<sub>3</sub> (60 °B) at '0' (7.10), 3 (6.80) and 6 months (5.20) storage.

The texture score of osmodehydrated slices was found to be decreased with increase in sugar syrup concentration from S<sub>1</sub> (40 °B) to S<sub>3</sub> (60 °B) during entire storage period. At '0', 3 and 6 months storage it increased from 7.63 to 7.10, 7.33 to 6.80 and 6.30 to 5.20 respectively, irrespective of maturity stages. The decrease in texture score of osmodehydrated slices may be the effect of increase in sugar syrup concentration from 40 °B (S<sub>1</sub>) to 60 °B (S<sub>3</sub>), which was absorbed by fruit pieces during 24 hours osmosis and hence more softening might have taken place with increase in sugar syrup concentration. Results analogous to

**Table 8: Changes in texture score of snapmelon osmodehydrated slices during storage at ambient temperature (27-29°C)**

Treatments (Maturity stages)	'0' month				3 months				6 months			
	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean
<b>M<sub>1</sub></b>	8.50	7.80	7.60	<b>7.97</b>	8.20	7.80	7.50	<b>7.83</b>	8.00	7.60	7.00	<b>7.53</b>
<b>M<sub>2</sub></b>	8.00	7.60	7.40	<b>7.67</b>	7.80	7.40	7.20	<b>7.47</b>	7.60	7.30	6.00	<b>6.97</b>
<b>M<sub>3</sub></b>	7.50	7.40	7.00	<b>7.30</b>	7.00	6.90	6.70	<b>6.87</b>	5.60	5.50	5.00	<b>5.37</b>
<b>M<sub>4</sub></b>	6.50	6.50	6.40	<b>6.47</b>	6.30	6.00	5.80	<b>6.03</b>	4.00	3.00	2.80	<b>3.27</b>
<b>Mean</b>	<b>7.63</b>	<b>7.33</b>	<b>7.10</b>	<b>7.35</b>	<b>7.33</b>	<b>7.03</b>	<b>6.80</b>	<b>7.05</b>	<b>6.30</b>	<b>5.85</b>	<b>5.20</b>	<b>5.78</b>
	<b>S.Em.±</b>		<b>C.D. at 1%</b>		<b>S.Em.±</b>		<b>C.D. at 1%</b>		<b>S.Em.±</b>		<b>C.D. at 1%</b>	
<b>Maturity stage (M)</b>	0.003		0.013		0.004		0.015		0.004		0.016	
<b>Sugar syrup (S)</b>	0.003		0.011		0.003		0.013		0.004		0.014	
<b>Interaction (MxS)</b>	0.006		0.023		0.006		0.026		0.007		0.028	

**M<sub>1</sub>**- Mature green,

**M<sub>2</sub>**- Turning stage,

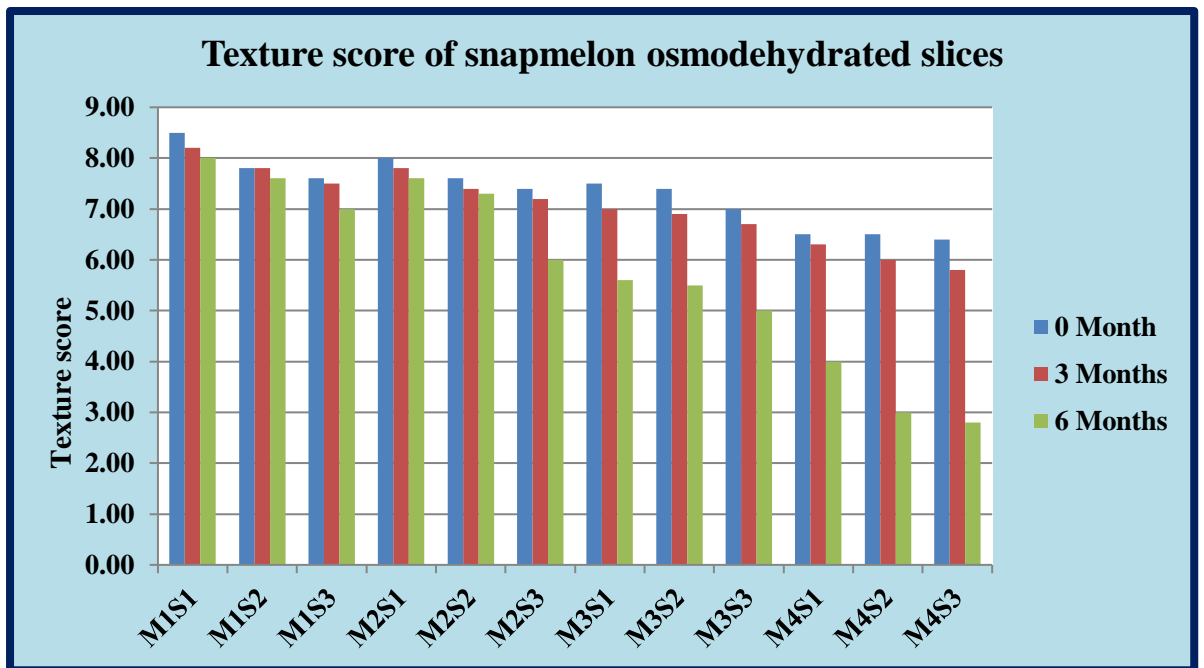
**M<sub>3</sub>**- Ripe stage,

**M<sub>4</sub>**- Over ripe stage

**S<sub>1</sub>**- 40 °B sugar syrup,

**S<sub>2</sub>**- 50 °B sugar syrup,

**S<sub>3</sub>**- 60 °B sugar syrup



**Fig.10 Percentage decrease in texture score of snapmelon osmodehydrated slices during storage at ambient temperature (27-29°C)**

**Treatments details –**

**M<sub>1</sub>S<sub>1</sub> – Mature green stage + 40<sup>o</sup>B sugar syrup concentration**

**M<sub>1</sub>S<sub>2</sub> – Mature green stage + 50<sup>o</sup>B sugar syrup concentration**

**M<sub>1</sub>S<sub>3</sub> – Mature green stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>1</sub> – Turning stage + 40<sup>o</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>2</sub> – Turning stage + 50<sup>o</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>3</sub> – Turning stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>1</sub> – Ripe stage + 40<sup>o</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>2</sub> – Ripe stage + 50<sup>o</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>3</sub> – Ripe stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>1</sub> – Over ripe stage + 40<sup>o</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>2</sub> – Over ripe stage + 50<sup>o</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>3</sub> – Over ripe stage + 60<sup>o</sup>B sugar syrup concentration**

present findings are also reported by Lingala *et al.* (2015) in osmo-dried karonda.

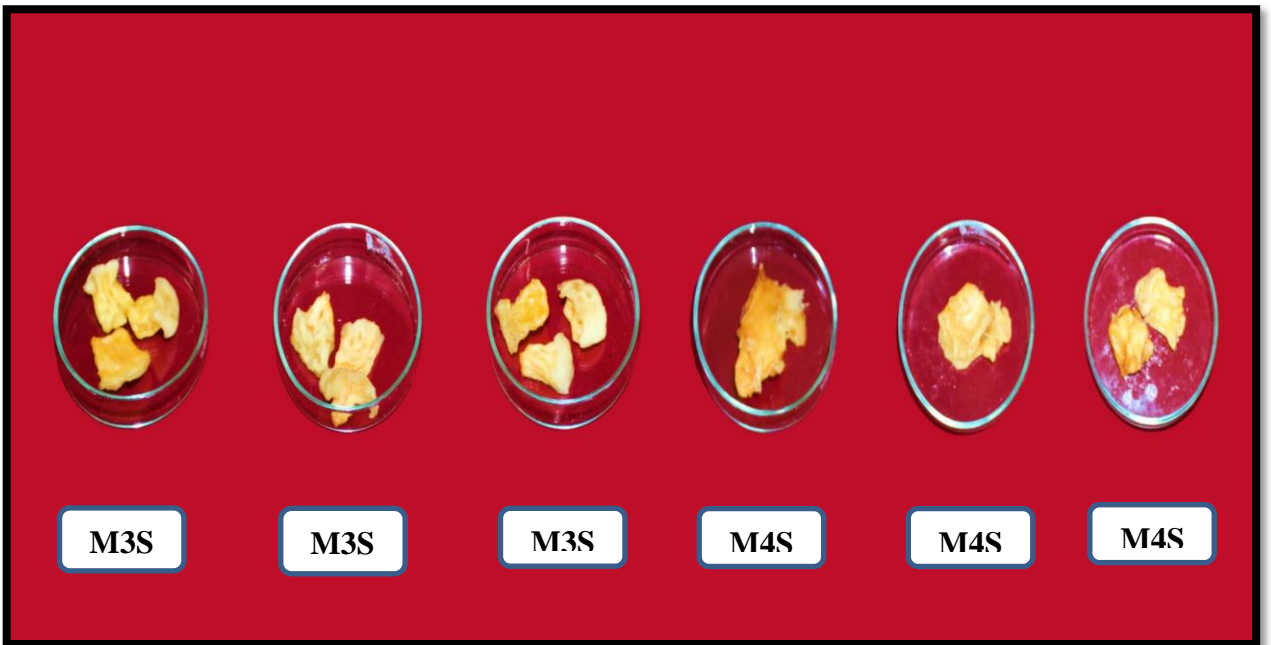
In interactions of maturity stage of fruit and sugar syrup concentration, results were found to be significant throughout the storage. At '0', 3 and 6 months storage interaction M<sub>1</sub>S<sub>1</sub> recorded significantly maximum texture score of 8.50, 8.20 and 8.00 respectively. Minimum texture score was recorded by M<sub>4</sub>S<sub>3</sub> at '0' (6.40), 3 (5.80) and 6 months storage (2.80). Maximum texture score recorded by M<sub>1</sub>S<sub>1</sub> may be due to slight hard texture of fruit at mature green stage (M<sub>1</sub>) and lower sugar syrup concentration at S<sub>1</sub> (40 °B). Hence, very small quantity of water is released and sugar syrup is absorbed by fruit pieces during osmosis, which gives good texture to the fruit.

#### **4.2.4 Overall acceptability (Average score)**

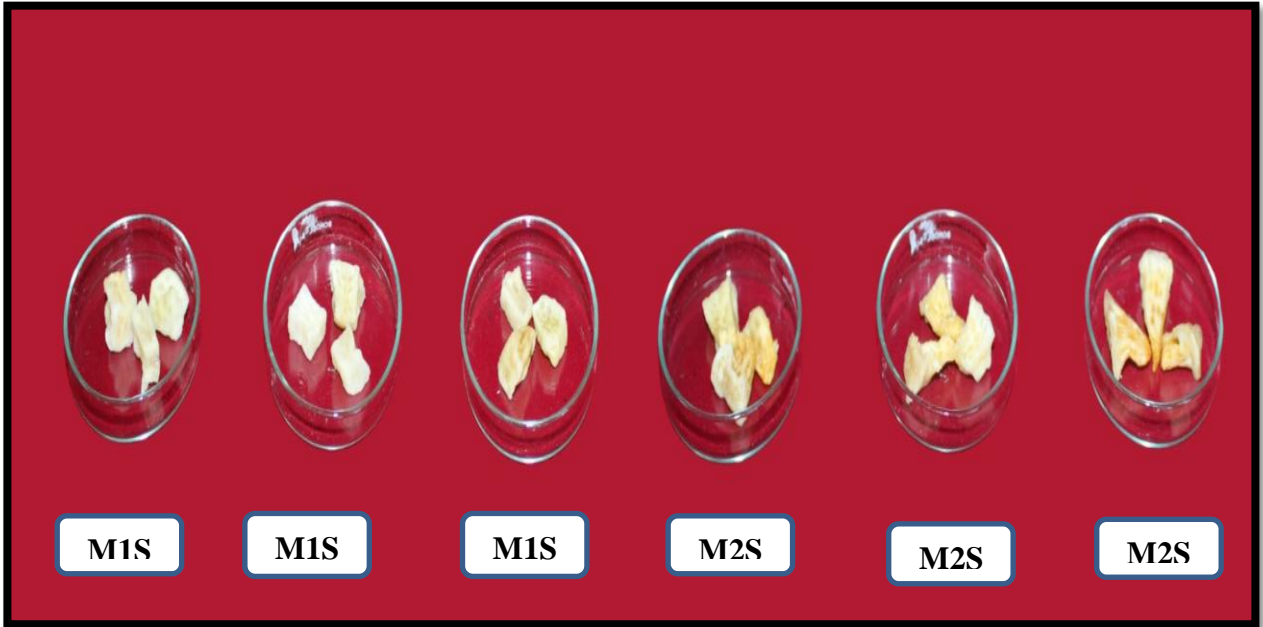
The data presented in Table 9 and depicted in Fig.11 indicates the changes in overall acceptability score of snapmelon osmodehydrated slices during storage. From the table it was observed that overall acceptability score of osmodehydrated slices decreased from '0' month (7.84) to 6 months (6.06) of storage, irrespective of maturity stages and sugar syrup concentrations.

The decrease in overall acceptability score during storage was due to decrease in colour, flavour and texture score during storage. Identical observations were also reported by Chavan *et al.* (2010) in osmo-dried banana slices.

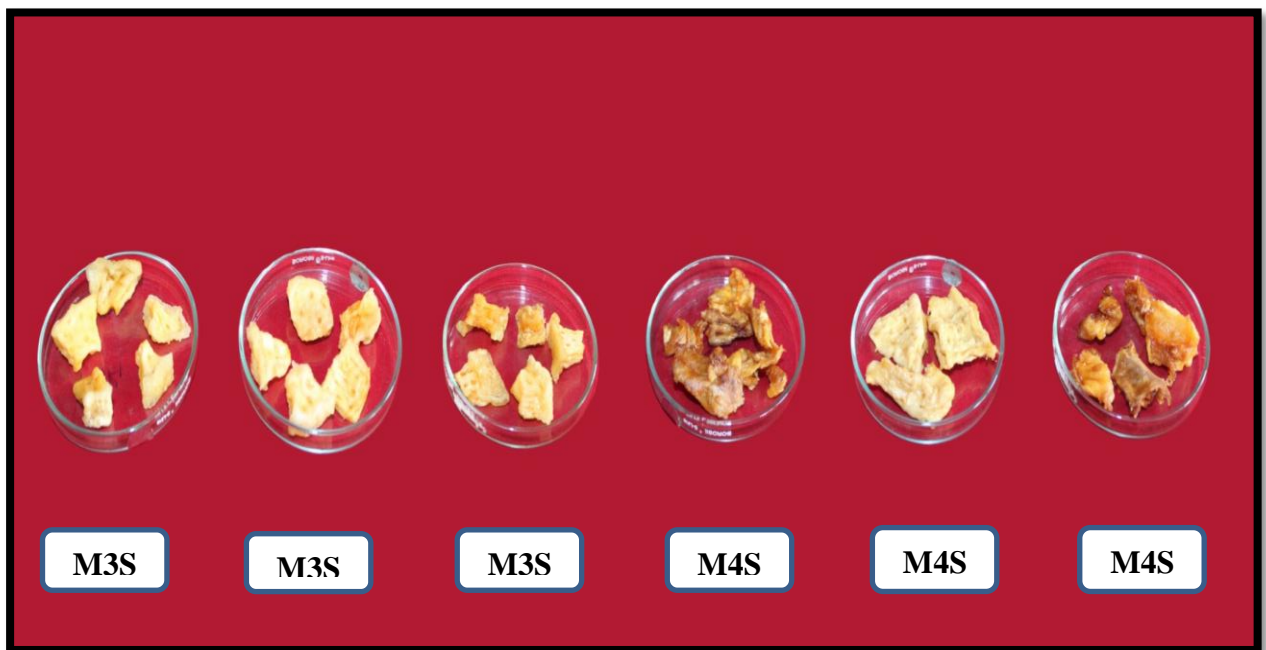
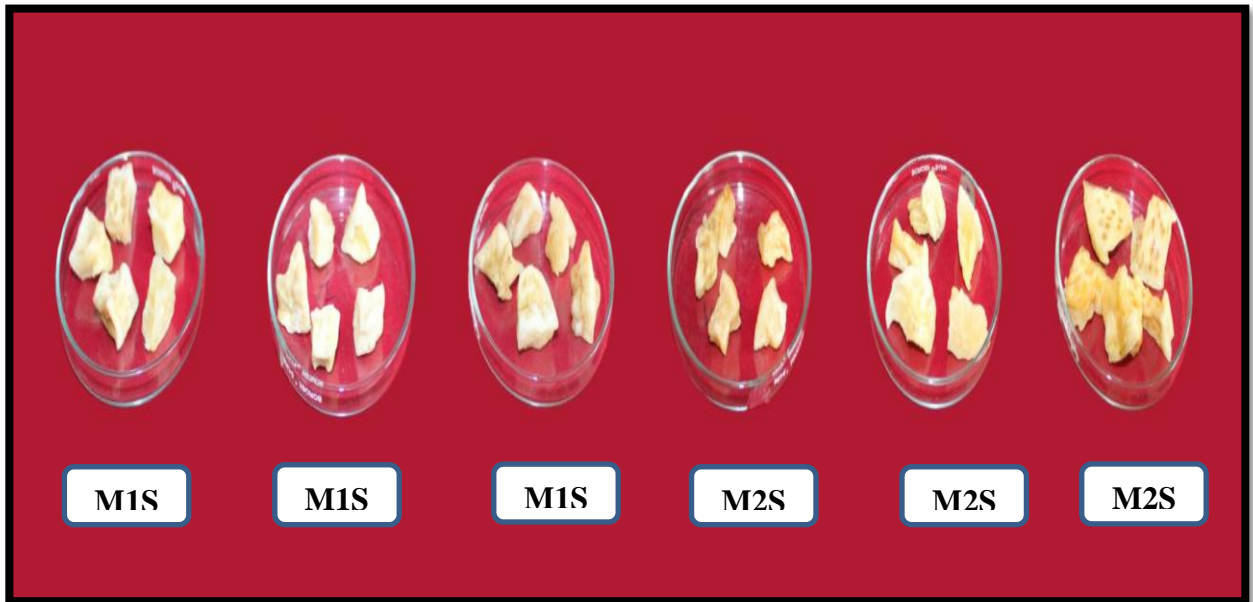
The overall acceptability score of osmodehydrated slices differs significantly with respect to different treatments of maturity stages during entire storage period. During storage, treatment M<sub>1</sub> recorded significantly maximum overall acceptability score at '0' (7.98) and treatment M<sub>2</sub> was at par with



**Plate II: Snapmelon osmodehydrated slices stored at ambient temperature ('0' month)**



**Plate III: Snapmelon osmodehydrated slices stored at ambient temperature (3 months)**



**Plate IV: Snapmelon osmodehydrated slices stored at ambient temperature (6 months)**

it. At 3 months storage treatment M<sub>1</sub> and M<sub>2</sub> recorded maximum score (7.53) and at 6 months M<sub>1</sub> (7.28) recorded significantly maximum score. Minimum overall acceptability score was recorded by M<sub>4</sub> at '0' (7.45), 3 (6.95) and 6 months (3.50) storage, irrespective of sugar syrup concentrations.

The overall acceptability score of osmodehydrated slices was found to be decreased from M<sub>1</sub> to M<sub>4</sub> during entire storage period. At '0' months storage it decreased from M<sub>1</sub> (7.98) to M<sub>4</sub> (7.45). At 3 months storage it decreased from M<sub>1</sub> (7.53) to M<sub>4</sub> (6.95). At the end of storage (6 months) it decreased from M<sub>1</sub> (7.28) to M<sub>4</sub> (3.50).

The decrease in overall acceptability score with increase in maturity stages of fruit during entire storage period may be due to combined effect of colour, flavour and texture score of osmodehydrated slices during storage.

In case of sugar syrup concentrations, overall acceptability score differs significantly at '0', 3 and 6 months storage. Treatment S<sub>1</sub> (40 °B) recorded significantly maximum overall acceptability score at '0' (7.99) and 3 (7.50) months. At 6 months S<sub>2</sub> (6.31) recorded maximum score, irrespective of maturity stages of fruit. Minimum overall acceptability score was recorded by S<sub>3</sub> (60 °B) at '0' (7.64), 3 (7.18) and 6 months (5.61) storage.

The overall acceptability score of osmodehydrated slices was found to be decreased with increase in sugar syrup concentration from S<sub>1</sub> (40 °B) to S<sub>3</sub> (60 °B) during entire storage period, except 6 months. At '0' and 3 months storage it decreases from 7.99 to 7.64 and 7.50 to 7.18 respectively. At 6 months storage it first increased from S<sub>1</sub> (6.28) to S<sub>2</sub> (6.31) and then decreased at S<sub>3</sub> (5.61). The decrease in overall acceptability score of osmodehydrated slices may be the combined effect of

**Table 9: Changes in overall acceptability score of snapmelon osmodehydrated slices during storage at ambient temperature (27-29°C)**

Treatments (Maturity stages)	'0' month				3 months				6 months			
	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean
<b>M<sub>1</sub></b>	8.20	7.97	7.77	<b>7.98</b>	7.70	7.60	7.30	<b>7.53</b>	7.53	7.37	6.93	<b>7.28</b>
<b>M<sub>2</sub></b>	8.20	7.93	7.77	<b>7.97</b>	7.70	7.57	7.32	<b>7.53</b>	7.50	7.40	6.67	<b>7.19</b>
<b>M<sub>3</sub></b>	8.10	7.97	7.80	<b>7.96</b>	7.53	7.53	7.33	<b>7.46</b>	6.40	6.47	6.00	<b>6.29</b>
<b>M<sub>4</sub></b>	7.47	7.67	7.20	<b>7.45</b>	7.08	6.98	6.78	<b>6.95</b>	3.67	4.00	2.83	<b>3.50</b>
<b>Mean</b>	<b>7.99</b>	<b>7.89</b>	<b>7.64</b>	<b>7.84</b>	<b>7.50</b>	<b>7.42</b>	<b>7.18</b>	<b>7.37</b>	<b>6.28</b>	<b>6.31</b>	<b>5.61</b>	<b>6.06</b>
	<b>S.Em.±</b>		<b>C.D. at 1%</b>		<b>S.Em.±</b>		<b>C.D. at 1%</b>		<b>S.Em.±</b>		<b>C.D. at 1%</b>	
<b>Maturity stage (M)</b>	0.003		0.013		0.004		0.015		0.004		0.016	
<b>Sugar syrup (S)</b>	0.003		0.011		0.003		0.013		0.004		0.014	
<b>Interaction (MxS)</b>	0.006		0.023		0.006		0.026		0.007		0.028	

**M<sub>1</sub>**- Mature green,

**M<sub>2</sub>**- Turning stage,

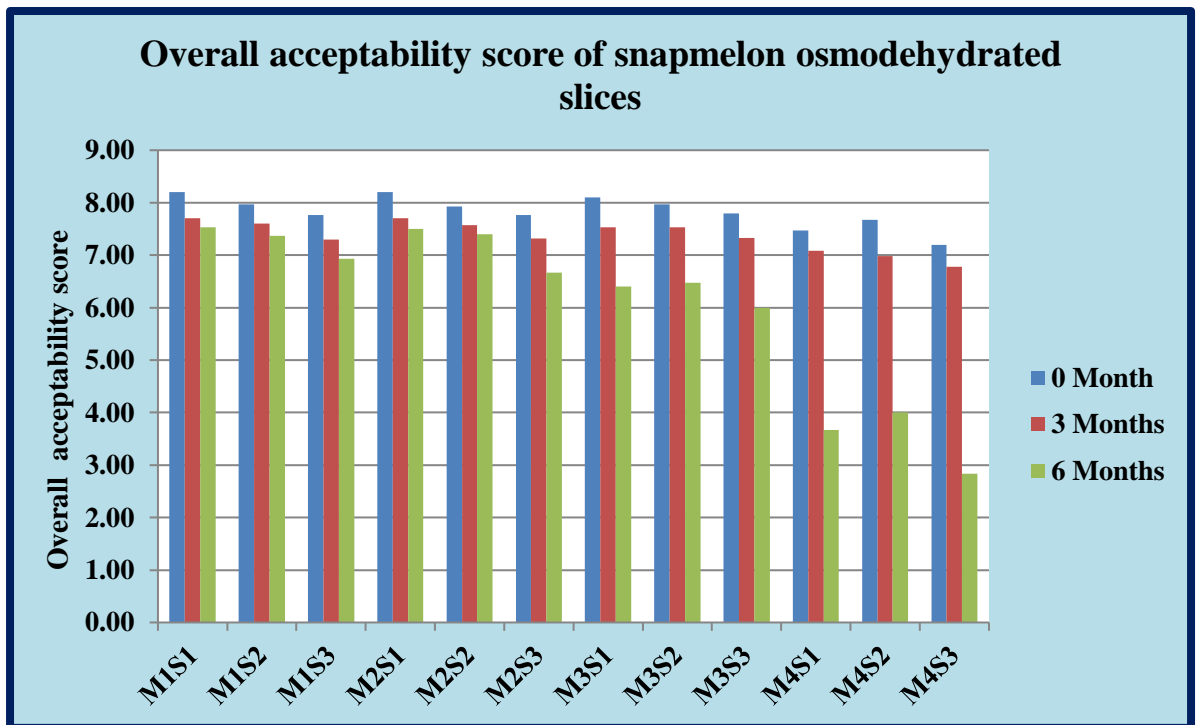
**M<sub>3</sub>**- Ripe stage,

**M<sub>4</sub>**- Over ripe stage

**S<sub>1</sub>**- 40 °B sugar syrup,

**S<sub>2</sub>**- 50 °B sugar syrup,

**S<sub>3</sub>**- 60 °B sugar syrup



**Fig.11 Percentage decrease in overall acceptability score of snapmelon osmodehydrated slices during storage at ambient temperature (27-29°C)**

**Treatments details –**

**M<sub>1</sub>S<sub>1</sub> – Mature green stage + 40<sup>o</sup>B sugar syrup concentration**

**M<sub>1</sub>S<sub>2</sub> – Mature green stage + 50<sup>o</sup>B sugar syrup concentration**

**M<sub>1</sub>S<sub>3</sub> – Mature green stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>1</sub> – Turning stage + 40<sup>o</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>2</sub> – Turning stage + 50<sup>o</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>3</sub> – Turning stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>1</sub> – Ripe stage + 40<sup>o</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>2</sub> – Ripe stage + 50<sup>o</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>3</sub> – Ripe stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>1</sub> – Over ripe stage + 40<sup>o</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>2</sub> – Over ripe stage + 50<sup>o</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>3</sub> – Over ripe stage + 60<sup>o</sup>B sugar syrup concentration**

colour, flavour and texture score during storage. Results analogous to present findings are also reported by Lingala *et al.* (2015) in osmo-dried karonda.

In interactions of maturity stage of fruit and sugar syrup concentration, results were found to be significant throughout the storage. At '0' month storage interaction M<sub>1</sub>S<sub>1</sub> and M<sub>2</sub>S<sub>1</sub> recorded significantly maximum overall acceptability score (8.20) and at 3 months storage again M<sub>1</sub>S<sub>1</sub> and M<sub>2</sub>S<sub>1</sub> (7.70) recorded significantly maximum overall acceptability score. At 6 months storage interaction M<sub>1</sub>S<sub>1</sub> (7.53) recorded maximum score and M<sub>2</sub>S<sub>1</sub> (7.50) was at par with it. Maximum overall acceptability score recorded by different interactions stated above is the combined effect of colour, flavour and texture score during storage.

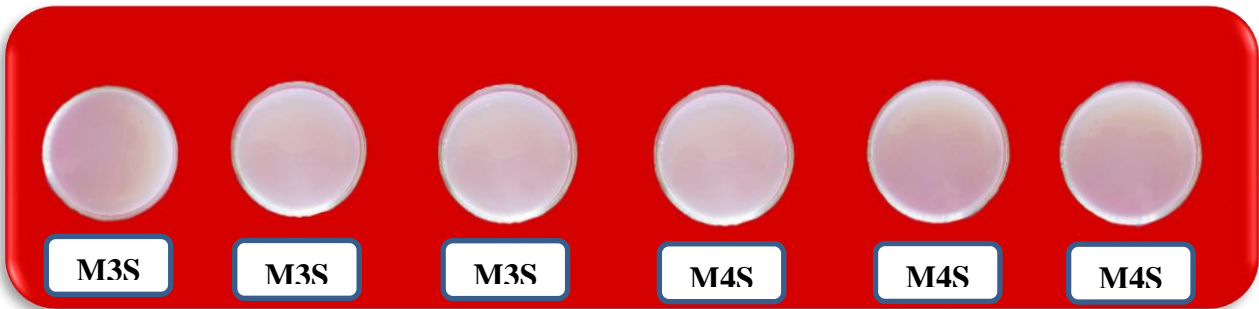
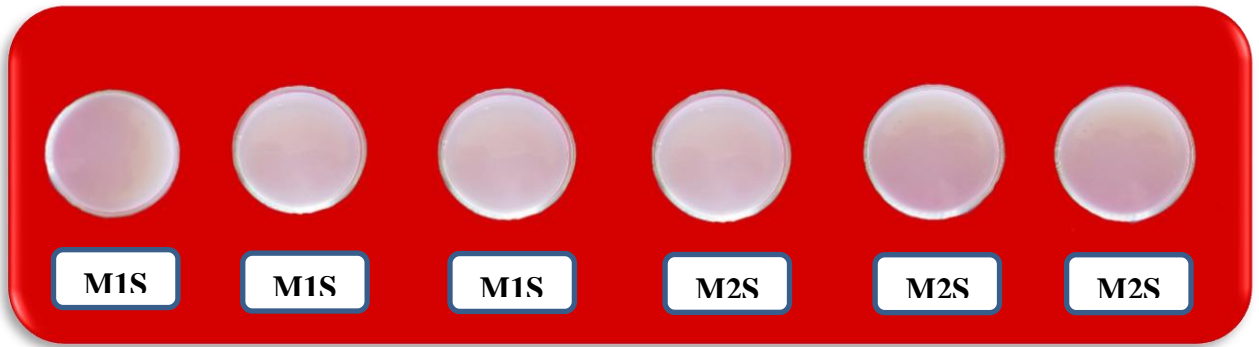
### **4.3 Microbial count of snapmelon osmodehydrated slices during storage under ambient temperature (27-29°C) condition.**

#### **4.3.1 Fungal count**

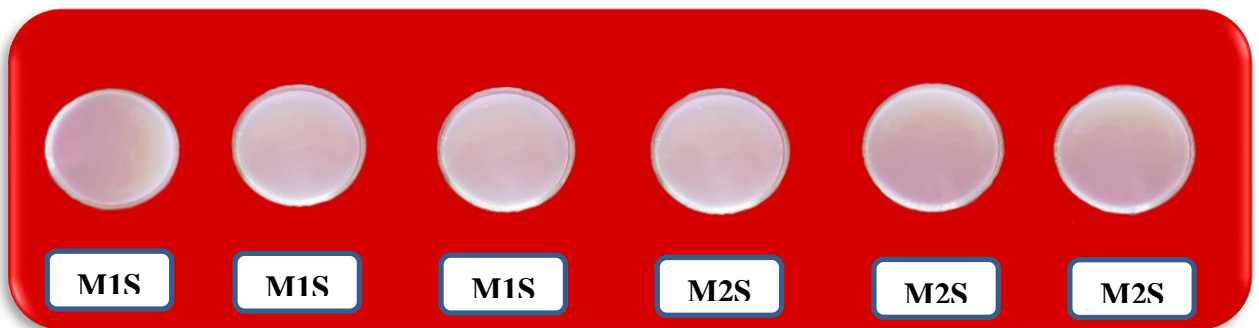
The data presented in Table 10 and depicted in Fig.12 indicates the fungal count in snapmelon osmodehydrated slices and it was observed that fungal count was increased from '0' month ( $0.00 \times 10^{-3}$  /ml) to 6 months ( $0.14 \times 10^{-3}$  /ml) of storage, irrespective of maturity stages and sugar concentrations.

Increase in fungal count during storage especially observed at 6 months storage may be due to decrease in T.S.S., acidity, phenolic compounds (not estimated) and increase in moisture during storage. Results analogous to present findings are also reported by Durrani and verma (2011) in aonla murabba.

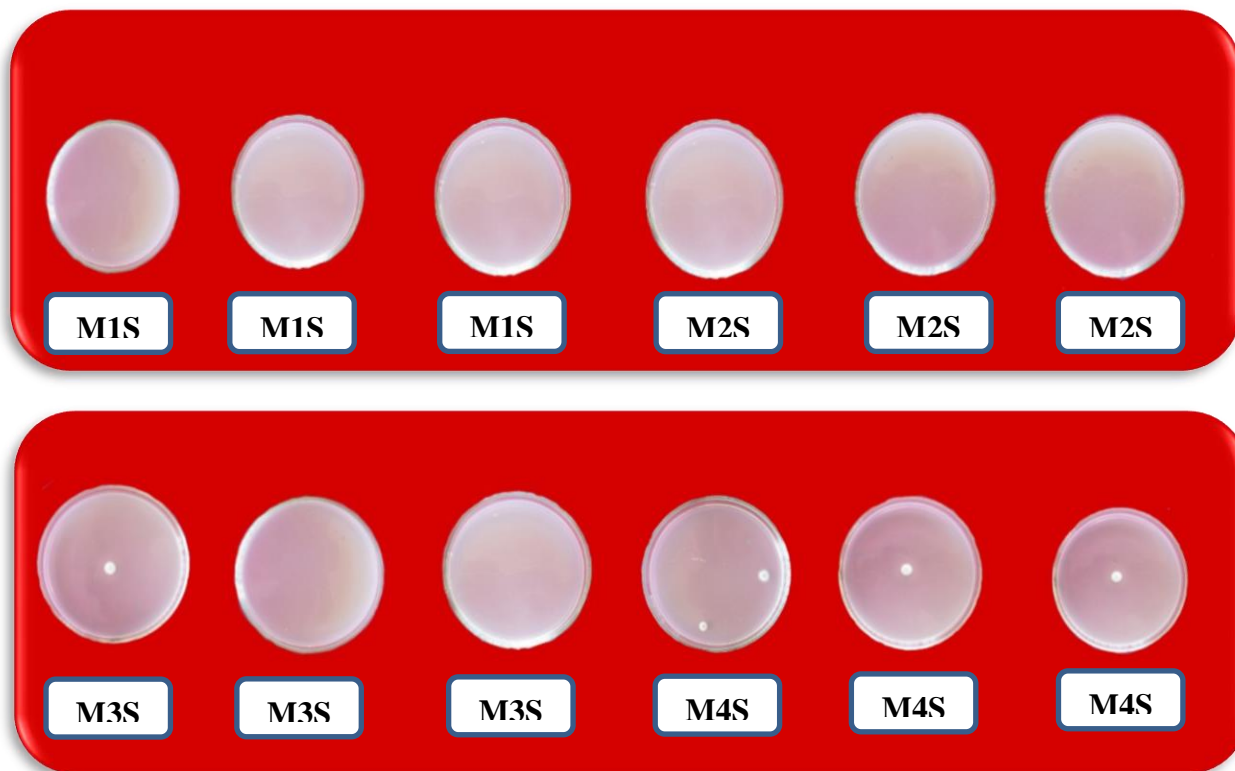
**'0' Month**



**3 Months**



**Plate V: Fungal count of snapmelon osmodehydrated slices at ambient temperature (27-29°C) ('0' and 3 months)**



**Plate VI: Fungal count of snapmelon osmodehydrated slices at ambient temperature (27-29°C) (6 months)**

The fungal count of snapmelon osmodehydrated slices differs significantly with respect to different treatments of maturity stages during entire storage period, except '0' and 3 months storage where fungal count was not detected. At 6 months storage significantly highest fungal count was recorded in M<sub>4</sub> ( $0.44 \times 10^{-3}$ ) and lowest by M<sub>1</sub> and M<sub>2</sub> ( $0.00 \times 10^{-3}$ ), irrespective of sugar syrup concentrations.

Fungal count of snapmelon osmodehydrated slices was found to be increased with increase in maturity stages of fruit. It may be the impact of increase in sugars and decrease in acidity with increase in maturity stages of fruits or it may be due to high phenol content in the initial maturity stages. Maximum fungal count at M<sub>4</sub> may be due to high percentage of moisture at M<sub>4</sub>. Jyothi (2000) reported that fruits with high phenol and crude fibre content show fungal contamination in later stage only.

In case of sugar syrup concentrations, fungal count of osmodehydrated slices was found to be decreased with increase in sugar syrup concentration from S<sub>1</sub> (60 °B) to S<sub>3</sub> (80 °B). However, at '0' and 3 months storage fungal growth was not detected. At 6 months storage the highest fungal count was recorded in S<sub>1</sub> ( $0.25 \times 10^{-3}$ ), irrespective of maturity stages. Maximum fungal count recorded by S<sub>1</sub> may be due to low sugar percentage at as compared to S<sub>2</sub> and S<sub>3</sub>. Identical results to present findings are also reported by Rahman *et al.* (2012) in osmotic dehydrated jackfruit.

In interaction of maturity stages of fruit and sugar syrup concentrations, at 6 months storage interaction M<sub>4</sub>S<sub>1</sub> recorded significantly maximum fungal count ( $0.66 \times 10^{-3}$ ).

**Table 10: Changes in fungal count (colony count  $\times 10^{-3}$  /ml) of snapmelon osmodehydrated slices during storage at ambient temperature (27-29°C)**

Treatments (Maturity stages)	'0' month				3 months				6 months			
	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean
<b>M<sub>1</sub></b>	0.00	0.00	0.00	<b>0.00</b>	0.00	0.00	0.00	<b>0.00</b>	0.00	0.00	0.00	<b>0.00</b>
<b>M<sub>2</sub></b>	0.00	0.00	0.00	<b>0.00</b>	0.00	0.00	0.00	<b>0.00</b>	0.00	0.00	0.00	<b>0.00</b>
<b>M<sub>3</sub></b>	0.00	0.00	0.00	<b>0.00</b>	0.00	0.00	0.00	<b>0.00</b>	0.33	0.00	0.00	<b>0.11</b>
<b>M<sub>4</sub></b>	0.00	0.00	0.00	<b>0.00</b>	0.00	0.00	0.00	<b>0.00</b>	0.66	0.33	0.33	<b>0.44</b>
<b>Mean</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.25</b>	<b>0.08</b>	<b>0.08</b>	<b>0.14</b>
	<b>S.Em.±</b>		<b>C.D. at 1%</b>		<b>S.Em.±</b>		<b>C.D. at 1%</b>		<b>S.Em.±</b>		<b>C.D. at 1%</b>	
<b>Maturity stage (M)</b>	0.000		0.000		0.000		0.000		0.002		0.008	
<b>Sugar syrup (S)</b>	0.000		0.000		0.000		0.000		0.002		0.007	
<b>Interaction (MxS)</b>	0.000		0.000		0.000		0.000		0.003		0.013	

**M<sub>1</sub>**- Mature green stage,

**M<sub>2</sub>**- Turning stage,

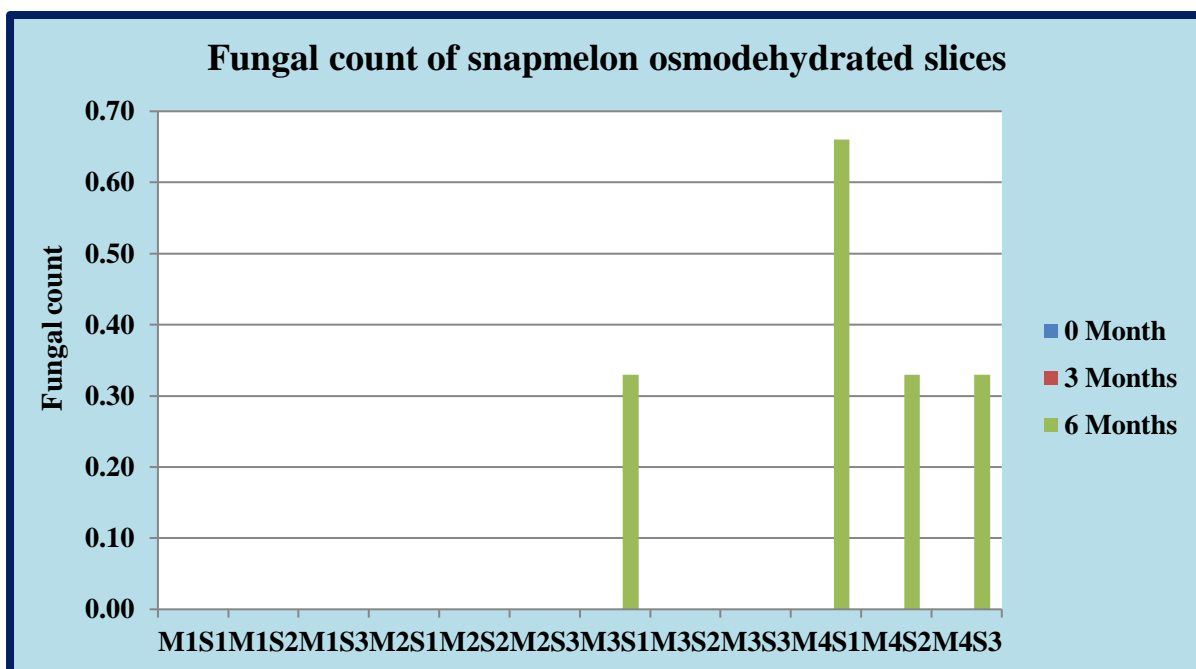
**M<sub>3</sub>**- Ripe stage,

**M<sub>4</sub>**- Over ripe stage

**S<sub>1</sub>**- 40 °B sugar syrup,

**S<sub>2</sub>**- 50 °B sugar syrup,

**S<sub>3</sub>**- 60 °B sugar syrup



**Fig.12 Percentage increase in fungal count of snapmelon osmodehydrated slices during storage at ambient temperature (27-29°C)**

**Treatments details -**

**M<sub>1</sub>S<sub>1</sub> - Mature green stage + 40°B sugar syrup concentration**

**M<sub>1</sub>S<sub>2</sub> - Mature green stage + 50°B sugar syrup concentration**

**M<sub>1</sub>S<sub>3</sub> - Mature green stage + 60°B sugar syrup concentration**

**M<sub>2</sub>S<sub>1</sub> - Turning stage + 40°B sugar syrup concentration**

**M<sub>2</sub>S<sub>2</sub> - Turning stage + 50°B sugar syrup concentration**

**M<sub>2</sub>S<sub>3</sub> - Turning stage + 60°B sugar syrup concentration**

**M<sub>3</sub>S<sub>1</sub> - Ripe stage + 40°B sugar syrup concentration**

**M<sub>3</sub>S<sub>2</sub> - Ripe stage + 50°B sugar syrup concentration**

**M<sub>3</sub>S<sub>3</sub> - Ripe stage + 60°B sugar syrup concentration**

**M<sub>4</sub>S<sub>1</sub> - Over ripe stage + 40°B sugar syrup concentration**

**M<sub>4</sub>S<sub>2</sub> - Over ripe stage + 50°B sugar syrup concentration**

**M<sub>4</sub>S<sub>3</sub> - Over ripe stage + 60°B sugar syrup concentration**

The maximum fungal count observed at M<sub>4</sub>S<sub>1</sub> may be the combined effect of over mature stage of fruit (M<sub>4</sub>) and low sugar syrup concentration at S<sub>1</sub> which might have allowed fungus to grow. Results of present study receive support from Kiranmai *et al.* (2018) in tamarind candy.

#### **4.3.2 Bacterial count**

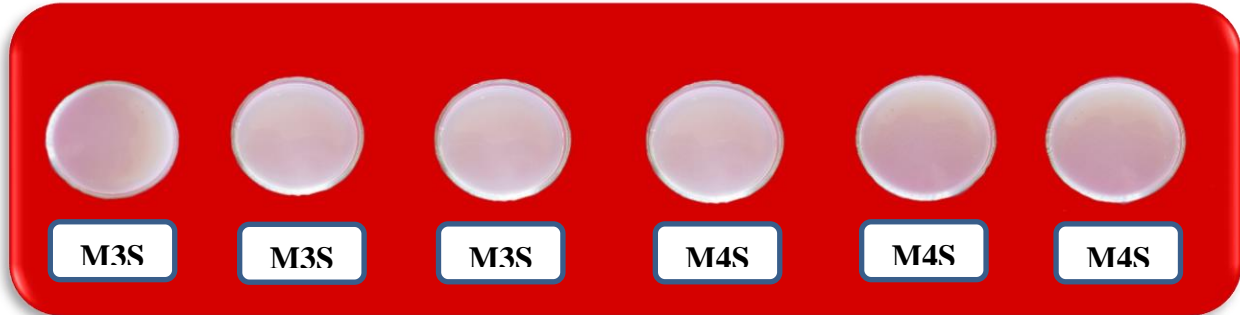
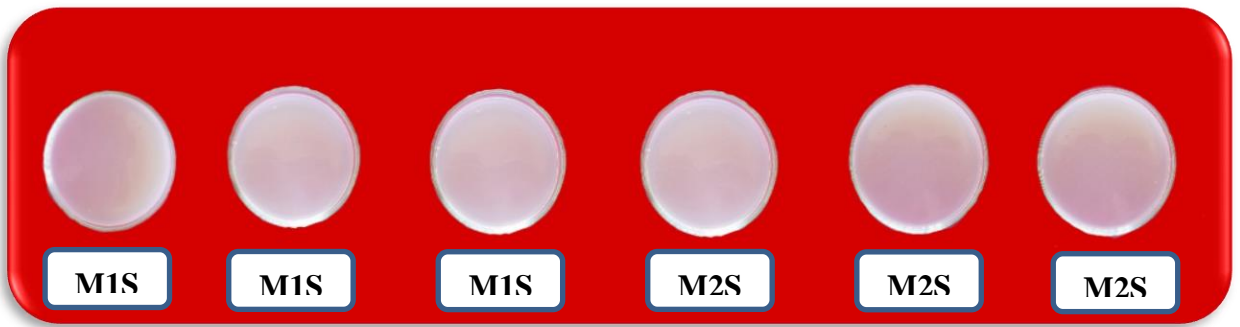
The data presented in Table 11 and depicted in Fig.13 indicates the bacterial count in snapmelon osmodehydrated slices and it was observed that bacterial count was increased from '0' month ( $0.00 \times 10^{-3}$  /ml) to 6 months ( $0.06 \times 10^{-3}$  /ml) of storage, irrespective of maturity stages and sugar concentrations.

Increase in bacterial count during storage especially at 6 months storage may be due to decrease in T.S.S., acidity, phenolic compounds (not estimated) and increase in moisture during storage. Results analogous to present findings are also reported by Tripura *et al.* (2017) in osmotic dehydrated ripe sapota slices.

The bacterial count of snapmelon osmodehydrated slices differs significantly with respect to different treatments of maturity stages during entire storage period, except '0' and 3 months storage were bacterial count was not detected. At 6 months storage the highest bacterial count was recorded in M<sub>4</sub> ( $0.22 \times 10^{-3}$ ), irrespective of sugar syrup concentrations.

Bacterial count was not observed at M<sub>1</sub>, M<sub>2</sub> and M<sub>3</sub> only M<sub>4</sub> stage of fruit (over ripe) recorded bacterial count of  $0.22 \times 10^{-3}$  at 6 months storage. It may be due to increase in sugar and decrease in acidity and phenol content with increase in growth stages of fruit and high moisture present at M<sub>4</sub>. Jyothi (2000)

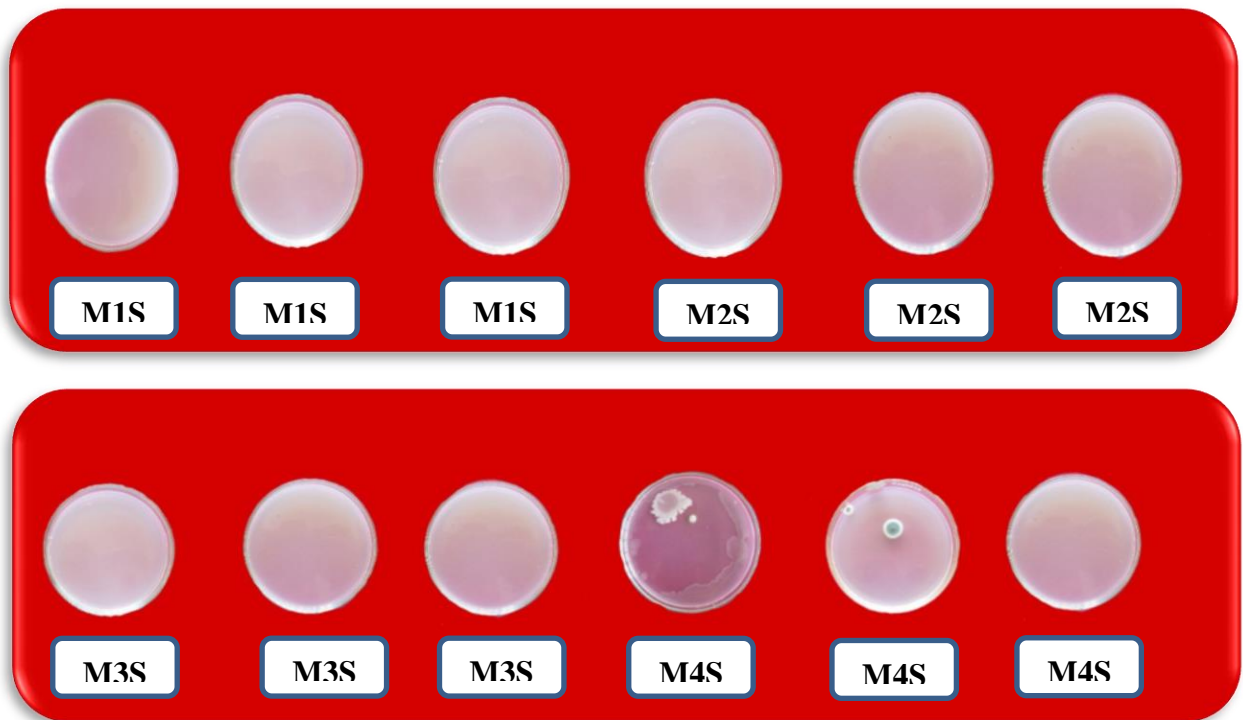
**'0' Month**



**3 Months**



**Plate VII: Bacterial count of snapmelon osmodehydrated slices at ambient temperature (27-29°C) ('0' and 3 months)**



**Plate VIII: Bacterial count of snapmelon osmodehydrated slices at ambient temperature (27-29°C) (6 months)**

**Table 11: Changes in bacteria count (colony count  $\times 10^{-3}$  /ml) of snapmelon osmodehydrated slices during storage at ambient temperature (27-29°C)**

Treatments (Maturity stages)	'0' month				3 months				6 months			
	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean
<b>M<sub>1</sub></b>	0.00	0.00	0.00	<b>0.00</b>	0.00	0.00	0.00	<b>0.00</b>	0.00	0.00	0.00	<b>0.00</b>
<b>M<sub>2</sub></b>	0.00	0.00	0.00	<b>0.00</b>	0.00	0.00	0.00	<b>0.00</b>	0.00	0.00	0.00	<b>0.00</b>
<b>M<sub>3</sub></b>	0.00	0.00	0.00	<b>0.00</b>	0.00	0.00	0.00	<b>0.00</b>	0.00	0.00	0.00	<b>0.00</b>
<b>M<sub>4</sub></b>	0.00	0.00	0.00	<b>0.00</b>	0.00	0.00	0.00	<b>0.00</b>	0.33	0.33	0.00	<b>0.22</b>
<b>Mean</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.08</b>	<b>0.08</b>	<b>0.00</b>	<b>0.06</b>
	<b>S.Em.±</b>		<b>C.D. at 1%</b>		<b>S.Em.±</b>		<b>C.D. at 1%</b>		<b>S.Em.±</b>		<b>C.D. at 1%</b>	
<b>Maturity stage (M)</b>	0.000		0.000		0.000		0.000		0.001		0.005	
<b>Sugar syrup (S)</b>	0.000		0.000		0.000		0.000		0.001		0.005	
<b>Interaction (MxS)</b>	0.000		0.000		0.000		0.000		0.002		0.009	

**M<sub>1</sub>**- Mature green,

**M<sub>2</sub>**- Turning stage,

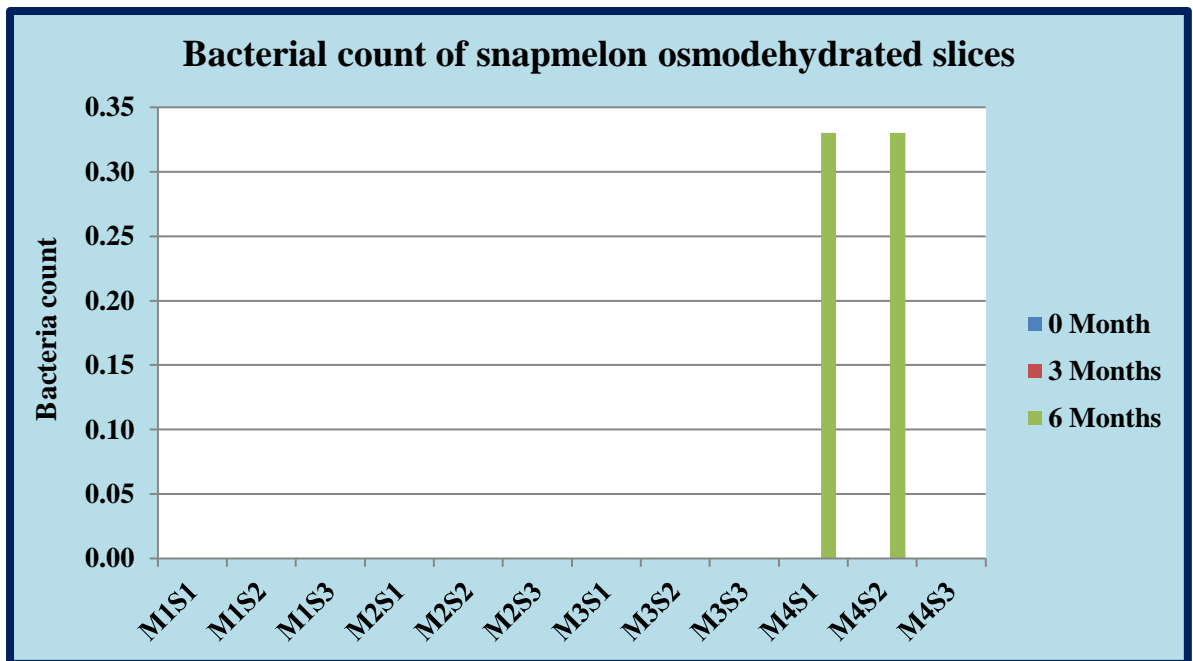
**M<sub>3</sub>**- Ripe stage,

**M<sub>4</sub>**- Over ripe stage

**S<sub>1</sub>**- 40 °B sugar syrup,

**S<sub>2</sub>**- 50 °B sugar syrup,

**S<sub>3</sub>**- 60 °B sugar syrup



**Fig.13 Percentage increase in bacterial count of snapmelon osmodehydrated slices during storage at ambient temperature (27-29°C)**

**Treatments details –**

**M<sub>1</sub>S<sub>1</sub> – Mature green stage + 40<sup>o</sup>B sugar syrup concentration**

**M<sub>1</sub>S<sub>2</sub> – Mature green stage + 50<sup>o</sup>B sugar syrup concentration**

**M<sub>1</sub>S<sub>3</sub> – Mature green stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>1</sub> – Turning stage + 40<sup>o</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>2</sub> – Turning stage + 50<sup>o</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>3</sub> – Turning stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>1</sub> – Ripe stage + 40<sup>o</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>2</sub> – Ripe stage + 50<sup>o</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>3</sub> – Ripe stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>1</sub> – Over ripe stage + 40<sup>o</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>2</sub> – Over ripe stage + 50<sup>o</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>3</sub> – Over ripe stage + 60<sup>o</sup>B sugar syrup concentration**

reported that fruits with high phenol and crude fibre content show fungal contamination in later stage only.

In case of sugar syrup concentrations, bacterial growth was not detected during '0' and 3 months storage. However, at 6 months storage the highest bacterial count was recorded in S<sub>1</sub> and S<sub>2</sub> ( $0.08 \times 10^{-3}$ ), irrespective of maturity stages. Maximum bacterial count recorded by S<sub>1</sub> and S<sub>2</sub> may be due to low amount of sugar at S<sub>1</sub> and S<sub>2</sub> as compared to S<sub>3</sub>. Results analogous to present findings are also reported by Rahman *et al.* (2012) in osmotic dehydrated jackfruit.

In interaction of maturity stages of fruit and sugar syrup concentrations, at 6 months storage interaction M<sub>4</sub>S<sub>1</sub> and M<sub>4</sub>S<sub>2</sub> recorded significantly maximum bacterial count ( $0.33 \times 10^{-3}$ ).

It may be due to the effect of low sugar syrup concentration at S<sub>1</sub> (40 °B) and S<sub>2</sub> (50 °B) and over ripe stage of fruit (M<sub>4</sub>) which might have allowed bacteria to grow. Similar results have been found by Kiranmai *et al.* (2018) in tamarind candy.

#### **4.4 Cost of production of 100 kg snapmelon osmodehydrated slices**

The cost of production for the preparation of snapmelon osmodehydrated slices from different maturity stages and sugar syrup concentration of snapmelon fruit is presented in Table 12. From the result it could be observed that total variable cost of snapmelon osmodehydrated slices with respect to different interactions of maturity stages and sugar syrup concentrations are Rs. 34726.34 (M<sub>1</sub>S<sub>1</sub>), 35673.32 (M<sub>1</sub>S<sub>2</sub>), 37081.5 (M<sub>1</sub>S<sub>3</sub>), 39359.01 (M<sub>2</sub>S<sub>1</sub>), 41145.78 (M<sub>2</sub>S<sub>2</sub>), 43170.7 (M<sub>2</sub>S<sub>3</sub>), 50799.08 (M<sub>3</sub>S<sub>1</sub>), 53431.74 (M<sub>3</sub>S<sub>2</sub>), 56304.16 (M<sub>3</sub>S<sub>3</sub>), 75792.35 (M<sub>4</sub>S<sub>1</sub>), 73479.74 (M<sub>4</sub>S<sub>2</sub>) and 74222.31 (M<sub>4</sub>S<sub>3</sub>) and total fixed cost was

**Table 12: Cost of production of 100 kg snapmelon osmodehydrated slices**

Sr. No.	Particulars	M <sub>1</sub> S <sub>1</sub>		M <sub>1</sub> S <sub>2</sub>		M <sub>1</sub> S <sub>3</sub>		M <sub>2</sub> S <sub>1</sub>	
		Qty	Cost	Qty	Cost	Qty	Cost	Qty	Cost
1	<b>Snapmelon fruits @ Rs.30/kg</b>	333.27	9998.1	310.37	9311.1	295.51	8865.3	369.14	11074.2
2	<b>Aluminium foil @ Rs. 0.8 / aluminium pouch (50 g/packet)</b>	2000	1600	2000	1600	2000	1600	2000	1600
3	<b>Sugar @ Rs. 39/kg</b>	239.9	9356.1	279.32	10893.48	319.14	12446.46	265.77	10365.03
3	<b>KMS @ Rs 262/kg i.e Rs.0.26/gm</b>	154.76	40.24	144.12	37.47	137.23	35.68	171.42	44.57
4	<b>Citric acids @ Rs. 92/kg i.e. Rs.0.09/gm</b>	299.94	26.99	279.32	25.14	265.95	23.94	332.22	29.90
5	<b>Fuel gas @ Rs 800/ cylinder of 14.2 kg i.e Rs. 0.05/gm of gas</b>	719.86	35.99	670.39	33.52	616.70	30.83	797.35	39.87
6	<b>Electricity charges @ Rs.10/- per unit</b>	441.88	4418.8	479.84	4798.54	530.91	5309.1	589.83	5898.3
7	<b>Labour charge @ Rs 300/- per skilled labour</b>	18.74	5622	17.49	5247	16.32	4896	20.65	6195
<b>A</b>	<b>a) Variable cost</b>		31098.22		31946.25		33207.31		35246.87
	<b>b) Supervision charges @10% on variable cost</b>		3109.82		3194.63		3320.73		3524.69
	<b>c) Interest on variable cost @ 10 % i.e. for 2 months</b>		518.30		532.44		553.46		587.45
	<b>d) Total variable cost (a+b+c)</b>		34726.34		35673.32		37081.5		39359.01
<b>B</b>	<b>Fixed cost</b>								
	<b>a) Depreciation charges on fixed capital @ 10% on Rs.25000 for dryer and Rs. 8000 for gas cylinder for different hour as per interaction</b>		28.55		30.67		33.66		37.65
	<b>b) Interest on fixed capital @ 10% on Rs.25000 for dryer and Rs. 8000 for gas cylinder for different hour as per interaction</b>		2.86		3.07		3.37		3.77
	<b>c) Total fixed cost (a+b)</b>		31.41		33.74		37.03		41.41
<b>C</b>	<b>Total cost (total variable cost + total fixed cost) in Rs.</b>		34757.75		35707.06		37118.53		39400.43
<b>D</b>	<b>Cost of production for 50 gm osmodehydrated slices in pouch in Rs.</b>		17.37		17.85		18.56		19.70
<b>E</b>	<b>Sell price of 50 g osmodehydrated slices in Rs.</b>		40		39		38		39
<b>F</b>	<b>Net profit for 50 g snapmelon osmodehydrated slices in Rs.</b>		22.63		21.15		19.44		19.3
<b>G</b>	<b>Benefit : cost ratio</b>		2.30		2.10		2.04		1.98

Continue...

Sr. No.	Particulars	M <sub>2</sub> S <sub>2</sub>		M <sub>2</sub> S <sub>3</sub>		M <sub>3</sub> S <sub>1</sub>		M <sub>3</sub> S <sub>2</sub>	
		Qty	Cost	Qty	Cost	Qty	Cost	Qty	Cost
1	Snapple fruits @ Rs.30/kg	352.51	10575.3	344.63	10338.9	483.09	14492.7	458.19	13745.7
2	Aluminium foil @ Rs. 0.8 / aluminium pouch (50 g/packet)	2000	1600	2000	1600	2000	1600	2000	1600
3	Sugar @ Rs. 39/kg	317.25	12372.75	372.2	14515.8	347.82	13564.98	412.37	16082.43
3	KMS @ Rs 262/kg i.e Rs.0.26/gm	163.7	42.56	160.04	41.61	224.34	58.32	212.78	55.32
4	Citric acids @ Rs.92/kg i.e. Rs.0.09/gm	317.25	28.55	310.17	27.91	434.78	39.13	412.37	37.11
5	Fuel gas @ Rs 800/ cylinder of 14.2 kg i.e Rs. 0.05/gm of gas	761.42	38.07	744.41	37.22	1043.47	52.17	989.69	49.48
6	Electricity charges @ Rs.10/- per unit	626.18	6261.75	628.79	6287.89	754.54	7545.42	855.43	8554.28
7	Labour charge @ Rs 300/- per skilled labour	19.76	5928	19.37	5811	27.13	8139	25.75	7725
A	a) Variable cost		36846.98		38660.33		45491.72		47849.32
	b) Supervision charges @10% on variable cost		3684.69		3866.03		4549.17		4784.93
	c) Interest on variable cost @ 10 % i.e. for 2 months		614.11		644.34		758.19		797.49
	d) Total variable cost (a+b+c)		41145.78		43170.7		50799.08		53431.74
B	Fixed cost								
	a) Depreciation charges on fixed capital @ 10% on Rs.25000 b) for dryer and Rs. 8000 for gas cylinder for different hour as per interaction		39.73		39.83		48.23		54.12
	b) Interest on fixed capital @ 10% on Rs.25000 for dryer and Rs. 8000 for gas cylinder for different hour as per interaction		3.97		3.98		4.82		5.41
	c) Total fixed cost (a+b)		43.7		43.81		53.05		59.53
C	Total cost (total variable cost + total fixed cost) in Rs.		41189.48		43214.51		50852.13		53491.27
D	Cost of production for 50 gm osmodehydrated slices in pouch in Rs.		20.59		21.61		25.42		26.74
E	Sell price of 50 g osmodehydrated slices in Rs.		39		38		37		37
F	Net profit for 50 g snapple osmodehydrated slices in Rs.		18.41		16.39		11.58		10.26
G	Benefit : cost		1.89		1.76		1.46		1.38

Continue...

Sr. No.	Particulars	M <sub>3</sub> S <sub>3</sub>		M <sub>4</sub> S <sub>1</sub>		M <sub>4</sub> S <sub>2</sub>		M <sub>4</sub> S <sub>3</sub>	
		Qty	Cost	Qty	Cost	Qty	cost	Qty	Cost
1	Snapmelon fruits @ Rs.30/kg	445.33	13359.9	713.62	21408.6	651.68	19550.4	602.23	18066.9
2	Aluminium foil @ Rs. 0.8 / aluminium pouch (50 g/packet)	2000	1600	2000	1600	2000	1600	2000	1600
3	Sugar @ Rs. 39/kg	480.96	18757.44	513.8	20038.2	586.51	22873.89	650.4	25365.6
3	KMS @ Rs. 262/kg i.e Rs.0.26/gm	206.81	53.77	331.41	86.17	302.64	78.69	279.68	72.72
4	citric acids @ Rs. 92/kg i.e. Rs.0.09/gm	400.8	36.07	642.26	57.80	586.51	52.79	542	48.78
5	Fuel gas @ Rs 800/ cylinder of 14.2 kg i.e Rs. 0.05/gm of gas	961.92	48.09	1541.42	77.07	1407.62	70.38	1300.82	65.04
6	Electricity charges @ Rs.10/- per unit	906.34	9063.37	1256.99	12569.91	1058.76	10587.6	1108.77	11087.7
7	Labour charge @ Rs 300/- per skilled labour	25.01	7503	40.12	12036	36.63	10989	33.87	10161
A	a) Variable cost		50421.64		67873.75		65802.75		66467.74
	b) Supervision charges @10% on variable cost		5042.16		6787.37		6580.28		6646.78
	c) Interest on variable cost @ 10 % i.e. for 2 months		840.36		1131.23		1096.71		1107.79
	d) Total variable cost (a+b+c)		56304.16		75792.35		73479.74		74222.31
B	Fixed cost								
	a) Depreciation charges on fixed capital @ 10% on Rs.25000 for dryer and Rs. 8000 for gas cylinder for different hour as per interaction		57.11		79.79		67.51		70.21
	b) Interest on fixed capital @ 10% on Rs.25000 for dryer and Rs. 8000 for gas cylinder for different hour as per interaction		5.71		7.97		6.75		7.02
	c) Total fixed cost (a+b)		62.82		87.76		74.26		77.23
C	Total cost (total variable cost + total fixed cost) in Rs.		56366.98		75880.11		73554		74299.54
D	Cost of production for 50 gm osmodehydrated slices in pouch in Rs.		28.18		37.94		36.78		37.15
E	Sell price of 50 g osmodehydrated slices in Rs.		36		32		32		30
F	Net profit for 50 g osmodehydrated slices in Rs.		7.82		-5.94		-4.78		-7.15
G	Benefit : cost		1.28		0.84		0.87		0.81

31.41 (M<sub>1</sub>S<sub>1</sub>), 33.74 (M<sub>1</sub>S<sub>2</sub>), 37.03 (M<sub>1</sub>S<sub>3</sub>), 41.41 (M<sub>2</sub>S<sub>1</sub>), 43.7 (M<sub>2</sub>S<sub>2</sub>), 43.81 (M<sub>2</sub>S<sub>3</sub>), 53.05 (M<sub>3</sub>S<sub>1</sub>), 59.53 (M<sub>3</sub>S<sub>2</sub>), 62.82 (M<sub>3</sub>S<sub>3</sub>), 87.76 (M<sub>4</sub>S<sub>1</sub>), 74.26 (M<sub>4</sub>S<sub>2</sub>) and 77.23 (M<sub>4</sub>S<sub>3</sub>).

Hence, cost for the production of 50 g snapmelon osmodehydrated slices was lowest (Rs. 17.37) in M<sub>1</sub>S<sub>1</sub> and highest (Rs. 37.94) in M<sub>4</sub>S<sub>1</sub>. Net profit for 50 g of snapmelon osmodehydrated slices was highest (Rs.22.63) in interaction M<sub>1</sub>S<sub>1</sub> and lowest (Rs. -7.15) was found in interaction M<sub>4</sub>S<sub>3</sub>. As per Benefit: cost ratio is concerned maximum (2.30) was recorded in interaction M<sub>1</sub>S<sub>1</sub> followed by M<sub>1</sub>S<sub>2</sub> (2.10) and M<sub>1</sub>S<sub>3</sub> (2.04) and minimum (0.81) was recorded in interaction M<sub>4</sub>S<sub>3</sub>.

#### **4.5 Changes in chemical composition of snapmelon preserve during storage under ambient temperature (27-29°C) condition.**

In this study snapmelon preserve was prepared by using the fruits of various maturity stages and also by using different concentrations of sugar syrup and stored for 6 months at ambient storage condition for further study.

##### **4.5.1 Total soluble solids (°B)**

The data presented in Table 13 and depicted in Fig.14 indicates the T.S.S. content of snapmelon preserve during storage. From the table it was observed that T.S.S. of preserve decreased from '0' month (71.12 °B) to 6 months (61.72 °B) of storage, irrespective of maturity stages and sugar syrup concentrations.

The decrease in T.S.S. of preserve pieces during storage may be due to release of absorbed sugar molecules by osmosis back to the sugar syrup. The decrease in texture of preserve pieces during storage might have affected the holding of sugar

molecules in fruit pieces. The decrease in texture of preserve can be seen from Table 20 of changes in texture of preserve during storage. Present findings are in line with the findings reported by Thakur *et al.* (2018) in aonla preserve and Singh *et al.* (2019) in aonla murabba.

The T.S.S. of preserve differs significantly with respect to different treatments of maturity stages during entire storage period. During storage, treatment M<sub>2</sub> recorded significantly maximum T.S.S. at '0' (73.82 °B), 3 (69.28 °B) and 6 months (66.33 °B) storage. Minimum T.S.S. was recorded by M<sub>4</sub> at '0' (69.66 °B), 3 months (61.57 °B) and 6 months (56.97 °B) storage, irrespective of sugar syrup concentrations.

In case of maturity stages, at '0' months storage T.S.S. of preserve was found to be increased from M<sub>1</sub> (69.97 °B) to M<sub>2</sub> (73.82 °B) and then decreased from M<sub>2</sub> to M<sub>4</sub> (69.66 °B). At 3 months storage it increased from M<sub>1</sub> (63.74 °B) to M<sub>2</sub> (69.28 °B) and then decreased from M<sub>2</sub> to M<sub>4</sub> (61.57 °B). At the end of storage (6 months) it again increased from M<sub>1</sub> (60.50 °B) to M<sub>2</sub> (66.33 °B) and then decreased at M<sub>4</sub> (56.97 °B).

The fruit pectin and starch impart good texture to the fruit. However, with the advancement of ripening, fruit softening takes place due to hydrolysis of insoluble pectins to soluble form and starch into sugars.

In the present study maximum T.S.S. recorded by treatment M<sub>2</sub> (turning stage) during entire storage may be due to semi-soft texture of fruit pieces which might have helped in better osmosis reaction. Hence, by osmosis water from fruit pieces might have moved through semi permeable membrane to the hypertonic solution of sugar syrup and the sugar syrup might have absorbed by fruit pieces to equalize the solute

concentration on both sides. However, with increase in maturity stages softening of fruit pieces increases, which might have affected holding of absorbed sugar syrup and hence decrease in T.S.S. was observed in later maturity stages. The texture of mature green stage ( $M_1$ ) fruit pieces was good as compared to other maturity stages. This can be seen from Table No. 20 of changes in texture score of preserve during storage. However, due to slight hard texture of fruit pieces water might have passed easily through semi-permeable membrane but sugar syrup might have not absorbed properly through it. Hence, slight less T.S.S. was observed at  $M_1$  as compared to  $M_2$  throughout storage period.

In case of sugar syrup concentrations the T.S.S. differ significantly at '0', 3 and 6 months storage. Treatment  $S_3$  (80 °B) recorded significantly maximum T.S.S. at '0' (76.60 °B), 3 (72.21 °B) and 6 months (68.90 °B) storage, irrespective of maturity stages of fruit. Minimum T.S.S. was recorded by  $S_1$  (60 °B) at '0' (66.56 °B), 3 (58.95 °B) and 6 months (54.45 °B) storage.

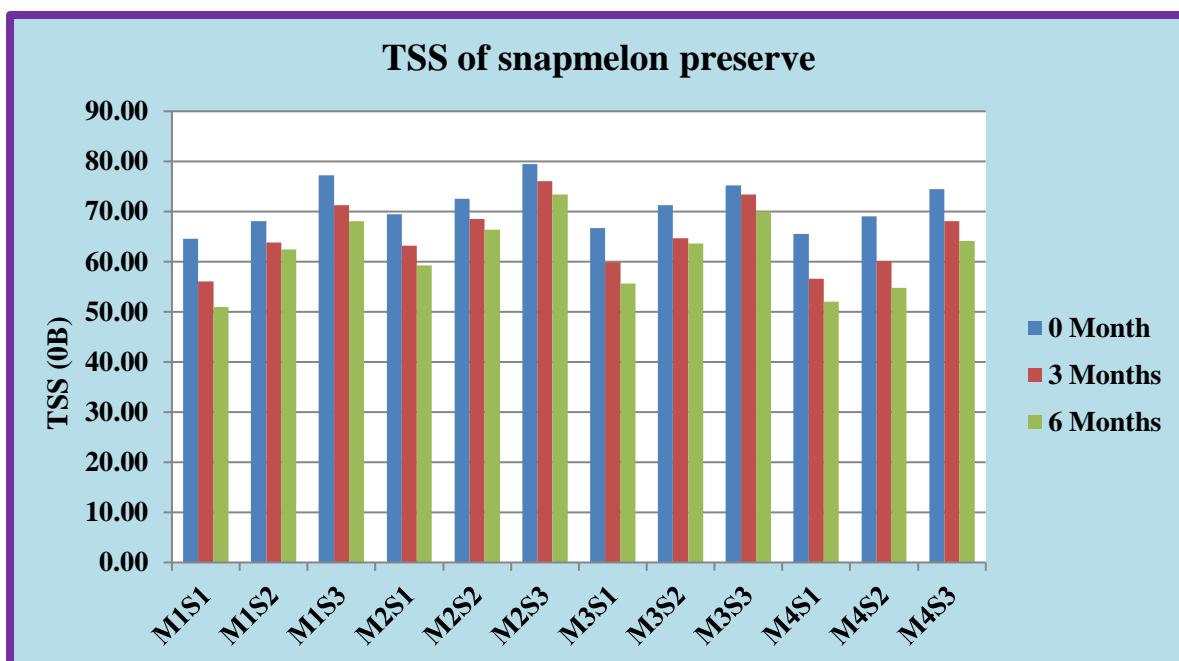
The T.S.S. of preserve was found to be increased with increase in sugar syrup concentration from  $S_1$  (60 °B) to  $S_3$  (80 °B) during entire storage period. At '0', 3 and 6 months storage it increased from 66.56 to 76.60 °B, 58.95 to 72.21 °B and 54.45 to 68.90 °B respectively, irrespective of maturity stages. The increase in T.S.S. of preserve may be the effect of increase in sugar syrup concentration from 60 °B ( $S_1$ ) to 80 °B ( $S_3$ ), which was absorbed by fruit pieces due to osmosis. Results analogous to present findings are also reported by Ghanwat *et al.* (2019) in aonla candy.

In interactions of maturity stage of fruit and sugar syrup concentration, results were found to be significant throughout

**Table 13: Changes in TSS (%) of snapmelon preserve during storage at ambient temperature (27-29°C)**

Treatments (Maturity stages)	'0' month				3 months				6 months			
	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean
<b>M<sub>1</sub></b>	64.62	68.10	77.20	<b>69.97</b>	56.10	63.88	71.25	<b>63.74</b>	51.00	62.40	68.10	<b>60.50</b>
<b>M<sub>2</sub></b>	69.43	72.53	79.51	<b>73.82</b>	63.22	68.52	76.11	<b>69.28</b>	59.20	66.40	73.40	<b>66.33</b>
<b>M<sub>3</sub></b>	66.67	71.23	75.20	<b>71.03</b>	59.85	64.70	73.42	<b>65.99</b>	55.60	63.60	70.00	<b>63.07</b>
<b>M<sub>4</sub></b>	65.50	69.02	74.47	<b>69.66</b>	56.61	60.05	68.06	<b>61.57</b>	52.00	54.80	64.10	<b>56.97</b>
<b>Mean</b>	<b>66.56</b>	<b>70.22</b>	<b>76.60</b>	<b>71.12</b>	<b>58.95</b>	<b>64.29</b>	<b>72.21</b>	<b>65.15</b>	<b>54.45</b>	<b>61.80</b>	<b>68.90</b>	<b>61.72</b>
	<b>S.Em.±</b>		<b>C.D. at 1%</b>		<b>S.Em.±</b>		<b>C.D. at 1%</b>		<b>S.Em.±</b>		<b>C.D. at 1%</b>	
<b>Maturity stage (M)</b>	0.333		1.317		0.294		1.162		0.333		1.318	
<b>Sugar syrup (S)</b>	0.288		1.140		0.254		1.006		0.289		1.142	
<b>Interaction (MxS)</b>	0.577		2.281		0.509		2.012		0.577		2.284	

**M<sub>1</sub>**- Mature green,**M<sub>2</sub>**- Turning stage,**M<sub>3</sub>**- Ripe stage,**M<sub>4</sub>**- Over ripe stage**S<sub>1</sub>**- 60 °B sugar syrup,**S<sub>2</sub>**- 70 °B sugar syrup,**S<sub>3</sub>**- 80 °B sugar syrup



**Fig.14 Percentage decrease in T.S.S. of snapmelon preserve during storage at ambient temperature (27-29°C)**

**Treatments details –**

**M<sub>1</sub>S<sub>1</sub> – Mature green stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>1</sub>S<sub>2</sub> – Mature green stage + 70<sup>o</sup>B sugar syrup concentration**

**M<sub>1</sub>S<sub>3</sub> – Mature green stage + 80<sup>o</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>1</sub> – Turning stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>2</sub> – Turning stage + 70<sup>o</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>3</sub> – Turning stage + 80<sup>o</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>1</sub> – Ripe stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>2</sub> – Ripe stage + 70<sup>o</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>3</sub> – Ripe stage + 80<sup>o</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>1</sub> – Over ripe stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>2</sub> – Over ripe stage + 70<sup>o</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>3</sub> – Over ripe stage + 80<sup>o</sup>B sugar syrup concentration**

the storage. At '0', 3 and 6 months storage, interaction M<sub>2</sub>S<sub>3</sub> recorded significantly maximum T.S.S. of 79.51, 76.11 and 73.40 °B respectively. Minimum T.S.S. was recorded by M<sub>1</sub>S<sub>1</sub> at '0' (64.62 °B), 3 (56.10 °B) and 6 months storage (51.00 °B). Maximum T.S.S. recorded by M<sub>2</sub>S<sub>3</sub> may be due to semi-soft texture of fruit at turning stage (M<sub>2</sub>) and higher sugar syrup concentration at S<sub>3</sub> (80 °B). The semi-soft texture of fruit might have helped in holding high concentration of sugar syrup.

#### **4.5.2 Reducing sugars (%)**

The data regarding reducing sugars of snapmelon preserve during storage is presented in Table 14 and depicted in Fig. 15. From the table it was observed that reducing sugar content of preserve increased from '0' month (29.65 %) to 6 months (35.84 %) of storage, irrespective of maturity stages and sugar syrup concentrations.

The increase in reducing sugars of preserve pieces during storage may be due to conversion of non-reducing sugars into reducing sugars during storage. Present findings are in line with the findings reported by Ranote *et al.* (2002) in amla preserve.

The reducing sugars of preserve differ significantly with respect to different treatments of maturity stages during entire storage period. During storage, treatment M<sub>2</sub> recorded significantly maximum reducing sugars at '0' (34.96 %), 3 (38.27 %) and 6 months (40.82 %) storage. Minimum reducing sugar content was recorded by M<sub>4</sub> at '0' (24.70 %), 3 months (28.43 %) and 6 months (30.68 %) storage, irrespective of sugar syrup concentrations.

At '0' months storage reducing sugar increased from M<sub>1</sub> (29.58 %) to M<sub>2</sub> (34.36 %) and then decreased from M<sub>2</sub> to M<sub>4</sub> (24.70 %). At 3 months storage it increased from M<sub>1</sub> (32.83 %) to

M<sub>2</sub> (38.27 %) and then decreased from M<sub>2</sub> to M<sub>4</sub> (28.43 %). At the end of storage (6 months) it increased from M<sub>1</sub> (35.55 %) to M<sub>2</sub> (40.82 %) and then decreased at M<sub>4</sub> (30.68 %).

The fruit pectin and starch impart good texture to the fruit. However, with the advancement of ripening, fruit softening takes place due to hydrolysis of insoluble pectins to soluble form and starch into sugars.

The maximum reducing sugars recorded by treatment M<sub>2</sub> (turning stage) during entire storage may be due to semi-soft texture of fruit pieces which might have helped in better osmosis reaction. Hence, by osmosis better release of water and absorption of sugar syrup might have taken place by fruit pieces and it was held properly by them during storage. From total amount of native and absorbed sugars, better conversion of non-reducing sugars to reducing sugars might have taken place at M<sub>2</sub> and hence recorded maximum reducing sugars. However, with increase in maturity stages softening of fruit pieces increases, which might have affected holding of native and converted reducing sugars and hence decrease in reducing sugars were observed in later maturity stages. The texture of mature green stage (M<sub>1</sub>) fruit pieces was good as compared to other maturity stages. This can be seen from Table No. 20 of changes in texture score of preserve during storage. However, as explained under T.S.S. (4.5.1) due to slight hard texture of mature green fruit pieces, water might have passed easily through semi-permeable membrane but sugar syrup might have not absorbed properly through it. Hence, due to presence of less amount of sugars at M<sub>1</sub>, less amount of reducing sugars might have formed as compared to M<sub>2</sub> even though texture is harder than M<sub>2</sub>.

**Table 14: Changes in reducing sugars (%) of snapmelon preserve during storage at ambient temperature (27-29°C)**

Treatments (Maturity stages)	'0' month				3 months				6 months			
	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean
<b>M<sub>1</sub></b>	25.80	29.90	33.05	<b>29.58</b>	29.03	32.88	36.57	<b>32.83</b>	31.65	35.95	39.04	<b>35.55</b>
<b>M<sub>2</sub></b>	31.06	34.23	37.80	<b>34.36</b>	35.00	38.62	41.20	<b>38.27</b>	37.06	41.15	44.25	<b>40.82</b>
<b>M<sub>3</sub></b>	25.80	29.41	34.61	<b>29.94</b>	29.43	33.50	37.34	<b>33.42</b>	31.45	36.00	41.55	<b>36.33</b>
<b>M<sub>4</sub></b>	20.60	25.15	28.36	<b>24.70</b>	24.73	28.04	32.51	<b>28.43</b>	26.11	30.88	35.05	<b>30.68</b>
<b>Mean</b>	<b>25.82</b>	<b>29.67</b>	<b>33.45</b>	<b>29.65</b>	<b>29.55</b>	<b>33.26</b>	<b>36.91</b>	<b>33.24</b>	<b>31.57</b>	<b>35.99</b>	<b>39.97</b>	<b>35.84</b>
	<b>S.Em.±</b>		<b>C.D. at 1%</b>		<b>S.Em.±</b>		<b>C.D. at 1%</b>		<b>S.Em.±</b>		<b>C.D. at 1%</b>	
<b>Maturity stage (M)</b>	0.333		1.318		0.430		1.702		0.333		1.318	
<b>Sugar syrup (S)</b>	0.289		1.142		0.373		1.474		0.289		1.142	
<b>Interaction (MxS)</b>	0.577		2.284		0.745		2.948		0.577		2.284	

**M<sub>1</sub>**- Mature green,

**M<sub>2</sub>**- Turning stage,

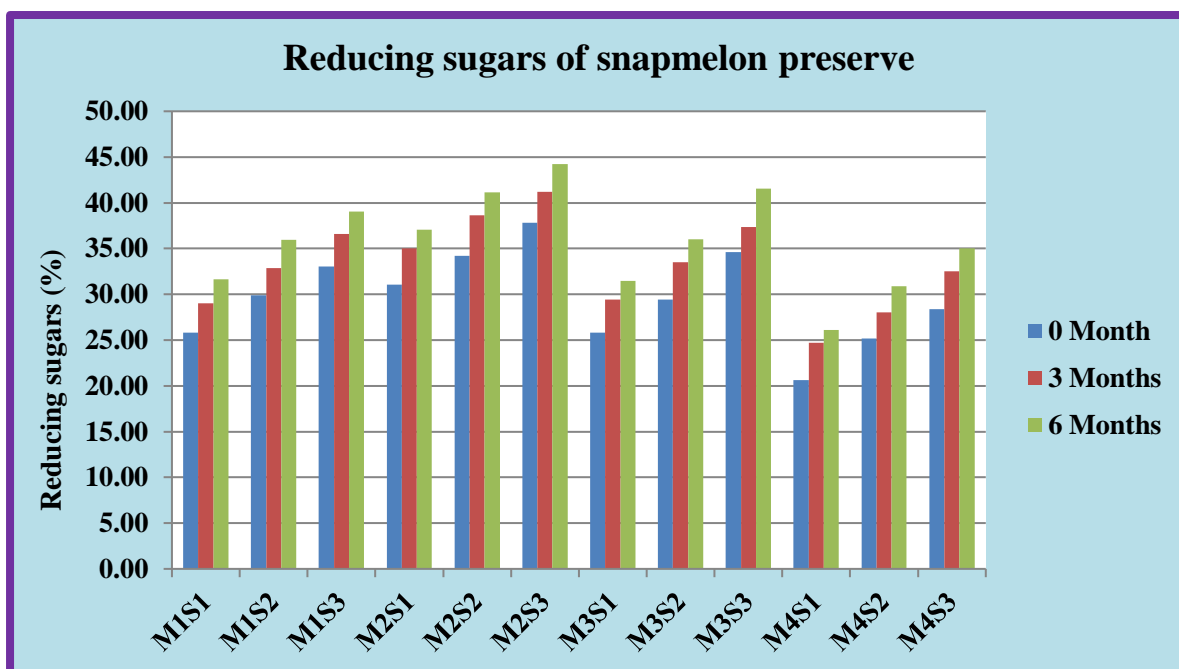
**M<sub>3</sub>**- Ripe stage,

**M<sub>4</sub>**- Over ripe stage

**S<sub>1</sub>**- 60 °B sugar syrup,

**S<sub>2</sub>**- 70 °B sugar syrup,

**S<sub>3</sub>**- 80 °B sugar syrup



**Fig.15 Percentage increase in reducing sugar of snapmelon preserve during storage at ambient temperature (27-29°C)**

**Treatments details –**

**M<sub>1</sub>S<sub>1</sub> – Mature green stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>1</sub>S<sub>2</sub> – Mature green stage + 70<sup>o</sup>B sugar syrup concentration**

**M<sub>1</sub>S<sub>3</sub> – Mature green stage + 80<sup>o</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>1</sub> – Turning stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>2</sub> – Turning stage + 70<sup>o</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>3</sub> – Turning stage + 80<sup>o</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>1</sub> – Ripe stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>2</sub> – Ripe stage + 70<sup>o</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>3</sub> – Ripe stage + 80<sup>o</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>1</sub> – Over ripe stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>2</sub> – Over ripe stage + 70<sup>o</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>3</sub> – Over ripe stage + 80<sup>o</sup>B sugar syrup concentration**

In case of sugar syrup concentrations the reducing sugars differ significantly at '0', 3 and 6 months storage. Treatment S<sub>3</sub> (80 °B) recorded significantly maximum reducing sugar at '0' (33.45 %), 3 (36.91 %) and 6 months (39.97 %) storage, irrespective of maturity stages of fruit. Minimum reducing sugar content was recorded by S<sub>1</sub> (60 °B) at '0' (25.82 %), 3 (29.55 %) and 6 months (31.57 %) storage.

The reducing sugars of preserve were found to be increased with increase in sugar syrup concentration from S<sub>1</sub> (60 °B) to S<sub>3</sub> (80 °B) during entire storage period. At '0', 3 and 6 months storage it increased from 25.82 to 33.45 per cent, 29.55 to 36.91 per cent and 31.57 to 39.97 per cent respectively, irrespective of maturity stages. The increase in reducing sugars of preserve may be the effect of increase in sugar syrup concentration from 60 °B (S<sub>1</sub>) to 80 °B (S<sub>3</sub>), which was absorbed by fruit pieces due to osmosis. Hence, with increase in sugar percentage of fruit pieces better conversion of non-reducing sugars to reducing sugars might have taken place. Results analogous to present findings are also reported by Rahman *et al.* (2012) in osmotic dehydration of jackfruit.

In interaction of maturity stage of fruit and sugar syrup concentration, results were found to be significant throughout the storage. Interaction M<sub>2</sub>S<sub>3</sub> recorded significantly maximum reducing sugars at '0' (37.80 %), 3 months (41.20 %) and 6 months (44.25 %) storage and at 3 months it was at par with M<sub>2</sub>S<sub>2</sub> (38.62 %). Minimum reducing sugars were recorded by M<sub>4</sub>S<sub>1</sub> at '0' (20.60 %), 3 (24.73 %) and 6 months storage (26.11 %). Maximum reducing sugars recorded by M<sub>2</sub>S<sub>3</sub> may be due to semi-soft texture of fruit at turning stage (M<sub>2</sub>) and higher sugar syrup concentration at S<sub>3</sub> (80 °B). The semi-soft texture of fruit

might have helped in holding high concentration of sugar syrup. Hence, more conversion of non-reducing sugars to reducing sugars at M<sub>2</sub>S<sub>3</sub>.

#### **4.5.3 Total sugars (%)**

The data presented in Table 15 and depicted in Fig.16 indicates the total sugar content of snapmelon preserve during storage. From the table it was observed that total sugars of preserve decreased from '0' month (53.60 %) to 6 months (43.60 %) of storage, irrespective of maturity stages and sugar syrup concentrations.

The decrease in total sugars of preserve pieces during storage may be due to release of absorbed sugar molecules by osmosis back to the sugar syrup due to decrease in texture of preserve pieces during storage, as stated under 4.5.1 (T.S.S.). Present finding are in line with the findings reported by Patel *et al.* (2013) in aonla murabba.

The total sugars of preserve differ significantly with respect to different treatments of maturity stages during entire storage period. During storage, treatment M<sub>2</sub> recorded significantly maximum total sugars at '0' (57.39 %), 3 (52.36 %) and 6 months (48.52 %) storage. Minimum total sugars were recorded by M<sub>4</sub> at '0' (49.86 %), 3 months (44.51 %) and 6 months (39.83 %) storage, irrespective of sugar syrup concentrations.

At '0' months storage total sugars increased from M<sub>1</sub> (54.37 %) to M<sub>2</sub> (57.39 %) and then decreased from M<sub>2</sub> to M<sub>4</sub> (49.86 %). At 3 months storage it increased from M<sub>1</sub> (47.63 %) to M<sub>2</sub> (52.36 %) and then decreased from M<sub>2</sub> to M<sub>4</sub> (44.51 %). At the end of storage (6 months) it increased from M<sub>1</sub> (41.85 %) to M<sub>2</sub>

(48.52 %) and then decreased at M<sub>4</sub> (39.83 %) as that of total soluble solids.

In the present study maximum total sugars recorded by treatment M<sub>2</sub> (turning stage) during entire storage may be due to semi-soft texture of fruit pieces which might have helped in better osmosis reaction and hence maximum absorption of sugar syrup by fruit pieces. Reasons behind decrease in total sugar content with increase in fruit maturity during storage and slight less amount of total sugars at M<sub>1</sub> as compared to M<sub>2</sub> are same as explained under 4.5.1 under total soluble solids.

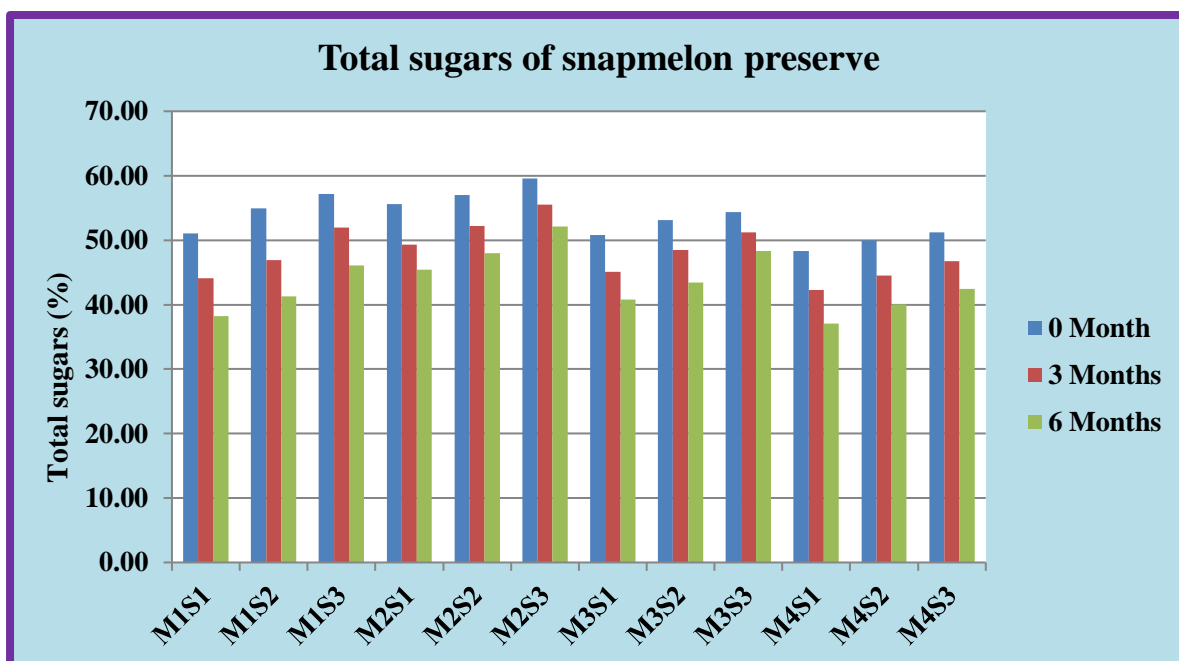
In case of sugar syrup concentrations, total sugars differ significantly at '0', 3 and 6 months storage. Treatment S<sub>3</sub> (80 °B) recorded significantly maximum total sugars at '0' (55.58 %), 3 (51.33 %) and 6 months (47.23 %) storage, irrespective of maturity stages of fruit. Minimum total sugar content was recorded by S<sub>1</sub> (60 °B) at '0' (51.46 %), 3 (45.21 %) and 6 months (40.37 %) storage.

The total sugars of preserve was found to be increased with increase in sugar syrup concentration from S<sub>1</sub> (60 °B) to S<sub>3</sub> (80 °B) during entire storage period. At '0', 3 and 6 months storage it increased from 51.46 to 55.58 per cent, 45.21 to 51.33 per cent and 40.37 to 47.23 per cent respectively, irrespective of maturity stages. The increase in total sugars of preserve from S<sub>1</sub> and S<sub>3</sub> may be the effect of increase in sugar syrup concentration as explained under 4.5.1. Results analogous to present findings are also reported by Singh *et al.* (2019) in aonla murabba.

**Table 15: Changes in total sugars (%) of snapmelon preserve during storage at ambient temperature (27-29°C)**

Treatments (Maturity stages)	'0' month				3 months				6 months			
	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean
<b>M<sub>1</sub></b>	51.02	54.92	57.18	<b>54.37</b>	44.08	46.90	51.92	<b>47.63</b>	38.20	41.30	46.05	<b>41.85</b>
<b>M<sub>2</sub></b>	55.62	57.01	59.55	<b>57.39</b>	49.35	52.23	55.50	<b>52.36</b>	45.40	48.02	52.13	<b>48.52</b>
<b>M<sub>3</sub></b>	50.84	53.13	54.36	<b>52.78</b>	45.13	48.46	51.18	<b>48.26</b>	40.80	43.42	48.33	<b>44.18</b>
<b>M<sub>4</sub></b>	48.35	50.00	51.22	<b>49.86</b>	42.28	44.53	46.72	<b>44.51</b>	37.08	40.01	42.41	<b>39.83</b>
<b>Mean</b>	<b>51.46</b>	<b>53.76</b>	<b>55.58</b>	<b>53.60</b>	<b>45.21</b>	<b>48.03</b>	<b>51.33</b>	<b>48.19</b>	<b>40.37</b>	<b>43.19</b>	<b>47.23</b>	<b>43.60</b>
	<b>S.Em.±</b>		<b>C.D. at 1%</b>		<b>S.Em.±</b>		<b>C.D. at 1%</b>		<b>S.Em.±</b>		<b>C.D. at 1%</b>	
<b>Maturity stage (M)</b>	0.333		1.318		0.325		1.285		0.430		1.702	
<b>Sugar syrup (S)</b>	0.289		1.142		0.281		1.112		0.373		1.474	
<b>Interaction (MxS)</b>	0.577		2.284		0.563		2.225		0.745		2.948	

**M<sub>1</sub>**- Mature green,**M<sub>2</sub>**- Turning stage,**M<sub>3</sub>**- Ripe stage,**M<sub>4</sub>**- Over ripe stage**S<sub>1</sub>**- 60 °B sugar syrup,**S<sub>2</sub>**- 70 °B sugar syrup,**S<sub>3</sub>**- 80 °B sugar syrup



**Fig.16 Percentage decrease in total sugars of snapmelon preserve during storage at ambient temperature (27-29°C)**

**Treatments details –**

**M<sub>1</sub>S<sub>1</sub> – Mature green stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>1</sub>S<sub>2</sub> – Mature green stage + 70<sup>o</sup>B sugar syrup concentration**

**M<sub>1</sub>S<sub>3</sub> – Mature green stage + 80<sup>o</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>1</sub> – Turning stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>2</sub> – Turning stage + 70<sup>o</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>3</sub> – Turning stage + 80<sup>o</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>1</sub> – Ripe stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>2</sub> – Ripe stage + 70<sup>o</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>3</sub> – Ripe stage + 80<sup>o</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>1</sub> – Over ripe stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>2</sub> – Over ripe stage + 70<sup>o</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>3</sub> – Over ripe stage + 80<sup>o</sup>B sugar syrup concentration**

In interactions of maturity stage of fruit and sugar syrup concentration, results were found to be significant throughout the storage period. At '0', 3 and 6 months storage interaction M<sub>2</sub>S<sub>3</sub> recorded significantly maximum total sugars of 59.55, 55.50 and 52.13 per cent, respectively. Minimum total sugars were recorded by M<sub>4</sub>S<sub>1</sub> at '0' (48.35 %), 3 (42.28 %) and 6 months storage (37.08 %). Maximum total sugars recorded by M<sub>2</sub>S<sub>3</sub> may be due to semi-soft texture of fruit at turning stage (M<sub>2</sub>) and higher sugar syrup concentration at S<sub>3</sub> (80 °B). The semi-soft texture of fruit might have helped in holding high concentration of sugar syrup.

#### **4.5.4 Titratable acidity (%)**

The data pertaining to titratable acidity of preserve as influenced by treatment of maturity stages of fruit and sugar syrup concentrations is given in Table 16 and illustrated in Fig. 17. From the table it was observed that titratable acidity of preserve decreased from '0' month (0.23 %) to 6 months (0.08 %) of storage, irrespective of maturity stages and sugar syrup concentrations.

The decrease in titratable acidity of preserve pieces during storage may be due to conversion of organic acids into sugars and their derivatives or their utilization in respiration. Present findings are in line with the findings reported by Thakur *et al.* (2018) in wild aonla preserve.

The titratable acidity of preserve differs significantly with respect to different treatments of maturity stages during entire storage period. During storage, treatment M<sub>1</sub> recorded significantly maximum titratable acidity at '0' (0.29 %), 3 (0.18 %) and 6 months (0.14 %) storage. Minimum titratable acidity

was recorded by M<sub>4</sub> at '0' (0.17 %), 3 months (0.13 %) and 6 months (0.03 %) storage, irrespective of sugar syrup concentrations.

At '0' months storage titratable acidity decreased from M<sub>1</sub> (0.29 %) to M<sub>4</sub> (0.17 %). At 3 months storage it decreased from M<sub>1</sub> (0.18%) to M<sub>4</sub> (0.13 %). At the end of storage (6 months) it again decreased from M<sub>1</sub> (0.14 %) to M<sub>4</sub> (0.03 %).

Decrease in acidity with increase in maturity stage may be due to conversion of organic acids into sugars or their utilization in respiration process. Results of the present findings are supported by Krishnamorthy *et al.* (1960) that titratable acidity decreases during ripening in mango fruit and Mandal *et al.* (1993) noticed that acidity showed the decreasing trend throughout the different stages of growth and development of mango fruits.

In case of sugar syrup concentrations the titratable acidity differs significantly at '0', 3 and 6 months storage. Treatment S<sub>1</sub> (60 °B) recorded significantly maximum titratable acidity at '0' (0.27 %), 3 (0.18 %) and 6 months (0.09 %) storage, irrespective of maturity stages of fruit. Minimum titratable acidity was recorded by S<sub>3</sub> (80 °B) at '0' (0.18 %), 3 (0.13 %) and 6 months (0.06 %) storage.

The titratable acidity of preserve was found to be decreased with increase in sugar syrup concentration from S<sub>1</sub> (60 °B) to S<sub>3</sub> (80 °B) during entire storage period. At '0', 3 and 6 months storage it decreased from 0.27 to 0.18 per cent, 0.18 to 0.13 per cent and 0.09 to 0.06 per cent respectively, irrespective of maturity stages. The decrease in titratable acidity of preserve pieces may be the effect of increase in sugar syrup concentration from S<sub>1</sub> (60 °B) to S<sub>3</sub> (80 °B), which was absorbed by pieces due

**Table 16: Changes in titratable acidity (%) of snapmelon preserve during storage at ambient temperature (27-29°C)**

Treatments (Maturity stages)	'0' month				3 months				6 months			
	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean
<b>M<sub>1</sub></b>	0.35	0.29	0.22	<b>0.29</b>	0.20	0.18	0.16	<b>0.18</b>	0.15	0.14	0.12	<b>0.14</b>
<b>M<sub>2</sub></b>	0.29	0.26	0.20	<b>0.25</b>	0.18	0.14	0.13	<b>0.15</b>	0.10	0.08	0.07	<b>0.08</b>
<b>M<sub>3</sub></b>	0.25	0.22	0.16	<b>0.21</b>	0.17	0.15	0.13	<b>0.15</b>	0.07	0.06	0.04	<b>0.06</b>
<b>M<sub>4</sub></b>	0.20	0.18	0.13	<b>0.17</b>	0.15	0.13	0.11	<b>0.13</b>	0.04	0.03	0.02	<b>0.03</b>
<b>Mean</b>	<b>0.27</b>	<b>0.24</b>	<b>0.18</b>	<b>0.23</b>	<b>0.18</b>	<b>0.15</b>	<b>0.13</b>	<b>0.15</b>	<b>0.09</b>	<b>0.08</b>	<b>0.06</b>	<b>0.08</b>
	<b>S.Em.±</b>		<b>C.D. at 1%</b>		<b>S.Em.±</b>		<b>C.D. at 1%</b>		<b>S.Em.±</b>		<b>C.D. at 1%</b>	
<b>Maturity stage (M)</b>	0.003		0.013		0.002		0.009		0.002		0.006	
<b>Sugar syrup (S)</b>	0.003		0.011		0.002		0.008		0.001		0.005	
<b>Interaction (MxS)</b>	0.006		0.022		0.004		0.015		0.003		0.010	

**M<sub>1</sub>**- Mature green,

**M<sub>2</sub>**- Turning stage,

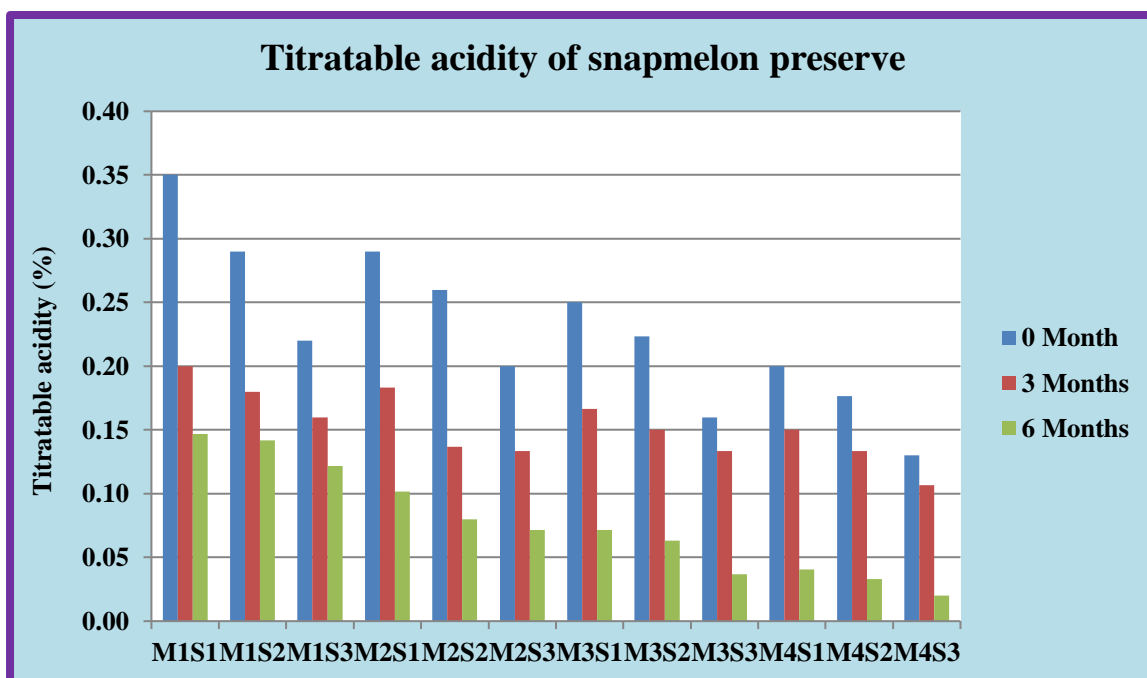
**M<sub>3</sub>**- Ripe stage,

**M<sub>4</sub>**- Over ripe stage

**S<sub>1</sub>**- 60 °B sugar syrup,

**S<sub>2</sub>**- 70 °B sugar syrup,

**S<sub>3</sub>**- 80 °B sugar syrup



**Fig.17 Percentage decrease in titratable acidity of snapmelon preserve during storage at ambient temperature (27-29°C)**

**Treatments details -**

**M<sub>1</sub>S<sub>1</sub> - Mature green stage + 60<sup>0</sup>B sugar syrup concentration**

**M<sub>1</sub>S<sub>2</sub> - Mature green stage + 70<sup>0</sup>B sugar syrup concentration**

**M<sub>1</sub>S<sub>3</sub> - Mature green stage + 80<sup>0</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>1</sub> - Turning stage + 60<sup>0</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>2</sub> - Turning stage + 70<sup>0</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>3</sub> - Turning stage + 80<sup>0</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>1</sub> - Ripe stage + 60<sup>0</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>2</sub> - Ripe stage + 70<sup>0</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>3</sub> - Ripe stage + 80<sup>0</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>1</sub> - Over ripe stage + 60<sup>0</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>2</sub> - Over ripe stage + 70<sup>0</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>3</sub> - Over ripe stage + 80<sup>0</sup>B sugar syrup concentration**

to osmosis and hence acids might have released from fruit pieces along with water due to osmosis. Higher the concentration of sugar syrup more will be the rate of osmosis and release of acids along with water from fruit pieces. Results of the present study are supported by Ghanwat *et al.* (2019) in aonla candy.

In interactions of maturity stage of fruit and sugar syrup concentration, results were found to be significant throughout the storage. At '0', 3 and 6 months storage interaction M<sub>1</sub>S<sub>1</sub> recorded significantly maximum titratable acidity of 0.35, 0.20 and 0.15 per cent respectively. Minimum titratable acidity was recorded by M<sub>4</sub>S<sub>3</sub> at '0' (0.13 %), 3 (0.11 %) and 6 months storage (0.02%). Maximum titratable acidity recorded by interaction M<sub>1</sub>S<sub>1</sub> may be due to high amount of native acids present in mature green stage (M<sub>1</sub>), which were released from fruit pieces in less amount by osmosis due to lower concentration of sugar syrup (60 °B) and hard texture of fruit pieces.

#### **4.5.5 Moisture (%)**

The data presented in Table 17 and depicted in Fig.18 indicates the moisture content of snapmelon preserve during storage. From the table it was observed that moisture of preserve increased from '0' month (29.32 %) to 3 months (44.38 %) and then decreased from 3 months to 6 months (31.99 %) storage, irrespective of maturity stages and sugar syrup concentrations.

First increase in moisture of preserve pieces may be due to absorption of sugar syrup by osmosis in which water is also absorbed. However, decrease at 6 months storage may be due to destruction of pieces texture during storage which was unable to hold the absorbed moisture in preserve pieces. Present findings

are in accordance with the findings reported by Durrani and verma (2011) in aonla preserve product.

The moisture of preserve differs significantly with respect to different treatments of maturity stages during entire storage period. During storage, treatment M<sub>2</sub> recorded significantly maximum moisture at '0' (33.23 %), 3 (51.35 %) and 6 months (38.84 %) storage. Minimum moisture was recorded by M<sub>1</sub> at '0' (25.69 %) and M<sub>4</sub> at 3 (38.42 %) and 6 months (26.28 %) storage, irrespective of sugar syrup concentrations.

At '0' months storage moisture increased from M<sub>1</sub> (25.69 %) to M<sub>2</sub> (33.23) and then decreased from M<sub>2</sub> to M<sub>4</sub> (28.27 %). At 3 months storage it increased from M<sub>1</sub> (44.26 %) to M<sub>2</sub> (51.35 %) and then decreased from M<sub>2</sub> to M<sub>4</sub> (38.42 %). At the end of storage (6 months) it increased from M<sub>1</sub> (33.02 %) to M<sub>2</sub> (38.84 %) and then decreased till M<sub>4</sub> (26.28 %).

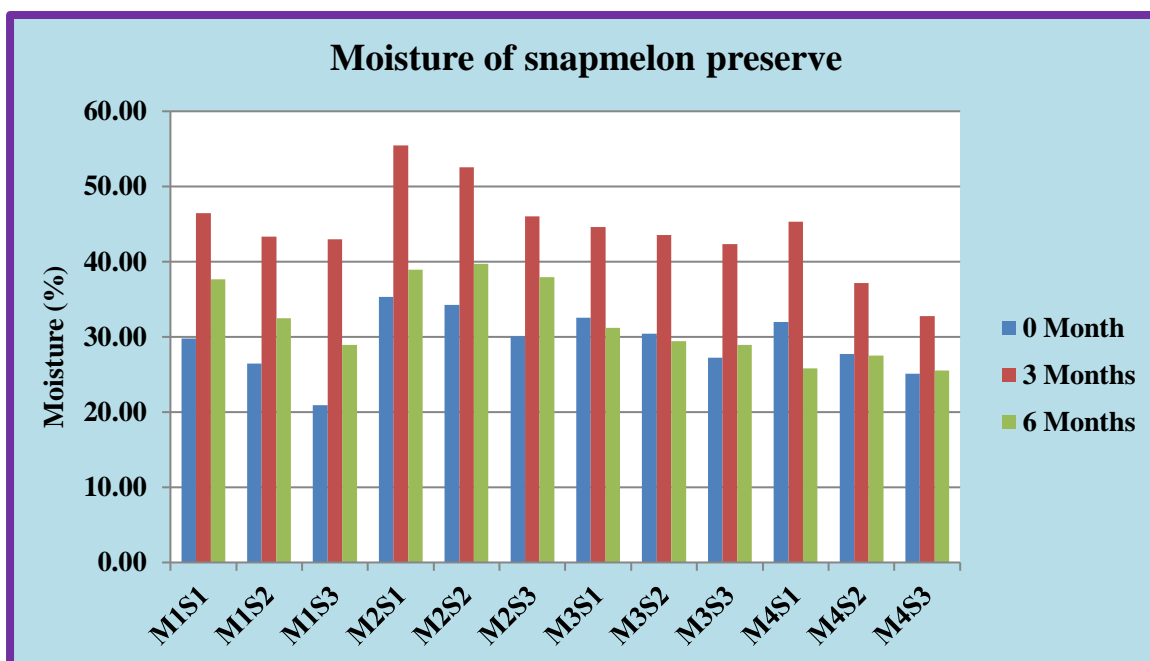
In the present study maximum moisture recorded by treatment M<sub>2</sub> (turning stage) during entire storage may be due to good texture of fruit pieces which might have hold the moisture in position as compared to other stages of maturity. However, decrease in moisture from M<sub>2</sub> to M<sub>4</sub> may be due to increase in fruit softening and destruction of fruit pieces with increase in maturity stage which was unable to hold moisture in position. Similar observations were also reported by Mali (1999) papaya.

In case of sugar syrup concentrations the moisture differs significantly at '0', 3 and 6 months storage. Treatment S<sub>1</sub> (60 °B) recorded significantly maximum moisture at '0' (32.41 %), 3 (47.95 %) and 6 months (33.39 %) storage, irrespective of maturity stages of fruit. Minimum moisture was recorded by S<sub>3</sub>

**Table 17: Changes in moisture (%) of snapmelon preserve during storage at ambient temperature (27-29°C)**

Treatments (Maturity stages)	'0' month				3 months				6 months			
	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean
<b>M<sub>1</sub></b>	29.76	26.42	20.89	<b>25.69</b>	46.45	43.35	42.98	<b>44.26</b>	37.67	32.50	28.90	<b>33.02</b>
<b>M<sub>2</sub></b>	35.33	34.27	30.08	<b>33.23</b>	55.44	52.58	46.02	<b>51.35</b>	38.90	39.70	37.93	<b>38.84</b>
<b>M<sub>3</sub></b>	32.58	30.45	27.23	<b>30.09</b>	44.58	43.55	42.31	<b>43.48</b>	31.20	29.40	28.90	<b>29.83</b>
<b>M<sub>4</sub></b>	31.98	27.72	25.11	<b>28.27</b>	45.34	37.15	32.78	<b>38.42</b>	25.80	27.53	25.50	<b>26.28</b>
<b>Mean</b>	<b>32.41</b>	<b>29.72</b>	<b>25.83</b>	<b>29.32</b>	<b>47.95</b>	<b>44.16</b>	<b>41.02</b>	<b>44.38</b>	<b>33.39</b>	<b>32.28</b>	<b>30.31</b>	<b>31.99</b>
	<b>S.Em.±</b>		<b>C.D. at 1%</b>		<b>S.Em.±</b>		<b>C.D. at 1%</b>		<b>S.Em.±</b>		<b>C.D. at 1%</b>	
<b>Maturity stage (M)</b>	0.304		1.204		0.360		1.424		0.333		1.318	
<b>Sugar syrup (S)</b>	0.264		1.042		0.312		1.233		0.289		1.142	
<b>Interaction (MxS)</b>	0.527		2.085		0.624		2.467		0.577		2.284	

**M<sub>1</sub>**- Mature green,**M<sub>2</sub>**- Turning stage,**M<sub>3</sub>**- Ripe stage,**M<sub>4</sub>**- Over ripe stage**S<sub>1</sub>**- 60 °B sugar syrup,**S<sub>2</sub>**- 70 °B sugar syrup,**S<sub>3</sub>**- 80 °B sugar syrup



**Fig.18 Percentage increase/decrease in moisture of snapmelon preserve during storage at ambient temperature (27-29°C)**

**Treatments details –**

**M<sub>1</sub>S<sub>1</sub> – Mature green stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>1</sub>S<sub>2</sub> – Mature green stage + 70<sup>o</sup>B sugar syrup concentration**

**M<sub>1</sub>S<sub>3</sub> – Mature green stage + 80<sup>o</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>1</sub> – Turning stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>2</sub> – Turning stage + 70<sup>o</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>3</sub> – Turning stage + 80<sup>o</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>1</sub> – Ripe stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>2</sub> – Ripe stage + 70<sup>o</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>3</sub> – Ripe stage + 80<sup>o</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>1</sub> – Over ripe stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>2</sub> – Over ripe stage + 70<sup>o</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>3</sub> – Over ripe stage + 80<sup>o</sup>B sugar syrup concentration**

(60 °B) at '0' (25.83 %), 3 (41.02 %) and 6 months (30.31 %) storage.

The moisture of preserve was found to be decreased with increase in sugar syrup concentration from S<sub>1</sub> (60 °B) to S<sub>3</sub> (80 °B) during entire storage period. At '0', 3 and 6 months storage it decreased from 32.41 to 25.83 per cent, 47.95 to 41.02 per cent and 33.39 to 30.28 per cent respectively, irrespective of maturity stages. The decrease in moisture of preserve may be the effect of increase in sugar syrup concentration from S<sub>1</sub> (60 °B) to S<sub>3</sub> (80 °B). With increase in sugar syrup concentration rate of osmosis increased and hence release of water from fruit pieces also increased. Results analogous to present findings are also reported by Sharma *et al.* (2016) in osmo-dehydrated sweet potato slices.

In interactions of maturity stage of fruit and sugar syrup concentration, results were found to be significant throughout the storage. At '0' and 3 months storage, interaction M<sub>2</sub>S<sub>1</sub> recorded significantly maximum moisture of 35.33 and 55.44 respectively and at 6 months storage, M<sub>2</sub>S<sub>2</sub> recorded significantly maximum moisture (39.7 %). At '0' month storage interaction M<sub>2</sub>S<sub>1</sub> was at par with M<sub>2</sub>S<sub>2</sub> (34.27 %). At 6 months storage interaction M<sub>2</sub>S<sub>2</sub> was at par with M<sub>1</sub>S<sub>1</sub> (37.67 %), M<sub>2</sub>S<sub>1</sub> (38.90 %) and M<sub>2</sub>S<sub>3</sub> (37.93 %). Minimum moisture was recorded by M<sub>1</sub>S<sub>3</sub> at '0' (20.89 %) and M<sub>4</sub>S<sub>3</sub> at 3 (32.78 %) and 6 months storage (25.5 %). Maximum moisture recorded by M<sub>2</sub>S<sub>1</sub> may be due to semi-soft texture of fruit at turning stage (M<sub>2</sub>) and lower sugar syrup concentration at S<sub>1</sub> (60 °B).

#### **4.6 Changes in sensory quality of snapmelon preserve during storage under ambient temperature (27-29°C) condition.**

The snapmelon preserve was examined for its sensory qualities. The evaluation of sensory qualities in terms of colour, flavour and texture was done at every 3 month interval by a panel of 10 judges with 9 point Hedonic scale. Data regarding the effect of maturity stages of fruit, sugar syrup concentration and their interactions on sensory quality are presented below.

##### **4.6.1 Colour**

The data presented in Table 18 and depicted in Fig.19 indicates the changes in colour score of snapmelon preserve during storage. From the table it was observed that colour score of preserve decreased from '0' month (7.71) to 6 months (7.15) of storage, irrespective of maturity stages and sugar syrup concentrations.

The decrease in colour score of preserve pieces during storage may be due to oxidation of preserve pieces and less retention of antioxidant like sulphur dioxide in preserve during storage. Similar findings have been reported by Chandra (2010) in karonda preserve.

The colour score of preserve differs significantly with respect to different treatments of maturity stages during entire storage period. During storage, treatment M<sub>4</sub> recorded significantly maximum colour score at '0' (7.83), 3 (7.63) and 6 months (7.53) storage. Minimum colour score was recorded by M<sub>1</sub> at '0' (7.50), 3 months (7.10) and 6 months (6.77) storage, irrespective of sugar syrup concentrations.

At '0' months storage colour score increased M<sub>1</sub> (7.50) to M<sub>4</sub> (7.83). At 3 months storage it increased from M<sub>1</sub> (7.10) to M<sub>4</sub> (7.63). At the end of storage (6 months) it again increased from M<sub>1</sub> (6.77) to M<sub>4</sub> (7.53).

The increase in colour score with increase in maturity stages of fruit may be due to increase in carotenoid pigment with advancement of maturity stages. Identical observations were also reported by Aina and Oladunjoye (1993) in mango fruit.

In case of sugar syrup concentrations the colour score differs significantly at '0', 3 and 6 months storage. Treatment S<sub>2</sub> (70 °B) recorded significantly maximum colour score at '0' (7.73), 3 (7.50) and 6 months (7.25) storage, irrespective of maturity stages of fruit. Minimum colour score was recorded by S<sub>3</sub> (80 °B) at '0' (7.68), 3 (7.35) and by S<sub>1</sub> at 6 months (7.08) storage.

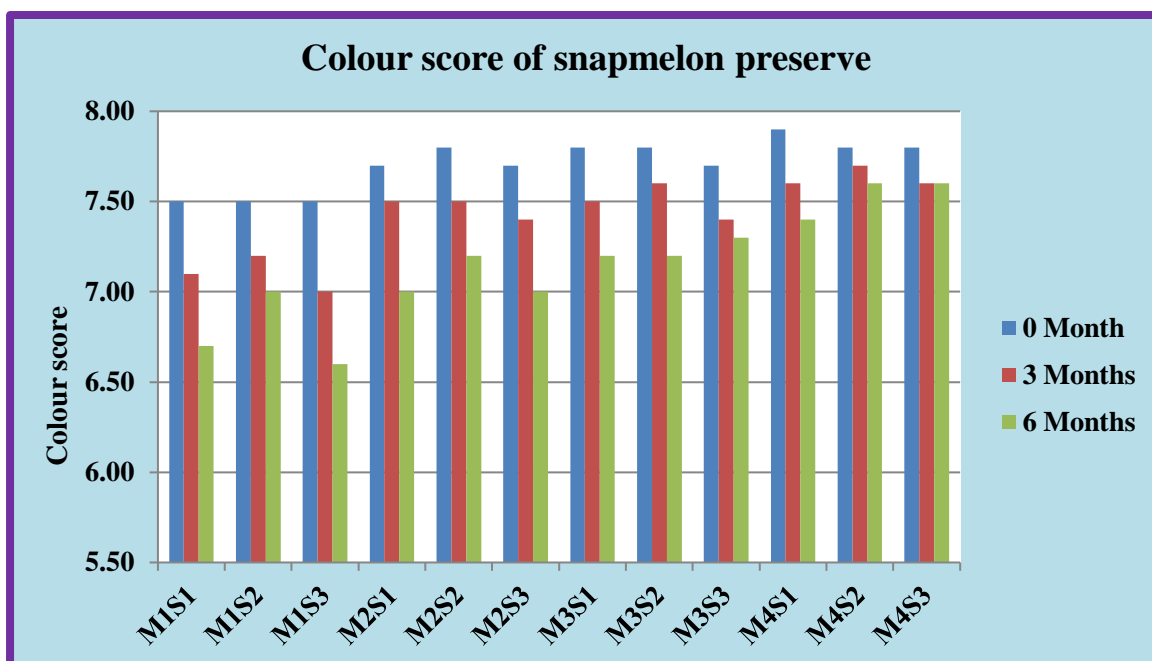
The colour score of preserve was found to be same (7.73) at S<sub>1</sub> and S<sub>2</sub> and then decreased from at S<sub>3</sub> (7.68) during '0' month storage. At 3 months storage it increased from S<sub>1</sub> (7.43) to S<sub>2</sub> (7.50) and then decreased from S<sub>2</sub> to S<sub>3</sub> (7.35). At the end of storage (6 months) it again increased from S<sub>1</sub> (7.08) to S<sub>2</sub> (7.25) and then decreased at S<sub>3</sub> (7.13), irrespective of maturity stages. The more decrease in colour score of preserve at S<sub>3</sub> may be the effect of higher sugar syrup concentration at S<sub>3</sub> (80 °B), which might have cause better osmosis reaction and hence release of colour pigments from fruit pieces along with water might have taken place. Results analogous to present findings are also reported by Lingala *et al.* (2015) in osmo-dried karonda.

In interactions of maturity stage of fruit and sugar syrup concentration, results were found to be significant throughout the storage. At '0' month storage interaction M<sub>4</sub>S<sub>1</sub> recorded significantly maximum colour score of 7.90. At 3 months storage

**Table 18: Changes in colour score of snapmelon preserve during storage at ambient temperature (27-29°C)**

Treatments (Maturity stages)	'0' month				3 months				6 months			
	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean
<b>M<sub>1</sub></b>	7.50	7.50	7.50	<b>7.50</b>	7.10	7.20	7.00	<b>7.10</b>	6.70	7.00	6.60	<b>6.77</b>
<b>M<sub>2</sub></b>	7.70	7.80	7.70	<b>7.73</b>	7.50	7.50	7.40	<b>7.47</b>	7.00	7.20	7.00	<b>7.07</b>
<b>M<sub>3</sub></b>	7.80	7.80	7.70	<b>7.77</b>	7.50	7.60	7.40	<b>7.50</b>	7.20	7.20	7.30	<b>7.23</b>
<b>M<sub>4</sub></b>	7.90	7.80	7.80	<b>7.83</b>	7.60	7.70	7.60	<b>7.63</b>	7.40	7.60	7.60	<b>7.53</b>
<b>Mean</b>	<b>7.73</b>	<b>7.73</b>	<b>7.68</b>	<b>7.71</b>	<b>7.43</b>	<b>7.50</b>	<b>7.35</b>	<b>7.43</b>	<b>7.08</b>	<b>7.25</b>	<b>7.13</b>	<b>7.15</b>
	<b>S.Em.±</b>		<b>C.D. at 1%</b>		<b>S.Em.±</b>		<b>C.D. at 1%</b>		<b>S.Em.±</b>		<b>C.D. at 1%</b>	
<b>Maturity stage (M)</b>	0.007		0.026		0.006		0.025		0.003		0.013	
<b>Sugar syrup (S)</b>	0.006		0.023		0.005		0.021		0.003		0.011	
<b>Interaction (MxS)</b>	0.012		0.046		0.011		0.043		0.006		0.023	

**M<sub>1</sub>**- Mature green,**M<sub>2</sub>**- Turning stage,**M<sub>3</sub>**- Ripe stage,**M<sub>4</sub>**- Over ripe stage**S<sub>1</sub>**- 60 °B sugar syrup,**S<sub>2</sub>**- 70 °B sugar syrup,**S<sub>3</sub>**- 80 °B sugar syrup



**Fig.19 Percentage decrease in colour of snapmelon preserve during storage at ambient temperature (27-29°C)**

**Treatments details –**

**M<sub>1</sub>S<sub>1</sub> – Mature green stage + 60<sup>0</sup>B sugar syrup concentration**

**M<sub>1</sub>S<sub>2</sub> – Mature green stage + 70<sup>0</sup>B sugar syrup concentration**

**M<sub>1</sub>S<sub>3</sub> – Mature green stage + 80<sup>0</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>1</sub> – Turning stage + 60<sup>0</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>2</sub> – Turning stage + 70<sup>0</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>3</sub> – Turning stage + 80<sup>0</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>1</sub> – Ripe stage + 60<sup>0</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>2</sub> – Ripe stage + 70<sup>0</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>3</sub> – Ripe stage + 80<sup>0</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>1</sub> – Over ripe stage + 60<sup>0</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>2</sub> – Over ripe stage + 70<sup>0</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>3</sub> – Over ripe stage + 80<sup>0</sup>B sugar syrup concentration**

interaction M<sub>4</sub>S<sub>2</sub> recorded significantly maximum colour score of 7.70. At 6 months storage interaction M<sub>4</sub>S<sub>2</sub> and M<sub>4</sub>S<sub>3</sub> recorded significantly maximum colour score of 7.60. Minimum colour score was recorded by M<sub>1</sub>S<sub>1</sub>, M<sub>1</sub>S<sub>2</sub> and M<sub>1</sub>S<sub>3</sub> at '0' (7.50), M<sub>1</sub>S<sub>3</sub> at 3 months (7.00) and again M<sub>1</sub>S<sub>3</sub> at 6 months storage (6.60). The minimum colour score recorded by interaction M<sub>1</sub>S<sub>3</sub> may be the combined effect of mature green stage of fruit and higher sugar syrup concentration as explained above.

#### **4.6.2 Flavour**

The data presented in Table 19 and depicted in Fig. 20 indicates the flavour score of snapmelon preserve during storage. From the table it was observed that flavour score of preserve decreased from '0' month (7.44) to 6 months (6.43) of storage, irrespective of maturity stages and sugar syrup concentrations.

The decrease in flavour score of preserve pieces during storage may be due to loss of flavour compounds during storage, since they are highly volatile. Similar findings have been reported Singh *et al.* (2019) in aonla murabba.

The flavour score of preserve differs significantly with respect to different treatments of maturity stages during entire storage period. During storage, treatment M<sub>4</sub> recorded significantly maximum flavour score at '0' (7.63), 3 (7.37) and treatment M<sub>3</sub> recorded at 6 months (6.73) storage. Minimum flavour score was recorded by M<sub>1</sub> at '0' (7.13), 3 months (6.73) and 6 months (6.27) storage, irrespective of sugar syrup concentrations.

At '0' months storage flavour score increased from M<sub>1</sub> (7.13) to M<sub>4</sub> (7.63). At 3 months storage it increased from M<sub>1</sub>

(6.73) to M<sub>4</sub> (7.37). At the end of storage (6 months) it increased from M<sub>1</sub> (6.27) to M<sub>3</sub> (6.73) and then decreased at M<sub>4</sub> (6.30).

The increase in flavour score of preserve pieces with increase in maturity stages of fruit may be due to increase in synthesis of various flavour compounds with the advancement of fruit maturity stages. Results of the present study receive support from Ragone and Catherine (2006) in breadfruit.

In case of sugar syrup concentrations the flavour score differs significantly at '0', 3 and 6 months storage. Treatment S<sub>2</sub> (70 °B) recorded significantly maximum flavour score at '0' (8.13), 3 (7.80) and 6 months (6.90) storage, irrespective of maturity stages of fruit. Minimum flavour score was recorded by S<sub>3</sub> (80 °B) at '0' (6.78), 3 (6.50) and 6 months (6.05) storage.

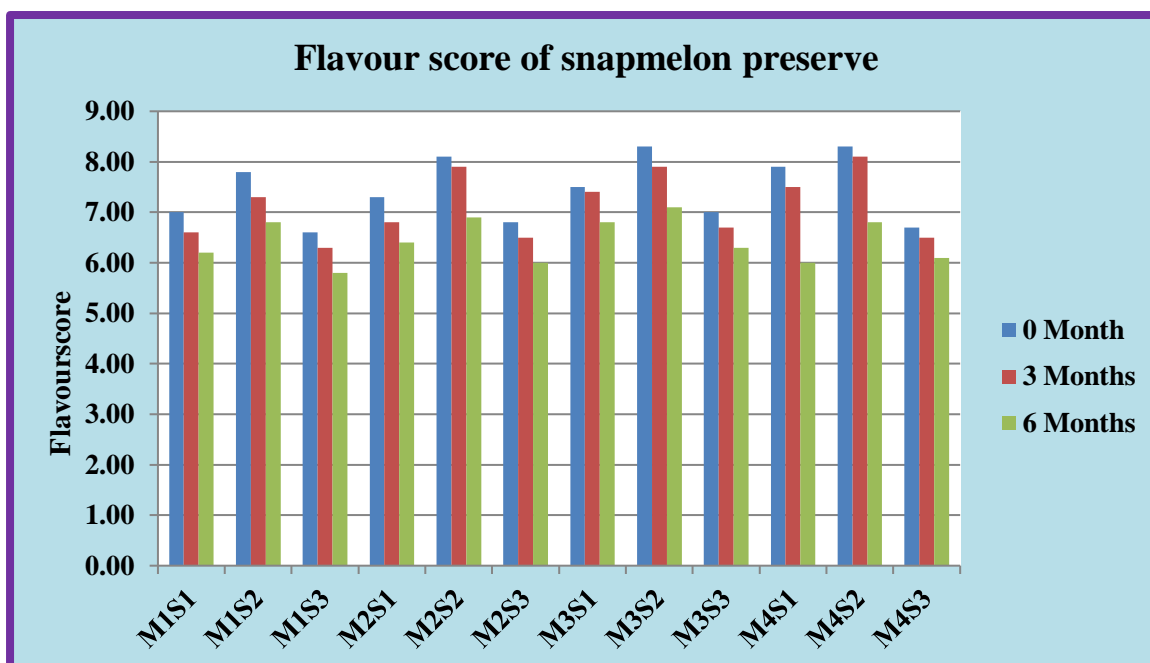
The flavour score of preserve was found to be increased with increase in sugar syrup concentration from S<sub>1</sub> (60 °B) to S<sub>2</sub> (70 °B) and then decreased at S<sub>3</sub> (80 °B) during entire storage period. At '0', 3 and 6 months storage it increased from 7.43 to 8.13, 7.08 to 7.80 and 6.35 to 6.90 respectively, from S<sub>1</sub> to S<sub>2</sub> and then decreased at S<sub>3</sub> i.e. 6.78, 6.50 and 6.05 respectively, irrespective of maturity stages. The decrease in flavour score of preserve at S<sub>3</sub> may be the effect of higher sugar syrup concentration of 80 °B at S<sub>3</sub> which might have released volatile compounds from fruit pieces as compared to S<sub>1</sub> and S<sub>2</sub> due to osmosis. Result analogous to present findings are also reported by Lingala *et al.* (2015) in osmo-dried karonda.

In interactions of maturity stage of fruit and sugar syrup concentration, results were found to be significant throughout the storage. At '0' month storage interaction M<sub>3</sub>S<sub>2</sub> and M<sub>4</sub>S<sub>2</sub> recorded maximum flavour score of 8.30. At 3 months storage interaction M<sub>4</sub>S<sub>2</sub> (8.10) and at 6 months storage interaction M<sub>3</sub>S<sub>2</sub>

**Table 19: Changes in flavour score of snapmelon preserve during storage at ambient temperature (27-29°C)**

Treatments (Maturity stages)	'0' month				3 months				6 months			
	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean
<b>M<sub>1</sub></b>	7.00	7.80	6.60	<b>7.13</b>	6.60	7.30	6.30	<b>6.73</b>	6.20	6.80	5.80	<b>6.27</b>
<b>M<sub>2</sub></b>	7.30	8.10	6.80	<b>7.40</b>	6.80	7.90	6.50	<b>7.07</b>	6.40	6.90	6.00	<b>6.43</b>
<b>M<sub>3</sub></b>	7.50	8.30	7.00	<b>7.60</b>	7.40	7.90	6.70	<b>7.33</b>	6.80	7.10	6.30	<b>6.73</b>
<b>M<sub>4</sub></b>	7.90	8.30	6.70	<b>7.63</b>	7.50	8.10	6.50	<b>7.37</b>	6.00	6.80	6.10	<b>6.30</b>
<b>Mean</b>	<b>7.43</b>	<b>8.13</b>	<b>6.78</b>	<b>7.44</b>	<b>7.08</b>	<b>7.80</b>	<b>6.50</b>	<b>7.13</b>	<b>6.35</b>	<b>6.90</b>	<b>6.05</b>	<b>6.43</b>
	<b>S.Em.±</b>		<b>C.D. at 1%</b>		<b>S.Em.±</b>		<b>C.D. at 1%</b>		<b>S.Em.±</b>		<b>C.D. at 1%</b>	
<b>Maturity stage (M)</b>	0.003		0.013		0.004		0.016		0.004		0.015	
<b>Sugar syrup (S)</b>	0.003		0.011		0.004		0.014		0.003		0.013	
<b>Interaction (MxS)</b>	0.006		0.023		0.007		0.028		0.006		0.026	

**M<sub>1</sub>**- Mature green,**M<sub>2</sub>**- Turning stage,**M<sub>3</sub>**- Ripe stage,**M<sub>4</sub>**- Over ripe stage**S<sub>1</sub>**- 60 °B sugar syrup,**S<sub>2</sub>**- 70 °B sugar syrup,**S<sub>3</sub>**- 80 °B sugar syrup



**Fig.20 Percentage decrease in flavour score of snapmelon preserve during storage at ambient temperature (27-29°C)**

**Treatments details –**

**M<sub>1</sub>S<sub>1</sub> – Mature green stage + 60<sup>0</sup>B sugar syrup concentration**

**M<sub>1</sub>S<sub>2</sub> – Mature green stage + 70<sup>0</sup>B sugar syrup concentration**

**M<sub>1</sub>S<sub>3</sub> – Mature green stage + 80<sup>0</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>1</sub> – Turning stage + 60<sup>0</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>2</sub> – Turning stage + 70<sup>0</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>3</sub> – Turning stage + 80<sup>0</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>1</sub> – Ripe stage + 60<sup>0</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>2</sub> – Ripe stage + 70<sup>0</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>3</sub> – Ripe stage + 80<sup>0</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>1</sub> – Over ripe stage + 60<sup>0</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>2</sub> – Over ripe stage + 70<sup>0</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>3</sub> – Over ripe stage + 80<sup>0</sup>B sugar syrup concentration**

(7.10) recorded maximum score. Minimum flavour score was recorded by M<sub>1</sub>S<sub>3</sub> at '0' (6.60), 3 (6.30) and 6 months storage (5.80). Maximum flavour score recorded by M<sub>3</sub>S<sub>2</sub> and M<sub>4</sub>S<sub>2</sub> may be due the combined effect of maturity stage and sugar syrup concentration which might have retained maximum flavour compounds in fruit pieces.

#### **4.6.3 Texture**

The data presented in Table 20 and depicted in Fig.21 indicates the changes in texture score of snapmelon preserve during storage. From the table it was observed that texture score of preserve decreased from '0' month (6.76) to 6 months (6.03) of storage, irrespective of maturity stages and sugar syrup concentrations.

The decrease in texture score of preserve pieces during storage may be due to absorption of moisture along with sugar syrup which might have destructed the texture of preserve pieces due to more softening. Similar findings have been reported by Patel (2012) in aonla preserve.

The texture score of preserve differs significantly with respect to different treatments of maturity stages during entire storage period. During storage, treatment M<sub>1</sub> recorded significantly maximum texture score at '0' (8.23), 3 (7.87) and 6 months (7.57) storage. Minimum texture score was recorded by M<sub>4</sub> at '0' (5.43), 3 months (5.08) and 6 months (4.80) storage, irrespective of sugar syrup concentrations.

At '0' months storage texture score decreased from M<sub>1</sub> (8.23) to M<sub>4</sub> (5.43). At 3 months storage it decreased from M<sub>1</sub> (7.87) to M<sub>4</sub> (5.08). At the end of storage (6 months) it again decreased from M<sub>1</sub> (7.57) to M<sub>4</sub> (4.80).

The fruit pectin and starch impart good texture to the fruit. However, with the advancement of ripening, fruit softening takes place due to hydrolysis of insoluble pectins to soluble form and starch into sugars. Hence, decrease in texture score was observed with the advancement of ripening. Similar findings Ragone and Catherine (2006) in breadfruit.

In case of sugar syrup concentrations texture differ significantly at '0', 3 and 6 months storage. Treatment S<sub>2</sub> (70 °B) recorded significantly maximum texture score at '0' (6.93), 3 (6.60) and 6 months (6.33) storage, irrespective of maturity stages of fruit. Minimum texture was recorded by S<sub>1</sub> and S<sub>3</sub> at '0' (6.68) and S<sub>3</sub> at 3 (6.23) and 6 months (5.65) storage.

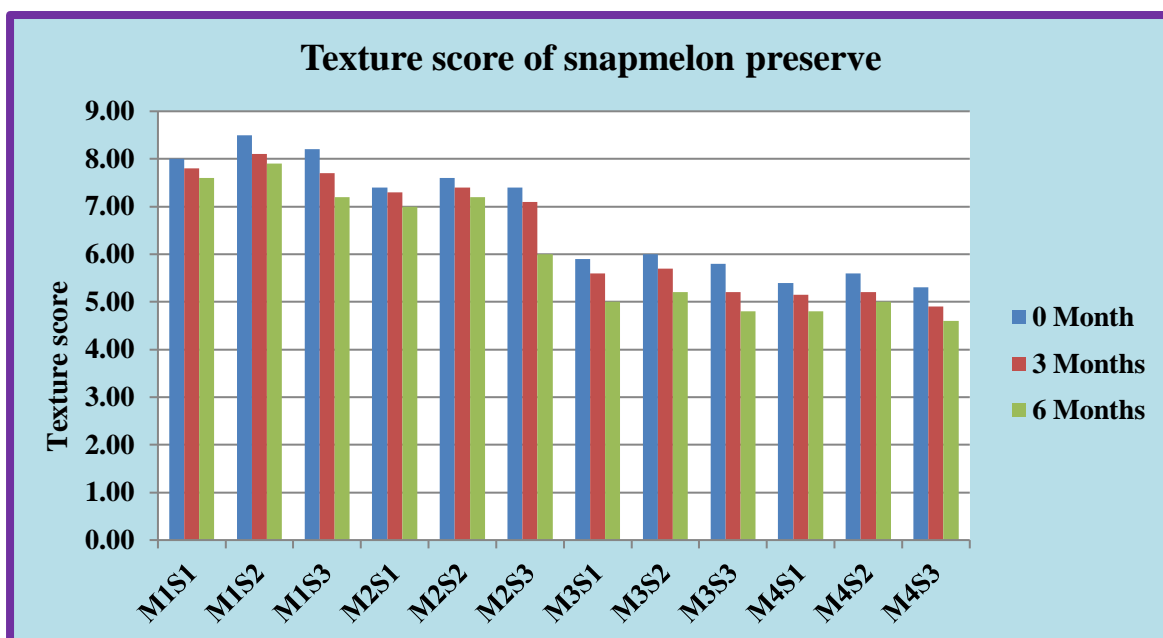
The texture score of preserve was found to be increased with increase in sugar syrup concentration from S<sub>1</sub> (60 °B) to S<sub>2</sub> (70 °B) and then decreased at S<sub>3</sub> (80 °B) during entire storage period. At '0', 3 and 6 months storage it increased from 6.68 to 6.93, 6.46 to 6.60 °B and 6.10 to 6.33 respectively from S<sub>1</sub> and S<sub>2</sub> then decreased at S<sub>3</sub> i.e. 6.68, 6.23 and 5.65 respectively, irrespective of maturity stages. The maximum texture score recorded by treatment S<sub>2</sub> may be the effect of sugar syrup concentration (70 °B) which might have created balance of water and sugar in fruit pieces by osmosis. However, decrease in texture score at S<sub>3</sub> (80 °B) may be due to more release of water from fruit pieces due to osmosis and hence fruit pieces became hard and rubbery. Results analogous to present findings are also reported by Lingala *et al.* (2015) in osmo-dried karonda.

In interactions of maturity stage of fruit and sugar syrup concentration, results were found to be significant throughout the storage. At '0', 3 and 6 months storage interaction M<sub>1</sub>S<sub>2</sub> recorded significantly maximum texture of 8.50, 8.10 and 7.90

**Table 20: Changes in texture score of snapmelon preserve during storage at ambient temperature (27-29°C)**

Treatments (Maturity stages)	'0' month				3 months				6 months			
	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean
<b>M<sub>1</sub></b>	8.00	8.50	8.20	<b>8.23</b>	7.80	8.10	7.70	<b>7.87</b>	7.60	7.90	7.20	<b>7.57</b>
<b>M<sub>2</sub></b>	7.40	7.60	7.40	<b>7.47</b>	7.30	7.40	7.10	<b>7.27</b>	7.00	7.20	6.00	<b>6.73</b>
<b>M<sub>3</sub></b>	5.90	6.00	5.80	<b>5.90</b>	5.60	5.70	5.20	<b>5.50</b>	5.00	5.20	4.80	<b>5.00</b>
<b>M<sub>4</sub></b>	5.40	5.60	5.30	<b>5.43</b>	5.15	5.20	4.90	<b>5.08</b>	4.80	5.00	4.60	<b>4.80</b>
<b>Mean</b>	<b>6.68</b>	<b>6.93</b>	<b>6.68</b>	<b>6.76</b>	<b>6.46</b>	<b>6.60</b>	<b>6.23</b>	<b>6.43</b>	<b>6.10</b>	<b>6.33</b>	<b>5.65</b>	<b>6.03</b>
	<b>S.Em.±</b>		<b>C.D. at 1%</b>		<b>S.Em.±</b>		<b>C.D. at 1%</b>		<b>S.Em.±</b>		<b>C.D. at 1%</b>	
<b>Maturity stage (M)</b>	0.003		0.013		0.004		0.015		0.004		0.016	
<b>Sugar syrup (S)</b>	0.003		0.011		0.003		0.013		0.004		0.014	
<b>Interaction (MxS)</b>	0.006		0.023		0.006		0.026		0.007		0.028	

**M<sub>1</sub>**- Mature green,**M<sub>2</sub>**- Turning stage,**M<sub>3</sub>**- Ripe stage,**M<sub>4</sub>**- Over ripe stage**S<sub>1</sub>**- 60 °B sugar syrup,**S<sub>2</sub>**- 70 °B sugar syrup,**S<sub>3</sub>**- 80 °B sugar syrup



**Fig.21 Percentage decrease in texture score of snapmelon preserve during storage at ambient temperature (27-29°C)**

**Treatments details –**

**M<sub>1</sub>S<sub>1</sub> – Mature green stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>1</sub>S<sub>2</sub> – Mature green stage + 70<sup>o</sup>B sugar syrup concentration**

**M<sub>1</sub>S<sub>3</sub> – Mature green stage + 80<sup>o</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>1</sub> – Turning stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>2</sub> – Turning stage + 70<sup>o</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>3</sub> – Turning stage + 80<sup>o</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>1</sub> – Ripe stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>2</sub> – Ripe stage + 70<sup>o</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>3</sub> – Ripe stage + 80<sup>o</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>1</sub> – Over ripe stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>2</sub> – Over ripe stage + 70<sup>o</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>3</sub> – Over ripe stage + 80<sup>o</sup>B sugar syrup concentration**

respectively. Minimum texture was recorded by M<sub>4</sub>S<sub>3</sub> at '0' (5.30), 3 (4.90) and 6 months storage (4.60). Maximum texture score recorded by M<sub>1</sub>S<sub>2</sub> may be the impact of mature green stage of fruit and 70 °B sugar syrup concentration which have made fruit pieces semi soft.

#### **4.6.4 Overall acceptability (Average score)**

The data presented in Table 21 and depicted in Fig.22 indicates the changes in overall acceptability score of snapmelon preserve during storage. From the table it was observed that overall acceptability score of preserve decreased from '0' month (7.30) to 6 months (6.54) of storage, irrespective of maturity stages and sugar syrup concentrations.

The decrease in overall acceptability score of preserve pieces during storage was due to cumulative loss in colour, flavour and texture score during storage. Similar findings have been reported by Nayak *et al.* (2011) in aonla preserve.

The overall acceptability score of preserve pieces differs significantly with respect to different treatments of maturity stages during entire storage period. During storage, treatment M<sub>1</sub> recorded significantly maximum overall acceptability score at '0' month (7.62), treatment M<sub>2</sub> recorded at 3 months (7.27) and treatment M<sub>1</sub> recorded at 6 months (6.86) score. Minimum overall acceptability score was recorded by M<sub>4</sub> at '0' (6.97), 3 months (6.69) and 6 months (6.21) storage, irrespective of sugar syrup concentrations.

At '0' months storage overall acceptability decreased from M<sub>1</sub> (7.62) to M<sub>4</sub> (6.97). At 3 months storage it increased from M<sub>1</sub> (7.23) to M<sub>2</sub> (7.27) and then decreased from (M<sub>2</sub>) to M<sub>4</sub> (6.69). At the end of storage (6 months) it again decreased from M<sub>1</sub> (6.86) to M<sub>4</sub> (6.21).

**Table 21: Changes in overall acceptability score of snapmelon preserve during storage at ambient temperature (27-29°C)**

Treatments (Maturity stages)	'0' month				3 months				6 months			
	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean
<b>M<sub>1</sub></b>	7.50	7.93	7.43	<b>7.62</b>	7.17	7.53	7.00	<b>7.23</b>	6.83	7.23	6.53	<b>6.86</b>
<b>M<sub>2</sub></b>	7.47	7.83	7.30	<b>7.53</b>	7.20	7.60	7.00	<b>7.27</b>	6.80	7.10	6.33	<b>6.74</b>
<b>M<sub>3</sub></b>	7.07	7.37	6.83	<b>7.09</b>	6.83	7.07	6.43	<b>6.78</b>	6.33	6.50	6.13	<b>6.32</b>
<b>M<sub>4</sub></b>	7.07	7.23	6.60	<b>6.97</b>	6.75	7.00	6.33	<b>6.69</b>	6.07	6.47	6.10	<b>6.21</b>
<b>Mean</b>	<b>7.28</b>	<b>7.59</b>	<b>7.04</b>	<b>7.30</b>	<b>6.99</b>	<b>7.30</b>	<b>6.69</b>	<b>6.99</b>	<b>6.51</b>	<b>6.83</b>	<b>6.27</b>	<b>6.54</b>
	<b>S.Em.±</b>		<b>C.D. at 1%</b>		<b>S.Em.±</b>		<b>C.D. at 1%</b>		<b>S.Em.±</b>		<b>C.D. at 1%</b>	
<b>Maturity stage (M)</b>	0.003		0.013		0.004		0.015		0.004		0.016	
<b>Sugar syrup (S)</b>	0.003		0.011		0.003		0.013		0.004		0.014	
<b>Interaction (MxS)</b>	0.006		0.023		0.006		0.026		0.007		0.028	

**M<sub>1</sub>**- Mature green,

**M<sub>2</sub>**- Turning stage,

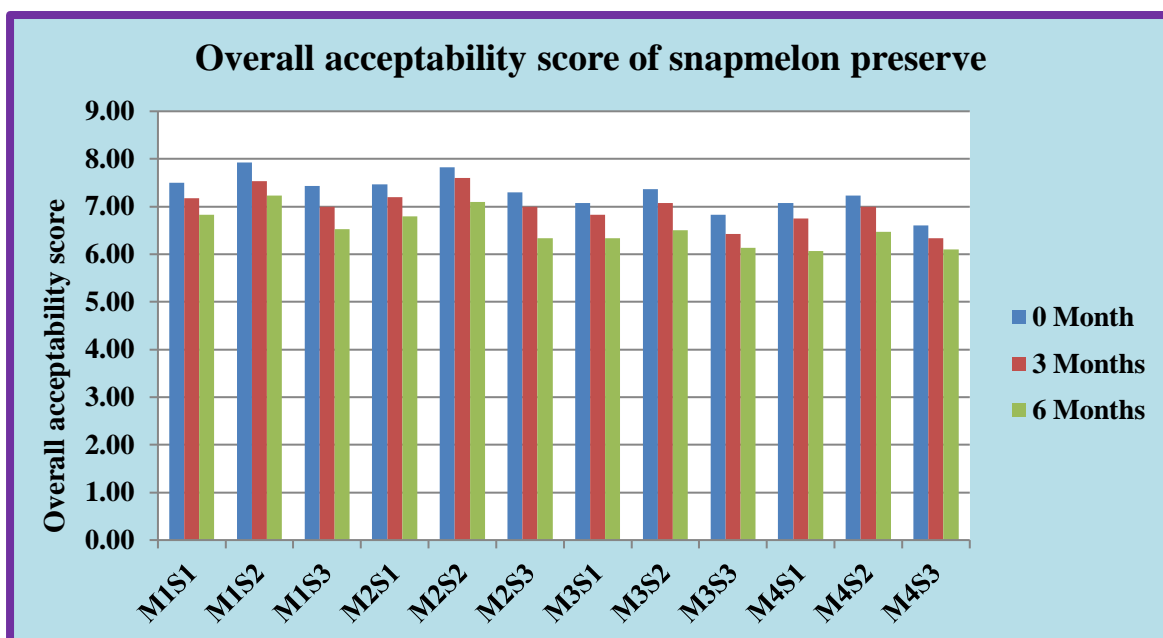
**M<sub>3</sub>**- Ripe stage,

**M<sub>4</sub>**- Over ripe stage

**S<sub>1</sub>**- 60 °B sugar syrup,

**S<sub>2</sub>**- 70 °B sugar syrup,

**S<sub>3</sub>**- 80 °B sugar syrup



**Fig.22 Percentage decrease in overall acceptability score of snapmelon preserve during storage at ambient temperature (27-29°C)**

**Treatments details –**

**M<sub>1</sub>S<sub>1</sub> – Mature green stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>1</sub>S<sub>2</sub> – Mature green stage + 70<sup>o</sup>B sugar syrup concentration**

**M<sub>1</sub>S<sub>3</sub> – Mature green stage + 80<sup>o</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>1</sub> – Turning stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>2</sub> – Turning stage + 70<sup>o</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>3</sub> – Turning stage + 80<sup>o</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>1</sub> – Ripe stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>2</sub> – Ripe stage + 70<sup>o</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>3</sub> – Ripe stage + 80<sup>o</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>1</sub> – Over ripe stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>2</sub> – Over ripe stage + 70<sup>o</sup>B sugar syrup concentration**

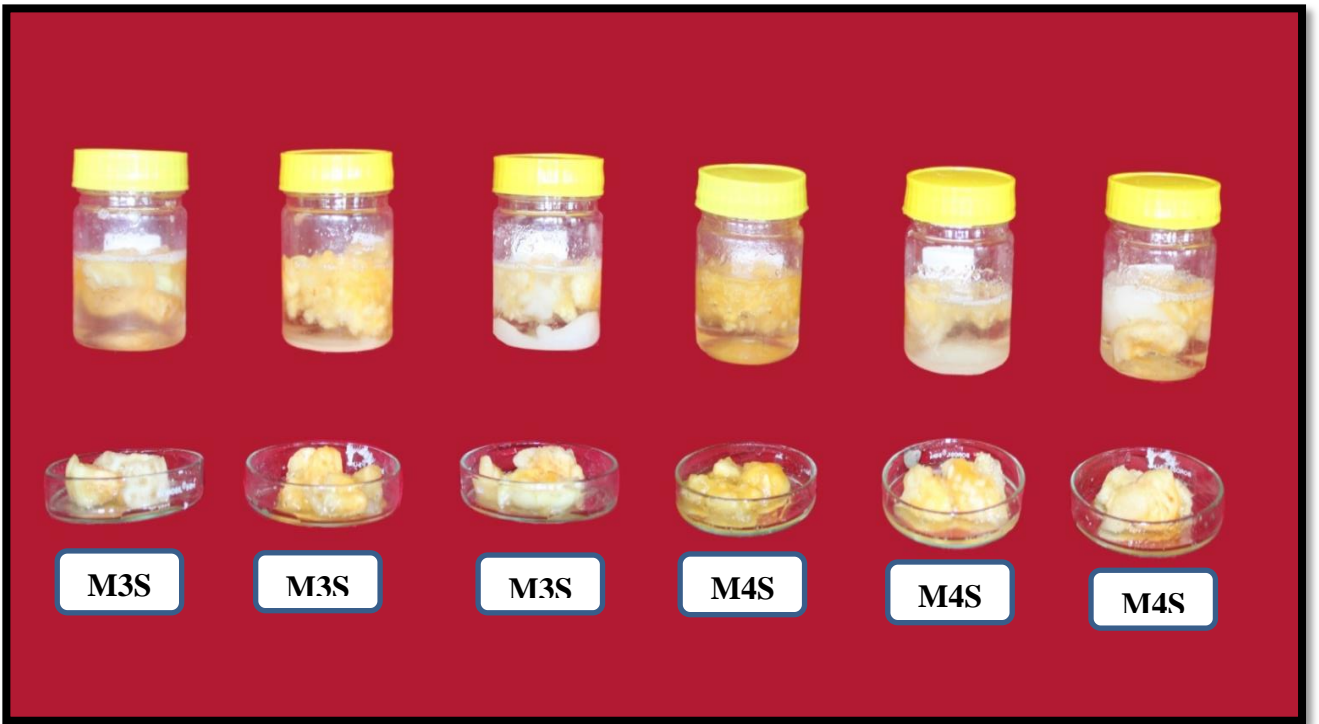
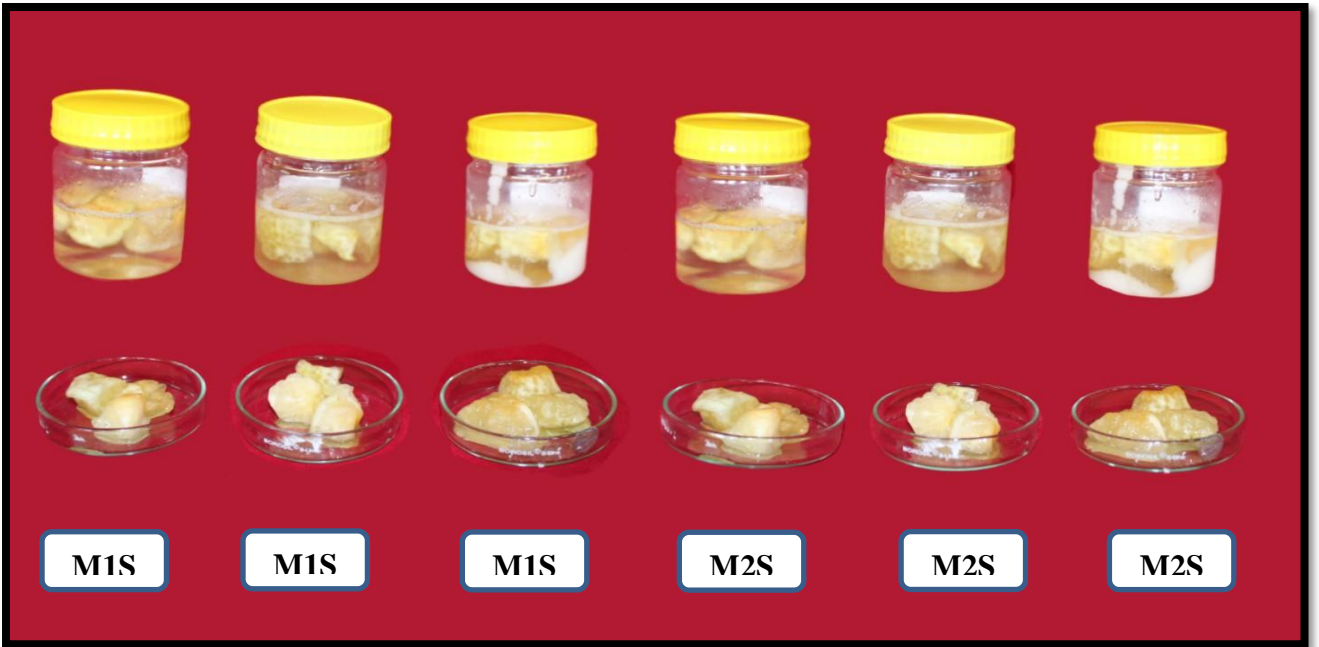
**M<sub>4</sub>S<sub>3</sub> – Over ripe stage + 80<sup>o</sup>B sugar syrup concentration**

The decrease in overall acceptability score with increase in maturity stages of fruit was due to combined effect of increase in colour, flavour score and drastic decrease in texture score with increase in maturity stages of fruit. Observations analogous to present findings were also reported by Barve (2001) in snapmelon fruits.

In case of sugar syrup concentrations overall acceptability score differs significantly at '0', 3 and 6 months storage. Treatment S<sub>2</sub> recorded significantly maximum overall acceptability at '0' (7.59), 3 (7.30) and 6 months (6.83) storage, irrespective of maturity stages of fruit. Minimum overall acceptability was recorded by S<sub>3</sub> at '0' (7.04), 3 (6.69) and 6 months (6.27) storage.

The overall acceptability score of preserve was found to be increased from S<sub>1</sub> to S<sub>2</sub> at '0' (7.28 to 7.59), 3 (6.99 to 7.30) and 6 months (6.51 to 6.83) storage. However, from S<sub>2</sub> to S<sub>3</sub> it was found to be decreased at '0' (7.59 to 7.04), 3 (7.30 to 6.69) and 6 months (6.83 to 6.27). This may be due to increase in colour, flavour and texture score from S<sub>1</sub> to S<sub>2</sub> and decrease from S<sub>2</sub> to S<sub>3</sub>. Similar results were also reported by Lingala *et al.* (2015) in osmo-dried karonda.

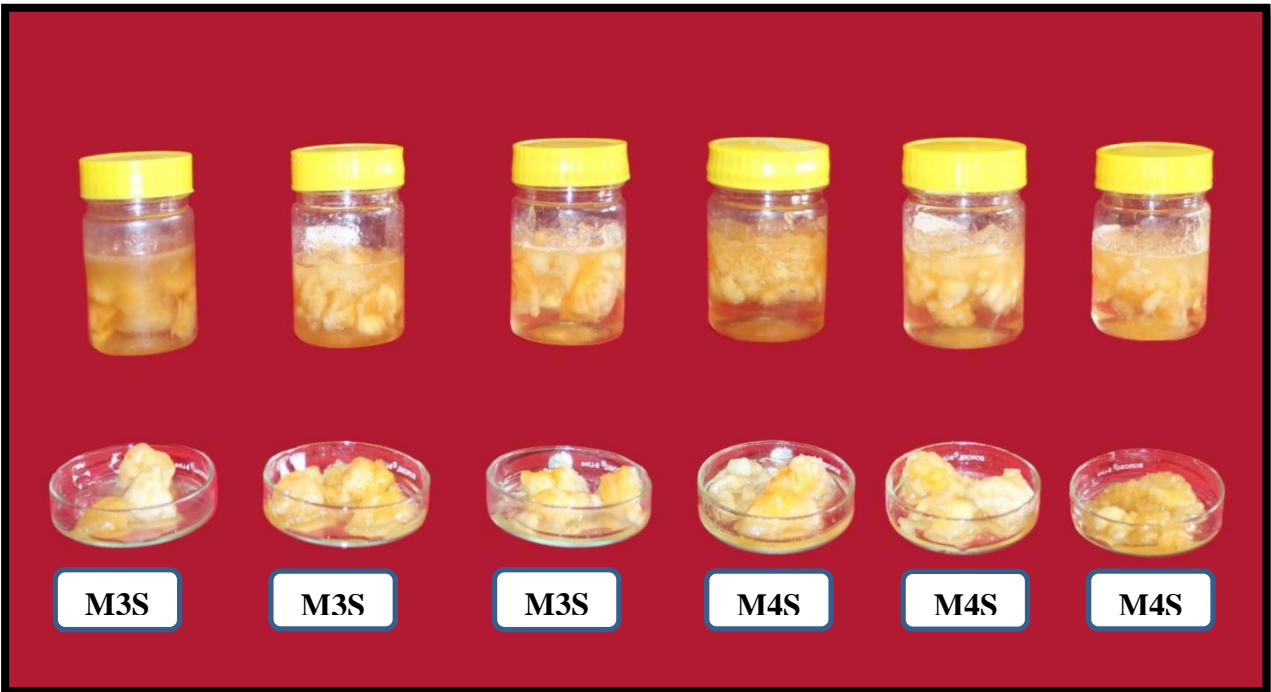
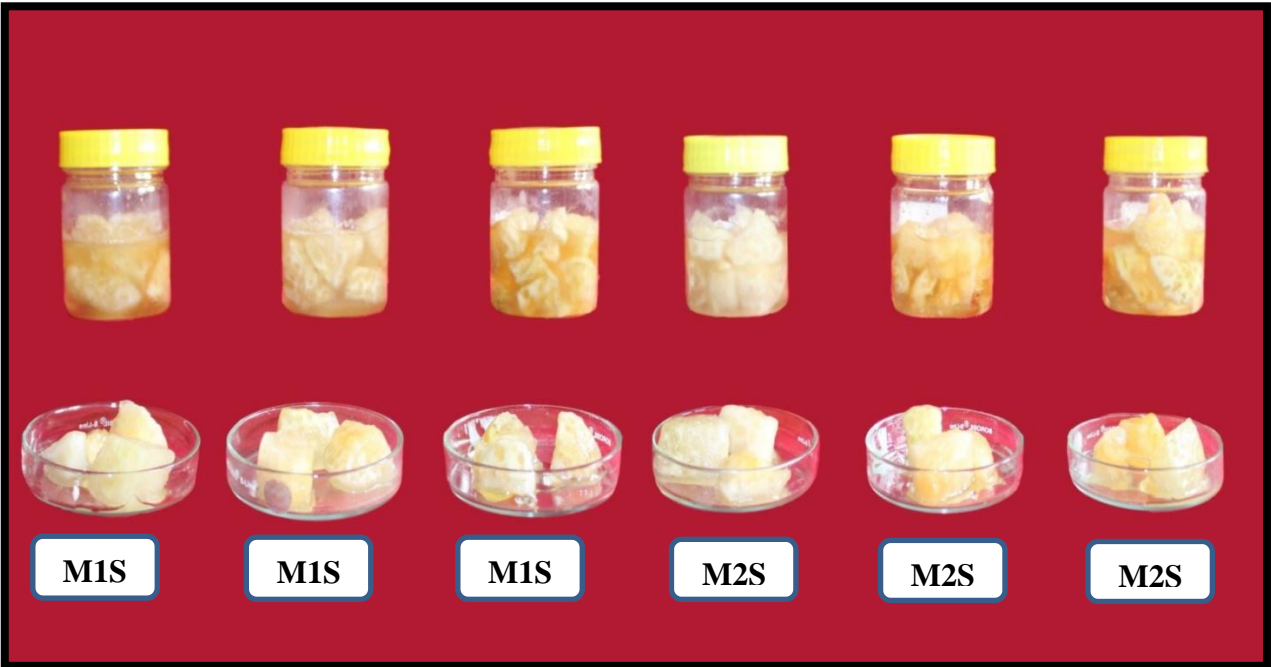
In interactions of maturity stage of fruit and sugar syrup concentrations, results were found to be significant throughout the storage. At '0' month, interaction M<sub>1</sub>S<sub>2</sub> recorded significantly maximum overall acceptability score of (7.93) and at 3 months interaction M<sub>2</sub>S<sub>2</sub> recorded significantly maximum overall acceptability score of (7.60) and at 6 months interaction M<sub>1</sub>S<sub>2</sub> recorded significantly maximum overall acceptability score of (7.23). Minimum overall acceptability score was recorded by M<sub>4</sub>S<sub>3</sub> at '0' (6.60), 3 (6.33) and interaction M<sub>4</sub>S<sub>1</sub> at 6 months



**Plate IX: Snapmelon preserve stored at ambient temperature ('0' month)**



**Plate X: Snapmelon preserve stored at ambient temperature (3 months)**



**Plate XI: Snapmelon preserve stored at ambient temperature (6 months)**

(6.07) during storage. Maximum overall acceptability score recorded by M<sub>1</sub>S<sub>2</sub> and M<sub>2</sub>S<sub>2</sub> may be due to combined effect of colour, flavour and texture score of preserve during storage.

#### **4.7 Microbial count of snapmelon preserve during storage under ambient temperature (27-29°C) condition.**

##### **4.7.1 Fungal count**

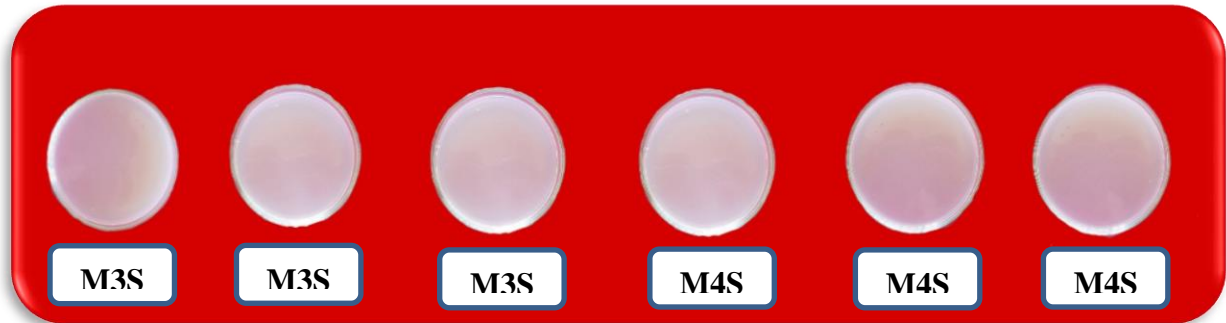
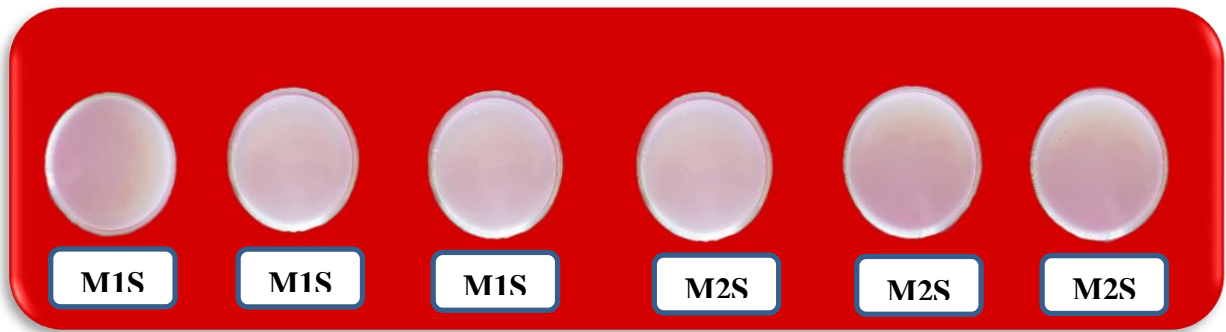
The data presented in Table 22 and depicted in Fig. 23 indicates the fungal count in snapmelon preserve during storage and it was observed that fungal count was increased from '0' month ( $0.00 \times 10^{-3}/\text{ml}$ ) to 6 months ( $0.53 \times 10^{-3} /\text{ml}$ ) of storage, irrespective of maturity stages and sugar syrup concentrations.

The increase in fungal count during storage may be due to decrease in high percentage of sugars, titratable acidity and phenolic compounds during storage which helped in the growth and activity of fungus. Results analogous to present findings are also reported by Durrani and verma (2011) in aonla murabba.

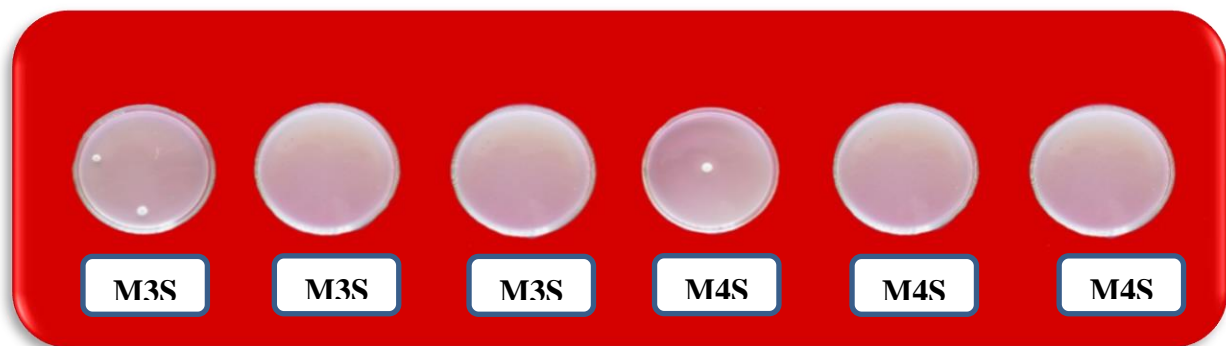
The fungal count of snapmelon preserve differs significantly with respect to different treatments of maturity stages during entire storage period, except '0' month storage. During '0' month of storage, fungal growth was not detected.

At 3 month storage, the lowest fungal count was found in treatment M<sub>1</sub> ( $0.11 \times 10^{-3}$ ) and it was significantly superior over rest of the treatments. While, highest fungal count was recorded in M<sub>4</sub> ( $0.33 \times 10^{-3}$ ), irrespective of sugar syrup concentrations. At 6 months storage the lowest fungal count was recorded in M<sub>1</sub> and M<sub>2</sub> ( $0.22 \times 10^{-3}$ ) and highest fungal count was recorded in M<sub>4</sub> ( $0.89 \times 10^{-3}$ ), irrespective of sugar syrup concentrations.

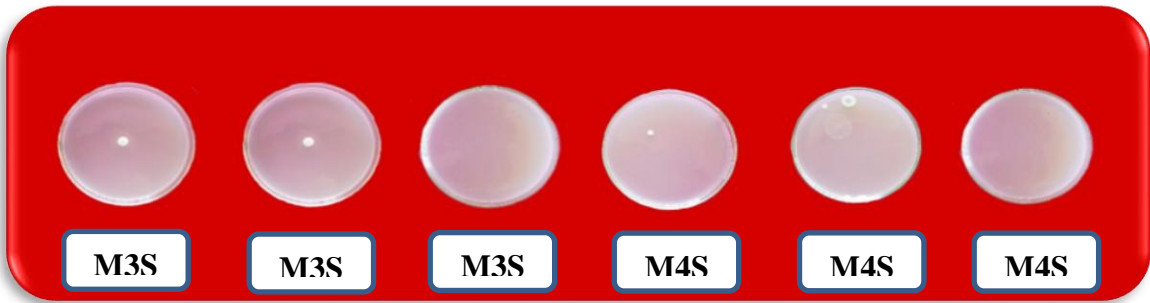
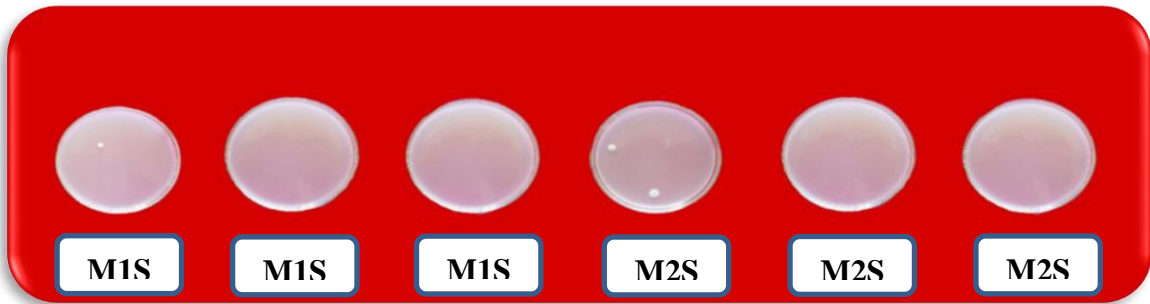
**'0' Month**



**3 Months**



**Plate XII: Fungal count of snapmelon preserve at ambient temperature (27-29°C) ('0' and 3 months)**



**Plate XIII: Fungal count of snapmelon preserve at ambient temperature (27-29°C) (6 months)**

Fungal count of preserve was found to be increased with increase in maturity stages of fruit. It may be the impact of increase in sugars, decrease in acidity and phenolic compounds with increase in maturity stages of fruit. Similar findings were reported by Jyothi (2000). She reported that fruits with high phenol and crude fibre content show fungal contamination in later stage only.

In case of sugar syrup concentrations, fungal count of preserve was found to be decreased with increase in sugar syrup concentration from S<sub>1</sub> (60 °B) to S<sub>3</sub> (80 °B) during entire storage period. At 3 month storage, the highest fungal count was found in treatment S<sub>1</sub> ( $0.66 \times 10^3$ ) and no fungal growth was detected in S<sub>2</sub> and S<sub>3</sub>. At 6 months storage no fungal growth was detected in S<sub>3</sub> and highest fungal count was recorded in S<sub>1</sub> ( $0.91 \times 10^{-3}$ ), irrespective of maturity stages. Maximum fungal count recorded by S<sub>1</sub> may be due to low sugar syrup concentration of preserve (66 °B) which might have allowed fungus to grow.

In interaction of maturity stages of fruit and sugar syrup concentrations, at 3 months storage interaction M<sub>4</sub>S<sub>1</sub> recorded significantly maximum fungal count of ( $1.00 \times 10^{-3}$ ) and at 6 months storage interaction M<sub>3</sub>S<sub>2</sub>, M<sub>4</sub>S<sub>1</sub> and M<sub>4</sub>S<sub>2</sub> recorded significantly maximum bacterial count of ( $1.33 \times 10^{-3}$ ) respectively.

The increase in fungal count with increase in storage period might be due to increase in sugars during storage. Similar findings have been reported by Emamifar (2010) in orange juice.

The interaction of maturity stage and sugar syrup concentrations showed no fungal growth at '0' month storage. 3 months storage interactions of all four growth stages with S<sub>2</sub>

**Table 22: Changes in fungal count (colony count  $\times 10^{-3}$  /ml) of snapmelon preserve during storage at ambient temperature (27-29°C)**

Treatments (Maturity stages)	'0' month				3 months				6 months			
	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean
M <sub>1</sub>	0.00	0.00	0.00	<b>0.00</b>	0.33	0.00	0.00	<b>0.11</b>	0.66	0.00	0.00	<b>0.22</b>
M <sub>2</sub>	0.00	0.00	0.00	<b>0.00</b>	0.66	0.00	0.00	<b>0.22</b>	0.66	0.00	0.00	<b>0.22</b>
M <sub>3</sub>	0.00	0.00	0.00	<b>0.00</b>	0.66	0.00	0.00	<b>0.22</b>	1.00	1.33	0.00	<b>0.78</b>
M <sub>4</sub>	0.00	0.00	0.00	<b>0.00</b>	1.00	0.00	0.00	<b>0.33</b>	1.33	1.33	0.00	<b>0.89</b>
Mean	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.66</b>	<b>0.00</b>	<b>0.00</b>	<b>0.22</b>	<b>0.91</b>	<b>0.67</b>	<b>0.00</b>	<b>0.53</b>
	<b>S.Em.±</b>		<b>C.D. at 1%</b>		<b>S.Em.±</b>		<b>C.D. at 1%</b>		<b>S.Em.±</b>		<b>C.D. at 1%</b>	
<b>Maturity stage (M)</b>	0.000		0.000		0.002		0.008		0.003		0.011	
<b>Sugar syrup (S)</b>	0.000		0.000		0.002		0.007		0.002		0.010	
<b>Interaction (MxS)</b>	0.000		0.000		0.003		0.013		0.005		0.020	

**M<sub>1</sub>**- Mature green,

**M<sub>2</sub>**- Turning stage,

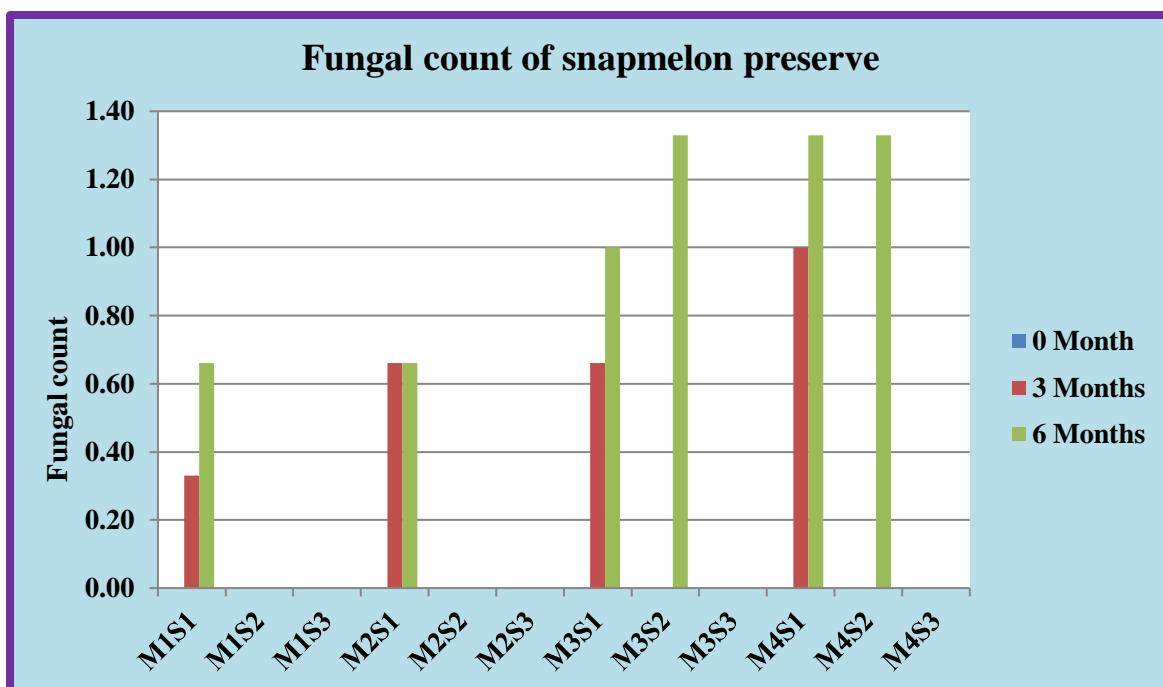
**M<sub>3</sub>**- Ripe stage,

**M<sub>4</sub>**- Over ripe stage

**S<sub>1</sub>**- 60 °B sugar syrup,

**S<sub>2</sub>**- 70 °B sugar syrup,

**S<sub>3</sub>**- 80 °B sugar syrup



**Fig.23 Percentage increase in fungal count of snapmelon preserve during storage at ambient temperature (27-29°C)**

**Treatments details -**

**M<sub>1</sub>S<sub>1</sub> - Mature green stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>1</sub>S<sub>2</sub> - Mature green stage + 70<sup>o</sup>B sugar syrup concentration**

**M<sub>1</sub>S<sub>3</sub> - Mature green stage + 80<sup>o</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>1</sub> - Turning stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>2</sub> - Turning stage + 70<sup>o</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>3</sub> - Turning stage + 80<sup>o</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>1</sub> - Ripe stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>2</sub> - Ripe stage + 70<sup>o</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>3</sub> - Ripe stage + 80<sup>o</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>1</sub> - Over ripe stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>2</sub> - Over ripe stage + 70<sup>o</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>3</sub> - Over ripe stage + 80<sup>o</sup>B sugar syrup concentration**

and S<sub>3</sub> sugar syrup concentrations does not showed any fungal growth. Maximum fungal growth was observed at M<sub>4</sub>S<sub>1</sub> ( $1.00 \times 10^{-3}$ ). At 6 months storage in the interactions M<sub>1</sub>S<sub>2</sub>, M<sub>1</sub>S<sub>3</sub>, M<sub>2</sub>S<sub>2</sub>, M<sub>2</sub>S<sub>3</sub>, M<sub>3</sub>S<sub>3</sub> and M<sub>4</sub>S<sub>3</sub> fungal growth was not detected. However, M<sub>3</sub>S<sub>2</sub>, M<sub>4</sub>S<sub>1</sub> and M<sub>4</sub>S<sub>2</sub> recorded maximum ( $1.33 \times 10^{-3}$ ) fungal count. This maximum fungal count may be the impact of advance maturity stages of fruit and lower sugar syrup concentration at S<sub>1</sub> and S<sub>2</sub> as compared to S<sub>3</sub> which might have allowed fungus to grow.

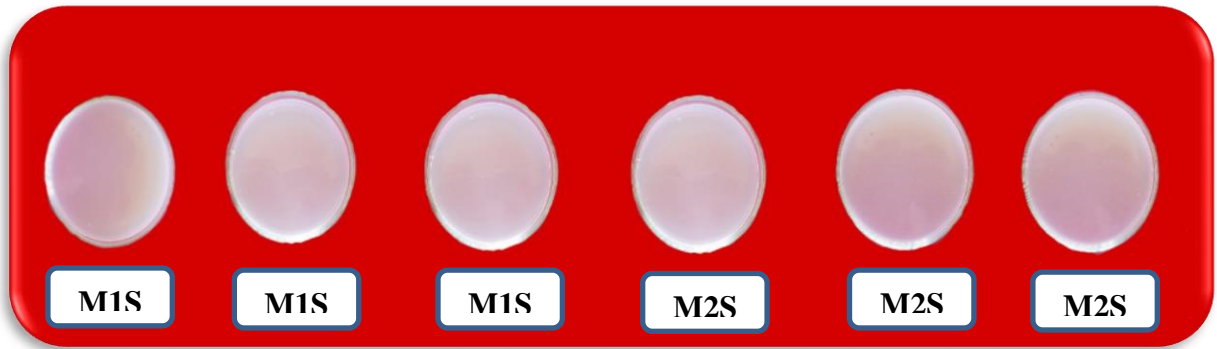
#### **4.7.2 Bacterial count**

The data presented in Table 23 and depicted in Fig. 24 indicates the bacterial count in snapmelon preserve during storage and it was observed that bacterial count was increased from '0' month ( $0.00 \times 10^3$ /ml) to 6 months ( $0.41 \times 10^{-3}$  /ml) of storage, irrespective of maturity stages and sugar syrup concentrations.

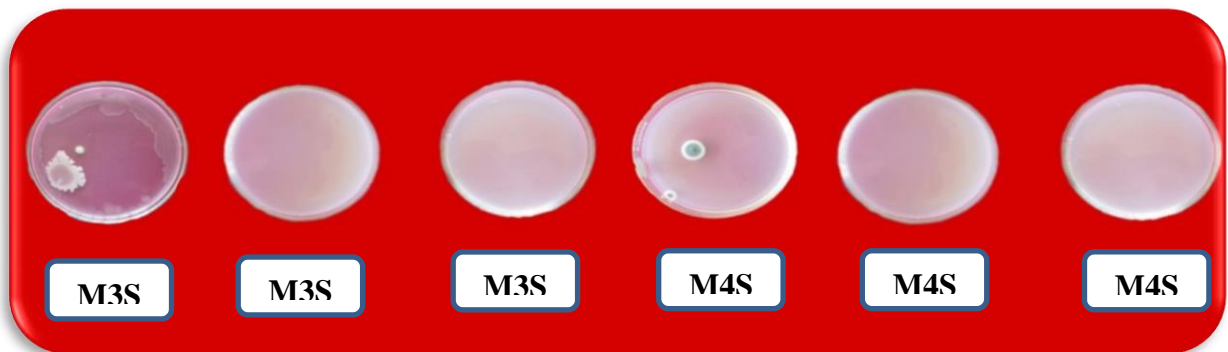
Increase in bacterial count during storage may be due to decrease in high percentage of sugar, titratable acidity and phenolic compounds during storage. Similar results were reported by Priya and Khatkar (2013) in aonla preserves.

The bacterial count of snapmelon preserve differs significantly with respect to different treatments of maturing stages during entire storage period, except '0' month storage. During '0' month of storage, bacterial growth was not detected.

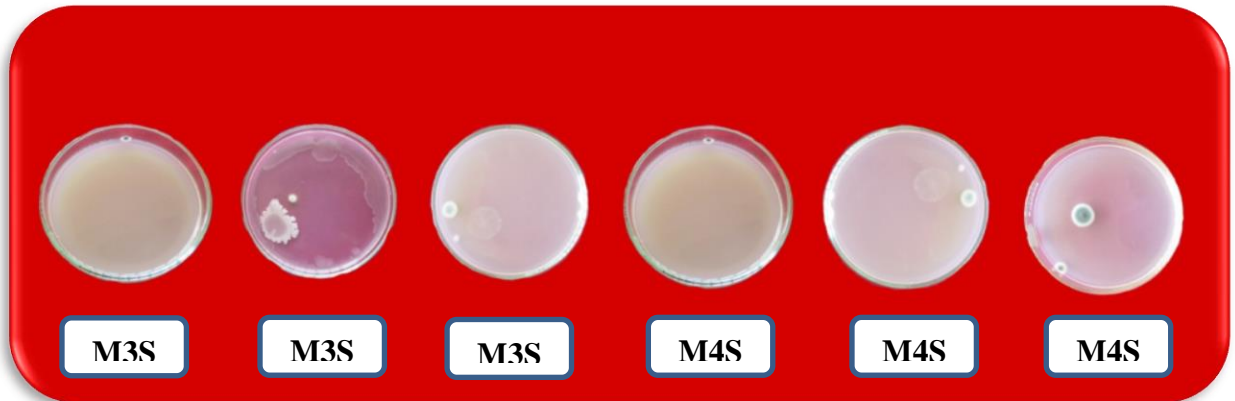
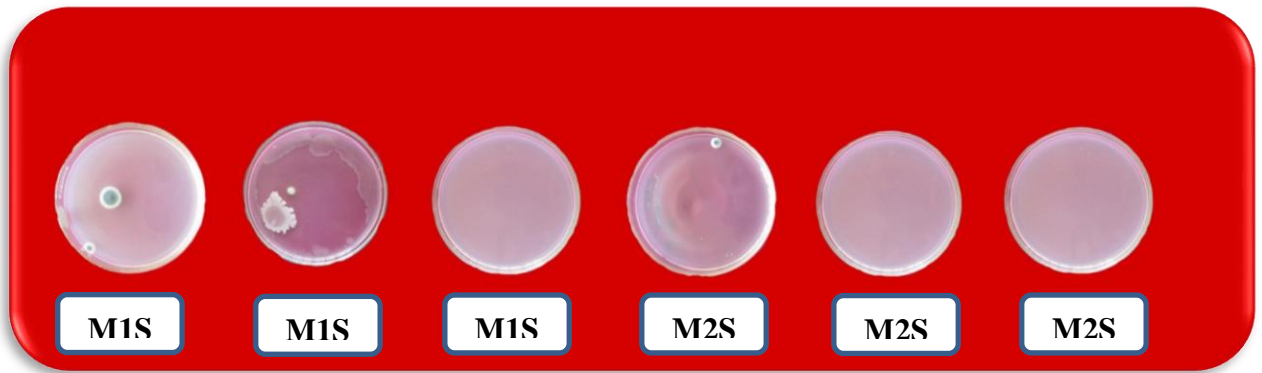
At 3 month storage, the lowest bacterial count was found in treatment M<sub>1</sub> and M<sub>2</sub> ( $0.11 \times 10^{-3}$ ) and it was significantly superior over rest of the treatments. While, highest bacterial count was recorded by M<sub>3</sub> and M<sub>4</sub> ( $0.22 \times 10^{-3}$ ), irrespective of sugar syrup concentration. At 6 months storage the lowest bacterial count was recorded by M<sub>2</sub> ( $0.11 \times 10^{-3}$ ) and it was



**3 Months**



**Plate XIV: Bacterial count of snapmelon preserve at ambient temperature (27-29°C) ('0' and 3 months)**



**Plate XV: Bacterial count of snapmelon preserve at ambient temperature (27-29°C) at 6 months**

significantly superior over rest of the treatments, while highest bacterial count was recorded by  $M_4$  ( $0.66 \times 10^{-3}$ ), irrespective of sugar syrup concentrations.

In general, the bacterial count was found to be increased at later stages of fruit maturity. It may be due to high phenol and crude fibre present in initial growth stages of fruit as stated by Jyothi (2000) and it also may be due to increase in sugar content and decrease in acidity with increase in maturity stages of fruit.

In case of sugar syrup concentrations, bacterial count of preserve pieces was found to be decreased with increase in sugar syrup concentration from  $S_1$  (60 °B) to  $S_3$  (80 °B) during entire storage period. At 3 month storage, the highest bacterial count was found in treatment  $S_1$  ( $0.50 \times 10^{-3}$ ) and bacterial growth was not detected in  $S_2$  and  $S_3$ . At 6 months storage the lowest bacterial count was recorded in  $S_3$  ( $0.17 \times 10^{-3}$ ) and highest bacterial count was recorded in  $S_1$  ( $0.75 \times 10^{-3}$ ), irrespective of maturity stages. Maximum bacterial count recorded by  $S_1$  may be due to low sugar syrup concentration of preserve (60°B) which might have allowed bacteria to grow. However, higher concentration of sugar syrup might have restricted the growth of bacteria and hence minimum bacterial count was observed at  $S_3$  (80°B).

In case of interactions of maturity stage and sugar syrup concentrations bacterial growth was not detected at '0' month storage. At 3 months storage interactions of all four maturity stages ( $M_1$ ,  $M_2$ ,  $M_3$  and  $M_4$ ) with  $S_2$  and  $S_3$  sugar syrup concentrations does not showed any bacterial count. However, maximum bacterial count ( $0.66 \times 10^{-3}$ ) was recorded by interaction  $M_3S_1$  and  $M_4S_1$ . At six months storage bacterial

**Table 23: Changes in bacterial count (colony count x 10<sup>-3</sup> /ml) of snapmelon preserve during storage at ambient temperature (27-29°C)**

Treatments (Maturity stages)	'0' month				3 months				6 months			
	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	Mean
<b>M<sub>1</sub></b>	0.00	0.00	0.00	<b>0.00</b>	0.33	0.00	0.00	<b>0.11</b>	0.66	0.33	0.00	<b>0.33</b>
<b>M<sub>2</sub></b>	0.00	0.00	0.00	<b>0.00</b>	0.33	0.00	0.00	<b>0.11</b>	0.33	0.00	0.00	<b>0.11</b>
<b>M<sub>3</sub></b>	0.00	0.00	0.00	<b>0.00</b>	0.66	0.00	0.00	<b>0.22</b>	1.00	0.33	0.33	<b>0.55</b>
<b>M<sub>4</sub></b>	0.00	0.00	0.00	<b>0.00</b>	0.66	0.00	0.00	<b>0.22</b>	1.00	0.66	0.33	<b>0.66</b>
<b>Mean</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.50</b>	<b>0.00</b>	<b>0.00</b>	<b>0.17</b>	<b>0.75</b>	<b>0.33</b>	<b>0.17</b>	<b>0.41</b>
	<b>S.Em.±</b>		<b>C.D. at 1%</b>		<b>S.Em.±</b>		<b>C.D. at 1%</b>		<b>S.Em.±</b>		<b>C.D. at 1%</b>	
<b>Maturity stage (M)</b>	0.000		0.000		0.002		0.008		0.003		0.013	
<b>Sugar syrup (S)</b>	0.000		0.000		0.002		0.007		0.003		0.011	
<b>Interaction (MxS)</b>	0.000		0.000		0.003		0.013		0.006		0.023	

**M<sub>1</sub>**- Mature green,

**M<sub>2</sub>**- Turning stage,

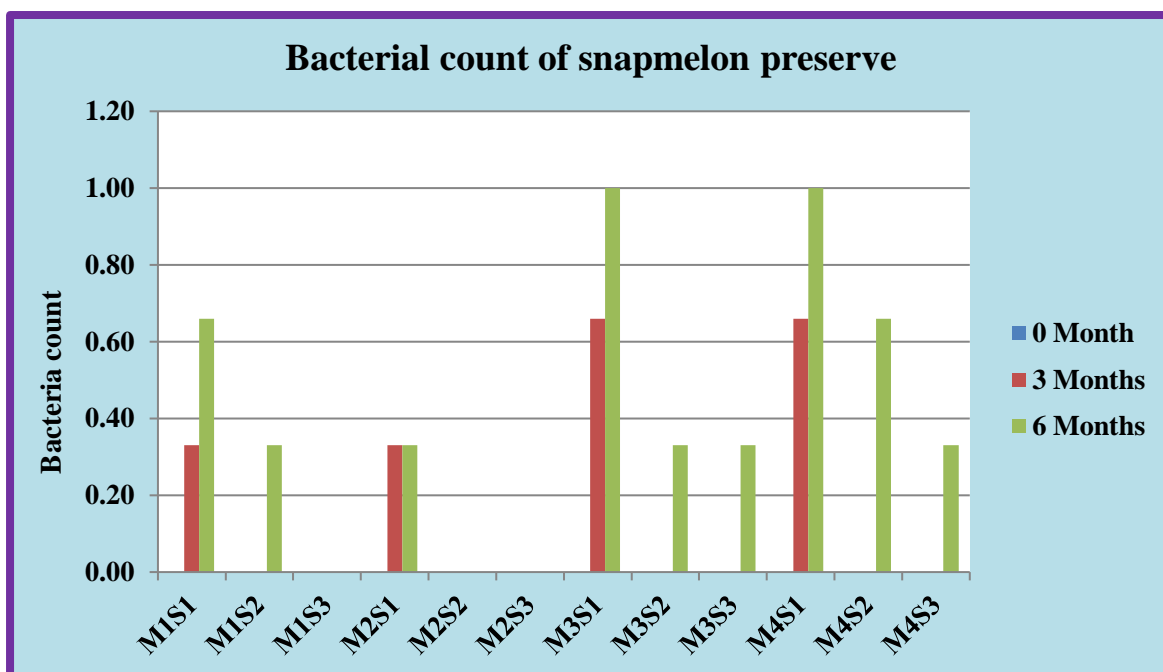
**M<sub>3</sub>**- Ripe stage,

**M<sub>4</sub>**- Over ripe stage

**S<sub>1</sub>**- 60 °B sugar syrup,

**S<sub>2</sub>**- 70 °B sugar syrup,

**S<sub>3</sub>**- 80 °B sugar syrup



**Fig.24 Percentage increase in bacterial count of snapmelon preserve during storage at ambient temperature (27-29°C)**

**Treatments details –**

**M<sub>1</sub>S<sub>1</sub> – Mature green stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>1</sub>S<sub>2</sub> – Mature green stage + 70<sup>o</sup>B sugar syrup concentration**

**M<sub>1</sub>S<sub>3</sub> – Mature green stage + 80<sup>o</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>1</sub> – Turning stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>2</sub> – Turning stage + 70<sup>o</sup>B sugar syrup concentration**

**M<sub>2</sub>S<sub>3</sub> – Turning stage + 80<sup>o</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>1</sub> – Ripe stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>2</sub> – Ripe stage + 70<sup>o</sup>B sugar syrup concentration**

**M<sub>3</sub>S<sub>3</sub> – Ripe stage + 80<sup>o</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>1</sub> – Over ripe stage + 60<sup>o</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>2</sub> – Over ripe stage + 70<sup>o</sup>B sugar syrup concentration**

**M<sub>4</sub>S<sub>3</sub> – Over ripe stage + 80<sup>o</sup>B sugar syrup concentration**

growth was not detected in  $M_1S_3$ ,  $M_2S_2$  and  $M_2S_3$ . Maximum bacterial count ( $1.00 \times 10^{-3}$ ) was observed at  $M_3S_1$  and  $M_4S_1$ .

At six months storage maximum bacterial count recorded by  $M_3S_1$  and  $M_4S_1$  may be due to the increase in sugar percentages and decrease in acidity at advance maturity stages ( $M_3$  and  $M_4$ ) and lower sugar syrup concentration at  $S_1$  (60 °B) which might have allowed bacteria to grow.

#### **4.8 Cost of production of 100 kg snapmelon preserve**

The cost of production for the preparation of snapmelon preserve from different maturity stages and sugar syrup concentration of snapmelon fruit is presented in Table 24. From the result it could be observed that total variable cost of snapmelon preserve with respect to different interactions of maturity stages and sugar syrup concentrations are Rs.11975.28 ( $M_1S_1$ ), 12304.35 ( $M_1S_2$ ), 13382.31 ( $M_1S_3$ ), 12377.83 ( $M_2S_1$ ), 12782.72 ( $M_2S_2$ ), 13412.5 ( $M_2S_3$ ), 13129.34 ( $M_3S_1$ ), 13516.87 ( $M_3S_2$ ), 13949.04 ( $M_3S_3$ ), 13466.37 ( $M_4S_1$ ), 14149.84 ( $M_4S_2$ ) and 14305.76 ( $M_4S_3$ ) and total fixed cost was 0.23( $M_1S_1$ ), 0.24 ( $M_1S_2$ ), 0.31 ( $M_1S_3$ ), 0.25 ( $M_2S_1$ ), 0.26 ( $M_2S_2$ ), 0.29 ( $M_2S_3$ ), 0.32 ( $M_3S_1$ ), 0.31 ( $M_3S_2$ ), 0.32 ( $M_3S_3$ ), 0.33 ( $M_4S_1$ ), 0.35 ( $M_4S_2$ ) and 0.33 ( $M_4S_3$ ).

Hence, cost for the production of 50 g snapmelon preserve was lowest (Rs.11.98) in  $M_1S_1$  and highest (Rs.14.31) in  $M_4S_3$ . Net profit for 50 g of snapmelon preserve was highest (Rs.11.70) in interaction  $M_1S_2$  and lowest in  $M_4S_3$  (Rs.5.69). As per Benefit: cost ratio is concerned maximum (1.95) was recorded in interaction  $M_1S_2$  followed by  $M_1S_1$  (1.92) and  $M_2S_2$  (1.88) and minimum was recorded by  $M_4S_3$  (1.39).

**Table 24: Cost of production of 100 kg snapmelon preserve**

Sr. No.	Particulars	M <sub>1</sub> S <sub>1</sub>		M <sub>1</sub> S <sub>2</sub>		M <sub>1</sub> S <sub>3</sub>		M <sub>2</sub> S <sub>1</sub>	
		Qty	cost	Qty	cost	Qty	cost	Qty	Cost
1	<b>Snapmelon fruits @ Rs 30/kg</b>	85.68	2570.4	82.36	2470.8	79.93	2397.9	89.49	2684.7
2	<b>Packaging material @ Rs.5 /- per jar</b>	1000	5000	1000	5000	1000	5000	1000	5000
3	<b>Sugar @ Rs. 39/kg</b>	36.9	1439.1	45	1755	64.8	2527.2	40.5	1579.5
3	<b>KMS @ Rs.262/kg i.e Rs.0.26/gm</b>	4.23	1.11	4.42	1.16	5.57	1.46	4.64	1.22
4	<b>citric acids @ Rs.92/kg i.e. Rs.0.09/gm</b>	30.75	2.83	32.14	2.96	40.5	3.73	33.75	3.11
5	<b>Fuel gas @ Rs 800/ cylinder of 14.2 kg i.e Rs. 0.05/gm of gas</b>	73.8	3.69	77.14	3.9	97.2	4.86	81	4.1
6	<b>Labour charge @ Rs 300/- per skilled labour</b>	5.69	1707	5.95	1785	6.83	2049	6.04	1812
<b>A</b>	<b>a) Variable cost</b>		10724.13		11018.82		11984.15		11084.63
	<b>b) Supervision charges @10% on variable cost</b>		1072.41		1101.88		1198.42		1108.46
	<b>c) Interest on variable cost @ 10 % i.e. for 2 months</b>		178.74		183.65		199.74		184.74
	<b>d) Total variable cost (A+B+C)</b>		11975.28		12304.35		13382.31		12377.83
<b>B</b>	<b>Fixed cost</b>								
	<b>a) Depreciation charges on fixed cost on Rs.8000 for gas cylinder for different hour as per interaction</b>		0.21		0.22		0.28		0.23
	<b>b) Interest on fixed cost @10% on Rs.8000 for gas cylinder for different hour as per interaction</b>		0.021		0.022		0.028		0.023
	<b>c) Total fixed cost (a+b)</b>		0.23		0.24		0.31		0.25
<b>C</b>	<b>Total cost (total variable cost + total fixed cost) in Rs</b>		11975.51		12304.59		13382.62		12378.08
<b>D</b>	<b>Cost of production for 100 g preserve in jar in Rs.</b>		11.98		12.30		13.38		12.38
<b>E</b>	<b>Sell price of 100 g preserve in Rs.</b>		23		24		22		23
<b>F</b>	<b>Net profit for 100g snapmelon preserve in Rs.</b>		11.02		11.70		8.62		10.62
<b>G</b>	<b>Benefit : cost</b>		1.92		1.95		1.64		1.86

Sr. No.	Particulars	M <sub>2</sub> S <sub>2</sub>		M <sub>2</sub> S <sub>3</sub>		M <sub>3</sub> S <sub>1</sub>		M <sub>3</sub> S <sub>2</sub>	
		Qty	Cost	Qty	Cost	Qty	Cost	Qty	Cost
1	Snapmelon fruits @ Rs 30/kg	87.16	2614.8	85.62	2568.6	92.59	2777.7	90.53	2715.9
2	Packaging material @ Rs.5 /- per jar	1000	5000	1000	5000	1000	5000	1000	5000
3	Sugar @ Rs. 39/kg	49.05	1912.9	60.75	2369.25	50.4	1965.6	58.5	2281.5
3	KMS @ Rs. 262/kg i.e Rs.0.26/gm	4.82	1.25	5.22	1.36	5.78	1.50	5.75	1.49
4	Citric acids @ Rs.92/kg i.e. Rs.0.09/gm	35.05	3.14	37.97	3.42	42	3.78	41.79	3.76
5	Fuel gas @ Rs 800/ cylinder of 14.2 kg i.e Rs. 0.05/gm of gas	84.12	4.21	91.12	4.56	100.8	5.04	100.28	5.01
6	Labour charge @ Rs 300/- per skilled labour	6.37	1911	6.88	2064	6.68	2004	6.99	2097
<b>A</b>	<b>a) Variable cost</b>		11447.21		12011.19		11757.62		12104.66
	<b>b) Supervision charges @10% on variable cost</b>		1144.72		1201.12		1175.76		1210.47
	<b>c) Interest on variable cost @ 10 % i.e. for 2 months</b>		190.79		200.19		195.96		201.74
	<b>d) Total variable cost (A+B+C)</b>		12782.72		13412.5		13129.34		13516.87
<b>B</b>	<b>Fixed cost</b>								
	<b>a) Depreciation charges on fixed cost on Rs.8000 for gas cylinder for different hour as per interaction</b>		0.24		0.26		0.29		0.28
	<b>c) Interest on fixed cost @10% on Rs.8000 for gas cylinder for different hour as per interaction</b>		0.024		0.026		0.029		0.028
	<b>c) Total fixed cost (a+b)</b>		0.26		0.29		0.32		0.31
<b>C</b>	<b>Total cost (total variable cost+total fixed cost)in Rs</b>		12782.98		13412.79		13129.66		13517.18
<b>D</b>	<b>Cost of production for 100 g preserve in jar in Rs.</b>		12.78		13.41		13.13		13.52
<b>E</b>	<b>Sell price of 100 g preserve in Rs.</b>		24		21		21		21
<b>F</b>	<b>Net profit for 100g snapmelon preserve in Rs.</b>		11.22		7.59		7.87		7.48
<b>G</b>	<b>Benefit : cost</b>		1.88		1.57		1.59		1.55

Continue...  
Continue...

Sr. No	Particulars	M <sub>3</sub> S <sub>3</sub>		M <sub>4</sub> S <sub>1</sub>		M <sub>4</sub> S <sub>2</sub>		M <sub>4</sub> S <sub>3</sub>	
		Qty	Cost	Qty	Cost	Qty	cost	Qty	Cost
1	Snampelon fruits @ Rs 30/kg	87.74	2632.2	96.7 1	2901.3	95.11	2853.3	90.59	2717.7
2	Packaging material @ Rs.5 /- per jar	1000	5000	100 0	5000	1000	5000	1000	5000
3	Sugar @ Rs. 39/kg	67.95	2650.05	52.6 5	2053.3 5	65.25	2544.7 5	71.55	2790.4 5
3	KMS @ Rs. 262/kg i.e Rs.0.26/gm	5.84	1.51	6.04	1.57	6.41	1.67	6.15	1.59
4	Citric acids @ Rs. 92/kg i.e. Rs.0.09/gm	42.47	3.82	43.8 8	3.95	46.61	4.19	44.65	4.02
5	Fuel gas @ Rs 800/ cylinder of 14.2 kg i.e Rs. 0.05/gm of gas	101.9 3	5.10	105. 3	5.27	111.8 5	5.59	107.3 2	5.37
6	Labour charge @ Rs 300/- per skilled labour	7.33	2199	6.98	2094	7.54	2262	7.64	2292
<b>A</b>	<b>a) Variable cost</b>		12491.6 8		12059.44		12671.5		12811.13
	<b>b) Supervision charges @10% on variable cost</b>		1249.17		1205.94		1267.15		1281.11
	<b>c) Interest on variable cost @ 10 % i.e. for 2 months</b>		208.19		200.99		211.19		213.52
	<b>d) Total variable cost (A+B+C)</b>		13949.0 4		13466.37		14149.84		14305.76
<b>B</b>	<b>Fixed cost</b>								
	<b>a) Depreciation charges on fixed cost on Rs.8000 for gas cylinder for different hour as per interaction</b>		0.29		0.30		0.32		0.30
	<b>b) Interest on fixed cost @10% on Rs.8000 for gas cylinder for different hour as per interaction</b>		0.029		0.030		0.032		0.030
	<b>c) Total fixed cost (a+b)</b>		0.32		0.33		0.35		0.33

<b>C</b>	<b>Total cost (total variable cost + total fixed cost) in Rs.</b>	13949.36	13466.7	14150.19	14306.09
<b>D</b>	<b>Cost of production for 100 g preserve in jar in Rs.</b>	13.95	13.47	14.15	14.31
<b>E</b>	<b>Sell price of 100 g preserve in Rs.</b>	20	20	21	20
<b>F</b>	<b>Net profit for 100g snapmelon preserve in Rs.</b>	6.05	6.53	6.85	5.69
<b>G</b>	<b>Benefit : cost</b>	1.43	1.48	1.48	1.39

## **CHAPTER V**

### **SUMMARY AND CONCLUSION**

The present investigation was undertaken on “Standardization of osmodehydrated slices and preserve making technology in snapmelon (*Cucumis melo var. momordica* L.)” and it was conducted at Olericulture Laboratory and Fruit Processing Unit of College of Horticulture, Dapoli of Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Dist. Ratnagiri during the year 2019-2020. Both the experiments under study were carried out in factorial completely randomized design (FCRD) with four maturity stages of snapmelon fruit and three sugar syrup concentrations.

**Expt.No.1. Standardization of osmodehydrated slices making technology from different maturity stages of snapmelon**

**Expt.No.2. Standardization of preserve making technology from different maturity stages of snapmelon**

Findings of the present investigation are summarized below:

**5.1 Changes in chemical composition of snapmelon osmodehydrated slices during storage under ambient temperature (27-29°C) condition.**

In the present study of snapmelon osmodehydrated slices, T.S.S. and titratable acidity was found to be decreased, whereas reducing sugars, total sugars and moisture was increased during storage of 6 months.

Among the four maturity stages, at the 6 months storage treatment M<sub>2</sub> (turning stage) was found be best with respect to

T.S.S. as this treatment was significantly superior over all other treatments. Also this treatment showed best results with respect to total and reducing sugars. The treatment M<sub>4</sub> (over ripe stage) was found be best with respect to titratable acidity and treatment M<sub>3</sub> (ripe stage) was found be best with respect to moisture. Hence, in the study of changes in chemical composition of snapmelon osmodehydrated slices during storage, treatment M<sub>2</sub> (turning stage) was found to be best with respect to maturity stages.

In case of sugar syrup concentrations, S<sub>3</sub> (60 °B) was found to be best with respect to T.S.S. as this treatment was significantly superior over all other treatments at the end of storage. Also this treatment showed best results with respect to total and reducing sugars. The treatment S<sub>1</sub> (40 °B) was found be best with respect to titratable acidity and treatment S<sub>2</sub> (50 °B) was found be best with respect to moisture. Hence, in the study of changes in chemical composition of snapmelon osmodehydrated slices during storage, treatment S<sub>3</sub> (60 °B) was found to be best with respect to sugar syrup concentrations.

In case of interactions of maturity stages and sugar syrup concentration, at 6 months storage interaction M<sub>2</sub>S<sub>3</sub> showed best results with three chemicals parameters (T.S.S., reducing sugars and total sugars) out of five. Interaction M<sub>4</sub>S<sub>1</sub> showed best result with titratable acidity and interaction M<sub>3</sub>S<sub>1</sub> showed best result with moisture. Hence, looking to the above findings interaction M<sub>2</sub>S<sub>3</sub> showed best results with respect to changes in chemical parameters of sanpmelon osmodehydrated slices during storage, followed by M<sub>4</sub>S<sub>1</sub> and M<sub>3</sub>S<sub>1</sub>.

## **5.2 Changes in sensory quality of snapmelon osmodehydrated slices during storage under ambient temperature (27-29°C) condition.**

In the present study of snapmelon osmodehydrated slices, the sensory scores for colour, flavour, texture and overall acceptability were found to be decreased during storage of 6 months.

Among the four maturity stages, treatment M<sub>2</sub> (turning stage) recorded maximum score for colour and flavour. However, treatment M<sub>1</sub> (mature green stage) recorded maximum score for texture and overall acceptability at the end of 6 months storage. Hence, in the study of changes in sensory quality of snapmelon osmodehydrated slices during storage with respect to maturity stages treatment M<sub>1</sub> (mature green stage) was found to be best as it recorded highest overall acceptability score.

In case of sugar syrup concentrations, S<sub>2</sub> (50<sup>0</sup>B) was found to be best with respect to colour and overall acceptability score at the end of storage. Treatment S<sub>1</sub> (40<sup>0</sup>B) recorded best results with flavour and texture score. Hence, in case of sugar syrup concentration treatment S<sub>2</sub> (50<sup>0</sup>B) was found to be best as it recorded highest overall acceptability score.

Among different interactions of maturity stages and sugar syrup concentration, interaction M<sub>1</sub>S<sub>1</sub> (mature green stage and 40<sup>0</sup>B) recorded maximum score for texture and overall acceptability after 6 month storage period. Interaction M<sub>2</sub>S<sub>2</sub> (turning stage and 50<sup>0</sup>B) recoded best results with colour score and M<sub>2</sub>S<sub>1</sub> (turning stage and 40<sup>0</sup>B) was found to be best with respect flavour score. Hence, interaction M<sub>1</sub>S<sub>1</sub> (mature green stage and 40<sup>0</sup>B) was found to be best with respect to sensory quality as it recorded maximum overall acceptability score.

### **5.3 Microbial count of snapmelon osmodehydrated slices during storage under ambient temperature (27-29°C) condition.**

In the present study of snapmelon osmodehydrated slices, fungal and bacterial count was found to be increased during storage of 6 months.

Among the four maturity stages, treatment M<sub>1</sub> (mature green stage) and M<sub>2</sub> (turning stage) were found to be best with respect to fungal count as fungal growth was not detected till 6 months storage. The treatment M<sub>1</sub> (mature green stage), M<sub>2</sub> (turning stage) and M<sub>3</sub> (ripe stage) was found to be best with respect to bacterial count as bacterial growth was not detected till 6 months storage. Hence, in the study of changes in microbial count of snapmelon osmodehydrated slices during storage, treatment M<sub>1</sub> (mature green stage) and M<sub>2</sub> (turning stage) were found to be best with respect to maturity stages.

In case of sugar syrup concentrations, S<sub>2</sub> (50 °B) and S<sub>3</sub> (60 °B) were found to be best with respect to fungal count as these treatments recorded lowest fungal count at the end of storage. The treatment S<sub>3</sub> (60 °B) was found to be best with respect to bacterial count. Hence, in the study of changes in microbial count of snapmelon osmodehydrated slices during storage, treatment S<sub>3</sub> (60 °B) was found to be best with respect to sugar syrup concentrations.

Among different interactions tried, in the interactions M<sub>1</sub>S<sub>1</sub>, M<sub>1</sub>S<sub>2</sub>, M<sub>1</sub>S<sub>3</sub>, M<sub>2</sub>S<sub>1</sub>, M<sub>2</sub>S<sub>2</sub>, M<sub>2</sub>S<sub>3</sub>, M<sub>3</sub>S<sub>2</sub> and M<sub>3</sub>S<sub>3</sub> does not showed any fungal growth at the end of 6 months storage. In case of bacterial count interactions M<sub>1</sub>S<sub>1</sub>, M<sub>1</sub>S<sub>2</sub>, M<sub>1</sub>S<sub>3</sub>, M<sub>2</sub>S<sub>1</sub>, M<sub>2</sub>S<sub>2</sub>, M<sub>2</sub>S<sub>3</sub>, M<sub>3</sub>S<sub>1</sub>, M<sub>3</sub>S<sub>2</sub>, M<sub>3</sub>S<sub>3</sub> and M<sub>4</sub>S<sub>3</sub> does not showed any bacterial growth at the end of 6 months storage.

#### **5.4 Cost of production of snapmelon osmodehydrated slices.**

In case of interactions of maturity stages and sugar syrup concentration, the minimum cost of production for 50 g osmodehydrated slices was recorded in interaction  $M_1S_1$  (Rs.17.37) with maximum (Rs.22.63) net profit, followed by  $M_1S_2$  (Rs.21.15). Highest benefit:cost ratio was recorded by interaction  $M_1S_1$  (2.30) followed by  $M_1S_2$  (2.10),  $M_1S_3$  (2.04) and  $M_2S_1$  (1.98).

#### **5.5 Changes in chemical composition of snapmelon preserve during storage under ambient temperature (27-29°C) condition.**

In the present study of snapmelon preserve, T.S.S., total sugars and titratable acidity was found to be decreased, whereas reducing sugars was found to be increased and moisture was found to first increased and then decreased during storage of 6 months.

Among the four maturity stages, treatment  $M_2$  (turning stage) was found be best with respect to T.S.S. as this treatment was significantly superior over all other treatments. Also this treatment showed best results with respect to total and reducing sugars. Treatment  $M_1$  (mature green stage) was found be best with respect to titratable acidity and treatment  $M_4$  (over ripe stage) was found be best with respect to moisture. Hence, in the study of changes in chemical composition of snapmelon preserve during storage, treatment  $M_2$  (turning stage) was found to be best with respect to maturity stages.

In case of sugar syrup concentration, 80 °B ( $S_3$ ) was found to be best with respect to T.S.S. as this treatment was significantly superior over all other treatments at the end of storage. Also this treatment showed best results with respect to

total sugars, reducing sugars and moisture. Treatment S<sub>1</sub> (60 °B) was found to be best with respect to titratable acidity. Hence, in the study of changes in chemical composition of snapmelon preserve during storage, treatment S<sub>3</sub> (80 °B) was found to be best with respect to sugar syrup concentrations.

In case of interactions of maturity stages and sugar syrup concentration at 6 months storage, interaction M<sub>2</sub>S<sub>3</sub> showed best results with three chemical parameters (T.S.S., reducing sugars and total sugars) out of five. Interaction M<sub>1</sub>S<sub>1</sub> showed best result with titratable acidity and interaction M<sub>4</sub>S<sub>3</sub> showed best result with moisture. Hence, looking to the above findings interaction M<sub>2</sub>S<sub>3</sub> showed best results with respect to changes in chemical parameters of snapmelon preserve during storage, followed by M<sub>1</sub>S<sub>1</sub> and M<sub>4</sub>S<sub>3</sub>.

### **5.6 Changes in sensory quality of snapmelon preserve during storage under ambient temperature (27-29°C) condition.**

In the present study of snapmelon preserve, the sensory scores for colour, flavour, texture and overall acceptability were found to be decreased during storage of 6 months.

Among the four maturity stages, treatment M<sub>4</sub> (over ripe stage) recorded maximum score for colour. Treatment M<sub>3</sub> (ripe stage) recorded maximum score for flavour. However, treatment M<sub>1</sub> (mature green stage) recorded maximum score for texture and overall acceptability at the end of 6 months storage. Hence, in the study of changes in sensory quality of snapmelon preserve during storage, treatment M<sub>1</sub> (mature green stage) was found to be best among different maturity stages as it recorded highest overall acceptability score.

In case of sugar syrup concentrations, S<sub>2</sub> (70°B) was found to be best with respect to colour, flavour, texture and overall

acceptability score at the end of storage. Hence, in case of sugar syrup concentration treatment S<sub>2</sub> (70 °B) was found to be best with respect to sugar syrup concentrations.

Among different interactions of maturity stages and sugar syrup concentration, interaction M<sub>1</sub>S<sub>2</sub> (mature green stage and 70 °B) recorded maximum score for texture and overall acceptability after 6 month storage period. Interaction M<sub>4</sub>S<sub>2</sub> (over ripe stage and 70 °B) and M<sub>4</sub>S<sub>3</sub> (over ripe stage and 80 °B) recoded best results with colour score and M<sub>3</sub>S<sub>2</sub> (ripe stage and 70 °B) was found to be best with respect flavour score. Hence, interaction M<sub>1</sub>S<sub>2</sub> (mature green stage and 70 °B) was found to be best with respect to sensory quality.

### **5.7 Microbial count of snapmelon preserve during storage under ambient temperature (27-29°C) condition.**

In the present study of snapmelon peserve, fungal and bacterial count was found to be increased during storage of 6 months.

Among the four maturity stages, treatment M<sub>1</sub> (mature green stage) and M<sub>2</sub> (turning stage) were found be best with respect to fungal count as these treatments recorded lowest fungal count at the end of storage. The treatment M<sub>2</sub> (turning stage) was found be best with respect to bacterial count as this treatment recorded lowest bacterial count at 6 months storage. Hence, in the study of changes in microbial count of snapmelon preserve during storage, M<sub>2</sub> (turning stage) were found to be best with respect to maturity stages.

In case of sugar syrup concentrations, S<sub>3</sub> (80 °B) was found to be best with respect to fungal count, as fungal growth was not detected till 6 months storage. The treatment S<sub>3</sub> (80 °B) was

found be best with respect to bacterial count as this treatment recorded lowest bacterial count at 6 months storage. Hence, in the study of changes in microbial count of snapmelon preserve during storage, treatment S<sub>3</sub> (80 °B) was found to be best with respect to sugar syrup concentrations.

Among different interactions tried, interactions M<sub>1</sub>S<sub>2</sub>, M<sub>1</sub>S<sub>3</sub>, M<sub>2</sub>S<sub>2</sub>, M<sub>2</sub>S<sub>3</sub>, M<sub>3</sub>S<sub>3</sub> and M<sub>4</sub>S<sub>3</sub> does not showed any fungal growth at the end of 6 months storage. In case of bacterial count interactions M<sub>1</sub>S<sub>3</sub>, M<sub>2</sub>S<sub>2</sub> and M<sub>2</sub>S<sub>3</sub> also dose not showed any bacterial growth.

### **5.8 Cost of production of snapmelon preserve.**

In case of interactions of maturity stages and sugar syrup concentration, the minimum cost of production for 100 g preserve was recorded in interaction M<sub>1</sub>S<sub>1</sub> (Rs.11.98) and maximum (Rs.11.70) net profit was obtained from interaction M<sub>1</sub>S<sub>2</sub> followed by M<sub>2</sub>S<sub>2</sub> (Rs.11.22). Highest benefit:cost ratio was recorded by interaction M<sub>1</sub>S<sub>2</sub> (1.95) followed by M<sub>1</sub>S<sub>1</sub> (1.92).

### **Conclusion:**

In the first experiment on preparation of snapmelon osmodehydrated slices, from the above findings it is concluded that interaction M<sub>1</sub>S<sub>1</sub> (mature green stage and 40 °B sugar syrup concentration) was found to be best followed by M<sub>2</sub>S<sub>1</sub> (turning stage and 40 °B sugar syrup concentration). However, same experiment required to be done again to confirm the results.

In the second experiment on preparation of snapmelon preserve, from the above findings it is concluded that interaction M<sub>1</sub>S<sub>2</sub> (mature green stage and 70 °B sugar syrup concentration) was found to be best. However, same experiment required to be done again to confirm the results.

## LITERATURE CITED

- Ahire, A. A. (1989). Studies on the development of preserved products from guava (*Psidium guajava* L.). M.Sc. (Agri.) thesis submitted to Mahatma Phule Krishi Vidyapeeth, Rahuri (M.S.).
- Ahmad, S. and N. Kumaran (2015). Studies on the effects of honey incorporation on quality and shelf life of aonla preserve. *Cogent Food and Agriculture*. **1** (1): 1-8.
- Aina J. O. and O. O. Oladunjoye (1993). Respiration, proteolytic activity and textural changes in ripening African Mango (*Irvingia gobenesis*) fruit. *Journal of Science of Food and Agriculture*. **63**: 451-454.
- Akhtar J., I. Banoa, R. K. Pandey, A. Hussain and S. Malik (2014). Effect of different levels of pectin and starch on quality and storage stability of apple-date fruit bar. *Journal of food product development and packaging*, **1**:31-36.
- Amerine, M. A., R. M. Pangborn and E. B. Rocssler (1965). Principles of sensory evaluation of food. *Academic press, London*.
- Amitabh, R. D. Singh and M. C. Tomar. (2000). Studies of osmotic dehydration of some mango varieties grown in uttar pradesh. *Indian food packer*, **54**(3): 66-70.
- Anonymous, (2013). Vegetable statistics. Technical bulletin no. 51. Indian Institute of Vegetable Research, Varanasi, U.P.
- Anonymous, (2018). Horticultural statistics at a glance 2018. Horticulture Statistics Division, Ministry of Agriculture & Farmers' Welfare, Government of India.

- A.O.A.C. (1975). Official method of analysis. Association of official analytical chemists. Washington, D.C., 12th Edn. pp 15 –18.
- Aparna, G. S., P. R. Geetha Lekshmi, C. Mini and T. C. Thushara (2018). Studies on sensory attributes and microbial analysis of stored osmo dehydrated bilimbi (*Averrhoa bilimbi*). *Asian J. Dairy and Food Res*, **37** (2) 2018:154-157.
- Aree J. (1987). Study on growth and development, biochemical changes and harvesting indices of mango (*Mangifera indica* L.) cv. Nang Klangwun. Bangkok (Thailand), 64 leaves.
- Azeredo, H. M. C., E. S. Brito, G. E. Moreira, V. L. Farias and L. M. Bruno (2006). Effect of drying and storage time on the physicochemical properties of mango leather. *International journal of food science and technology*, **41**:635-638.
- Babariya, V. J., A. N. Makwana, M. Hadwani and N. Panjiar (2014). Standardization of a recipe for the preparation of candy (Tuti Fruiti) from unripe papaya. *The Asian Journal of Horticulture*, **9**(1) June, 2014:94-99.
- Barve, S. A. (2001). Studies on maturity indices, some aspects of post-harvest handling and processing of snapmelon (*Cucumis melo var. momordica*). A M. Sc. (Agri) thesis submitted to Konkan Krishi Vidyapeeth, Dapoli, Dist. Ratnagiri, Maharashtra State.
- Basnet, S. (2017). Effect of pretreatments on quality of amla (*Phyllanthus Emblica*) preserve. B. Tech. in Food Technology thesis submitted to Department of food

technology, central campus of technology, Tribhuvan University, Nepal.

- Bhattacharjee, A. K., A. Dikshit, S. Kumar and D. K. Tandon (2013). Quality of aonla candy and segments-in-syrup prepared from steep preserve fruits in water. *Indian Journal of Natural Products and Resources*, March, 2013 **4**(1):119-122.
- Bisen, B. P., P. Y. Tembhrane and S. Chouksey (2017). Standardization of recipes and acceptability of value added products of aonla (*Emblica Officinalis*) pulp. *International journal of agriculture sciences.*, **9**(18): 2017.
- Chachad, S. S. (1995). Studies on maturity indices, some aspects of post-harvest handling and processing of watermelon (*Citrullus lanatus*) Cv. Sugar baby. A M. Sc. (Agri) thesis submitted to Konkan Krishi Vidyapeeth, Dapoli, Dist. Ratnagiri, Maharashtra State.
- Chakravarty, H. L. (1982). Fascicles of Flora of India – II cucurbitaceae, *Botanical Survey of India*, PP. 136.
- Chandra, P. (2010). Studies on physico-chemical characteristics, sensory quality and storage behaviour of karonda preserve. A M.Sc. (Agri.) thesis submitted to Indira Gandhi Krishi Vishwavidyalaya, Raipur.
- Chaudhari, A. P., K. P. Dhake and M. R. Bari (2015). Osmotic dehydration of pineapple. *International Journal in IT and Engineering*, **3**(4): (April, 2015).
- Chavan, U. D., A. E. Prabhukhanolkar, V. D. Pawar (2010). Preparation of osmotic dehydrated ripe banana slices. *J Food Sci Technol*, **47**(4):380–386.

- Corey, K. A. and D. V. Schlimme (1988). Relationship of rind gloss and groundspot colour to flesh quality of watermelon fruits during maturation. *Scientia Hort.*, **34**: 211-218.
- Daisy and R. Gehlot (2006). Physical and bio-chemical differences in fresh aonla fruits and preserve of cv. Banarasi and Chakaiya. *Journal of Horticultural Sciences*, **35** (1): 57-59.
- Deshi, N. S. and D. S. Padda (1962). Place of vegetable in human diet. *Punjab Hort. J.*, **11** (2): 147-148.
- Dhakal, D. and M. Pradhananga (2017). Utilization of watermelon rind (by product) in preparation of candy and its quality evaluation. *International journal of multidisciplinary papers 2017*; **2** (1): 1-6.
- Dhavan, S. S. (1990). Studies on post-harvest technology of ber (*Zizyphus mauritiana* L.). Ph.D. thesis, Haryana Agricultural University, Hissar.
- Dhiman, A. K., A. Sharma, L. Devi and S. Attri (2018). *Pyrus serotina*: a himalayan wild pear fruit utilized for preparation of whole fruit preserve. *International journal of agriculture sciences*, **10**(7): 2018.
- Dhumal, R. D. (2016). Studies on post-harvest handling and juice extraction methods of aonla (*Emblica officinalis* Gaertn.) fruits. M.Sc. thesis submitted to Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli.
- Durrani, A. M. and S. Verma (2011). Preparation and quality evaluation of honey amla murabba. *Journal of Industrial Research and Technology*, **1**(1):40-45.

- Dwivedi, S. K and A. Pandey (2017). Development of protocol for preparation and preservation of ginger flavoured aonla candy for nutritional and biochemical evaluation. *The Pharma Innovation Journal* , **6**(11): 78-83.
- Emamifar, A. (2010). Evaluation of nanocomposite packaging containing Ag and ZnO on shelf life of fresh orange juice. *Innovative Food Science and Emerging Technologies*, **11**:742-748.
- Escriche, I., R. Garcia-Pinchi, J. M. Carot and J. A. Serra (2002). Comparison of must and sucrose as osmotic solutions to obtain high quality minimally processed kiwi fruit (*Actinidia chinensis* P.) slices. *Int. J. Food. Sci. Technol.*, **37**:87-95.
- Gade, G. S. (2017). Development of process for preparation of ber (*Ziziphus mauritiana* L.) *tuti fruiti*. A M.Sc. thesis submitted to Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli.
- Gaikwad, G. P., A. R. Sawate, R. B. Kshirsagar, S. J. Veer and R. P. Mane (2019). Studies on development and organoleptic evaluation of sweetener-based carrot preserve. *The pharma innovation journal*, **8**(3): 340-343.
- Garande, V. K. (1992). Studies on maturity indices, storage and processing of jamun (*Syzygium cumini* skeels) fruits. A M. Sc. (Agri) thesis submitted to Konkan Krishi Vidyapeeth, Dapoli, Dist. Ratnagiri, Maharashtra State.
- Gawale, (2014). Studies on preparation of blended pineapple-papaya leather. A M. Sc. thesis submitted to Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli. (Unpublished).

- Ghadge A. J. (2013). Studies on effect of osmotic dehydration on quality and shelf life of ripe banana (*Musa paradisiac* L.) slices. M.Sc. thesis submitted to Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli. (Unpublished).
- Ghanwat, A. B., V. S. Khandare and S. J. Syed (2019). Effect of various treatments on physico-chemical composition of indian gooseberry (*Emblica officinalis*) candy during storage. *Journal of Pharmacognosy and Phytochemistry*, **8**(4): 2580-2586.
- Gharoskar, P. B. (2014). Studies on preparation of sapota (*Manilkara achras*) spicy nectar. M.Sc. thesis submitted to Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli.
- Ghosh, S. K., R. S. Dhua and S. K. Mintra (1985). Studies on physico-chemical characteristics of some mango cultivars grown at West Bengal. *Indian Fd. Packer*, **39** (1): 46-50.
- Gosavi, P. G. (1998). Studies on drying and utilization of dried kokam (*Garcinia indica* Choisy) and karonda (*Carissa carandas* L.) fruits. A M.Sc. (Agri.) thesis submitted to the Konkan Krishi Vidyapeeth, Dapoli, Dist. Ratnagiri, Maharashtra State.
- Gurumeenakshi, G. and N. Varadharaju (2019). Effect of pretreatment on the quality characteristics of osmodried mango slices. *Int. J. Curr. Microbiol. App. Sci.*, **8**(11): 1905-1910.
- Hiremath, J. B. and A. K. Rokhade (2012). Preparation of sapota candy. *International Journal of Food, Agriculture and Veterinary Sciences*, 2277-209.

- Hussain, A., M. A. Sumrah, A. Akhtar, S. H. Mahfooz and M. A. Tariq (2019). Effect of maturity stage of olive fruit on quality of olive products. *International Journal of Horticultural Science and Technology*, **6** (2): 159-165.
- Jadhav, R. A. (2017). Studies on post harvest handling and processing of kokum (*Garcinia indica* Choisy) fruits. M.Sc. thesis submitted to Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli.
- Jain, K. M., V. K. Tripathi, H. B. Ram and S. Singh (1983). Optimum stage of maturity for preparation of aonla preserve. *Indian Food Packer*, **37**(6):85-90.
- Jangle A. R. (2013). Effect of combined processes of osmotic dehydration and freezing on papaya (*Carica papaya*) cubes. M.Sc. thesis submitted to Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli.
- Jeffrey, C. (1983). Proc. conference on the biology and chemistry of cucurbitaceae. Cornell University, Ithaca, New York, August, 1980.
- Jyothi, M. L. (2000). Variability and character association analysis of pickling type mango. Ph. D. thesis. Dept. of Hort., Kerala Agric. Univ. pp.22-33.
- Kenghe, R. N. (2016). Effect of machine pricked aonla (*Phyllanthus emblica* G.) on preparation and storage of candy. *Engineering and Applied Sciences*, **1**(3): 54-58.
- Khan, S., W. Ali, T. Kamal, M. U. Khan and S. Gul (2016). Preservation of mango slices in sucrose solution with various concentrations. *J. Food Microbiol Saf. Hyg, an open access journal*, **1**(2): 2476-2059.

- Khanom, S. A. A., M. Rahman and M. B. Uddin (2015). Preparation of pineapple (*Ananas comosus*) candy using osmotic dehydration combined with solar drying. *A Scientific Journal of Krishi Foundation*, **13**(1): 87-93.
- Kiranmai, E., K. Rajeswari, S. Sharma and U. K. Maheswari (2018). Standardization and development of tamarind candy by blending with mango pulp. *Journal of pharmacognosy and phytochemistry*, **7**(2): 2042-2047.
- Kolambe, S. C. (2018). Studies on storage of firm flesh jackfruit bulbs and preparation of wine from soft flesh jackfruit. A M.Sc. (Agri.) thesis submitted to the Konkan Krishi Vidyapeeth, Dapoli, Dist. Ratnagiri, Maharashtra State.
- Koprivica, G. B., L. L. Pezo, B. L. Curcic, L. B. Levic and D. Z. Suput (2013). Optimization of osmotic dehydration of apples sugar best molasses. *Journal of food processing and preservation*, 1745-4549.
- Kore, P. N., V. Singh, R. B. Kadu, M. Makhmale and L. Yadav (2017). Standardization of recipe and drying method for candy making of ber (*Zizyphus mauritiana* L.) Cv. umran. *International Journal of Research in Applied, Natural and Social Sciences*, **5**(9): 143-146.
- Kore, P. N., V. Singh, C. R. Bharodia, H. Y. Maheta, P. A. Maheriya and L. Yadav (2017 a). Standardization of recipe and drying method for candy making of aonla (*Emblica Officinalis* G.) Cv. Gujarat Aonla-1. *International Journal of Agricultural Science and Research*, **7**(4): 605-608.
- Korgaonkar, M. D., K. H. Pujari and V. R. Morgaonkar (2015). Effect of different varieties of snapmelon on chemical and

sensory properties of syrup. *IOSR Journal of Agriculture and Veterinary Science*, **8** (4): 04-07.

Krishnamoorthy G. V., N. L. Jain and B. S. Bhatia (1960). Changes in the physio-chemical composition of mangoes during ripening after packaging. *J. Food Sci.*, **9**: 277.

Kshirsagar, P. B. (2004). Studies on fruiting and some aspects of post-harvest handling of some promising varieties of mango (*mangifera indica* L.). A M.Sc. (Agri.) thesis submitted to the Konkan Krishi Vidyapeeth, Dapoli, Dist. Ratnagiri, Maharashtra State.

Kumar, S. P., V. R. Sagar and U. Singh (2008). Effect of ripening stages osmo-dehydrated guava slices. *J. Food Sci. Technol.*, **45**(6):546-548.

Kumar, P. S., V. R. Sagar and Lata (2008 a). Quality of osmo-vac dehydrated ripe mango slices influenced by packaging material and storage temperature. *Journal of Scientific and Industrial Research*, **67**, Dec.2008, pp. 1108-1114.

Lane, J. H. and Eynon (1923). Determination of reducing sugar by fehling solution with methylene blue as a internal indicator. *J. Soil Science and Chemistry. Ind.*, **42**: 32.

Lauren, K. M. and N. Badrie (2005). Consumer acceptance and physicochemical quality of osmodehydrated carambola (*Averrhoa carambola* L.) slices. *International Journal of Consumer Studies*, January, 2006 16–24.

Lingala, S., K. Vanajalatha, A. S. Padmavathamma and P. V. Rao (2015). Studies on sensory evaluation and microbial count of osmodried karonda (*Carissa carandas* L.). *Asian J. Dairy and Food Res.*, **34**(2):141-145.

- Mali, P. C. (1999). Studies on maturity indices and aspects of post harvest handling and processing of papaya (*Carica papaya* L.) cv. Red lady. A M.Sc. (Agri.) thesis submitted to the Konkan Krishi Vidyapeeth, Dapoli, Dist. Ratnagiri, Maharashtra State.
- Mandal U., S. K. Mandal and B. C. Mazumdar (1993). Comparative fruit development studies of two mango varieties in the Western Lateritic Zone of West Bengal. *Indian Biol.*, **25** (2): 69-71.
- Martinez-Valencia, B. B., M. Abud-Archila, M. A. Ruiz-Cabrera, A. Grajales-Lagunes, L. Dendooven, S. L. Ovando-Chacon and F. A. Gutierrez-Miceli (2011). Pulsed vacuum osmotic dehydration kinetics of melon (*Cucumis melo* L.) var. cantaloupe. *African Journal of Agriculture Research*, **6**(15): 3588-3596.
- Mondal, S. C., M. Kamal, M. I. Mumin, M. Hosain and R. Ali (2017). Effect of sucrose on the physicochemical properties, organoleptic qualities and shelf-life stability of aonla (*Emblica Officinalis*) candy. *IOSR Journal of Environmental Science, Toxicology and Food Technology*, **11**(12): 85-94.
- More, T. A. (1999). Breeding muskmelon (*Cucumis melo*. L) resistance to diseases. In: Souvenir and Abstr. National Symposium on crop pest management. Challenge for Next Millenium. MPKV, Rahuri, India 27-28 November. 16.
- Moreira, R. and A. M. Sereno (2003). Evaluation of mass transfer coefficient and volumetric shrinkage during osmotic dehydration of apple using sucrose solutions in static and non-static condition. *J. Food. Eng.*, **57**:25-31.

- Nayak, P., D. K. Bhatt, D. K. Shukla and D. K. Tandon (2011). Evaluation of aonla (*Phyllanthus Emblica* G.) segments-in syrup prepared from stored fruits. *Research Journal of Agricultural Science*, **43** (2), 2011.
- Nayak, P., D. K. Tandon and D. K. Bhatt (2012). Study on changes of nutritional and organoleptic quality of flavoured candy prepared from aonla (*Emblica officinalis* G.) during storage. *International journal of nutrition and metabolism*, **4**(7):100-106.
- Nazaneen, N. S., A. K. Senapati, N. Kumar and R. V. Tank (2015). Study on osmotic dehydration of pineapple cubes. *Trends in Bioscience*, **8**(1): 2015, 242-247.
- Panase, V. G. and P. V. Sukhatme (1985). Statistical methods for agricultural workers, I. C. A. R., New delhi.
- Panda, P., M. K. Garg, S. Jain and R. B. Grewal (2005). Osmo-air drying of grapes (cv.Perlette) for raisin preparation. *Beverages and food world*.
- Pandey, R. M., M. M. Rao and R. N. Singh (1974). Biochemical Changes in developing mango fruit (*Mangifera indica* L.) cv. Dashehari. *Prog. Hort.*, **5**:47-59.
- Parekh, B. V. (2015). Studies on physical and biochemical changes during growth of some mango (*Mangifera indica* L.) cultivars. M.Sc. thesis, submitted to Fruit Science Dept., ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari.
- Patel, K. K. (2012). Effect of aonla varieties and pre- treatment on quality of aonla preserve during storage. M. Sc. (Horti)

thesis submitted to Rajmata Vijayraje Scindia Krishi Vishwa Vidyalaya, Gwalior.

- Patel, K. K., R. Gupta and V. S. Kuchi (2013). Study of organoleptic quality on aonla murabba during storage. *Asian J. Dairy and Food Res.*, **33** (1): 67- 70.
- Phisut, N., M. Rattanawedee, and K. Aekkasak, (2013). Effect of osmotic dehydration process on the physical, chemical and sensory properties of osmo-dried cantaloupe. *International food research journal*, **20**(1):189-196.
- Priya, M. D. and B. S. Khatkar (2013). Effect of processing methods on keeping quality of aonla (*Emblica officinalis* G.) preserve. *International Food Research Journal*, **20**(2): 617-622.
- Ragone, D. and G. C. Catherine (2006). Sensory evaluation of fruit quality and nutritional composition of 20 breadfruit. *Economic Botany*, **60**(4), 2006, 335-346.
- Rahman, M., M. G. Miaruddin, F. Chowdhury, H. H. Khan and M. E. Rahman (2012). Preservation of jackfruit (*Artocarpus heterophyllus*) by osmotic dehydration. *Bangladesh J. Agril. Res.*, **37**(1): 67-75, March 2012.
- Rai, S., R. K. Pal and K. S. Jayachandran (2007). Optimization of process parameters for osmotic dehydration of pineapple slices. *Indian J. Hort.*, **64**(3):304-308.
- Ranganna, S. (1986). Handbook of analysis and quality control for fruit and vegetable products, 2<sup>nd</sup> Edn. *Tata McGraw – Hill Publishing company ltd.*, New delhi.
- Ranote, P. S., R. K. Hothe and A. S. Bawa (2002). Preparation, evaluation and storage of preserve made from amla

- cultivars grown in khandi area of Punjab state. *J. of scientific and industrial res.*, **61**: 461-465.
- Rashmi, H. B., Doreyappa gowda and G. K. Mukanda (2005). Studies on osmo-air dehydration of pineapple fruits. *J. Food Sci. Technol.*, **42**:64-67.
- Rodrigues, A. C. C., L. M. Pereira, C. I. G. L. Sarantopoulos, H. M. A. Bolini, R. L. Chuha, V. C. A. Junqueira and M. D. Hubinger (2006). Impact of modified atmosphere packaging on the osmodehydrated papaya stability. *Journal of food processing and preservation*, **30**:563-581.
- Sablani, S. S. and M. S. Rahman (2003). Effect of syrup concentration, temperature and simple geometry on equilibrium distribution coefficients during osmotic dehydration of mango. *Food Res. Int.*, **36**:65-71.
- Sagar, V. R., D. S. Khurdiya and A. K. Balkrishanan (1998). Effect of storage temperature and period of quality of dehydrated ripe mango slices. *J. Food. Sci. Technol.*, **35**(2):147-150.
- Samadia, D. K. (2003). Snapmelon production technology for arid and semi- arid regions *Int. J. Agri.*, 2003: 23-29.
- Sambandam, C. N. (1979). Inheritance of certain qualitative characters in muskmelon (*Cucumis melo* L.). *Annamalai Univ. Agric. Res.*, **9**: 41-44.
- Sawant, A. A., N. J. Thakor, N. R. Naik and K. R. Jalgaonkar (2011). Studies on osmotic dehydration of pineapple. *Beverages and Food World*, **38**(5):47-49 and 52.
- Selvakumar, R. (2011). Studies on osmotic dehydration of carrot (*Daucus carota*). A M. Sc. (Agri.) thesis submitted to

University of Agricultural Sciences, Bangalore, Karnataka State.

- Senesi, E., F. C. Lulgi, P. Caterina and R. L. Scalzo (2005). Influence of ripening stage on volatile composition, physiochemical indexes and sensory evaluation in two variety of muskmelon (*Cucumis melo* L. var. *reticulatus* naud). *Journal of the science of food and agriculture*, **85**(8): 1241-1251.
- Shamrez, B., S. Aftab, M. Junaid, N. Ahmed and S. Ahmed (2013). Preparation and evaluation of candies from citron peel. *IOSR Journal of Environmental Science, Toxicology And Food Technology*, **7** (4): PP 21-24.
- Sharma, S., Y. S. Dhaliwal and M. Kalia (1998). Candied apples: A New Perspective. *J. Food Sci. Technol.*, **35**(1):79-82.
- Sharma, E., A. Singh, Y. Singh, P. Singh, A. Sharma, R. K. Dohrey and J. Singh (2016). Studied on physico-chemical properties of osmo-dehydrated sweet potato slices during storage. *International Journal of Agriculture Sciences*, **8** (48).
- Shinde, K. A. (2016). Studies on osmodehydration of muskmelon (*Cucumis melo*). A M. Sc. (Agri.) thesis submitted to Konkan Krishi Vidyapeeth, Dapoli, Dist. Ratnagiri, Maharashtra State.
- Shinde, S. N. (2016a). Studies on standardization of karonda (*Carissa congesta* L.) leather. A M. Sc. thesis submitted to Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli.

- Singh, K., A. S. Bawa and J. Ahmed (2001). Dehydration of ginger slices. *Journal of Scientific and Industrial Research*, June 2001, 510-512.
- Singh, D., V. Bahadur, D. Wilson, E. S. Ttopno and A. Kerketta (2019). Value addition of aonla (*Emblica officinalis*) murabba with cardamom. *Int.J.Curr.Microbiol.App.Sci.*, **8**(12): 433-438.
- Solanke, S., S. Deshmukh and B. N. Patil (2018). Development of osmo-convective drying of sweet orange slices by using different osmotic agents. *International Journal of Chemical Studies*, **6**(5): 838-842.
- Taiwo, K. A., A. Angersbach, B. I. O. Ade-Omowayer and D. Knorr (2001). Effects of pretreatment on the diffusion kinetic and some quality parameters of osmotically dehydrated apple slices. *J. Agric. Food Chem*, **49**:2804-2811.
- Thakur, N. S., N. Thakur, A. Thakur and P. Kumar (2018). Standardization of method for the preparation of preserve from wild aonla (*Phyllanthus emblica* L.) fruits and its quality evaluation during storage. *International Journal of Chemical Studies*, **6**(1): 1841-1847.
- Tondon D. K. and S. K. Kalra (1983). Changes in sugars, starch and amylase activity during development of mango fruit cv. Dashehari. *J. Hort. Sci.*, **58** (3): 449-453.
- Tripura, T., T. Sarkar, M. Meduri and N. Datta (2017). Effect of packaging material and storage period on physico-chemical attributes of osmotic dehydrated ripe sapota slices. *Int. J. Curr. Microbiol. App. Sci.*, **6**(10): 1600-1611.

- Tyagi, M. and S. S. Dhawan (2017). Development of osmotic dehydrated aonla (*Emblica officinalis* G.). *Int. J. Curr. Microbiol. App. Sci.*, **6**(11): 1369-1374.
- Wanve B. V., K. H. Pujari and P. P. Relekar (2015). Studies on effect of osmotic dehydration on quality and storage behavior of ripe jackfruit bulbs (*Artocarpus heterophyllus* L.). *Eco. Env. and Cons.*, **21**(2):1083-1087.
- Whitaker, T. W. and G. N. Davis (1962). Cucurbits, Leonard Hill and *Inter Sci. Publ. Inc.*, :250.

**APPENDIX**  
**ABBREVIATIONS USED**

%	-	Per cent
/	-	Per
@	-	at the rate
°B	-	Degree brix
°C	-	Degree Celsius
Anon.	-	Anonymous
AT	-	Ambient temperature
CD	-	Critical difference
cm	-	Centimeter
<i>et al.</i>	-	et alia (and others)
etc.	-	Etcetera
Fig.	-	Figure
FCRD	-	Factorial completely Randomized Design
g	-	gram
i.e.	-	that is
kg	-	Kilogram
mg	-	milligram
ml	-	milliliter
mm	-	millimeter
No.	-	Number
NS	-	Non-significant