

# Development of Turmeric Based Sweetened Condensed Milk

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**Abstract:** Turmeric is reported to be beneficial for health but it also contains some phytochemicals having ill effect on health. The turmeric milk is well known for its health benefits like cold & cough, digestive system inflammation, cardiovascular disease etc. The preparations of turmeric milk however require long heating of milk along with turmeric powder. The aim of the present investigation was to prepare a phytochemical free turmeric powder and its incorporation in milk to develop a sweetened condensed milk so that the developed product can be used in instant preparation of turmeric milk. In the said work the phytochemicals from the turmeric powder was extracted using ethanol. The obtained powder was then incorporated in cow's milk at different level (0.1, 0.2, 0.4, 0.8 and 1.6 %) and subjected to heating till to obtain the turmeric based condensed milk. The prepared condensed milk samples were then subjected for sensory analysis and the level of incorporation was optimized to be 0.4 %. The developed turmeric based condensed milk was further studied for shelf life and found to have improved shelf life as compared to control sweetened condensed milk. However, the improvement in shelf life was found to be storage temperature dependent. At ambient and refrigerated temperature, the turmeric incorporated sweetened condensed milk had shown to be 1.6 times and 2 times greater shelf life as compare to control sweetened condensed milk.

**IndexTerms - Sweetened condensed milk, Turmeric, phytochemical, extraction, Shelf life.**

## I. INTRODUCTION

Milk is essential in our daily diet, it is pale liquid produced from mammary glands of mammals Silva P. H. F., 1997. It is the primary source of nutrition for infant mammals before they are able to digest other type of food. This liquid as secreted by cows, goats, or certain other animals Kassmran A and Rizvi SMA. 2013 and used by humans for food or as a source of butter, cheeses, yoghurt, Shrikhand, flavor milk, different types of milk and milk products etc. The dairy industry is fortunate to have a naturally wholesome food i.e. milk which can be processed easily and inexpensively into liquid milk products (skimmed milk, semi-skimmed milk, UHT milk, pasteurized milk, etc.), concentrated milk products (condensed milk, evaporated milk, Khoa, Mawa, Rabri etc.) or fermented/coagulated milk products (dahi/yoghurt, Kumiss, keifer, acidophilus milk, paneer/cheese, etc.) with superior nutritive qualities. People prefer more healthy and delicious foods according to their food habits and consumed it in different forms like fresh, boiled and/or processed Hussain M et al 2010. Not only of cattle, but also sheep, goats, yaks, water buffalo, horses, reindeer and camels. The largest producer and consumer of cattle and buffalo milk in the world is India.

Condensed milk is products obtained by evaporating part of the water of whole milk with or without addition of sugar. Milk has large water content. This makes it a bulk food resulting in problem of storage and refrigeration. To avoid this problem the method is used to remove the considerable part of water is condensed milk and dry milk. Unsweetened condensed milk is called as evaporating milk Board. Niir., 2000.

The occurrence of condensed milks belongs to the nineteenth century. In 1809, Nicholas Appert (1749-1840), a French Food scientist declared his invention of a means of preserving milk (without the admixture of sugar or other preservatives) by the innovative method Sweetened Condensed Milk means the product obtained by partial removal of water from milk of Cow and/or Buffalo with the addition of sugar or a combination of sucrose with other sugars or by any other process which leads to a product of the same composition and characteristics. The fat and/or protein content of the milk may be adjusted by addition and / or withdrawal of milk constituents in such a way as not to alter the whey protein to casein ratio of the milk being adjusted. It shall have pleasant taste and flavor free from off flavor and rancidity. It shall be free from any substance foreign to milk. FSSAI 2011.

Turmeric milk is well known product from ancient time for curing the diseases. But it required too much time for preparation. Condensed milk had limited shelf life. For avoid this problem I tried to prepared Turmeric incorporated Sweetened condensed milk is a delicious, healthy, semi solid sweet product. Condensed milk had shelf life up to 12 month remains same as it is when it is in sterile and canned packed condition if it is in open can condition get it spoil within 5 days under the refrigeration condition. After literature survey study shows that research work had been done on incorporation of Turmeric to prepare paneer and cheese. Turmeric is very good preservative for extending the shelf life of the product. The literature work was done on the extending the shelf life of paneer and cheese on addition of turmeric. Turmeric has Antioxidant, nutraceutical, ant mutagenic, anti-inflammatory, antidiabetic, antibacterial, antifungal, antiprotozoal, and antiviral, hypocholesteremic, preservative properties. Miquel J. et al 2002.

The traditional usages of turmeric in various conditions like biliary disorders, anorexia, cough. In present research, I was decided to work on phytochemical free Turmeric enriched sweetened condensed milk is instant functional food product because some plant phytochemicals are toxic they directly attacked on nervous system. Due to addition of turmeric the shelf life of sweetened condensed milk should be increase. This product is helpful for the patients who were suffering from cold, cough and chronic diseases, diabetes etc.

Present investigation is carried out with the aim to develop formulation of turmeric based sweetened condensed milk and to study its shelf life. Considering the Healthy, nutritious product and importance of enriched turmeric as Nutraceuticals, preservative in finished product. PET bottles were selected for packaging material due to good strength of Polyethylene terephthalate and high heat resistive capacity. Heat resistive capacity beneficial for sterilization of bottles. I was decided this aim and objective for preparation of healthy, nutraceutical based ready to eat instant food product. This gives the health benefits.

## II. MATERIALS AND METHODS

### 2.1 Ingredients:

For the sweetened condensed milk preparation Vikas brand pasteurized homogenized Cow Milk was used which is purchased from the local market of jalgaon. Cow milk were the main ingredient in present study and the Rajopuri variety of turmeric rhizomes was used for the preparation of turmeric powder which was purchased from local market of Sangli and good quality of sucrose (pure sugar) from jalgaon market were purchased. Good strength and heat resistant PET bottles for packaging were purchased from local market of Jalgaon.

### 2.2 Methods

In present work the analysis was carried out in pilot plant Department of Food Technology, University Institute of Chemical Technology, North Maharashtra University Jalgaon.

The various raw materials, their analysis and methods required in the present study they were done at departmental lab.

Physicochemical analysis	Method and instrument.
Milk Fat (%)	Gerber Method. Centrifuge Gerber 1995.
Lactose	S. Ranganna1995 Lactometer
Titrateable Acidity	S. Ranganna1995
Moisture (%)	S. Ranganna1995, Hot air oven
TSS	Kader, A. et al, 2003 Refractometer
TS	S. Ranganna1995
Ash (%)	S. Ranganna1995, Muffle furnace
Fat (%)	S. Ranganna1995, solvent extraction method
Total Sugar	S. Ranganna1995
Protein (%)	S. Ranganna1995, Protein analyzer (kjaldhal)
Crude fiber (%)	S. Ranganna1995, Crude fiber analyzer
Alcohol extract	S. Ranganna1995, Hot air oven

Table 2.1 Methods for the and Instruments Physicochemical analysis results.

### 2.3 Phytochemical extraction from raw turmeric rhizomes:

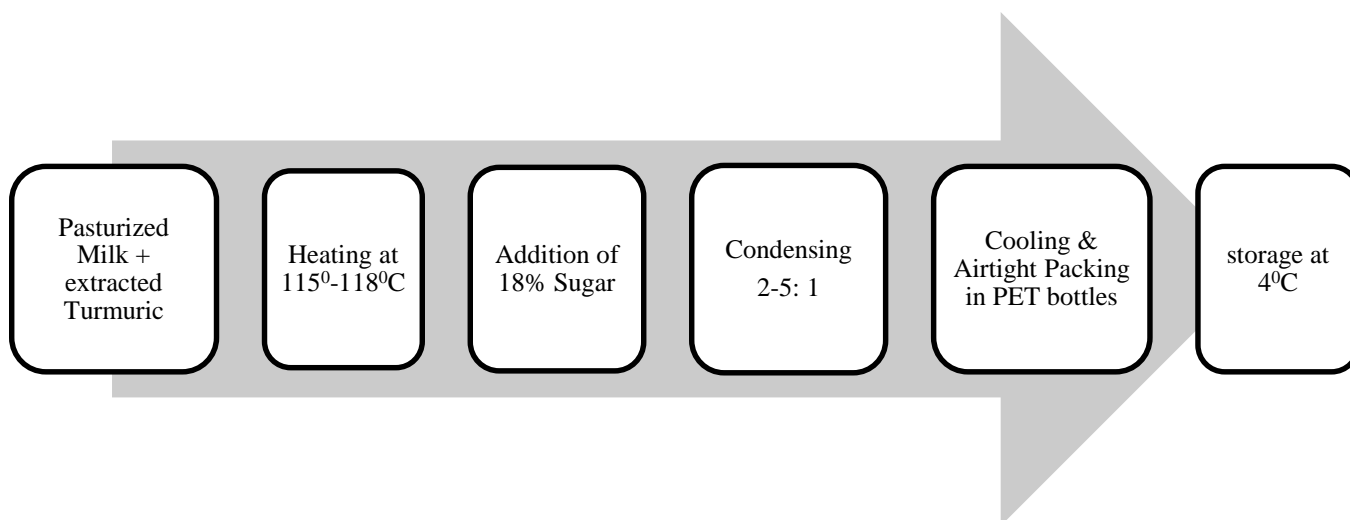
Raw rhizomes of Rajopuri type were taken from Sangli district. First raw rhizomes were washed by water. Boiled in water for curing. Dried in Hot air oven at 105°C. Ground it to form a fine powder.

Phytochemical extraction process of ground turmeric powder. For phytochemical extraction Soxhlet extraction process was used. Turmeric sample were packed in thimble and kept in Soxhlet siphon. 95 % ethanol was used as solvent. Boiled it at 80°C for 6 hours. After extraction, pure turmeric powder removed from thimble and kept it in hot air oven at 100°C for 5 min for evaporating the solvent traces.

Phytochemical analysis	Methods.
Terpenoids	(Agarwala, 2011)
Alkaloids	
phenols and tannins	
Flavonoids	
Saponins	

Table 2.2 Methods for the Phytochemical analysis results.

### 2.4 Preparation of turmeric incorporated sweetened condensed milk sample:



Sukumar De., 2001.

## 2.5 Microbial analysis

Microbial analysis	Method and instrument.
Total plate count	Da Silva et al, 2012
Coli form count	Da Silva et al, 2012
Yeast and Mould Count	Da Silva et al, 2012

Table 2.3 Methods for Microbial analysis

## 2.6 9-Points Hedonic Scale Sensory Evaluation.

The organoleptic characteristics of sweetened condensed milk were evaluated. The panel member were trained (Food Technologist) and untrained (Consumers). The panelists were asked to evaluate the sweetened condensed milk based on approval of the Flavor, color, texture, appearance, mouth feel, after taste and overall acceptability on a 9-point hedonic scale. The value scales ranged from 9 (like, extremely) to 1 (dislike extremely) for each organoleptic attribute. Samples were served on white plastic dishes presented in random. For rinsing between samples, drinking water was available to the assessors. Girardot, N. F. 1992.

## 2.7 Storage study:

The prepared Sweetened Condensed Milk and Turmeric incorporated sweetened condensed milk samples were analyzed for storage study after preparation. The formulated products with control sample were kept at ambient & refrigerated temperature at (4 - 6 °C) for storage study. After 0, 15, 30, 60, 90, 120, 150, 180, 210, 270 days checked the quality parameter and overall acceptability of the formulated product. During 180 days of storage study the physicochemical parameters, microbial load and the sensory attributes were analyzed of the product after 30 days interval of time. The storage studies of sample were analyzed up to the spoilage of product.

## III. RESULTS AND DISCUSSION

### 3.1 Analysis Result of Cow Milk

Table 3.1: Results of the Chemical Analysis of Cow Milk

Parameter	Literature Value of Cow Milk (%) Gemechu, T. 2015.	Result (%)
moisture	87.8	86.5 ± 1.0
Total solids	12.87	12.26 ± 0.24
Fat	3.3	12.26 ± 0.24
Solid Non-fat	8.5	3.5±1.5
Solid Non-fat	8.5	8.6± 1.5
Lactose	4.7	4.13± 0.26
Ash	0.7	0.46± 0.12
Proteins	3.3	3.20± 0.24
Acidity	0.194	0.195 ± 0.02

### 3.2 Sweetened condensed milk

Table 3.2: Results of the composition of SCM.

Parameter	Literature Value, IS:1166, 1973	Result
Moisture	26.0	23.5±0.2
Fat	9	10.5± 0.2
Protein	8.3	7.8±0.12
Sucrose	40	43.1±0.7
Total Milk solid	31.0	33.4±0.47
Ash	1.5	1.4±0.2
Acidity	0.35	0.31±0.01

The proximate analysis of raw cow milk reported that (Moisture - 86.5 %, Total solids - 12.26 %, Fat - 3.5%, Solid nonfat -8.6 %, Lactose - 4.13 %, Ash- 0.46 %, Protein - 3.20 % and Acidity - 0.195 %) which was nearly close to the results in the literature. The milk analyzed was also found to satisfy the FSSAI specification therefore considered in the present work. Prepared sweetened condensed milk (Control) was also analyzed for composition it revealed that the values obtained (Moisture - 23.5%, Fat – 10.5 %, Protein - 7.8%, Sucrose – 43.1%, Total solid - 33.4%, Ash - 1.4%, Acidity - 0.31%) were nearly equal to with reported literature value. IS:1166, 1973.

### 3.3 composition of prepared turmeric powder

Table 3.3: Results of composition prepared turmeric powder.

Parameter	Literature value	Result
Moisture %	8.92 %	10.7 ±0.12%
Total Ash %	7.01 %	8.2± 0.1 %
Crude Fat %	6.85 %	2.5 ±0.2 %
Protein %	9.42 %	12.3± 0.3 %
Crud fiber %	4.60 %	10.6 ± 0.2 %
Alcohol extract %	8.23 %	8.16 ± 0.1 %

Results of composition of prepared turmeric powder was found to Moisture - 10.7%, Total ash - 8.2%, Crude Fat - 2.5%, Protein - 12.3 %, Crude fiber - 10.6 %, Alcohol extract-8.16 %. When the reported values of composition were compared with the literature readings Ikpeama et.al., 2014, it shows the composition of turmeric powder is nearly same except fat content was quite lesser and crude fiber content is more than literature value. These might be due to different cultivation and post-harvest processing practices. The Turmeric powder analysis result was also found to satisfy the FSSAI specification.

### 3.4 Phytochemical Analysis

Table 3.4: Results of the Phytochemical tests of turmeric powder

Test	Observation	Result
Alkaloids content	Reddish brown	+ Ve
Flavonoids content	Yellow	+ Ve
Triterpenoids	Red to blue color	+ Ve
Saponin	Foam formed	- Ve
Tannin	Blackish red color	+ Ve

Table 3.5: Result of the Phytochemical tests of Extracted Turmeric Powder

Test	Observation	Results
Alkaloids content	Reddish brown	- Ve
Flavonoids content	Yellow	-Ve
Triterpenoids	Red to blue color	- Ve
Saponin	Foam formed	- Ve
Tannin	Blackish red color	- Ve

(+ve: Present, -ve: Absent)

Ground turmeric powder and extracted turmeric powder analyzed for phytochemical content (Alkaloids content, Flavonoids content, Triterpenoids, Saponin and Tannin) results shows the presence of phytochemical and antinutritional factor like Tannin, Alkaloids, Flavonoids and Triterpenoids whereas saponin found to be absent in Ground turmeric powder whereas after solvent extraction using ethyl alcohol all the phytochemical test observes negative.

### 3.5 Sensory Evaluation of SCM

Table 3.6: Result of Sensory Evaluation of SCM with 0.1 to 1.6 (%) Turmeric powder Incorporation.

Parameter	Level of Turmeric (%)				
	0.1%	0.2%	0.4%	0.8%	1.6%
Colour	5.81±0.2	6.96±0.1	7.96±0.4	6.06±0.9	6.1±0.14
Flavour	6.12±0.5	7.03±0.5	7.03±0.12	6.1±0.57	5.03±0.4
Appearance	6.90±0.3	6.03±0.14	7.06±0.91	6.96±0.4	5.06±0.31
Texture	5.96±0.1	6.03±0.3	7.03±0.5	6.96±0.4	5.06±0.4
Overall acceptability	6.96±0.1	7.03±0.2	7.96±0.5	6.1±0.8	6.03±0.4

SCM with incorporation of extracted turmeric powder at 0.1%, 0.2%, 0.4%, 0.8% & 1.6% were prepared then diluted with warm water in 25:75, 50:50, 75:25 concentrations for sensory evaluation. Sample was analyzed by trained panel members as per 9-point hedonic scale; sample contains 0.4 % turmeric was like extremely as compared with another sample. Overall acceptability of 0.4 % was also good hence sample (0.4%) kept and analyzed for its storage study along with control sample.

### 3.6 Storage study Results at ambient Temperature.

Table 3.7: Result of Chemical Analysis of SCM at ambient Temperature storage

Days	0	8	15	30	60	90	120
Acidity % (lactic acid)	0.32±0.02	0.33±0.04	0.32±0.06	0.32±0.04	0.33±0.06	0.33±0.04	0.40±0.06
Moisture	23.45±0.02	23.24±0.2	24.22±0.2	23.54±0.2	23.55±0.2	24.52±0.2	24.58±0.2

Table 3.8: Result of Chemical Analysis of 0.4% TSCM at ambient Temperature storage

Days	0	8	15	30	60	90	120	150	180
Acidity % (L A)	0.32±0.04	0.31±0.06	0.32±0.04	0.33±0.05	0.32±0.04	0.32±0.05	0.32±0.03	0.34±0.04	0.38±0.07
Moisture (%)	24.12±0.2	24.34±0.2	24.22±0.2	24.52±0.2	24.36±0.2	24.48±0.2	24.30±0.2	24.34±0.2	24.54±0.2

Chemical analysis (% acidity and moisture) at ambient temperature for SCM and 0.4% TSCM showed that SCM spoiled within 120 days. After 90 days, the acidity of product was increased which was not equal to the standard specified acidity limit as per the Indian standard specification: 1166, 1973 and % Moisture obtained within limit (24.58±0.2). In 0.4% TSC the acidity there was no change up to 120 days, change in acidity in TSCM were started from 150 days and increased by 0.03% on 180 days and the sample were considered as spoiled and no change in moisture content. Results revealed that the shelf life of TSCM is more than that of SCM at ambient temperature.

Table 3.9: Results of Sensory Evaluation of SCM at ambient Temperature storage

Days	Color	Flavor	Appearance	Texture	Overall Acceptability
0	7.3±0.3	6.6±0.2	7.3±0.1	7.3±0.4	8.3±0.5
8	7.3±0.4	6.6±0.6	7.3±0.3	7.3±0.4	8.3±0.5
15	7.3±0.2	6.6±0.4	7.3±0.1	7.3±0.3	8.3±0.4
30	7.3±0.4	6.6±0.2	4.3±0.4	7.3±0.2	7.3±0.6
60	6.3±0.3	6.4±0.2	6.5±0.2	6.5±0.4	7.6±0.4
90	6.2±0.3	6.3±0.2	6.4±0.2	6.4±0.4	6.6±0.4
120	6.3±0.2	3.3±0.4	4.3±0.3	4.4±0.3	5.3±0.5

Table 3.10: Results of Sensory Evaluations of 0.4% TSCM at ambient Temperature storage.

Days	Color	Flavor	Appearance	Texture	Overall Acceptability
0	8.3±0.5	8.3±0.3	7.3±0.4	8.3±0.5	8.3±0.2
8	8.3±0.2	8.2±0.4	6.3±0.1	7.3±0.4	7.8±0.3
15	8.3±0.4	8.5±0.5	6.9±0.3	6.3±0.2	8.2±0.4
30	7.3±0.14	8.3±0.2	7.3±0.3	7.1±0.6	7.8±0.4
60	7.3±0.3	7.6±0.4	7.2±0.2	6.8±0.4	7.9±0.2

90	7.3±0.4	6.6±0.2	6.6±0.4	6.6±0.2	6.8±0.13
120	7.3±0.4	6.6±0.2	6.6±0.4	6.6±0.2	6.8±0.13
150	7.3±0.4	6.6±0.2	6.6±0.4	6.6±0.2	6.8±0.13
180	5.3±0.4	4.6±0.2	4.6±0.4	4.6±0.2	5.8±0.3

In sensory evaluation of SCM (control sample) and 0.4 % TSCM at ambient temperature it is found that the flavor gets changed after 90 days that may be because of increase in acidity. After 90 days, the overall acceptability of SCM starts to reduce. In 0.4 % TSCM there was change in sensory score after 90 days but it was acceptable up to 150 days after that drastic change in flavor, colour, appearance and overall acceptability due to change in acidity and may be microbial spoilage and turns the sample unacceptable. Results of sensory score exposed that the 0.4 % TSCM was better as compare to SCM.

Table 3.11: Results of microbial count of SCM at ambient Temperature storage

Days	0	8	15	30	60	90	120
TPC	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10	3×10 <sup>2</sup>	9×10 <sup>2</sup>
Coli form	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10	2×10 <sup>2</sup>
Y & M	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10	10×10 <sup>1</sup>

Table 3.12: Results of microbial count of 0.4 % TSCM at ambient Temperature storage

Days	0	8	15	30	60	90	120	150	180
TPC	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10	4×10 <sup>2</sup>	5×10 <sup>2</sup>	7×10 <sup>2</sup>
Coli form	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10	1×10 <sup>2</sup>	2×10 <sup>2</sup>
Y & M	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10	1×10 <sup>1</sup>	9×10 <sup>1</sup>

TPC, Coli form and yeast and mold count of SCM (Control sample) and 0.4 % TSCM at ambient temperature was observed for 0 to 120 days (SCM) and 0 to 180 days (0.4 % TSCM); in SCM up to 60 days TPC was found to be ≤ 10 after 90 days TPC was observed 3×10<sup>2</sup> that shows sample was spoiled. For coli form and yeast and mold there was no growth above unacceptable till 90 days after that that was reported to be 2×10<sup>2</sup> and 10×10<sup>1</sup> that makes sample microbial spoiled.

In 0.4 % TSCM sample there was TPC is acceptable up to 90 days after 120, 150 and 180 days it was reported 4×10<sup>2</sup>, 5×10<sup>2</sup> and 7×10<sup>2</sup> CFU respectively that is unacceptable for consumption. Coli form and yeast and mold count was reported contaminated after 150 days with the growth of 1×10<sup>2</sup> and 4×10<sup>1</sup> CFU.

Results revealed that turmeric act as antimicrobial agent and preserve the sweetened condensed milk up to 150 days at ambient temperature.

Table 3.13: Result of Chemical Analysis of SCM at Refrigeration Temperature storage

Days	0	8	15	30	60	90	120	150
Acidity % (L A)	0.32±0.02	0.32±0.04	0.32±0.05	0.32±0.06	0.32±0.04	0.32±0.06	0.34±0.05	0.38±0.06
Moisture (%)	23.52±0.2	23.59±0.4	23.53±0.5	23.61±0.4	23.58±0.3	23.66±0.5	23.61±0.6	23.55±0.5

Table 3.14: Result of Chemical Analysis of 0.4% TSCM at Refrigeration Temperature

Days	0	8	15	30	60	90	120	150	180	210	240	270
Acidity% (LA)	0.32±0.02	0.32±0.05	0.33±0.04	0.32±0.06	0.32±0.04	0.32±0.03	0.33±0.05	0.32±0.07	0.34±0.07	0.34±0.07	0.39±0.08	0.39±0.08
Moisture (%)	24.02±0.2	24.44±0.3	24.36±0.2	24.24±0.4	24.55±0.3	24.59±0.2	24.41±0.5	24.62±0.2	24.68±0.02	24.68±0.02	24.64±0.2	24.64±0.2

Chemical analysis (% acidity and moisture) at refrigeration temperature for SCM and 0.4% TSCM showed that SCM spoiled within 120 days. On 120th day the acidity of product was increased by 0.2%. The shelf life of TSCM was 30 days more than ambient temperature and no significant changed in moisture content (23.61±0.6). In 0.4% TSCM, there was no significant changed in acidity up to 210 days, after that acidity start to increase on 240th day acidity is increased by 0.05%. Hence sample considered to be spoiled after 270 days. There was no significant changed in moisture content. The results of TSCM were better than the SCM at refrigeration temperature which were revealing that the shelf life of TSCM is more than that of SCM.

Table 3.15: Results of Sensory Evaluation of SCM at Refrigeration Temperature storage

Days	Color	Flavor	Appearance	Texture	Overall Acceptability
0 day	8.3±0.4	8.2±0.3	7.3±0.4	7.5±0.2	8.1±0.1
8 day	7.3±0.2	7.6±0.4	7.4±0.3	7.2±0.4	7.3±0.1

15 days	7.3±0.5	6.6±0.2	7.2±0.4	7.1±0.2	7.7±0.4
30 days	7.5±0.4	7.6±0.4	7.3±0.3	7.6±0.4	8.3±0.3
60 days	6.4±0.4	5.3±0.5	6.3±0.4	7.2±0.2	7.6±0.12
90 days	6.5±0.1	6.4±0.3	6.3±0.4	6.6±0.6	7.2±0.4
120 days	6.3±0.1	6.5±0.3	6.3±0.4	6.7±0.6	7.3±0.4
150 days	5.3±0.1	5.5±0.3	5.2±0.4	5.1±0.6	5.7±0.4

Table 3.10: Results of Sensory Evaluations of 0.4% TSCM at Refrigeration Temperature storage.

Days	Color	Flavor	Appearance	Texture	Overall Acceptability
0 day	8.3±0.3	7.2±0.4	8.2±0.2	8.1±0.4	8.1±0.5
8 day	7.3±0.2	7.6±0.3	7.3±0.4	7.2±0.2	7.3±0.6
15 days	7.4±0.4	6.9±0.14	7.1±0.24	7.1±0.4	7.9±0.6
30 days	7.3±0.5	7.2±0.4	7.6±0.4	7.7±0.2	8.2±0.4
60 days	7.4±0.4	6.3±0.7	7.7±0.2	7.2±0.3	7.8±0.7
90 days	7.3±0.2	7.5±0.4	7.4±0.5	8.3±0.3	8.3±0.6
120 days	7.3±0.2	7.5±0.4	7.4±0.5	8.3±0.3	8.3±0.6
150 days	7.3±0.2	7.5±0.4	7.4±0.5	7.7±0.3	8.3±0.6
180 days	7.4±0.2	7.2±0.4	7.4±0.5	7.6±0.3	7.5±0.6
210 days	7.5±0.2	7.4±0.4	7.2±0.5	6.7±0.3	7.2±0.6
240 days	7.3±0.2	7.2±0.4	7.4±0.5	6.3±0.3	7.3±0.6
270 days	5.3±0.2	6.5±0.4	6.4±0.5	5.2±0.3	5.3±0.6

In sensory evaluation of SCM (control sample) and 0.4 % TSCM at refrigeration temperature, overall acceptability of the sample like extremely because there was no change in appearance, color, flavor up to 120 days. After 150 days the overall acceptability of SCM starts to reduce and sample was reported unacceptable after 150 days. Sensory evaluation of 0.4 % TSCM. The colors, appearance, flavor & texture of sample was good up to 240 days. There was no change in present appearance of the sample so; it was like extremely by panelist. After 270 day's appearance and flavor of sample were changed so, the overall acceptability for sample by sensory score became dislike slightly by panelist.

Results reported that the 0.4 % TSCM become unacceptable after 270 days which was too longer than the SCM (150 days). Addition of turmeric retains sweetened condensed milk more acceptable for longer time.

Table 3.11: Results of microbial count of SCM at Refrigeration Temperature storage

Days	0	8	15	30	60	90	120	150
TPC	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10	4×10 <sup>2</sup>	7×10 <sup>2</sup>
Coli form	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10	2×10 <sup>2</sup>
Y & M	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10	5×10 <sup>1</sup>

Table 3.11: Results of microbial count of 0.4% TSCM at Refrigeration Temperature storage

Days	0	8	15	30	60	90	120	150	180	210	240	270
TPC	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10	4×10 <sup>2</sup>	7×10 <sup>2</sup>
Coli form	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10	2×10 <sup>2</sup>
Y & M	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10	≤ 10	2×10 <sup>2</sup>

TPC, Coli form and yeast and mold count of SCM (Control sample) and 0.4 % TSCM at refrigeration temperature was observed for 0 to 150 days (SCM) and 0 to 270 days (0.4 % TSCM); in SCM up to 90 days TPC was found to be ≤ 10 after 120 days TPC was observed 4×10<sup>2</sup> that shows sample was spoiled. For coli form and yeast and mold there was no growth till 120 days after that that was reported to be 2×10<sup>2</sup> and 5×10<sup>1</sup> CFU that makes sample microbial spoiled.

In 0.4 % TSCM sample there was TPC is acceptable up to 210 days after 240 and 270 days it was reported 4×10<sup>2</sup> and 7×10<sup>2</sup> CFU respectively that is unacceptable for consumption. Coli form and yeast and mold count was reported contaminated after 270 days with the growth of 2×10<sup>2</sup> and 2×10<sup>2</sup> CFU.

Results revealed that turmeric act as antimicrobial agent and preserve the sweetened condensed milk up to 240 days at refrigeration temperature.

#### IV. CONCLUSION

Study concludes that the 0.4% TSCM sample was selected by panelist as acceptable turmeric level. Results showed that the ethanol extraction treatment given to turmeric powder made it safe for incorporation as it removed nearly all the phytochemical (Alkaloid, Flavonoids, Tannin, Terpenoids). The optimized turmeric incorporated sweetened condensed milk had shown the improved shelf life

as compared to control sweetened condensed milk. However, the improvement in shelf life was found to be storage temperature dependent. At ambient and refrigerated temperature, the turmeric incorporated sweetened condensed milk had shown to be 1.6 times and 2 times greater shelf life as compare to control sweetened condensed milk.

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